Space and astronomy: Washburn Observatory. 1948/2003

[Madison, Wisconsin]: [s.n.], 1948/2003

https://digital.library.wisc.edu/1711.dl/3FDSO2GEYU6KM9C

Madison, Wis. (Special)---The nation's leading astronomers, numbering over 100 men and women from widely scattered observatories, will begin sessions Sunday afternoon of a four-day meeting of the American Astronomical Society, being held on the University of Wisconsin campus.

Main part of the program of the semi-annual meeting will be the reading of 37 scientific papers on various astronomical subjects, ranging from "the variations of Rho Cassiopeiae" to "astrophysical projects in the high altitude rocket program." Sessions of the meeting will be held in the Memorial Union building.

Among those who will present papers are Prof. Joel Stebbins, chairman of the Astronomy department and director of the Washburn observatory on the Wisconsin campus; Prof. Charles M. Huffer, Prof. Albert E. Whitford, and Olin J. Eggen, all of the University of Wisconsin. Prof. Stebbins is a past president of the American Astronomical society, and Prof. Huffer is in charge of local arrangements for this week's meeting.

Visiting astronomers who will present papers are: Paul Herget, Cincinnati; Gerald M. Clemence, United States Nautical almanac; Ida Barney and Lyman Spitzer, Jr., Yale; J. Allen Hynek, Perkins observatory; Fred L. Whipple, Zdenek Kopal, Cecilia Payne Gaposchkin, S. Goposchkin, Margaret Mayall, Martha B. Shapley, and Leon Campbell,

(more)

Harvard observatory; Grote Reber; Peter van de Kamp, Sproul observatory; Geoffrey Keller; R. M. Petrie, and Kenneth O. Wright, Victoria, B.C.; Newton L. Pierce and Frank Bradshaw Wood, Princeton observatory; John B. Irwin, Flower observatory; Balfour S. Whitney, Oklahoma; Oliver J. Lee, Thomas J. Bartlett, and Greenville D. Gore, Dearborn observatory; Daniel M. Popper, Yerkes and McDonald observatory; E. A. Fath, Goodsell observatory; D. B. McLaughlin, Michigan; William P. Bidelman, Jesse L. Greenstein, W. W. Morgan, and Irene Hansen, Yerkes observatory; M. Minnaert; Louis C. Green, Haverford; Frank K. Edmondson, Indiana; Philip S. Riggs, Crane observatory; Helen B. Sawyer, David Dunlap observatory; Armin J. Deutsch; and Lawrence Aller, Indiana.

Present officers of the American Astronomical society are Harlow Shapely, Cambridge, Mass., president; J. A. Pearce, Victoria, B.C., and Alfred H. Joy, Pasadena, Cal., vice-presidents; Dean B. McLaughlin, Ann Arbor, Mich., secretary; and Keivin Burns, Pittsburgh, Penn., treasurer.

Election of new officers will be held at Monday's session. Next meeting of the society will be held at Christmas time at Harvard University, in conjunction with the meeting of the American Association for the Advancement of Science.

###

University of Wisconsin News Service Immediate Release

Madison, Wis. (Special)---More than 100 leading astronomers of the nation will meet next week on the campus of the University of Wisconsin here at the 75th semi-annual meeting of the American Astronomical society.

Papers dealing with such astronomical subjects as stars, meteors, comets, and nebulae will be read by visiting scientists and by members of the Astronomy department of Wisconsin's Washburn observatory. Visitors will be housed at the Kronshage dormitories on the campus during the meeting, which will be held Sunday through Wednesday, Sept. 8 to 11.

Prof. Charles M. Huffer is in charge of campus arrangements for the meeting. Other Wisconsin hosts next week, all of whom will read papers during the program, will be Prof. Joel Stebbins, Prof. Albert E. Whitford, and Olin J. Eggen, research assistant. Prof. Stebbins, chairman of the Astronomy department and director of Washburn observatory on the campus, is a past president of the American Astronomical society.

President of the society now is Howard Shapley, of Harvard observatory, Cambridge, Mass. Included on the program next week, besides presentation of the scientific papers, will be election of new officers and a trip to Yerkes observatory at Lake Geneva.

###

University of Wisconsin News Service

Release Wednesday
Sept. 11:

Madison, Wis., Sept. 11: The apparent position of the center of our galaxy in the direction of the constellation of Sagittarius has long been known, but a bright nucleus or clustering of stars about the center as in other galaxies has never been observed, presumably because of interstellar dust clouds. The use of infrared light by Drs. Joel Stebbins and A. E. Whitford, of Washburn Observatory, University of Wisconsin, has served to reveal the outlines of a central bulge hitherto hidden by the great dust clouds in the Sagittarius region of the sky.

Using the 60-inch reflector at Mount Wilson Observatory, with a photocell and filter glass giving effective sensitivity in the infrared region near wave length 10,300 angstroms, the Wisconsin astronomers found definite evidence that such a bulge in the nucleus of the Milky Way must exist. Their use of infrared light to give increased penetration through the celestial haze is just the same practice as that employed to improve photography of distant landscapes through the earth's atmosphere. A color screen and red-sensitive films "see" through haze and fog and are often used in aerial mapping projects.

In the case of the Milky Way, Dr. Stebbins estimates that less than 1/1,000 of the ordinary blue photographic light from the center gets through the obscuring interstellar dust.

###

Madison, Wis. (Special)---Otto Struve, of Yerkes Observatory at Williams Bay, Wis., was elected president of the American Astronomical Society at its 75th semi-annual meeting in the Memorial Union building at the University of Wisconsin here Monday afternoon.

Dr. Struve succeeds Prof. Harlow Shapley of the Harvard Observatory at Cambridge, Mass. Other officers elected for the coming year include Donald H. Menzel, of the Harvard Observatory, vice-president, succeeding J. A. Pearce of Victoria, B. C.; Prof. Charles M. Huffer, of the Washburn Observatory at the University of Wisconsin here, secretary succeeding Dean B. McLaughlin of Ann Arbor, Mich.; and J. J. Nassau, of East Cleveland, Ohio, treasurer, succeeding Keivin Burns of Pittsburgh, Pa. Three new councilors of the society remain to be elected.

Prof. Huffer is the third Wisconsin man to serve as secretary of the society since its founding. Prof. George C. Comstock, third director of Washburn Observatory at the State University, was its first secretary, and Prof. Joel Stebbins, present director of the Wisconsin observatory, served as the society's director for nine years. Both also served as president of the society for three year terms.

####

Madison, Wis., Sept. 9: One of the most serious problems confronting travel through space in the rocket ships of the future is that of collision with meteorites. Space in the solar system in the vicinity of the earth is filled with debris which is ordinarily invisible. The earth sweeps up some of this material and it then appears as the familiar "shooting stars" of the night sky, properly called meteors. Friction with the atmosphere is so great that a meteoritic particle no larger than a pinhead may glow as bright as a 1st-magnitude star.

Dr. Fred L. Whipple, of Harvard College Observatory, reported to the American Astronomical Society meeting at the University of Wisconsin here today on his computation of the frequency of collisions between a spaceship and the amount of protection required to avoid disaster. He finds that if a spherical space vessel of 12 feet diameter were covered with a ¼-inch steel skin, that skin would be penetrated by an average-sized meteorite or a larger one only once in 50 years. Such an average meteorite weighs approximately a milligram. For thinner coverings, however, the probability of penetration increases rapidly, so the ¼-inch protection of steel, or the equivalent in a lighter metal, seems a necessity.

The large meteorites which occasionally dig holes in theearth and produce meteor craters are so few and far between that an unhappy "accident" might occur to space ships now and then. In the event a spaceship hit a meteor the size of a walnut or a man's fist, the heat generated by the kinetic energy of the collision would destroy both the ship and the meteorite.

###

Madison, Wis., Sept. 9: The V-2 rocket fired in the experimental tests by the Army at White Sands, N. Mex., on October 24 will carry apparatus designed to record the far ultraviolet spectrum of the sun from an altitude of 100 or more miles. The apparatus was described here today by Dr. J. Allen Hynek, Ohio State University astronomer associated with the Applied Physics Laboratory at Johns Hopkins University. This laboratory is providing the scientific equipment to be carried in the rocket to be fired on October 24th. Dr. Hynek spoke before the first session of the meeting of the American Astronomical Society, which is being held at the University of Wisconsin. More than 100 American astronomers are in attendance.

To the present time, astronomers have never been able to make observations of this region of the sun's spectrum because the atmosphere completely blocks these short wave lengths of light from ever reaching telescopes on the surface of the earth. Wave lengths of radiation shorter than 3000 angstroms (the visible region extends from 7000 to 4000 angstroms) are absorbed largely by the ozone and other layers in the rarefied upper atmosphere.

The Johns Hopkins apparatus for photographing the ultraviolet spectrum of the sun contains no optical elements made of conventional glass, for this too absorbs ultraviolet radiation. Instead, the prism and lenses are made of lithium fluoride which is transparent to 1500 angstroms or better. The film-recording mechanism consists of a ten-sided rotating steel rod, eight sides of which have affixed to them strips of film. The entire plateholder is encased in a light-

(more)

tight steel cylinder which preliminary drop tests have shown to be exceedingly rugged. Clockwork controls exposures, turning successive faces of the polygon into the focal plane as the flight progresses.

There are at present four groups engaged in utilizing these rockets for that high-altitude research which is primarily non-military in character. The Naval Research Laboratory has assigned 60 men to the project. The other groups are at the Applied Physics Laboratory of Johns Hopkins University, where this work is directed by Dr. J. A. Van Allen, and at Princeton University and the University of Michigan.

The rocket on October 24th will carry, in addition to the solar spectrograph, two cosmic ray telescopes and associated recording apparatus.

The angle of attack for a well-behaved V-2 is known, as is the altitude of the sun for the date and time of flight. The axis of the spectrograph will thus be oriented as closely as possible toward the sun. A small hemisphere of lithium fluoride placed over the slit acts as a light diffuser to pick up sunlight even if the apparatus is not pointed directly at the sun. The V-2 is known to rotate slowly about its longitudinal axis, and the hope is that at least some of the exposures will be taken in a favorable aspect.

Each exposure of the spectrograph is to be taken through a step slit to compensate as far as possible for the uncertainty of exposure time which arises, of course, from the fact that the spectrograph can be aimed only approximately.

###

University of Wisconsin News Service Immediate Release

Madison, Wis., Sept. 9: A theory that radio static from the Milky Way originates principally in the spaces between the stars rather than from the stars themselves was proposed here today by a well-known investigator of "Cosmic static," as the radio waves from space are called.

Before the meeting of the American Astronomical Society, holding its sessions at Washburn Observatory of the University of Wisconsin, Mr. Grote Reber, of Wheaton, Ill., proposed that the free electrons and ionized atoms of the star clouds in the Milky Way produce radio pulsations as they pass close to one another and lose energy in what physicists call free-free transitions. That is the term for a trading of energy among atomic particles, such as between an electron and the nucleus of a hydrogen atom, when neither particle becomes attached to the other.

The cosmic static appears in Mr. Reber's radio receiver earphones as a hissing sound similar to the boiling of a teakettle. The "aerial" of the apparatus at Wheaton is a sheet-metal mirror 31.4 feet in diameter with a focal length of 20 feet. It scans the sky after the manner of a giant telescope.

Extensive surveys at a frequency of 160 megacycles have shown the cosmic static to have its maximum intensity in the direction of the constellation of Sagittarius. This is the direction of the center of the Milky Way galaxy, the system of stars of which the sun is a part. With the sun's radiation of radio energy already observed as a standard, it is easy to compute that at their tremendous distances

(more)

even the multitudes of stars in the Sagittarius region cannot produce energy with a millionth the intensity observed by Mr. Reber's apparatus. Consequently, the Wheaton scientist proposed the theory that near collisions between interstellar particles produce the observed radio energy.

Astronomers are handicapped to some extent by their inability to see through the very same dark clouds in which the radio static may originate. Mr. Reber suggests that radio techniques may enable a study of what lies beyond such clouds to be made, just as radar enables a mapping of the ground through fog.

The intensity of the cosmic static is quite high at the frequencies used by long-distance short-wave commercial stations; somewhat weaker at frequencies used by FM and television broadcasting stations; quite faint at the lower radar frequencies and below perception on the best equipment designed for the higher radar frequencies.

Radio static of this same type should be produced in the tails of large comets, if Mr. Reber's theory is correct and if it is true that conditions in a comet's tail resemble those in the interstellar clouds. A radio observing station similar to that at Wheaton could be established at a low latitude to study the southern Milky Way, where some of the darkest of the interstellar clouds lie, but which are unobservable from Illinois. Such a station might also help observing a comet were a sizable one to make its appearance.

###

Observatory
Washburn

22. The CARILLON TOWER (R), is a tall, square-based sandstone structure designed by Arthur Peabody and errected in 1934 with the accumulated memorial funds of senior classes from 1919 to 1926. The loft contains a set of twenty-five musical bells, whose chimes peal over the campus and Lake Mendota during the regular school period. Back of the tower a strip of wild woods, with elms, oaks and feathery aspens standing above a tangle of low-growing brush and vines, pitches sharply down to the lake. This spot is often surveyed by engineering students, who work in pairs, squinting through their transits and adjusting their scales on the steep hillside. Across the driveway from the Carillon and at the rear of Bascom hall are Temporary buildings which house classrooms for the School of Commerce and the University generally.
Follow the sidwalk downhill and across a driveway, continue west on the sidewalk uphill.
23. ELIZABETH WATERS HALL (R), a new dormitory for women which opened in the summer of 1940, is a three-story sandstone structure built into the northern slope of Observatory Hill. The building consists of a main central unit with four connecting wings, each stepped lower down the hillside. The dormitory, which was erected at a cost of $875,000, provides rooms for 485 students, a large reception room and smaller lounges, a library, a music room, two dining rooms, and a broad lakeshore terrace overlooking Mendota. The dormitory was named in honor of Miss Elizabeth Waters, Fond du Lac, Wisconsin school teacher for almost half a century, who served on the Board of Regents for 15 years, in 1911-15, in 1921-27, and in 1928-33. Miss Waters was vice-president of the Regents at the time of her death on March 3, 1933.
At left, across the driveway from Elizabeth Waters Hall, are:
24. The STUDENT OBSERVATORY, a small frame house overlooking Lake Mendota. Dr. James C. Watson, first director of Washburn Observatory (see below), began building this structure with his own money. When he died before its completion, C. C. Washburn donated sufficient funds to finish construction and equip the building with astronomical instruments. Finished in 1880, the Student Observatory is used primarily for class instruction by the department of astronomy.
25. WASHBURN OBSERVATORY, was built in 1878 on the crest of Observatory Hill, which overlooks the agricultural campus and Lake Mendota. Cadwallader C. Washburn, former governor of Wisconsin for whom the observatory is named, donated and furnished the building, which

June, 1947

houses the University department of astronomy, and the home of the Director of the Observatory. The dome is outfitted with a refracting telescope of 15.6 inches aperture; other appartus includes a photoelectric photometer, a termionic amplifier, precision clocks, and chronographs. Detailed reports of the astronomical work done by the staff here are printed by the state in the Publications of the Washburn Observatory of the University of Wisconsin, of which fifteen volumes have been published to date. In the building is the Woodman Astronomical Library, established and endowed by Cyrus Woodman, a life-long friend of Washburn.

Observatory Hill provides a sweeping view of Lake Mendota and the surrounding countryside. Left and below on the shore of sheltered University Bay are the men's dormitories, west of Elizabeth Waters Hall. Forming the far arm of the bay is Picnic Point, a narrow tree-fringed peninsula projecting far out into the lake's blue water.

Continue westward along the sidewalk.

26. CHAMBERLIN ROCK, west of Washburn Observatory, is a boulder, 12 feet tall, of pre-Cambrian bedrock brought to Wisconsin from Canada by the continental glacier. On the boulder is a bronze plaque commemorating Thomas Chrowder Chamberlin, famous geologist and president of the University (1887-1892). As state geologist (1876-1882) Chamberlin conducted a survey which distinguished and named the drifts left in the Wisconsin region by successive glaciers; as president "he made the spirit of research effective in the organization and life of the University."

27. Two INDIAN EFFIGY MOUNDS west of Chamberlin Rock, identified by markers, lie on the hill above the site of a former Winnebago Indian village on the lakeshore. Both mounds were constructed about 500 years ago as religious monuments. The first is a bird effigy with a body 52½ feet long and a wing spread which measured about 133 feet before the mound was damaged. The second is a rare two-tailed type of turtle effigy, 104 feet long.

Continue west downhill to the eastern end of the Soils building.

28. The SOILS BUILDING (L), also called King Hall, is a four-story structure built in 1894 by a legislative grant as Horticultural Hall. In 1896 an addition was made to the building, and in 1910 the entire structure was remodelled and renamed. Today the oldest section, known as King Hall, is occupied by the University department of economic entomology, the United States

University of Wisconsin News Service   Release Tuesday Afternoon
and after:

Madison, Wis., Sept. 10: Further light on the problem of the formation of stars from the diffuse matter spread out in space was presented by Dr. Lyman Spitzer, Jr., of Yale University Observatory, before the meeting of the American Astronomical Society here today. He discussed the relative temperatures of particles of matter, such as compose interstellar dust coulds, and of the gases which are also found in space and are associated with the dust clouds.

"Interstellar space is not so hot!" said Dr. Spitzer, "for under certain circumstances the gases in space, which may have temperatures as high as that of the surface of a typical star, 20,000° Farhenheit, can be cooled off by the solid grains which radiate their energy so effectively that their temperatures may fall to within a few degrees of absolute zero, -459° Fahrenheit."

Interactions between gases and solid grains have been previously neglected by students of the problem of the temperature of space, Dr. Spitzer stated. Some gases, it is true, by repeatedly losing their electrons as they absorb radiant energy from the stars, stay rather hot, but where most of the gases are not in such a state the cooling effect of associated solid particles may be very great. How low the temperature may fall is still uncertain, since information is lacking on the many physical processes which affect the final temperature. But temperatures similar to those found on the earth may be quite possible in interstellar space.

The presence of such low gas temperatures is significant in that it may facilitate the condensation of gas into additional solid grains. Such condensations may be an important step in the continual formation of stars from diffuse matter in space.

###

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

5/26/49

RELEASE: Sunday, May 29, and thereafter

By Dr. A. E. Whitford
(director, Washburn Observatory)

A little-known chapter in the history of the University of Wisconsin has been brought to light as a result of the scheduled demolition of the Watson solar observatory. This quaint building at the foot of the south slope of Observatory hill has mystified many generations of students, and quite a number of the faculty as well.

The building takes its name from the first astronomer at the University, Prof. James C. Watson, who began its construction. Its purpose was to provide a special form of telescope in order to search the sky near the sun for the hypothetical planet Vulcan.

Professor Watson came to Madison late in 1878, being lured from the University of Michigan by a telescope to be provided by the gift of former Wisconsin Gov. C. C. Washburn. The telescope, which was to become for a time one of the country's larger instruments, had to be, according to Washburn, "equal or superior to that of the Observatory of Harvard university, Cambridge." Harvard's telescope was 15 inches in diameter; therefor, Wisconsin received a 15 and one half inch telescope.

(more)

When Professor Watson arrived, the observatory building was not complete, nor was the telescope ready for use. He brought with him an intense interest in the problem of planets nearer the sun than Mercury. In July, 1878, he had taken a small telescope to Wyoming to scan the darkened sky near the eclipsed sun in a search for such a planet. He believed he had seen not one but two such objects.

There were reasons to suspect the existence of such a planet, since Mercury was running slightly ahead of schedule. A few years previously the existence of planet Neptune had been predicted from the irregular motion of Uranus, and discovered as a result of the prediction. Various observers had supposedly seen suspicious objects, and the name Vulcan was proposed.

Professor Watson wanted to verify the existence of Vulcan without waiting for the rare moments provided by an eclipse. Perhaps inspired by the experience that the brighter stars may be seen in the daylight sky from the bottom of a well or mine shaft, he designed an arrangement for examining the sky near the sun at any time during the day. While superintending the completion of the main observatory building and its interior appointments, he began construction of the solar observatory at his own expense.

From a 20-foot cellar at the foot of the hill a tube made of drainage tile sloped up just under the surface of the hillside to an opening at the top, pointing to the pole star. Here an inclined mirror could reflect the sun or any sky area near it down the tube. The reduction in sky glare, it was hoped, would enable the elusive planet to be seen in a six-inch telescope at the bottom of the tube. The sandstone structure above ground provided an ornamental roof over the cellar.

(more)

Before the installation was complete, Professor Watson died in November, 1880, at the age of 42, after less than two years in Madison. His successor, Prof. E. S. Holden, came in 1881 and carried through the unfinished experiment.

In a report to the Board of Regents in 1883, he said that the hoped-for gain in ability to see stars (and hence planets) in the daytime was not realized, and the search for Vulcan by such a method would be fruitless. In 1883 he went to an island in the South Pacific and continued the search during a very long seven-minute eclipse of the sun. With time for a thorough scanning of the area near the sun, with a better telescope than Watson's, and better star maps, he found no planet.

Interest declined, and the ghost of Vulcan was finally laid to rest a few years later when Einstein explained away the need for an inner planet. He showed that the peculiar motion of Mercury was a natural consequence of the theory of relativity.

But the Watson solar observatory served in other capacities. A stove was installed, and the building was used as living quarters for the meteorological observer, usually a student. The last of these was Archie G. Worthing, who lived in the solar observatory building from 1902 to 1905; he later became head of the physics department at the University of Pittsburgh.

In January, 1905, the keeping of meteorological records was transferred to the newly established weather bureau office in Madison. Since then the solar observatory has served as a storage vault, first for books from the Extension division, and later for unused and obsolete equipment from the main observatory.

(more)

ad three--Watson observatory

The blocks of Madison sandstone which form the outer walls came from the same quarry which furnished the building stone for North hall, Bascom hall, and the main observatory building. They are still in good condition and are being preserved for other uses.

#

make 4 copies

In the year 1878, C. C. Washburn, ex-governor of the state of Wisconsin, gave the university a building and telescope for the observatory which bears his name. The telescope, made by the famous firm of Clark Brothers, and erected on ~~the campus of the university~~ Observatory hill overlooking Lake Mendota, was at that time one of the largest and finest in the country. It was supplemented by a less ~~popularly~~ known instrument called the meridian circle.

In order to use this telescope ~~properly~~ to the best advantage, ~~the~~ university officials ~~[illegible]~~ secured the services of Professor Watson, a well-known astronomer who had written a text on theoretical astronomy. Unfortunately Professor Watson died before the observatory was completed. But his plans were carried ~~on~~ out and for forty-five years the Washburn Observatory carried on a program of observation of stars by visual methods.

Three major programs kept the two instruments busy on all clear nights and the results have been published ~~in the publications~~ as contributions of the observatory. Professor Comstock, who was director for over thirty years, studied the motions of double stars. He also determined the direction in which the sun and its system of planets is moving among the nearer stars. At the same time Professor Flint with the meridian circle was determining the distances of ~~these~~ stars. The work of Mr. Flint was one of the first attempts to determine the distances of bodies outside the solar syatem.

Meanwhile the development of the science of photography was having a pfofound influence on the progress of astronomy. It soon became possible to take a photograph through a telescope and have a permanent record of the positions of the stars with respect to their neighbors. This method was applied to the problem of determining the distances of stars. The success of this problem depends on being able to measure accurately small changes of position of one star with respect to other stars in the same field, but which are actually at much greater distances. Then, too, the building of larger telescopes made the study easier and more accurate. So the pioneer work of Mr. Flint was abandoned in favor of the more accurate methods.

By the end of the 19th century, this older visual astronomy was being replaced in many observatories by a more interesting branch of astronomy. This branch is called astrophysics. That is, it is the application of the instruments and methods of the physics laboratory to the science of astronomy.

Among the discoveries made in the physics laboratory was one which became very important in the work of the Washburn Observatory. It had to do with the electrical nature of matter, particularly of the alkali metals which include the familiar metals sodium and potassium. These elements are composed of elecgrons and protons as are all elements, but with the difference that they have an inner structure of electrons ~~about a nucleus~~ like a miniature solar syatem and also a single electron moving about the center at a much greater distance. When a beam of light comes along it removes this electron from the others. If many atoms are present and the light is bright enough, the electrons of many atoms are removed and make up a small current of electricity. The brighter the light, the more electrons are released; the larger is the electric current. So it becomes possible to measure the brightness of a light by measuring the amount of the electric current released from the surface of the alkali metal.

This method has been applied to the study of astronomy. And in 1922 it was brought to the University of Wisconsin by Professor Stebbins who has been director of the observatory since that time. In other words, the telescope is no longer used to measure the positions and motions of stars, but has become a part of an astrophysical observatory, and is now used to measure the light from the celestial bodies. Now the telescope is not used for looking at objects in the sky except on visitors nights or for classes in astronomy, but is simply used as a means of bringing the light of stars onto a surface covered with potassium. This potassium surface is the important part of a little instrument called the photo-electric cell or more popularly styled the electric eye. The astronomer no longer sees the star whose light he wishes to measure, but lets the photo-electric cell do the looking while he measures the amount of electricity which his "electric eye" delivers to him.

There have been two interesting problems attacked with this electrical instrument. Astronomers have been long interested in the size and weight of stars. Direct methods are possible in only a few cases. The spectroscope can bring the state of the problem up to a certain point, then says, "I can go no further." An element of uncertainty still remains. In these favorable cases, the stars are really double, two stars revolving around each other. If they are turned a certain way, each star gets in front of the other; ~~an~~ eclipses take place. Then the photo-electric cell steps in and finishes the job by simply measuring the amount of light lost by each body getting behind the other. In the mathematical treatment which follows, it is possible to remove the uncertainty about the size and weight and the problem is solved.

Several of these determinations have been made at the Washburn Observatory in the last twelve years. Usually the interval between eclipses is only a few days, sometimes a few hours. One star however, zeta Aurigae, has just gone through its eclipse which lasted about forty days and we shall have to wait another three years before another occurs. But these long waits with the uncertainty of the weather which might prevent observations at the critical times add interest to the study and it is only by cooperation with many observatories that some of these difficult problems can be solved. A neighboring star, epsilon Aurigae, loses some of its light every 27 years. We shall have to wait until 1955 before this happens again.

University of Wisconsin News Service
9/25/48

Release Saturday, Sept. 25,
after Regents' Action

Madison, Wis.--The appointment of Prof. A. E. Whitford to the directorship of the Washburn Observatory was approved by the University of Wisconsin Board of Regents today.

Whitford was also advanced from associate professor to professor.

The regents also approved transfer of the university's world-famed observatory to departmental status in the College of Letters and Science.

Professor Whitford replaces Dr. Joel Stebbins, director of the observatory since 1922, who reached the retirement age of 70 last year.

Under Dr. Stebbins, the Washburn astronomers conducted pioneer research on the determination of the size and density of stars trillions of miles from the earth. This research gained world fame for the observatory and Dr. Stebbins. The work is now being continued by Profs. Charles Huffer and Whitford.

One of the landmarks of the university campus, the observatory was erected in 1878 at a cost of $250,000 donated to the university by the late former governor of the state, Cadwallader C. Washburn.

(more)

A strategic figure in Wisconsin politics, Washburn was a Civil War hero, a philanthropist, and an amateur scientist. His only stipulation in donating the observatory was that it should be "vigorously used."

A native of Milton, Wis., Professor Whitford received his bachelor' degree from Milton college in 1926. His two higher degrees were granted by the University of Wisconsin in 1928 and 1932.

He was a national research fellow at the Mount Wilson Observatory from 1933 to 1935, in the latter year becoming a research associate at Washburn Observatory. He worked closely in research with Dr. Stebbins.

Small as telescopes go, the Wisconsin 15½-inch instrument is known as one of the work-horses of the field of astronomy. In addition to the work on size and density of stars, research at Washburn is directed toward study of the eclipsing variable, or "twin" stars.

#

300

University ~~of Wisconsin News Bureau~~

State U. Men Invent Device to Force Stars to Guide Telescopes

14 pt. Bold

A unique astronomical device, known as an "automatic guider," which has the power to force a star millions of miles away from earth to guide and [redacted] afix the eyepiece of a telescope directly on [redacted] its center so that the star can be accur~~r~~ately photographed, has been invented by two young astronomers [redacted] in the Washburn Observatory at the University of Wisconsin.

The two young astronomers are A.E. [redacted] Whitford and G.E. Kron, who reported on their invention at the recent sessions of the National Academy of Science.

Pointing out that during long photographic exposures the astronomer must have his eye fixed at the [redacted] eyepiece of a telescope, in order to keep the instrument centered exactly on the object being photographed, the two astronomers revealed that their "automatic guider" delegates this tedious task to a tiny [redacted] photoelectric cell.

In using the guider, the light of the guiding star is divided into two beams by a reflecting [redacted] knife edge, and the two beams are made to shine alternately on the light-sensitive surface of the cell, they explained. If [redacted] the star is not centered exactly, one beam will be brighter than the other and a flickering intensity will result. Suitably amplified, the flicker controls a motor which makes the proper correction to center the star on the knife edge and reduce the flicker to zero, when the telescope's eyepiece is centered exactly on the star.

In order to make the extremely small amount of starlight available actuate the mechanism, the feeble impulse from the star must be amplified as much as a billion billion times, the Wisconsin astronomers said. They admitted that the instrument is still in the experimental stage, but successful preliminary tests have been made with the 60-inch telescope of the Mount Wilson observatory in California, and although artificial errors were introduced into the driving mechanism of the telescope, the guider continuously corrected them and produced satisfactory star images which were photographed.

PROGRAM

of the

EIGHTIETH MEETING

of the

AMERICAN ASTRONOMICAL SOCIETY

YALE UNIVERSITY

NEW HAVEN, CONNECTICUT

December 28 to 31, 1948

★

COUNCIL

President	Otto Struve	Williams Bay, Wis.
Vice-Presidents	Paul W. Merrill	Pasadena, Calif.
	Fred L. Whipple	Cambridge, Mass.
Secretary	C. M. Huffer	Madison, Wis.
Treasurer	J. J. Nassau	East Cleveland, Ohio
Councillors	H. L. Alden	Charlottesville, Va.
	O. C. Wilson	Pasadena, Calif.
	Miss Ida Barney	New Haven, Conn.
	C. D. Shane	Mount Hamilton, Calif.
	P. M. Millman	Ottawa, Ontario
	J. L. Greenstein	Pasadena, Calif.
	Lyman Spitzer, Jr.	Princeton, N. J.
	G. E. Kron	Mount Hamilton, Calif.
	Leo Goldberg	Ann Arbor, Mich.
Ex-Presidents	Joel Stebbins	Madison, Wis.
	Harlow Shapley	Cambridge, Mass.

PROGRAM

(Eastern Standard Time)

Tuesday, December 28
- Afternoon. Registration. Timothy Dwight College.
- 3:00 p. m. Council meeting.
- 7:30 p. m. Open House.

Wednesday, December 29
- 9:00 a. m. Session of papers. W. L. Harkness Hall.
- 12:00 m. Society photograph.
- 2:00 p. m. Session for papers.
- 4:00 p. m. Tea.

Thursday, December 30
- 9:00 a. m. Session for papers.
- 2:00 p. m. Invited papers on micro-wave astronomy.
- 3:30 p. m. Teachers' conference.
- 6:30 p. m. Society dinner.

Friday, December 31
- 9:00 a. m. Session for papers.

PROGRAM OF PAPERS

Subject to the approval of the Council, the following papers are placed on the program:

SYMPOSIUM: MICRO-WAVE ASTRONOMY (December 30)

1. The origin of galactic radio-noise, JESSE L. GREENSTEIN (California Institute of Technology)........20 min.
2. Current series of solar radio emission, RALPH E. WILLIAMSON (David Dunlap Observatory)........20 min.
3. The measurement of extra-terrestrial radio wave emissions, JOHN P. HAGEN (Naval Research Laboratory)........20 min.

TEACHERS' SYMPOSIUM: THE UNDERGRADUATE CURRICULUM IN ASTRONOMY IN AMERICAN UNIVERSITIES AND COLLEGES (December 30)

FREEMAN MILLER (University of Michigan), Presiding

1. The requirements for the graduate student at an observatory, OTTO STRUVE (Yerkes Observatory)........15 min.
2. The undergraduate curriculum at the large State University, GEOFFREY KELLER (Ohio State University)........10 min.
3. The astronomy curriculum at the small College, VICTOR GOEDICKE (Ohio University)........10 min.
4. Special methods in the undergraduate curriculum in astronomy, THORNTON PAGE (University of Chicago)........10 min.
5. Discussion........30 min.

CONTRIBUTED PAPERS

1. Construction and use of optimum interval mathematical tables, H. R. J. GROSCH (Watson Laboratory)..10 min.

2. Investigation of the magnitude error in the declinations of the General Catalogue from a comparison with the Yale photographic positions, IDA BARNEY (Yale University Observatory)..10 min.

3. The solar parallax determined from lunar occultations 1932-1942, DIRK BROUWER (Yale University Observatory)..10 min.

4. Systematic effects in the probable errors of the Yale parallaxes, GUSTAV LAND (Yale University Observatory)..10 min.

5. On the evolution of galactic clusters, U. VAN WIJK (Harvard College Observatory)..10 min.

6. Variations of the luminosity function in Auriga and Orion, S. W.McCUSKEY (Warner and Swasey Observatory)..10 min.

7. A relativistic model for a cluster of nebulae, GUY C. OMER, JR. (University of Oregon)..10 min.

8. On emission lines at high kinetic temperature, RICHARD N. THOMAS (Institute for Advanced Study)..10 min.

9. The radiative equilibrium of a spherical planetary nebula, HARI K. SEN (Harvard College Observatory)..10 min.

10. On the role of the guillotine factor in stellar structure, G. F. D. DUFF and RALPH E. WILLIAMSON (David Dunlap Observatory)..10 min.

11. The pole of the galaxy as determined by radiofrequency radiation, RUTH J. NORTHCOTT and RALPH E. WILLIAMSON (David Dunlap Observatory)..10 min.

12. Heating of the Solar Corona and Chromosphere by turbulence, EVRY SCHATZMAN (Princeton University Observatory) (Introduced by L. Spitzer)..10 min.

13. The effect of stellar encounters on a velocity distribution, IVAN KING (Harvard College Observatory)..10 min.

14. Electron scattering in stellar atmospheres, ARTHUR D. CODE (Yerkes Observatory)..10 min.

15. The profile of the CaII K-line in the solar spectrum, LAWRENCE H. ALLER (University of Michigan)..10 min.

16. Recent astrometric results, N. E. WAGMAN (Allegheny Observatory)..10 min.

17. A study of the galactic structure in a clear region in Cygnus, J. J. NASSAU and D. MacRAE (Warner and Swasey Observatory)..10 min.

18. The period-color, period-amplitude and period-luminosity relations for galactic Cepheids, OLIN J. EGGEN (Lick Observatory)..10 min.

19. Positions of solar flares within a spot group, RUTH HEDEMAN and HELEN W. DODSON (University of Michigan)..10 min.

20. Isotopes of carbon and oxygen in the earth's atmosphere, L. GOLDBERG, O. C. MOHLER, and R. R. McMATH (University of Michigan)..........10 min.

21. Three-station radar and visual triangulation of meteors, PETER M. MILLMAN (Dominion Observatory) and D. W. R. McKINLEY (National Research Council of Canada)..10 min.

22. Photographic colors of faint Cepheids in Cygnus, BART J. BOK and MARGARET OLMSTED (Harvard College Observatory)..........................10 min.

23. Recent analyses of atomic spectra, CHARLOTTE MOORE SITTERLY (Washington, D. C.)..10 min.

24. The eclipsing variable RX Herculis, FRANK BRADSHAW WOOD (Steward Observatory) ....10 min.

25. Spectrum of Comet 1948-L, PAUL D. JOSE (McDonald Observatory)..5 min.

26. Comparison of atmospheric methane content above Flagstaff, Arizona, and Columbus, Ohio, ARTHUR ADEL (Arizona State College)..................5 min.

27. The spectrum of the C_2 molecule between 2370A and 2855A, JOHN G. PHILLIPS (Yerkes Observatory)..10 min.

28. The masses and dimensions of the O-type spectrographic binary H. D. 215835, JOSEPH A. PEARCE (Domination Astrophysical Observatory)........ ....10 min.

29. Notes on dually classified stars, DORRIT HOFFLEIT (Harvard College Observatory) ....10 min.

30. Two RV Tauri variables in globular clusters, HELEN SAWYER HOGG (David Dunlap Observatory)..10 min.

31. Period changes in RW Draconis stars, EVERETT C. YOWELL (National Bureau of Standards)..10 min.

32. The Harvard photographic meteor program, FRED L. WHIPPLE (Harvard College Obervatory)..10 min.

33. Velocity study of eight stars formerly assigned to the Beta Cephei group, J. F. HEARD (David Dunlap Observatory)..............................10 min.

34. The variation of the period of RZ Cassiopeiae, C. M. HUFFER (Washburn Observatory) ....5 min.

35. The Poynting-Robertson effect on meteor orbits, FRED L. WHIPPLE and STANLEY P. WYATT, JR. (Harvard College Observatory)..............10 min.

36. Luminosity distribution and secular parallaxes of tenth magnitude K stars, F. K. EDMONDSON (Kirkwood Observatory) and EDITH M. JANSSEN and A. N. VYSSOTSKY (Leander McCormick Observatory)..............10 min.

37. Colors of elliptical and spiral nebulae in the Corona Borealis cluster, A. E. WHITFORD (Washburn Observatory)..............................10 min.

38. The spectrum of the cluster-type variable CY Aquarii, OTTO STRUVE (Yerkes Observatory)..10 min.

39. General perturbations of (659) Nestor, HANS G. HERTZ (Naval Observatory) ....10 min.

40. Luminosity function of A stars—preliminary results, J. KIEWIET DE JONGE (Harvard College Observatory)..10 min.

41. Radio detection of meteors at 3.5 megacycles, WILLIAM LILLER (Harard College Observatory)..10 min.

42. Local behavior of spherically symmetric relativistic solutions, GUY C. OMER, JR. (University of Oregon)....................10 min.

43. A new RV Tauri type variable, DORRIT HOFFLEIT (Harvard College Observatory) ....10 min.

44. Magnetic oscillations of a star, MARTIN SCHWARZSCHILD (Princeton University Observatory)....................10 min.

45. A symbolic solution of the equation of radiative transfer, DONALD H. MENZEL (Harvard College Observatory)....................7 min.

46. Anharmonic pulsations of the standard model, MALCOLM P. SAVEDOFF (Princeton University Observatory), (Introduced by Martin Schwarzschild) ....10 min.

47. Coordination of solar activity observations, A. H. SHAPLEY (National Bureau of Standards)....................5 min.

48. The light variation of Pleione, A. BINNENDYK (Sproul Observatory)..10 min.

49. Continuous absorption by interstellar molecules, RUPERT WILDT (Yale University Observatory)....................10 min.

50. The galactic pole at 200 megacycles, CHARLES R. SEEGER, CHARLES R. BURROWS, and W. E. GORDON (Cornell University)....................10 min.

51. A new eclipsing variable of heavy mass, SERGEI GAPOSCHKIN (Harvard College Observatory)....................7 min.

52. The variable AE Aquarii, SERGEI GAPOSCHKIN (Harvard College Observatory) ....5 min.

ANNOUNCEMENTS

Headquarters and the registration desk will be in Timothy Dwight College, 345 Temple Street. Meals will be served in the dining room in this building with the following schedule:

Breakfast	7:45-8:15 A. M.
Luncheon	12:30-1:00 P. M.
Dinner	6:00-6:30 P. M.

Mail address: Care of American Astronomical Society, Timothy Dwight College, Yale University, 345 Temple Street, New Haven 11, Connecticut.

Sessions for papers will be held in W. L. Harkness Hall.

Timothy Dwight College is at a distance of approximately one mile from the Railroad Station, and can be reached conveniently by "Spring Glen" bus, getting off at Church and Wall Streets (Telephone Building), and walking one block west to Temple Street.

Those who have not yet made their reservations for rooms are urged to do so at once.

81st MEETING. The 81st meeting of the Society will be held in Ottawa, Ontario, June 20-22, 1949. Sessions will probably be held in the auditorium of the National Research Council.

C. M. HUFFER,
Secretary

December 1, 1948.

The following members and guests have indicated that they expect to attend the New Haven meeting:

Alden, Aller, Baker, Miss Barney, Belserene, Binnendyk, Bok, Mrs. Bok, Brouwer, Mrs. Brouwer, A. Brown, Burrows, Butler, Code, Dimitroff, Miss Dodson, Donner, Edmondson and family, Eggen, Miss Farnsworth, Federer, Mrs. Federer, Fleischer, Miss Gill, Goedicke, Mrs. Goedicke, Goldberg, Gordon, Greenbaum, Greenstein, Grosch, Mrs. Grosch, Miss Harwood, Heard, Mrs. Heard, Hen, Hertz, Miss Hill, Miss Hoffleit, Hogg, C. M. Huffer, Irwin, Miss Janssen, Keller, Kiewiet de Jonge, King, Land, Mrs. Land, Levitt, Mrs. Levitt, Ligda, Liller, Linnell, McCuskey, Miss McNical, Menzel, F. D. Miller, Mrs. Miller, Millman, Moffitt, Mrs. Moffitt, Nassau, Neubauer, Mrs. Neubauer, Miss Northcott, Omer, T. L. Page, Mrs. Page, Perkin, J. G. Phillips, N. L. Pierce, Ramshaw, Miss Reilly, Roberts, Roth, Rothschild, Savedoff, Schatzman, Schwarzschild, Seeger, Sen, A. H. Shapley, H. Shapley, Mrs. Shapley, Sitterly, Mrs. Sitterly, Smiley, Mrs. Smiley, Stearns, Mr. and Mrs. Stephens, Streeter, Mrs. Streeter, Struve, Miss Swope, R. N. Thomas, Van Biesbroeck, Van Wijk, Vyssotsky, Wagman, Whipple, Mrs. Whipple, Whitford, Wildt, R. E. Williamson, Wyatt, Mrs. Wyatt, Miss L. Young, E. C. Yowell.

University of Wisconsin News Service   Immediate Release
(6/9/48)

Madison, Wis. (Special)--Olin J. Eggen, Madison, a graduate student at the University of Wisconsin who is studying astronomy at the Washburn Observatory, will present a scientific paper before the American Astronomical Society which will hold its annual meeting in Pasadena, California, June 28 to July 1.

The title of Eggen's paper is "Photoelectric Magnitudes and Colors in the Coma and Hyades Clusters." The annual meeting of the society is being held jointly with the Astronomical Society of the Pacific.

###

University of Wisconsin News Service

Release Wednesday,
August 11. 1948

Madison, Wis.(Special)--To Charles M. Huffer it's all in a day's--or night's--work to be literally "out of the world".

For only the quiet buzzing of electrical instruments and the occassional sound of a passing automobile remind Prof. Huffer that he is, after all, not at some outpost in space but the Washburn Observatory on the University of Wisconsin campus, watching the light from stars which are perhaps a million million miles distant.

Prof. Huffer is scheduled to give a non-technical public lecture on "The Origin of the Solar System" tonight (Aug. 11) at 8:15 p.m. in room 165 in Bascom Hall, on the University campus.

Prof. Huffer is carrying on the pioneer research of Wisconsin astronomers in his study of the relations between the temperature, size, and physical nature of stars. The Washburn Observatory is known over the world for work in determining the size and density of stars trillions of miles from the earth.

Wisconsin's 15-inch telescope--small as telescopes go--is one of the work-horses in the astronomical field. While the giant new 200-inch Palomar telescope and the Mount Wilson 100-inch instrument are reserved for the prima-donna roles of searching the outermost reaches of the universe, the smaller observatories are busy with the relatively tame but exacting and necessary work of learning all that can be known about the stars within their more limited range.

And the phrase "limited range" is misleading. Few people would call being able to see a million million miles very limited range of vision.

In fact, seldom do modern astromomers actually expect to learn very much by simply p ering through their telescopes. Instead, cameras, photoelectric cells, and spectrographs are attached to telescopes to determine the size, temperature, and composition of the burning gasses on other distant suns. "For that is what stars are," Huffer said, "just suns, similar to the one we know, though often many times larger, but so distant as to appear as points of light."

By using a complicated "electric-eye" which is an extremely sensitive photoelectric cell, the astronomers at the Washburn Observatory have been working for years to chart the characteristics of all the astronomically interesting stars visible from the northern hemisphere.

At the moment, Prof. Huffer's specialty is the eclipsing variable stars--which may need some explanation. The eclipsing stars are twins which revolve around one another. The light coming from them will vary from a maximum when they are both visible to a minimum when one is behind the other.

The apparatus used by Huffer was designed and built by Dr. A. E. Whitford, also professor of astronomy at the Washburn Observatory. It is sensitive enough to tell whether the center of distant stars is brighter than the edge. To use a more mundane example, if the instruments were located in California they could "see" a candle in Boston--if the candle could be held high enough over the earth's curvature.

"When you look at the sun through a dark solar telescope," Huffer said, "you can see it is brighter in the center than at the edge. We're trying to find a rule governing the distribution of light on a star--for this is related to its temperature."

Prof. Huffer and Olin J. Eggen, who received his doctor's degree in June and who is now at the Lick Observatory in California, recently published the result of their study of a star named AR Aurigae, one of the eclipsing variables. Each of the twins in AR Aurigae is more than a million and a half miles in diameter and weighs two and a half times as much as the sun. The sun is burning at a temperature of about 6,000 degrees; the AR Aurigae is estimated at 12,000 degrees.

One of the major difficulties confronting astronomers is the smoke which drifts across Madison even on the clearest night. The Washburn Observatory staff hopes to be able in the near future to construct a 40-inch reflecting telescope somewhere outside the city.

The present telescope is a "refractor." This means it is constructed on the same principle as those with which everyone is familiar. The reflector type, on the other hand, is built around a concave mirror which reflects the light from distant stars into an eyepiece for observation. The reflector is a better type for many reasons, one of which is that it can be built in larger sizes than refractor types at the same cost.

The present observatory, which was built on a grant from Cadwallader Washburn, a former governor of Wisconsin, will then be used exclusively for teaching. In addition to the advanced technical instruction, Prof. Huffer is setting up at Wisconsin, introductory courses in astronomy which will be directed toward giving a broad, cultural understanding of the subject rather than a preparation for those who intend to pursue astronomy as a career.

#####

University of Wisconsin News Service
(Date)

DEC 1 5 1948

Madison News
Times, Jnl, Card

~~Madison, Wis.~~ -- Charles M. Huffer, associate professor of astronomy, and Prof. A.E. Whitford, director of Washburn Observatory, will represent the University of Wisconsin at the 80th annual meeting of the American Astronomical Society, to be held Dec. 28-31 at Yale University.

Prof. Huffer is secretary of the council of the society. Both he and Prof. Whitford will ~~also~~ deliver scientific papers at the meeting. Prof. Huffer's is entitled "The Variation of the Period of RZ Cassiopeiae," and Prof. Whitford will talk on "Colors of Elliptical and Spiral Nebulae in the Corona Borealis Cluster."

(30)

WIRE NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

3/1/49

RELEASE: Immediately

Washburn Observatory

Madison, Wis.--A discussion of the possibility of life on other units of our solar system will set the stage for the annual meeting of the North-Central region of the Astronomical league, in Madison Apr. 2, it was announced today by Dr. C. M. Huffer, of the University of Wisconsin astronomy staff, chairman of the event.

The topic, "Is There Life on Other Worlds?," will be given by Sir Harold Spencer Jones, astronomer royal of England. He will speak at 8 p.m. Apr. 1 in room 272, Bascom hall.

Dr. Huffer said that Saturday, Apr. 2, had been selected for the league's annual gathering to take advantage of the scheduled lecture by Sir Harold.

Saturday sessions will include a discussion of photoelectric work of the Washburn observatory on the University campus by Dr. Albert E. Whitford, director, and reports by member societies of the league, Dr. Huffer said.

Formal sessions will end Saturday night with a banquet for participants. The dinner program will feature the complete, official, color moving pictures of the planning and building of the 200-inch telescope recently installed at Hale observatory on Palomar mountain in southern California, Dr. Huffer declared.

###

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

3/30/49

RELEASE: Immediately

Washburn Observatory

Madison, Wis.--A phenomenon, last observed in December, 1945, will darken the heavens again the night of Apr. 12, when there will be a total eclipse of the moon, Dr. Charles M. Huffer, of the University of Wisconsin astronomy department, revealed today.

The Apr. 12 eclipse is the first of three which will take place within a year and one-half, rapid succession in terms of astronomy. The second total eclipse will occur Oct. 6, and the third on Sept. 25, 1950, Professor Huffer revealed.

The beginning of the Apr. 12 eclipse will be preceded by slight darkening at 7:31.6 p.m. as the earth's shadow begins moving between the moon and the sun, Dr. Huffer said.

The eclipse will begin at precisely 8:27.7 p.m. and will become total at 9:28 p.m., the astronomer said. The total eclipse will end at 10:53.8 p.m., the eclipse will end at 11:54.1 p.m., and darkening will end at 12:50.3 p.m.

"The earth's shadow on the moon will appear curved and the eclipse will begin on the southeastern edge. There will be marked contrast between the bright and dark parts of the moon. During the total eclipse the moon still will be visible but will be a dull reddish color," the astronomer said.

-more-

ad one--eclipse

"This is due to the fact that the earth's atmosphere filters out the blue light but allows the red light to get through," Huffer explained.

The professor said that field glasses will offer good optical assistance to view the eclipse.

Dr. Huffer pointed out that two eclipses of the sun must take place somewhere on the earth each year but such is not the case for eclipses of the moon, since a year may pass without a moon eclipse.

During an eclipse the temperature on the moon drops rapidly and severely, the astronomer said. As an example, he noted that during a 1927 eclipse of the moon the temperature, measured by radiation, was observed to have fallen more than 300 degrees. This is because the moon has no atmosphere and thus absorbs and loses heat readily, Dr. Huffer explained.

###

WIRE NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

4/8/49

RELEASE: Tuesday, April 12

Washburn Observatory

Madison, Wis.--Tonight the western hemisphere will have a ringside seat for a total eclipse of the moon, the first since December, 1945.

In this part of the world, both the beginning and the end of the eclipse will be clearly visible, according to Dr. Charles M. Huffer, of the University of Wisconsin astronomy department.

Tonight's eclipse will usher in a series of three total eclipses of the moon. The second will occur Oct. 6, and the third on Sept. 25, 1950, Dr. Huffer announced.

Tonight's eclipse will begin at 8:27.7 p. m. However, slight darkening will be noted at 7:31.6 p. m. The eclipse will become total at 9:28 p. m. and continue until 10:53.8 p. m. The eclipse will be over at 11:54.1 p. m., and darkening will end at 12:50.3 p. m., the astronomer said.

During the eclipse the moon still will be visible but will be a dull reddish color, he revealed. He said you can see the show with the naked eye--but you'll get a better look at it with binoculars or a telescope.

#

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/25/50

RELEASE: Immediately

File

Madison, Wis.--Astronomers--not historians--are studying some of the most ancient history known to man--a history to be read only in the cold wink of the stars on these clear fall nights.

And at the University of Wisconsin's Washburn observatory--now 72 years old--that "cold wink" is being translated by amazingly sensitive photoelectric devices into intelligible facts concerning events which took place millions of years ago at unimaginably great distances across space from the earth.

For the approximate speed of light is some 186,000 miles per second, and the light from the most distant of the observable stars has taken a billion years to come to the end of its journey in an astronomical telescope.

Washburn observatory on the Wisconsin campus is one of the world's better-known small observatories, a fact which in part stems from the photoelectric devices Prof. Joel Stebbins, now emeritus, adapted to measure the intensity and color of the light coming from the heavens.

"Over the years we have improved the photoelectric equipment," say Prof. C. M. Huffer and Director A. E. Whitford, "and its advantages are now being recognized as similar instruments are coming into use throughout the world for analyzing starlight, a job impossible with the unaided eye, and difficult, if not impossible, with photographic equipment."

-more-

All of the stars are at such great distances that all appear as points of light even in the most powerful telescopes. Differences of intensity and color enable astronomers to judge size, temperature, and distance.

"Stars vary so greatly in intensity," says Whitford, "that comparing the faintest to the brightest is like measuring the breadth of the U. S. with a two-inch ruler."

One thing astronomers hope to learn from measuring intensity of the light from the stars is how long stars can continue to burn--and whether the universe will some day die away like the burned-out stump of a candle.

"It is clear, for one thing, that there are 'spendthrift' stars," Whitford points out. "For instance, Rigel and the belt stars in the constellation Orion are examples of supergiant stars which burn at a rate a thousand times faster than our sun--which is another star, and one not unlike thousands of others in the universe."

Astronomers know that blue stars are the hottest. One of the puzzles modern astronomers have had to solve is why some very hot stars do not shine with as blue a light as they apparently should.

"The answer," Professor Whitford says, "evidently lies in the fact that dust and gases in the space between stars in our galaxy filter some of the light as fog obscures a streetlight or a dusty atmosphere dims and reddens the setting sun."

How the dust and gases draw together to form burning stars such as the "spendthrifts" which are younger than the sun is a problem theorists are now working on, Whitford says.

The Milky Way, which can be seen any clear night, is the galaxy to which the earth belongs. A neighbor galaxy is in the constellation Andromeda. If the Milky Way and Andromeda were the size of dinner plates they would be about 10 feet apart.

-more-

"And beyond our neighbors there are millions of more remote galaxies," the Washburn astronomers explain. "They appear as tiny smudges in the field of view of our telescopes, and they exist as far out in space as astronomers have so far been able to penetrate."

And what are the chances of other galaxies existing beyond the observable limit? Even with the new 200-inch Mt. Palomar telescope in California, the outer edge of the universe--if there is one--has not been reached.

By using the color-detecting instruments the Washburn astronomers have come upon a major astronomical mystery. Distant galaxies are found to be considerably redder than nearby ones, and there appears to be no dust or gases in the cold space between galaxies to account for the fact.

By using an instrument known as the spectroscope, astronomers found years ago that these same galaxies appeared to be rushing away from the earth and from one another at speeds up to 25,000 miles per second--indicating that the universe is expanding, blowing up at a tremendous rate of speed.

"Another plausible suggestion," says Whitford, "is that we are seeing an earlier stage in the life of galaxies. As we look out into space we are looking backward into time. Perhaps in that earlier day there were more cool red stars everywhere--stars which have since burned out and died and have not been replaced. Their loss makes the nearby galaxies--which we see as they are now--bluer than the distant ones. We are observing, in other words, the slow process of stellar evolution."

Although the fifteen and one-half inch Washburn telescope is now far from the front line of astronomical research--it was once the third largest in existence--it is being used on every clear night for further study of the intensity and color of the stars. Professor Huffer has recently completed a five-year project with the variable or "twin" stars--which revolve around one another--and has obtained valuable information on their size, mass, and density.

-more-

Because of the limitations imposed by the small lens of the Washburn telescope, Professors Huffer and Whitford frequently also use the facilities of other observatories in their work. Professor Huffer recently returned from the East where better computing machines are available and Whitford spent the summer at Mt. Wilson, using the 100-inch reflecting telescope with the Washburn photo-electric equipment attached.

Although the Washburn astronomers still place it in the realm of "aspiration," some plans have been made for obtaining a bigger telescope, and they hope some day to be able to move to the Madison outskirts where smoke and haze will not impede work as often as in the heart of the city.

When such plans are complete, one of the well-known "work horses" of the astronomical world will be put to pasture, and the telescope that was once one of the world's largest will be used more extensively for student instruction in a field which, more than any other, makes the world seem a small and insignificant spot.

##

CUT LINES

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

File

3/2/51

RELEASE: Immediately

This 600-pound disk of glass will some day mirror the heavens. Purchased by the University of Wisconsin with Wisconsin Alumni Research Foundation funds, it is the first step toward a new 36-inch reflecting telescope to supplement the 71-year-old refractor being used in the UW's [Washburn observatory.] Shown inspecting the pyrex disk, which was poured and annealed in the furnaces of the Corning Glass works, Corning, N. Y., makers of the giant 200-inch Palomar mirror, are University Astronomers A. E. Whitford and C. M. Huffer. The disk will be ground into a concave mirror by Fred Pearson, experienced telescope mirror grinder at the Yerkes observatory of the University of Chicago, located at Williams Bay, Wis. The astronomers estimate at least four months will be required for the job, even though the depression at the center of the mirror will be only six tenths of an inch. The new telescope is needed to continue the work with variable stars and with temperature and other characteristics of stellar bodies which has made the Washburn observatory and its present $15\frac{1}{2}$-inch instrument one of the best-known workhorses of the astronomical world. The present telescope was provided the UW in 1880 by Gov. C. C. Washburn, founder of the observatory.

###

See Pix in astronomy dept file Pix

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

7/6/51

RELEASE: Immediately

Washburn Observatory

Madison, Wis.--A better-than-average summer for displays of northern lights may be in store for residents of the northern portion of the U.S.

This possibility was explained by a University of Wisconsin professor of astronomy, C. M. Huffer, as the result of a noticeable recent increase in sunspot activity.

Northern lights, Professor Huffer points out, are apparently caused by a shower of electrical particles pushed away from an erupting prominence on the sun by the pressure of light.

These particles collide with atoms in the earth's atmosphere near the magnetic pole, resulting in the well-known glow of the northern lights.

Amateur astronomers who want to see a sunspot may have a chance about July 12. An unusually large spot was visible on the surface of the sun beginning June 16, and by June 20 it had crossed the face of the sun and passed out of sight. It may be back, however, about July 12.

"A spot as big as that should come around again," Professor Huffer says, "but there's always the possibility that it will disintegrate before it becomes visible."

Professor Huffer has a good tip for anyone who wants to watch the sun for sunspots--which should be pretty numerous throughout the summer. "Don't try to look at the sun without protecting the eyes," he warns. "A heavily exposed photographic film is one of the best things to look through."

-more-

Sunspots come and go in cycles of some 11 years on the average. The last maximum was in 1947, a year in which northern lights were spectacular. One display continued for five straight nights.

If the sun always followed a regular cycle, this would be a year of fewer spots. The sun, however, is irregular in its cyclic behavior. There have been more sunspots this spring than expected, although still not as numerous as in 1947.

What else can be seen in the summer sky?

Venus is sharing the spotlight with Saturn as the evening star, and both will be visible until late August. Venus is the brightest star in the evening sky, and Saturn ranks next. Jupiter rises about midnight, and by fall will replace Venus and Saturn in the evening sky.

Venus, Saturn, Jupiter, and the earth are four of the sun's planets. Beyond the planet farthest from the sun--Pluto--the next nearest stellar bodies are trillions of miles distant, Huffer says.

On Aug. 11 the annual Perseid meteor shower is expected, and on Sept. 1 a partial eclipse of the sun will be visible to early risers from 5:30 at sunrise until 6:05.

The most easily located constellations in the summer sky will be Hercules, which will be directly overhead, Scorpio to the south, and Lyra, also directly overhead but distinguishable by the bright star Vega.

What will UW astronomers be watching this summer?

The UW Washburn Observatory telescope will be trained, as usual, on twin eclipsing stars and on the hot stars in the Milky Way.

But neither can be seen with the unaided eye, Huffer points out. If you want to see those, you'll have to use a telescope.

####

CUT LINES

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

Commanding one of the finest views on the University of Wisconsin campus and in the entire city of Madison as well, Washburn Observatory, dignified old home of astromonical science at the UW, is another building on a hill; looks toward the blue waters of Lake Mendota; is the traditional goal of campus sweethearts on starlight evening walks.

* * *

Wisconsin, the university, founded in 1849 on lands granted by the federal government for educational purposes, followed the founding of Wisconsin, the state, by less than a year. Widely famed for its beauty, it stretches for six miles along the southern shores of Lake Mendota at Madison, a motley architecture of old buildings and new among venerable trees and the green sweep of hills.

Now launched into its second century of life, ~~and~~ the institution claims teaching as its main function, but maintains strong programs for research and public service. It carries on in a close significant relationship with the people of the state--a relationship known as the "Wisconsin Idea," embodying the ideals of academic freedom, education for all who seek it, and knowledge, not only for its own sake but for practical application to human needs.

With its 10 widely distributed extension centers, the University has a total enrollment of 15,575 students; a strong instructional staff including 1,053 professors and hundreds of instructors, teaching and research assistants, lecturers, and project associates; and a total land area of more than 7,500 acres.

Edwin Broun Fred, a distinguished research bacteriologist, is the UW's 12th president.

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

1/26/53

RELEASE: Immediately

MADISON--Men may dream of reaching the moon, but for Thursday they must be content with a shadow touching it.

The weather being equal, Wisconsin residents will have a chance on Jan. 29 to see a total eclipse of the moon. An eclipse happens when the moon runs into the earth's shadow.

"The satellite will be almost totally eclipsed at moonrise," Prof. C. M. Huffer of the University of Wisconsin's Washburn Observatory announced today and gave the following time schedule which has been computed for the eclipse as seen in the Madison area Thursday evening (Jan. 29):

Moonrise----------------------4:58.8

Beginning of total eclipse----5:04.6

Sunset------------------------5:05.9

End of total eclipse----------6:29.9

End of partial eclipse--------7:40.4

The moon will appear first about 30 degrees north of east with a small portion still illuminated by full sunlight. Within five minutes it will rise completely above the horizon and be in total eclipse. During eclipse it will take on the characteristic reddish color, which, according to the UW astronomer, is caused by bending of the sun's rays as they pass through the earth's atmosphere on their way to the moon.

-more-

ad one--Eclipse of moon

The eclipse may be seen, Prof. Huffer said, either with the naked eye or with a pair of field glasses for closer observation.

Prof. Huffer called attention to the question which thoughtful observers may ask:

How is it that since the earth's shadow is directly opposite the sun, the sun and the eclipsed moon can both be above the horizon at the same time? And he answered the query by pointing out that the earth's atmosphere bends the rays of light from the sun and moon in such a way that each body is raised above the visible horizon by an amount equal to the diameters of each. Thus instead of being 180 degrees apart during total eclipse, the moon and sun will be separated by only 179 degrees.

This phenomenon occurs every full moon, but this eclipse is a very special full moon with the satellite passing completely through the earth's shadow. Lunar eclipses do not occur every year, but there may be as many as three total or partial eclipses of the moon in a single calendar year.

"1953 will produce two eclipses of the moon, both total, but only one will be visible in Wisconsin," Prof. Huffer said.

He anncunced that Washburn Observatory will be open to UW astronomy classe and members of the Madison Astronomical Society for the Thursday evening event, but he regretted space did not permit extending invitations for observation to the general public.

##

WIRE NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

2/19/53

RELEASE: Immediately

MADISON--Members of a University of Wisconsin astronomical research team which left Madison last month for South Africa have arrived on the Dark Continent and have already begun a study to learn more about the structure of the Milky Way.

The scientists, Prof. Arthur D. Code and Research Asst. T. E. Houck, have set up their instruments at Capetown and started observations, according to word received this week by A. E. Whitford, director of the UW's Washburn Observatory and of the African research.

The Milky Way, which the average skygazer knows as a broad flat band of light stretching across the sky, is described by astronomers as actually a thin disc-shaped great cloud of stars with curved arms, the whole resembling a gigantic pinwheel.

All study of the structure of the Milky Way is handicapped by the fact that the earth lies within the Milky Way, but studies in the Northern Hemisphere are especially handicapped becaused in northern latitudes the equatorial bulge of the earth hides from view some of the most vital parts of the Milky Way.

Under the more favorable circumstances to the south, the UW scientists will attempt to learn more about the inner or hub portion of the Milky Way by determining accurate distances of the blue super-giant stars in that direction.

In addition to special equipment brought from the States, the Wisconsin men will have the instruments at Cape Observatory, Capetown, and Radcliffe Observatory, Pretoria, at their disposal.

-more-

ad one--Astronomical Research Team

The expedition, financed by the National Science Foundation, developed out of initial research carried on by the UW's Washburn Observatory, the University of Chicago's Yerkes Observatory, and the Warner Swasey Observatory of Case Institute.

##

University of Wisconsin News Service <u>Release Wednesday Sept. 11 Morning and After:</u>

Madison, Wis., Sept. 10: International co-operation is advanced and Irish and American astronomy will take significant steps forward in the next decade as a result of work with a powerful new type of telescope to be erected in South Africa and operated jointly by the governments of Eire and North Ireland and by Harvard University. Construction of a Baker-Schmidt telescope, the first astronomical camera of its kind, has already begun. The instrument will be located at Harvard's southern hemisphere station near Bloenfontein, South Africa, and operated by both Irish and American astronomers.

The completion of negotiations with Prime Minister Eamon de Valera and the Archbishop of Armagh was announced here Tuesday night by Dr. Harlow Shapley, director of Harvard Observatory. He spoke Tuesday night at the dinner meeting of the American Astronomical Society, of which he is president, and which is meeting at the University of Wisconsin. Just prior to the meeting he had received from Dr. Eric Lindsay, director of the archbishopric observatory at Armagh, a cablegram reporting the full concurrence and participation of the two Irish governments in the plan.

The Baker-Schmidt telescope is the design of Dr. James G. Baker, of Harvard, and is an adaptation of the well-known Schmidt-type telescope, now in operation at such observatories as Mount Palomar in California, Case School of Applied Science at Cleveland, and the Mexican National Astrophysical Observatory in the state of Puebla. The Mexican instrument was established as the result of co-operative efforts between Harvard astronomers and the Mexican government.

The program of the Irish observatories supporting the new plan will comprise principally problems of the nature and distribution of

(more)

of stars in the Milky Way, based on studies of photographic plates taken with the new instrument. The southern part of the sky, which may be very favorably observed from South Africa, includes portions of the Milky Way inaccessible to northern telescopes.

First discussion of the plan took place between Prime Minister de Valera and Dr. Shapley when the latter was on his way to a meeting of the International Astronomical Union at Copenhagen in March of this year. Astronomy has long been a field of science in which international co-operation has been practiced, astronomers of various countries observing and computing side-by-side at large observatories and on expeditions. Dr. Lindsay, who is carrying on active work at Armagh, is himself a former observer at Harvard's Bloenfontein station. The arrangement marks the revival of the presently dormant Dunsink Observatory at Dublin, famous for its contributions to 19th-century astronomy.

Schmidt telescopes are large astronomical cameras which employ one or more mirrors and a thin lens or correcting plate, and cover perfectly an area of the sky more than 100 times that of the ordinary reflecting telescope, no matter how large the latter may be. Very short exposures, astronomically speaking, enable rapid photography with fine definition of large fields of faint stars and nebulae.

The new telescope will be constructed by the Perkin-Elmer Corporation, of Glenbrook, Conn., and mounted on the piers and cross axes of a now outmoded instrument already operating at the South African station. Its optical parts will consist of a correcting plate 30 inches in diameter, a 36-inch pyrex primary mirror, made by the Corning Glass Works, Corning, N. Y., and a 16-inch secondary mirror. The focal length will be 120 inches.

###

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/23/52

RELEASE: Immediately

(PICTURE AVAILABLE)

MADISON--"You can't see the Milky Way for the stars".....

That's an astronomer's version of the old dilemma--"you can't see the forest for the trees." It's also the reason behind an expedition to South Africa, some 9,000 miles distant from the University of Wisconsin campus, which two scientists will make this coming February.

The scientists are Prof. Arthur D. Code and Research Asst. T. E. Houck, both of the UW's Washburn Observatory staff, and the thing they are going to study is the structure of the Milky Way.

The M.W., identified by casual observers as a broad flat band of light stretching across the sky, is actually a thin disc-shaped great cloud of stars with curved arms, the whole resembling a gigantic pinwheel.

Astronomers have successfully photographed other great spiral systems of stars--spiral galaxies--but have not been so successful in interpreting the photographs of our own Milky Way system because "the earth is a tree within the forest."

"We are imbedded in the middle of it," Prof. A. E. Whitford, director of Washburn Observatory, explains. And observers in the Northern Hemisphere especially are handicapped because some of the most vital parts of the Milky Way can never be seen at this latitude---the equatorial bulge of the earth hides them from view.

Until very recently astronomers had not been able to mark out the stars that outline the bright pinwheel arms of the Milky Way. However, in a recent cooperative study carried on by the UW's Washburn Observatory, the Warner Swasey Observatory of Case Institute of Technology, Cleveland, and the University of Chicago's

-more-

Yerkes Observatory, Williams Bay, Wis., progress was made. For the first time parts of two spiral arms were clearly discerned by Dr.W. W. Morgan of Yerkes and he located our sun along the edge of one of the parts.

The Wisconsinstudy in South Africa, developing out of the co-operative pioneering, will be directed by Prof. Whitford at Washburn with Dr. Morgan as consultant.

From vantage points in the Southern Hemisphere Code and Houck will attempt to learn more about the inner or hub portion of the Milky Way by determining accurate distances of the blue super-giant stars in that direction. (Examples of blue super-giants visible in the Northern Hemisphere are the belt stars in the constellation Orion.)

They will have with them special instruments brought from the States including photo-electric equipment for measuring the color and brightness of the stars, and a special wide-angle camera for filter photographs. They will also have at their disposal the instruments at Cape Observatory, Capetown, and at Radcliffe Observatory, Pretoria. The 74-inch Radcliffe reflector is the largest telescope in the Southern Hemisphere.

The expedition will be financed by the National Science Foundation.

##

WIRE NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/15/52 RELEASE: Immediately

MADISON--The eye-witness information which the University of Wisconsin's Washburn Observatory has been receiving from Wisconsin people who saw a brilliant meteor streak across the sky at 10 p.m., Saturday, Sept. 27, is being put to good use, Prof. A. E. Whitford, director of the observatory, announced today.

The data received is being turned over to Prof. C. C. Wylie of the University of Iowa, who is correlating it with reports from other states to calculate an accurate path of the meteor. Wisconsin data alone is inadequate to determine the path, Prof. Whitford said.

Observers from Waupaca to La Crosse and as far south as Lancaster all agreed that the meteor was nearly due west when it faded out.

Reports from states to the west of Wisconsin indicate that the meteor ran over a wide area in northern Wisconsin and burned itself out over eastern South Dakota.

A rumble like thunder was heard in Vermillion, S. D., where the end of the path was still to the west. The height at disappearance was about 50 miles, the UW astronomer said.

##

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

3/31/53

RELEASE: Immediately

Washburn Observatory

MADISON--Look up as well as out for signs of spring....

The sky has its own beautiful recurring patterns for the vernal months, and here are some tips from University of Wisconsin astronomers on easy-to-find objects in it.

The planet Venus--one of the nine cold bodies including the earth which travel around the sun--has been for some weeks a dazzling white, bright object in the western sky in the twilight and early evening hours.

Shining as all planets do by reflected light from the sun, it goes around the sun on a smaller radius than does the earth, making the complete circuit in seven and one half months. The earth takes 12 months to go around. Every 19 months Venus gains a lap, the UW scientists point out, and passes the earth. At this time of passing, the planet, because of its nearness to the earth, appears most brilliant to us.

In early April Venus will rapidly sink into the twilight, becoming invisible as it passes between us and the sun. By the end of the month it will appear in the dawn sky and will be very bright in May.

Jupiter is another bright planet in the spring sky, not far above Venus in the west and near a little group of six faint stars called the Pleiades. Largest of all the planets--10 times as large as the earth--it is much farther away than Venus--something like 500 million miles at present. The men at the UW's Washburn

-more-

Observatory suggest that owners of eight-power binoculars try them for a closeup of the planet and its four bright moons which circle it. As the spring advances the planet will set earlier but will be visible into May.

Stars, unlike planets, shine by the light of their own burning. They are like our sun, balls of intensely hot gas, some as much as a million miles in diameter, and all far more distant from the earth than the planets.

Sirius, called the dog star, is the brightest of these suns. White in color, it swings down through the southwest sky in the early evening and will be setting earlier each evening as the spring advances.

Vega, the second brightest star, is rising in the northeast to take the place of Sirius.

Orion, a striking constellation which has dominated the southern sky through the winter, will be with us for another month, and is moving further and further into the west as spring comes on. At the upper left in the constellation grouping is the reddish star Betelgeuse, and in the lower right, bright bluish Rigel. These are stars easily seen with the naked eye, but for detail viewing of the belt stars in Orion, the Wisconsin scientists again suggest use of the eight-power binoculars.

They point out that the belt stars, though 1,600 light years away from the earth, can be seen from this great distance only because of their intense luminosity. They shine each with the light of 50,000 suns and are burning so fiercely they will have burned themselves out in a few million more years.

Our old friend the Big Dipper is always in the sky, circling about the Pole Star. Look for it now in the northeast, the Wisconsin astronomers suggest, where it is swinging higher and higher and by mid-evening in April will be seen inverted above the Pole Star.

-more-

ad two--spring skies

Look for bright orange star Arcturus and bluish white Spica along the curve of the Dipper handle in the east and the southeast respectively. To the left of Spica and about equally bright but yellower is the planet Saturn.

Cassiopeia, the W-shaped constellation opposite the Big Dipper across the Pole Star, is low in the northwest and will be scraping the northern horizon by late spring, the Wisconsin astronomers say.

####

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

6/15/53

RELEASE: Immediately

MADISON--Prof. Joel Stebbins, director emeritus of the University of Wisconsin Washburn Observatory, will receive the honorary degree of doctor of laws Friday from the University of California at Berkeley, the UW announced today.

Considered one of the country's leading astronomers, Prof. Stebbins retired from the UW staff in 1948. He has since been research associate at the University of California Mount Lick Observatory at Mount Hamilton.

During his 25 years at Wisconsin Dr. Stebbins conducted pioneer research in electrical measurement of star light. In co-operation with UW Profs. A. E. Whitford, C. M. Huffer, and H. L. Johnson, he helped expand findings in the field of photometry and automatic methods of stellar computations.

In 1950 Stebbins received the gold medal award of the Royal Astronomical Society of London, becoming one of the few American astronomers to be so honored.

The retired UW professor was born in Omaha and was graduated from the University of Nebraska in 1899. After receiving his Ph.D. from the University of California in 1903, he taught at the University of Illinois for the next 19 years. Stebbins came to Wisconsin's Washburn Observatory in 1922, where he served as director until his retirement at the age of 70. He was succeeded in the post by the Observatory's present director, Prof. A. E. Whitford.

Prof. Stebbins will be the second Wisconsin faculty member to receive an honorary degree this month. On June 13 the University of Michigan conferred the degree of Doctor of Letters on Prof. Einar Haugen, chairman of the UW department of Scandinavian languages.

-more-

The citation presented at the Michigan commencement lauded Prof. Haugen for his interpretive studies of Norse language and literature in America, calling him "an ambassador between nations."

Prof. Haugen was born in 1906, graduated from St. Olaf College in 1928, and received his M.A. and Ph.D. from the University of Illinois. Since 1931 he has been chairman of Wisconsin's department of Scandinavian languages.

A member of the Oslo Academy of Science, Prof. Haugen has published numerous books and articles on the Norwegian language as well as a study of the Norse explorations in America, "Voyages to Vinland." He is a past president of the Linguistic Society of America, and is well known for his lectures and broadcasts on Scandinavian topics.

####

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

5/18/53

RELEASE: Immediately

MADISON--The scientists are going to take the stars into the laboratory at the University of Wisconsin with the location of a classroom planetarium on the Madison campus, the University announced today.

Prof. A. E. Whitford, director of Washburn Observatory, explained that equipment for the planetarium--a hemispherical indoor "sky" and a projector--will be installed during the summer months in the former Art Education Building near Science Hall and will be ready this fall for use as a teaching aid to astronomy students.

It will require a room 16 feet high to accommodate the installation. The "sky" canopy will measure 20 feet in diameter and will permit some 50 people to be seated comfortably in concentric circles beneath it.

"Astronomy students have not been able to take the things they were studying into the laboratory for examination," the Washburn director said. "Therefore they haven't had as much done for them in the way of laboratory or demonstration equipment as has been done for students in other sciences."

The projector will flash images of naked-eye stars on the overhead rounding surfaces of the synthetic sky. It will be capable of showing such things as the daily rotation of the stars about Polaris, the variation in the length of winter and summer days, the sky as seen from the North Pole or from the Southern Hemisphere where celestial objects like the Southern Cross and the Magellanic clouds, never seen in Wisconsin, are prominent.

-more-

ad one--astronomy department

The planetarium, which can "produce" any sky season or latitude, realizes a long-felt need in the UW astronomy department, Dr. Whitford said. Though it is greatly reduced in size, complexity, and cost as compared with the large installations in places like New York, Chicago, and other major cities, the new UW possession will be capable of demonstrating most of the phenomena of the skies.

"We run into long stretches of cloudy weather in the winter when the real sky cannot be studied," Prof. Whitford declared. "Classes will be able to use the synthetic one to learn constellations, to see the motions of the stars on a greatly accelerated scale.

"Furthermore, those imaginary lines by which we measure the positions and motions of the stars can be shown as visible lines projected on the canopy."

This direct three-dimensional demonstration will help students over one of the traditional stumbling blocks of astronomy, Whitford pointed out.

The public is also going to have a chance to use the planetarium. Prof. Whitford announced there will be regularly scheduled times set aside for students who are not studying astronomy and for members of the community to see demonstrations of planetarium workings. The open hours will be co-ordinated with events in the real sky during each season. This is an extension of the department policy of making the Washburn Observatory telescope available to the public for two nights out of each month.

Minnesota, Indiana, Michigan, and Ohio State Universities already maintain planetariums as regular parts of their teaching equipment.

####

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

9/24/53

RELEASE: Immediately

MADISON, Wis.--Now they "can see the Milky Way in spite of the stars.

"We got what we set out to get," University of Wisconsin Astronomer Arthur D. Code, just returned to the Madison campus from South Africa and a six-month study of the structure of the Milky Way, declared today. "We do have some pictures now where we 'can see the forest in spite of the trees.'"

The Milky Way, observed by the average man, appears as a broad, flat band of light across the night sky, but it is known by the experts to be actually a thin, disc-shaped great cloud of stars with curved arms, a kind of giant pinwheel.

Astronomers have photographed other great spiral systems of stars such as this, but they have been less successful in photographing and interpreting the Milky Way because it is our own galaxy.

"The earth is imbedded in the middle of it," Prof. A. E. Whitford, director of the UW's Washburn Observatory and director of the research, explained last January when Prof. Code and Research Asst. T. E. Houck were readying for the trip to South Africa.

In the Northern Hemisphere, he pointed out, only part of the Milky Way can be seen because the equatorial bulge of the earth hides some of the most vital parts from view. In Africa, however, the team could study this important gap.

Armed with special instruments including photo-electric equipment and a wide-angle camera, the UW scientists left Madison last February and "set up shop," 9,000 miles from the home campus: at the Royal Observatory in Capetown, again at the Radcliffe Observatory in Pretoria, and also at Boyden Station at Bloemfontein.

-more-

Their object was to learn more about the hub or inner portion of the Milky Way as well as about the outline of the galaxy's spiral structure. (This was an extension of a recent pioneering study in which Wisconsin co-operated and which clearly discerned parts of two spiral arms and located our sun along the edge of one of the parts.)

"Around the neighborhood of the sun, half the matter of our Milky Way is in the form of dust and gas," Prof. Code explained. "The other half consists of stars." The dust and gas was a detriment to good photographs, but with the team's wide-angle camera equipped with infra-red plates, much of the obscuring matter was penetrated.

Charting the outline of the spiral arms was done by measuring the accurate distances from the earth of the blue super-giant stars which occur only along the arms and which are restricted very much to the plane of the galaxy.

"We have the material now to sketch out the arms of our own galaxy," Prof. Code concluded, "but the work won't be ended until all observations are reduced or analyzed." Then he added: "We suspect that on this phase we'll be working for a good number of months."

Prof. Code has resumed his campus teaching duties this fall. Research Asst. Houck is still in Africa, mopping up details of the expedition which was financed by the National Science Foundation. Dr. W. W. Morgan of the University of Chicago's Yerkes Observatory, Williams Bay, Wis., is serving as consultant to the study.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

9/24/53

RELEASE: Immediately

MADISON--The newly-completed University of Wisconsin Planetarium will be utilized in a UW Extension Division evening special class, "Survey of Astronomy," scheduled to begin Monday (Sept. 28). The announcement was made today by Dr. Charles M. Huffer, professor of astronomy at the University and instructor for the course.

According to Prof. Huffer, the use of the planetarium, located in the Journalism Building, will facilitate the study of the solar system and the galaxy of stars.

Also available to the class is the UW's 15 and one-half inch telescope at Washburn Observatory, through which can be seen the light from stars a million trillion miles away in space.

The three-credit special class will include the same curriculum prescribed for the UW's regular "Survey of Astronomy" course. Among the subjects covered will be the physical apparatus required for astronomical research; methods of locating stars and constellations; the solar system, including the physical nature of the sun, moon, and planets; the arrangement and physical nature of the stars; and modern theories of the universe.

Prof. Huffer, a student and staff member at the UW for 31 years, received his doctorate here in 1926. Previously he had studied at Albion College and the University of Illinois, and from 1917 to 1922 worked at the Lick Observatory's southern station in Santiago, Chile.

-more-

ad one--Huffer

The professor, who has done extensive research in the field of photo-electric studies of variable stars, is secretary for both the American Astronomical Society and the Madison Astronomical Society. He is also a member of the American Association for the Advancement of Science and the Madison Technical Club. Last year Prof. Huffer was official delegate for the U. S. at the annual General Assembly of the International Astronomical Union at Rome, Italy.

The fall semester special class will meet on Monday and Wednesday evenings at 7:30 p.m. Prerequisites are one year each of high school algebra and geometry, and the fee is $27 for the semester.

Enrollment may be made in 203 Extension Building, or by telephoning 5-3311, extension 4628.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/8/53

RELEASE: Immediately

MADISON--Prof. Arthur D. Code of the University of Wisconsin astronomy department will deliver a lecture at Chicago's Adler Planetarium on Sunday, Nov. 8.

Speaking before the Burnham Astronomical Society on "The Galaxy As a Spiral Nebula," Dr. Code will present the historical approach to his subject with special emphasis on results obtained by the UW's Washburn Observatory expedition to Africa.

The studies in Africa, from which Code returned this fall, have brought more knowledge about the previously little-known structure of the Milky Way, the spiral galaxy of stars to which the earth itself belongs.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/21/53

RELEASE: Immediately

Observatory, Washburn

The weekly demonstration of the University of Wisconsin's new planetarium to which the public is invited will be given again on Friday evening, Oct. 23, in Journalism Hall.

The lecture and demonstration of the synthetic sky and stars at 7 p.m. will be repeated at 8 p.m. The subject will be "Autumn Skies."

Tickets for the event may be obtained in advance from the Information Booth at the Langdon Street entrance to the Memorial Union.

Entrance to the planetarium is through the Observatory Drive door in the east wing of Journalism Hall.

####

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

11/12/53

RELEASE: Immediately

MADISON--Things are going to be hot at the University of Wisconsin's Washburn Observatory--too hot to risk the best instruments.

When the planet Mercury comes between our earth and the sun on Saturday morning, UW astronomers will be on hand to witness the transit, but they won't be using the 15-inch old "workhorse" of Washburn.

Mercury is the smallest of the planets, the sun is large, and the focussed rays from it might break an eye-piece. The scientists will use instead the six-inch student telescope in the small building east of the observatory. Being smaller, it will present a heat problem about one-seventh as great as the larger instrument, Prof. C. M. Huffer said.

The astronomers won't do much actual observation through the eye-piece either. They'll be content for the most part to look at the image as it is projected on paper.

Good weather is predicted for observation, but this will not affect wide public participation for the event can only be witnessed with the aid of instruments.

Mercury will cross only a section of the sun, beginning on the east side and progressing northwest to come out at the north side. In the Wisconsin area, Prof. Huffer said, the planet will be tangent to the sun's edge at 9:36.7 a.m. and will be completely on the sun at 9:40.3. It will start to go off at 12:06.5 p.m. and will be completely clear of it at 12:12.

-more-

ad one--Huffer

Transits of Mercury have occurred a total of 11 times since 1868. They occur only in November and May, with twice the November transits to the number for May.

The most recent transit was one on Nov. 11, 1940. After the Saturday event, the next one will not occur until May 6, 1957.

The U. S. Naval Observatory will collect accurate observations of the Nov. 14 phenomenon to check on the position of Mercury through times of contact.

Present scientific interest in transits of Mercury centers on the information they give on the irregularities in the earth's rotation. Since the rotation period of the earth on its axis is the standard of astronomical time, these irregularities are problems in accurate time computation.

####

University of Wisconsin News Service   Release Tuesday Afternoon and after:

Madison, Wis., Sept. 10: Evidence in favor of the view long held by astronomers that the moon has no atmosphere was presented here today by Dr. A. E. Whitford, of Washburn Observatory of the University of Wisconsin, where the American Astronomical Society is meeting. This summer, Dr. Whitford made observations with special apparatus attached to the 100-inch reflecting telescope on Mount Wilson in California. He watched the moon as it passed in front of or "occulted" stars.

The immediate disappearance of the pinpoint of light which any star presents as it passes behind the moon during an occultation has long been cited as supporting the theory that the moon has no air. If it did have an appreciable atmosphere, the star's light would be gradually dimmed as it went behind our satellite. However, some astronomers have contended that a very thin atmospheric envelope around the moon would not be detected by ordinary observations with the human eye.

Dr. Whitford's apparatus made possible a refined technique in occultation observations. He employed a principle long known to physicists as the diffraction of light, the moon serving as the edge past which the light of the star passes to form diffraction fringes (light and dark) as much as 30 feet apart. These fringes sweep across the telescope at the moment of obscuration of the star by the moon, their speed about 1,000 miles an hour and their total duration only 1/50 of a second.

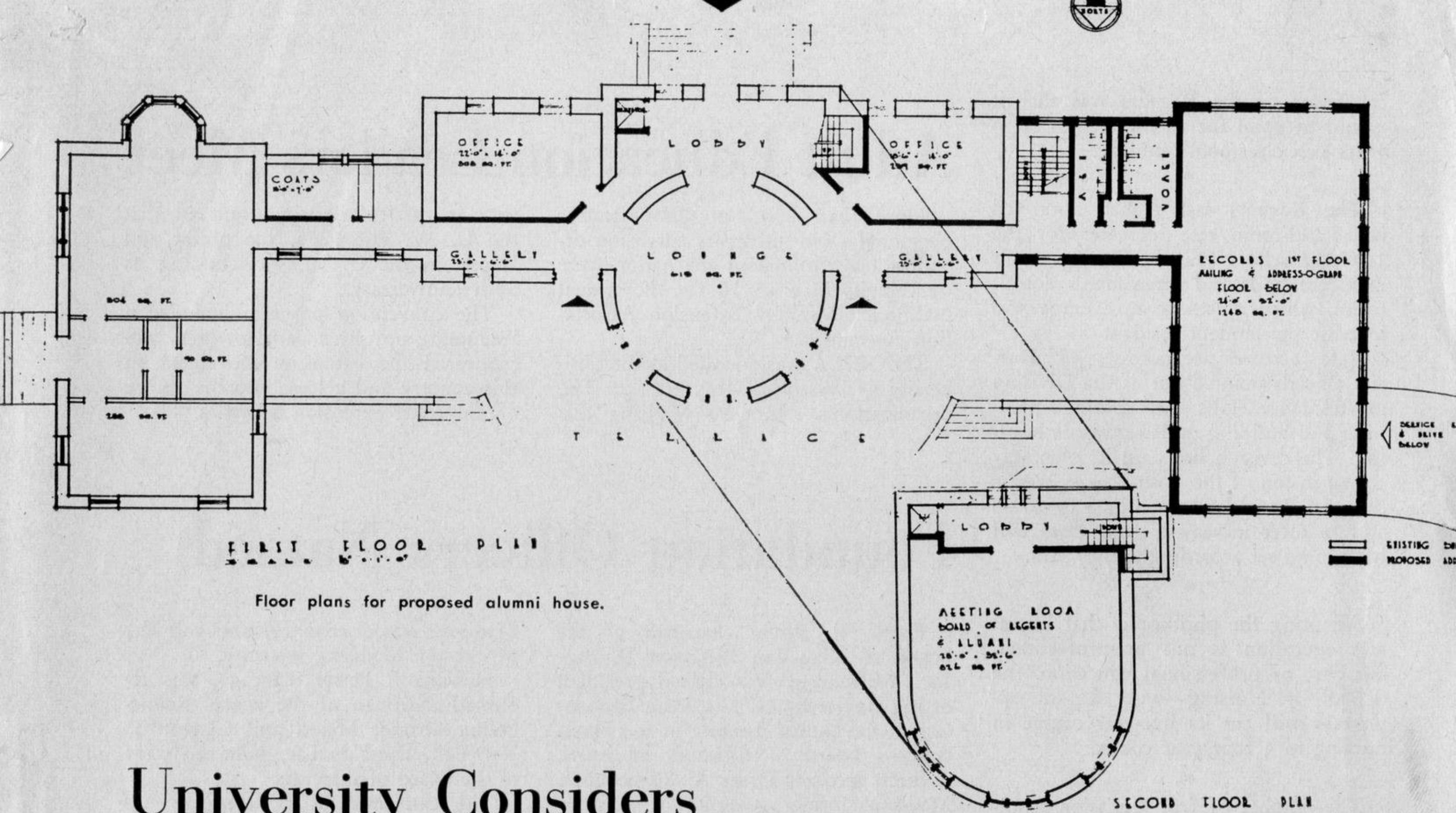
During this brief interval, Dr. Whitford employs a photoelectric cell, oscilloscope, and moving-film camera to measure the fluctuations in light.

(more)

A result of equal importance to the bearing of Dr. Whitford's work on the question of the moon's atmosphere is the successful measurement of the angular diameters of these stars. Even the largest telescope fails to make any star in the sky except the sun appear as more than a point of light. We know the stars are large, some hundreds of times the sun's diameter, but their distances are so very great that their angular diameters become exceedingly small, as demonstrated by Dr. Whitford's results.

The largest angular diameter of any star measured by this method was 1/120 of a second of arc, equivalent to the apparent size of a pea at a distance of 75 miles. Close agreement with theoretical predictions confirmed the belief that the moon has no atmosphere. Even a trace of lunar air would have hopelessly blurred the diffraction fringes.

###



Floor plans for proposed alumni house.

University Considers Observatory As Site Of Alumni House

HISTORIC WASHBURN Observatory—will it play a part in the realization of a long-standing alumni desire for an Alumni House, a hearth for the University family?

Last month the Regents referred a Wisconsin Alumni Association request for use of the building to the University Campus Planning Commission for study.

Use of the Observatory, which was built in 1878 as a gift from a former Wisconsin governor, C. C. Washburn, is made possible by a gift from the Wisconsin Alumni Research Foundation for a new observatory. The latter will be constructed west of Madison away from the distracting lights and haze of the city.

Included in preliminary Alumni Association plans is considerable internal remodeling and the addition of a wing (possibly making use of stone salvaged from the razing of Chadbourne Hall) to balance the old structure and provide added space. However, the present "feel" and atmosphere of the Observatory would be retained.

In its presentation to the Regents, the Association particularly stressed the increasing need for alumni records facilities; the enrichment of University–alumni relations made possible by an alumni house as the "home for the Wisconsin spirit"; and the symbolic value of the Observatory itself to alumni, students and faculty.

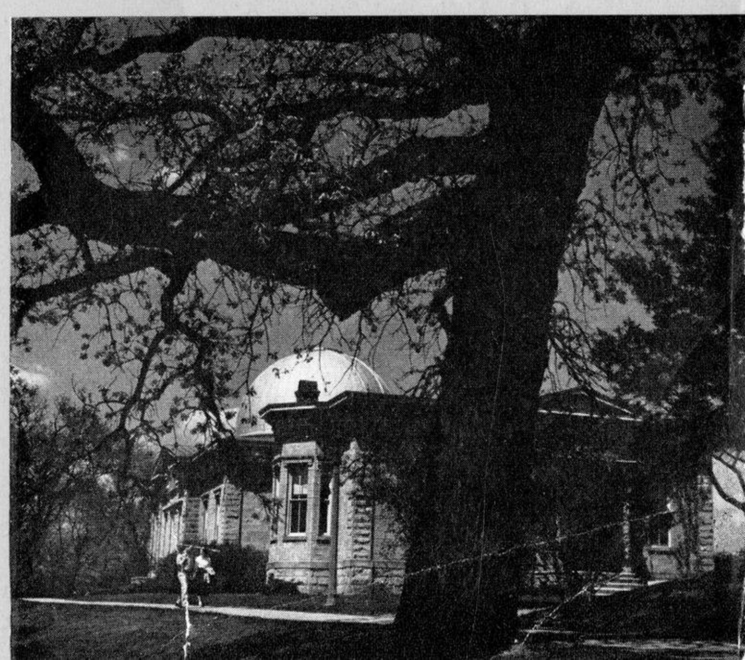
Currently, record-keeping and mailing facilities of the Alumni Association and University alumni records offices are split up, with a loss of efficiency. An Alumni House would also free additional space for the Wisconsin Union.

The Alumni House plans call for a 28 by 32 foot meeting room overlooking Lake Mendota which could be used by both University and alumni groups.

The estimated cost of the remodeling and furnishing will be about $175,000 of which more than $21,000 has already been contributed.

WAA President Gordon Walker pointed out that the beauty and dignity of the present Observatory would be retained and enhanced, and the desirability of turning a building which has become obsolete for present use into a building which will be an important asset for the University.

Observatory Hill holds many memories for Badgers.



consensus of the Regents was that it would be good for another dozen or so years as a classroom building.

*

The Regents last month approved board-and-room rate increases for the 1956–57 school year in four women's residence halls and three men's dormitories, which represent an average $50 increase per student resident.

Rate increases are necessary, University officials pointed out, if the Division of Residence Halls is to continue planning and building under-graduate housing. The division has paid its own way in expansion of the dormitory system in the past. In order to continue to do so and to meet increased costs, rates will have to be set accordingly, they said.

*

Adopting the philosophy that liberal arts education is not pre-professional but part of professional education, the School of Nursing—with Regent approval—will cut its five-year course in nursing to a four year course.

*

The number of free remission scholarships to Wisconsin high school students was raised from a 250 maximum to a 350 maximum figure by the Regents in April.

*

Bob Homme's "The Friendly Giant—II", WHA–TV and nationally televised children's program, won first place in U.S. competition, and another WHA–TV show "Quiz the Professor" received honorable mention.

*

Wisconsin scientists William L. Leosche and Conrad A Elvehjem reported that what was formerly believed to have been an unknown vitamin is instead a matter of protein quality. They were studying mink nutrition.

*

Lafayette H. Noda and Stephen A. Kuby of the Enzyme Institute announced successful crystallization in the test tube of myokinase, an important enzyme in muscle—a substance essential for the mechanisms of contraction.

*

Other Wisconsin enzyme research scientists have worked out the duplication in the test tube of the vital chemical process by which animal tissues produce fat.

*

Orchesis, student creative dance group, has been involved in a lecture-demonstration and concert tour around Wisconsin during the past month.

Adult Education Leaders Meet

More than 200 top administrative personnel from university extension organizations throughout the nation were on campus May 13–16 for the annual National University Extension Association convention.

The NUEA was founded at the University of Wisconsin 41 years ago. The organization's return to Madison this year is particularly significant in that the U. W. Extension, the oldest and largest in the U. S., is celebrating its 50th anniversary.

The convention program included a "summing up" by a panel of men who pioneered the extension movement in this country and a look into the future of university extension activities.

Foundation Officers Named

Frank V. Birch, chairman of the board of Klau-Van Pietersom-Dunlap, Inc., Milwaukee, was elected president of the University of Wisconsin Foundation at the annual meeting of the Foundation's board of directors in April.

Birch succeeds Oscar A. Rennebohm, Madison, former governor of Wisconsin. Rennebohm will continue his activity with the Foundation as a vice-president.

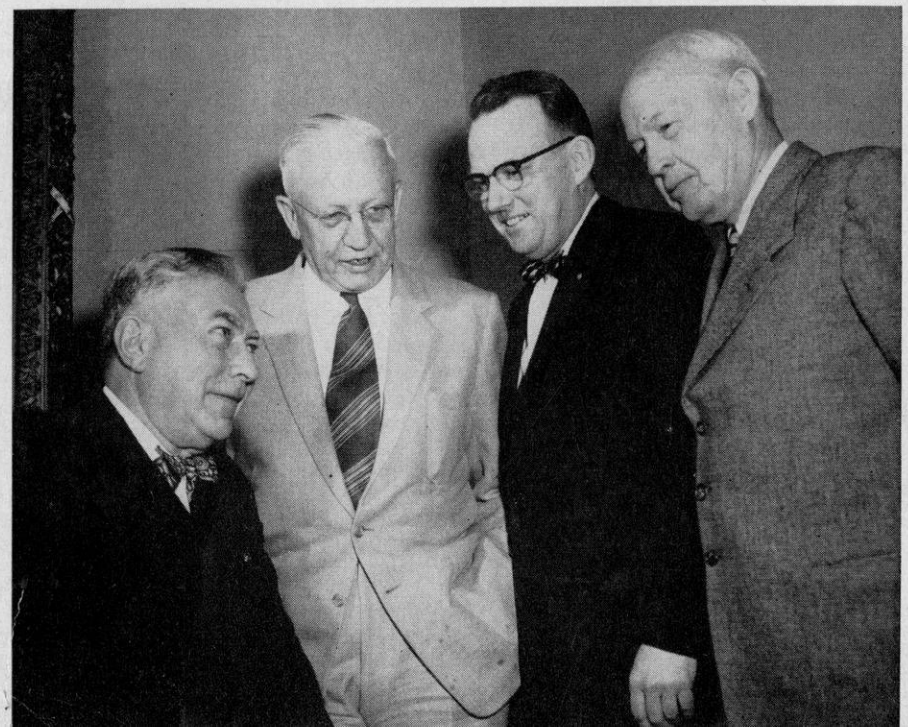
Four other vice-presidents elected were: Irwin Maier, publisher of *The Milwaukee Journal;* George B. Luhman, president, First Wisconsin Trust Co., Milwaukee; Joseph A. Cutler, president of Johnson Service Co., Milwaukee; and William J. Hagenah, Glencoe, Ill. Harlan C. Nicholls, vice-president and cashier of First National Bank of Madison, was elected treasurer and Ray M. Stroud, Madison, secretary.

Howard I. Potter, Chicago, was re-elected chairman of the board. Rennebohm, Stroud, Maier, and Clayton F. Van Pelt, Fond du Lac, were re-elected to the board of directors.

The University of Wisconsin Foundation raises money for special gifts to the university. It was announced at the meeting that the group has raised $3,098,035 of its five million dollar centennial fund drive.

The foundation hopes that its $2,250,000 center building for adult meetings on the university campus will be started this year. The group also supports endowed scholarships and professorships at the University of Wisconsin.

Frank V. Birch, board chairman of Klau–Van Pietersom–Dunlap, Inc., left, has been elected president of the University of Wisconsin Foundation. Others shown are Oscar A. Rennebohm, former state governor and immediate past president of the Foundation; Harlan C. Nicholls, Madison, treasurer; and Ray M. Stroud, Madison, secretary.



WIRE NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

3/26/54

RELEASE: Immediately

MADISON--The University of Wisconsin will be host to the Midwest Group of Astronomers on Saturday, April 3.

The group includes representatives from the Universities of Wisconsin, Michigan, Illinois, Indiana, Chicago, Minnesota, Iowa, and Northwestern University.

Sessions for the annual informal get-together will be held in the UW's Washburn Observatory and the Home Economics Building directly south of there.

Three UW graduate students in astronomy--John Bahng, Seoul, Korea; Kenneth L. Hallam, Indianapolis, Ind.; and Ross Douglas, (522 W. Johnson) Madison, will present papers at the 2 to 5 afternoon meeting in the Home Economics Auditorium.

The professional astronomers who will read papers include Drs. G. Van Biesbroeck, W. A. Hiltner, Adrian Blaauw, and Raymond Hide, British visitor, all from the University of Chicago's Yerkes Observatory, Williams Bay; Prof. Wasley S. Krogdahl, Northwestern; and Prof. Lawrence Aller, University of Michigan.

A 6:15 p.m. dinner scheduled for the visitors in the Memorial Union will have for its guest speaker Dr. George P. Woollard, UW geophysicist, who will talk on "Current Geophysical Problems."

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

4/20/54

RELEASE: Immediately

Though the University of Wisconsin is in spring recess, the weekly public demonstration and lecture at the UW Planetarium will be presented as usual on Friday evening, April 23, Prof. A. E. Whitford, director of the UW's Washburn Observatory, announced today.

Prof. Arthur D. Code will tell the story of the nebulae with the aid of the synthetic sky and stars offering two performances, one at 7 p.m. and one immediately following at 8.

This week's presentation will be the last on the Planetarium's schedule of two performances within the evening. Beginning April 30, the lecture and demonstration will be given only once each Friday night and will start at 7:30 rather than at 7.

####

MADISON NEWS
FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN
4/27/54
RELEASE: Immediately

Prof. A. E. Whitford, director of the University of Wisconsin's Washburn Observatory, has been invited to deliver the McMillin lecture in astronomy at Ohio State University May 7.

The director of Washburn will talk on "Galaxies, Past and Present" when he presents the annual lecture in Columbus, Ohio.

###

WIRE NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN
4/30/54
RELEASE: Immediately

MADISON--A. E. Whitford, professor of astronomy at the University of Wisconsin, has been elected to the National Academy of Sciences, it was announced in New York this week.

Prof. Whitford is the only Wisconsin faculty member to be elected to the academy this year. He joins more than a dozen other Wisconsin professors in membership in what is considered the nation's outstanding scientific group.

Membership in the academy is one of the highest honors the scientific world can bestow on American scientists.

Prof. Whitford is known to the astronomical world as an expert in photo-electric measurements of stars and in development of automatic methods of stellar computations. He has been director of the Washburn Observatory at the University of Wisconsin since 1948.

###

WIRE NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

5/17/54 RELEASE: Immediately

MADISON--The work of University of Wisconsin Prof. A. E. Whitford, director of Washburn Observatory, is included in a new publication of the American Association for the Advancement of Science (AAAS).

"Limits of Sensitivity and Precision Attainable by Photoelectric Methods: Critical Summary and Comparison of Various Techniques" is the title of the UW astronomer's contribution to "Astronomical Photoelectric Photometry."

The photoelectric method of measuring starlight, now used at most major observatories, grew out of pioneering studies done at Wisconsin by Emeritus Prof. Joel Stebbins. Director Whitford was long associated with Dr. Stebbins in this work.

The volume on this newer and rapidly growing method for astronomical study is based on papers presented at a symposium of the 1951 meeting of the AAAS.

Director Whitford was recently elected to the National Academy of Sciences. Membership in the academy is one of the highest honors the American scientific world can bestow upon an individual.

####

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

6/11/54

RELEASE: Immediately

MADISON--When northwestern Wisconsin and other favored points around the world are treated to a total eclipse of the sun on June 30, University of Wisconsin scientists will be prominent among the professionals observing the rare event.

Prof. A. E. Whitford, director of the University's Washburn Observatory, will head a research team of Wisconsin astronomers including Prof. Arthur Code and graduate students John Bahng and Kenneth Hallam, who will set up instruments at Mellen in the northern part of the state.

Dr. J. G. Hirschberg and student Donald Liebenberg of the UW physics department will probably make their observations from a point at Copper Harbor on the top of Michigan's Keweenaw Peninsula.

The Wisconsin scientists say this opportunity for studying the sun and its secrets is most uncommon. A total solar eclipse--one of the most showy displays among sky events--has not occurred in the Wisconsin-Michigan area since 1925 and after the June 30, 1954 event, will not happen again in the area until 2106.

As the moon on its regular route around the earth passes between the earth and the sun, it will cast a great shadow and for some 80 seconds will blot out the sun. Beginning in Nebraska, the shadow will pass eastward. It will cross Wisconsin in the very early morning, darkening a strip in the northwest portion of the state 75 miles wide and centered on a line from St. Croix Falls to Hurley. In this strip--the path of totality--the total covering of the sun by the moon will occur between 5:08 and 5:09 a.m. It will be dark enough, Wisconsin scientists say, to see the brighter stars then.

-more-

The shadow crossing Upper Michigan then, will sweep beyond, over Canada, Labrador, Norway, Sweden, and the USSR before it is last seen by the peoples of Pakistan and India.

When the eclipse occurs at Mellen, Prof. Whitford and his men will be using the rare opportunity to learn more about the sun as a typical star--the only one close enough for detailed study. The sun is a ball of gas diffusing off on the edge into a hazy nothing. Telescopes are not sharp enough to reveal much about this edge, astronomers say.

"We intend to measure with accuracy the light of the extreme edge of the sun," explains Prof. Whitford. "This could never be done without the help of the moon. It will blot out the blaze of the central portion during eclipse, and at any chosen instant will be slicing off a razor-edge bit of the sun for our analysis."

The Wisconsin astronomers, concentrating on this area--the photosphere--will try to learn how the light at each level compares with that at the center of the disc. This information will then reveal how the density of the glowing gases at the outer edges increasesas they go inward.

The observations will be made by photo-electric techniques for the development of which Prof. Whitford and UW Emeritus Prof. Joel Stebbins are noted. A horizontal telescope, photo-electric cells, and automatic recording meters are among the equipment which the Washburn group will take to Mellen.

The Wisconsin physicists at their Michigan station will study atomic spectra.

By adopting a technique, also photo-electric, which Dr. Hirschberg has been developing for laboratory study of spectrum lines, the physicists will examine the light from the inner corona--that portion just outside the edge of the sun. Again, for the physicists, the eclipse will make an ideal situation, covering the billiant sun so that the area just outside the edge can be seen.

-more-

The spectrum lines from the corona were interpreted about 15 years ago, Dr. Hirschberg explains, as atoms in a remarkable state, very highly ionized and at temperatures of two million degrees. The color of the spectrum lines is the key to the physical and chemical make-up of the corona, he points out.

Oddly enough, the temperature at the surface of the sun is a mere 6,000 degrees. Why the corona is so much hotter than the sun itself, and the nature of the atomic nucleus of iron are the mysteries which the Wisconsin physicists will explore.

They will take with them to Copper Harbor five or six hundred pounds of equipment including a delicate spectrograph and an electronic recorder.

Another UW faculty member will also travel north to be in the path of totality for the eclipse. Astronomy Prof. C. M. Huffer, secretary of the Madison Astronomical Society, will be located at Eagle River, Mich., in the Keweenaw Peninsula, with some 15 or 20 members of the capital city's amateur group.

Amateur astronomers will be spotted throughout the northwestern Wisconsin-Michigan area, many of them members of the nationwide Astronomical League. League members will come from all over the United States to witness the event and then will proceed to the UW campus for a three-day meeting, July 3-5.

The meet is sponsored by the UW astronomy department and the Madison society.

####

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

6/16/54

RELEASE: Thursday, June 24

WITH MAP

MADISON--"A once-in-a-lifetime experience...one of the greatest and most spectacular shows that nature can present--"

As they made preparations for viewing the phenomenon from northern vantage points, University of Wisconsin astronomers thus described the total eclipse of the sun which will turn the early morning of June 30 into night in northwestern Wisconsin and bring a morning gloom for much of the state to the south of there.

Not since 1925 has a total solar eclipse occurred in the Wisconsin area, and not until May 3, 2106, will one occur again, Prof. A. E. Whitford, director of the UW's Washburn Observatory, declared. Even for the whole United States, eclipses will be scarce for the remainder of the 20th century. The next one will visit the Pacific Northwest in 1979.

The great shadow which will be cast on the earth by the moon as it passes between us, and the sun will sweep over northwest Wisconsin between 5:08 and 5:09 a.m., June 30, covering a strip about 75 miles wide centered on a line from St. Croix Falls to Hurley. Included in the path of totality (where the sun will be completely blotted out and it will be dark enough to see the brighter stars) will be Hudson, River Falls, Grantsburg, Barron, Cameron, Rice Lake, Spooner, Hayward, Park Falls, Ashland, Mellen, Washburn, Manitowish, and Mercer.

The shadow will begin in Nebraska, where early risers will see the rising sun already under total eclipse; will pass eastward across Wisconsin, Canada, Labrador, Norway, Sweden, the USSR: and will end around the Khyber Pass in India.

-more-

Astronomers and other scientists around the world are setting up equipment along the path of the 1954 eclipse. A team of UW physicists headed by Dr. J. G. Hirschberg as well as Prof. Whitford and the men from Washburn will be among the observers, professional and amateur, who will crowd into the northland to see the spectacle.

The phenomenon is well worth getting up early for and, if necessary, traveling miles to see, in the opinion of Prof. Whitford. This is what he says is in store for the viewers:

"Over most of the area the sun will rise with the moon already biting into its rim. As the time of totality approaches, the sun will be narrowed to a crescent. Then as the last thin line of the sun is covered, the pearly white light of the sun's corona will flash into view.

"For a scant 80 seconds then, until the sun appears on the opposite side of the moon, the sky will be dark enough to see the brighter stars. The partial phases will be repeated in reverse then--and the sun will be completely uncovered by a few minutes after 6 a.m."

The Wisconsin astronomer made these suggestions for the eclipse-minded:

Pick for your station a high spot with an unobstructed view to the north-east--the southwest shore of a fairly large lake is ideal. If you live near the edge of the path of totality as in Ladysmith, Iron River, or Solon Springs and want to be certain of seeing the total eclipse, choose your spot at least 10 miles inside the zone.

Don't use ordinary sunglasses or even heavy welder's goggles for looking at the crescent sun, he warned. These are not sufficient protection against the millions of candlepower light of the sun. Several thicknesses of dense photo-negatives are the best device for the amateur, he said.

If clear skies arrive with the morning of June 30, these are some of the things which viewers will see:

-more-

1. TINY CRESCENTS--as the moon bites away at the sun, outlined on walls or other surfaces, the sun's beams projected through small openings in the tree leaves or buildings;

2. BAILEY'S BEADS--bright beads of light on the edge of the disappearing crescent caused by light shining between mountains and ridges on the moon;

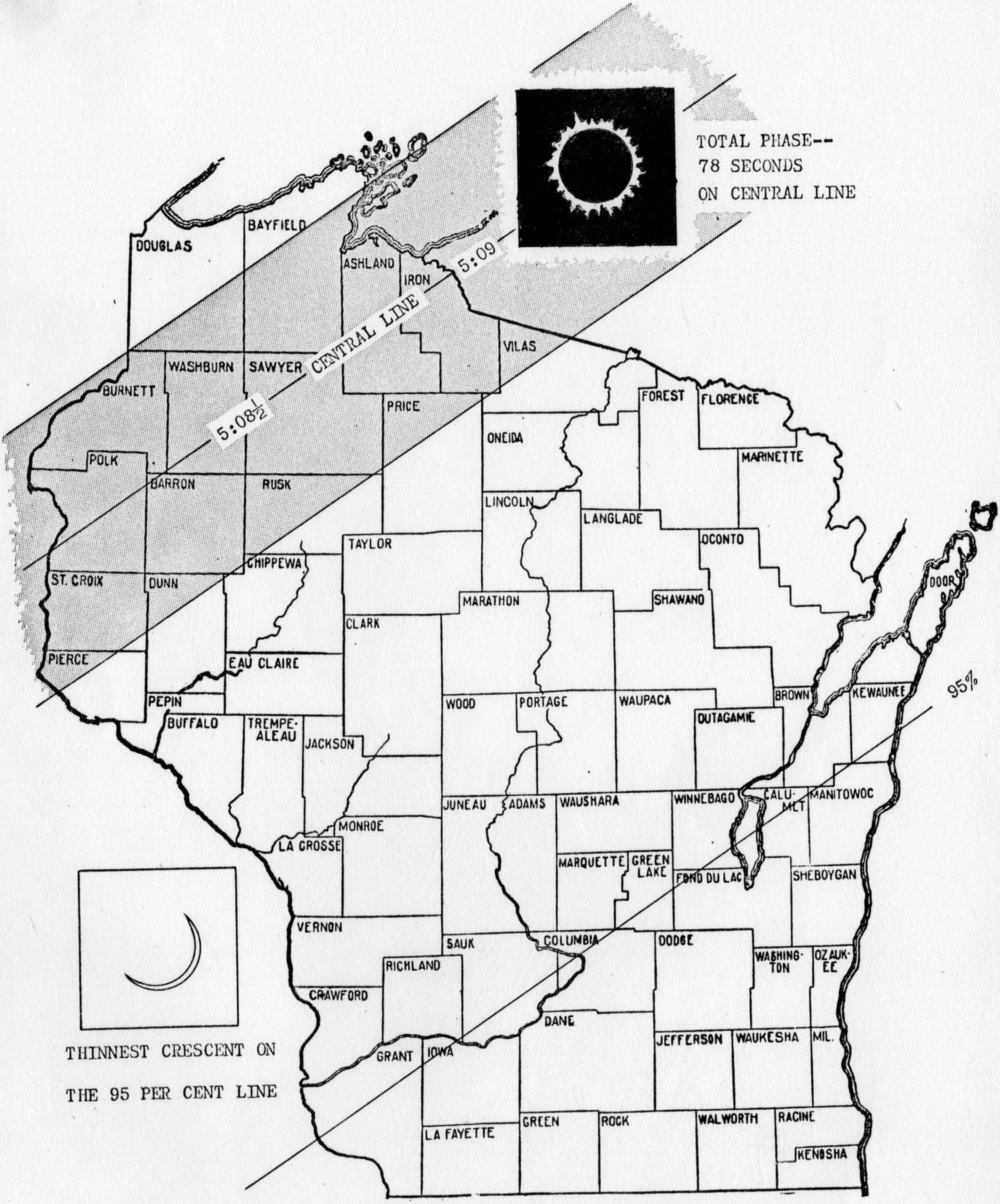
3. CORONA--the fiery area surrounding the sun, flames and gas extending from the sun's edge outward through hundreds of thousands of miles in space;

4. WAVERING BANDS OF SHADOW a few inches wide, moving at high speed over the ground just before and just after totality.

Persons on the fringe of the path of totality in towns like Bloomer, Phillips, and Woodruff will see an eclipse just short of total, Prof. Whitford pointed out, and said that for them the view will be one of the thin crescent of the sun slipping rapidly around the moon from the lower left hand corner, counter-clockwise.

Viewers in the populous southeastern portion of the state will also see a partial eclipse, but only 90 per cent of the sun will be covered, Prof. Whitford said. He counseled all viewers to be wide awake and on their toes to greet the spectacle, for in the area of totality it will come and go within a matter of 80 seconds.

####



DATA FROM: Washburn Observatory,
University of Wisconsin

WIRE NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

6/14/54 Immediately

MADISON--Emeritus Prof. Joel Stebbins, former director of the University of Wisconsin Washburn Observatory, received an honorary doctor of science degree from the University of Chicago at Commencement exercises Friday,June 11, the University of Wisconsin announced today.

The scientist is in Madison for a few days, visiting with former colleagues and other friends.

Since his retirement from Wisconsin in 1948, he has continued his astronomical research at the University of California's Lick Observatory, Mount Hamilton.

####

File

Washburn Observatory

For history see

Transactions of Wis Ac
of Sci, Arts, Letters
Vol 48 –
Dec 23, 1959

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

6/29/54 RELEASE: Immediately

MADISON, Wis.--Amateur astronomers from across the nation and as far away as Germany and Japan will meet at the University of Wisconsin, July 2-5, when the convention of the Astronomical League is held at Babcock Hall.

Many league members will arrive on the Madison campus fresh from witnessing a rare astronomical event, the total eclipse of the sun, early on the morning of June 30. The convention date and place was chosen so that members could precede the meet with a visit to northern Wisconsin and Michigan, in the path of eclipse totality.

The Friday opening-day schedule for the meet will include registration, roll call of the member societies, reports of the officers and nominating committee, and an evening trip to Yerkes Observatory at Williams Bay, Wis.

The Saturday program will include a morning observation session with the following papers or addresses being given: "The Present Phase of the Solar Cycle," "Sun Spots," "Polaris, the Pole, and Precession," "Aids to Amateur Observing," and "Report of German Amateur Astronomy During 1945-54."

The afternoon observing session will include the following titles: "Filter Techniques," "Occultations of Planets by the Sun," "Saturn's Ring D," "Observations of the Planet Uranus," "The Possibility of, and Search Techniques for Other Satellites of the Earth," "Amateur Aspects of Mars Committee Work, 1954-56."

Titles for the Sunday morning observing session will include: "Lunar Photography," "Lunar Colors," "Work on the Miyamori Valley,""Why Nothing Ever Happens on the Moon," "Contributions to Lunar Photography and to Selenology," and "Certain Lunar Formations of Interest to the Serious Amateur Observer."

-more-

6-29-54

ad one--astronomical league convention

A session for reports from the junior astronomers will fill the Sunday afternoon program. The evening will be devoted to eclipse reports.

Leaguers will attend an instrument session on Monday morning to hear reports and papers on the following subjects: "Film on Climax Instruments," "The M . A. S. Linblad Camera," "Teaching Methods in Amateur Telescope Making," "Technique of Mirror Figuring to Professional Standing," "The Application and Building of Maksutov Telescopes," "Helpful Hints for Observers," "Lunar Work With Large Apertures," and "A New Portable Telescope Mount."

Campus highlights for the amateur star-gazers will include visits to the UW's Washburn Observatory, demonstrations of the UW Planetarium, and a 7 p.m. banquet on Saturday evening at which Dr. H. Percy Wilkins, chairman of the lunar division of the British Astronomical Association, will talk on "Amateur Astronomy in the British Isles."

Hosts to the league will be the UW department of astronomy, the Beloit, Madison, and Milwaukee Astronomical Societies, and the North Central Region of the Astronomical League.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

9/29/54

RELEASE:

Immediately

MADISON--Visitors at the University of Wisconsin Planetarium will explore "Autumn Skies" in the first public lecture demonstration of the 1954-55 season, scheduled for Friday evening, Oct. 1, at 7:30 p.m., the University announced today.

Madison area residents are invited to attend the performance in which Prof. C. M. Huffer of the UW Washburn Observatory, with the help of the man-made sky and stars, will show how the lengthening nights of approaching winter will bring changes in the celestial scenery.

A showing of photographs made by Madison's amateur photographers at the time of the June solar eclipse will be an additional feature this week.

Some 1,700 persons have attended the lecture-demonstrations at the Planetarium since last fall when the University first installed this teaching device for its students and set aside Friday evenings for the public to share its instruction.

This season the public performances will be given on alternate Fridays and the subject will be changed monthly.

The Planetarium is installed in the east wing of Journalism Hall. Entrance is on Observatory Drive just west of the Memorial Union.

####

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

11/3/54

RELEASE: Immediately

Picture Available

By VIVIEN HONE

MADISON, Wis.--Ask any astronomer about occupational hazards and he will list weather the number one threat.

Ask University of Wisconsin Prof. C. M. Huffer about the problems of the elements and this astronomer will tell you he has one of them conquered.

Traditionally, the men who study the stars must face observation of the heavens without the benefits of central heating. Feet may grow frosty and fingers numb while the Wisconsin scientists open Washburn Observatory's revolving dome to the night, crank their 'scope into position, and focus on Mercury or Mars--but they may not turn on the steam, if steam there be.

According to the Washburn men, explaining the cold facts:

"As soon as you open up enough, you're in the out-of-doors. A heated area opened suddenly to the unheated outside would set up turbulent air currents, destroy the stability of the air. It's like the wavy atmosphere you see above hot pavements on a summer day."

Most of the weather problems which astronomers encounter are nature's own doing, they point out, but to the act-of-God visual handicaps lying between the lens and a millions-of-miles-away object, "we don't want to add difficulties."

Acceptance of this chilly state of affairs was general among the men on Observatory Hill until 1950. Usually they just buttoned overcoats a little higher when temperatures were low, racked the 'scope toward infinity, and drew their warmth from the satisfactions of watching a "hot" blue star.

-more-

Then came the gift to Prof. Huffer from Emeritus Prof. Joel Stebbins. A former director of Washburn, who, since his retirement from Wisconsin, has been occupied with research at the Lick Observatory on Mt. Hamilton, Calif., Prof. Stebbins had experienced the benefits of the United States Air Force electrically-heated flying suit and was eager to spread these to stargazers like himself.

In experimental use since the 1930s,"hot suits" became general utility for American airmen in cold places during World War II. Some of these garments ultimately reached the counters as war surplus. Purchased as such, the Stebbins gift needed only a rewiring from 28 volts to 66 to fit facilities at Washburn and spell toasty comfort in the cold dark hours under the dome on Observatory Drive.

Since the Stebbins' donation, other UW astronomy department staff members have acquired the heated flight garments and use of them by American astronomers is widespread, Prof. A. E. Whitford, present director of Washburn, believes.

The Huffer suit, now standard equipment for the man who explores his sky while two feet remain solidly fixed on earth, was carefully packed and traveled west last week to be plugged in at a new site in Flagstaff, Ariz.

"It's a really breezy place," is the way Washburn staff members who know describe the Lowell Observatory on a pine-and-juniper studded hill at the jumping off point for the Grand Canyon.

Built by Percival Lowell, member of the Massachusetts family which produced a great poetess and a great Harvard president, it is the observatory where planet Pluto was discovered and where extensive study of Mars has been carried on. By invitation of the Lowell staff, Prof. Huffer, for the next two months, will study there eclipsing stars, using the observatory's photo-electric equipment.

Nights in the high altitudes of the Canyon country are sharp, but Prof. Huffer is unconcerned...Arizona or Wisconsin by starlight--he's currently in fashion, with his "hot suit" to keep him warm.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

11/10/54

RELEASE: Immediately

Enthusiasts for the University of Wisconsin Planetarium public lecture-demonstrations will hear about and see a new subject, "The Moon," in the performance to be given this Friday evening (Nov. 12) at 7:30 p.m.

Prof. Arthur D. Code will deliver the lecture.

The public demonstrations of sky events are scheduled this season for every other Friday evening, and lecture subjects are changed monthly.

Patrons should arrive early enough to be seated before the man-made twilight of the performance begins, A. E. Whitford, director of Washburn Observatory, stressed.

Entrance to the Planetarium in the east wing of Journalism Hall is on Observatory Drive, a short distance west of the Memorial Union.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

11/24/54

RELEASE: Immediately

MADISON--Though many activities will be suspended at the University of Wisconsin during the Thanksgiving weekend, the UW Planetarium public lecture-demonstration will be presented according to schedule on Friday evening (Nov. 26) at 7:30, Prof. A. E. Whitford, director of Washburn Observatory, said today.

Subject for the man-plus-machine demonstration of sky events will be "The Moon." Prof. Whitford will serve as lecturer.

The planetarium was installed at the University in the fall of 1953, primarily as a modern teaching device for students in astronomy. Lecture-demonstrations every other Friday evening are being presented this year so that the public may also enjoy planetarium benefits.

The planetarium is in the east wing of Journalism Hall on Observatory Drive, across from Science Hall.

Persons planning to attend the performance in groups should make reservations through the department of astronomy, telephone 5-3311, extension 2551.

###

MADISON NEWS
FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

12/8/54

RELEASE: Immediately

MADISON--"The Moon," last public lecture-demonstration for December at the University of Wisconsin Planetarium, will be presented this Friday evening (Dec. 10) at 7:30.

Prof. Arthur D. Code of the UW department of astronomy will serve as lecturer.

During the University's Christmas recess the planetarium will be closed. However, it will be back in business after school resumes Jan. 3, Prof. A. E. Whitford, director of Washburn Observatory said, and business, according to him, is good.

Attendance at the every-other-Friday evening lecture-demonstrations for the public continues to be excellent, he said, with Madison area people waiting in line and asking for repeat performances so that they may enjoy the highly visualized lessons on the stars.

The planetarium, housed in the east wing of Journalism Hall, is reached through the entrance on Observatory Drive.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

1/5/55

RELEASE: Immediately

MADISON--Discontinued during the Christmas recess, the public lecture-demonstrations at the University of Wisconsin Planetarium will be resumed again this Friday evening (Jan. 7), the University's Washburn Observatory announced today.

Subject for the performances this week and Jan. 21 will be "Stories About the Winter Stars." Prof. Arthur Code will lecture.

"Some of the scientific detective stories about the stars are quite as exciting as any of the ancient legends that grew up about them," Prof. A. E. Whitford, director of Washburn, pointed out in indicating what is in store for the Friday evening planetarium visitors.

The show will start promptly at 7:30 and because of the necessity of maintaining darkness, no one will be admitted once it has begun, Prof. Whitford stressed. However, late comers may catch a second performance at 8:30, if the crowd is large enough to warrant one, he said.

Visitors unfamiliar with the planetarium will find it in the east wing of Journalism Hall with entrance gained through the door opposite Science Hall on Observatory Drive.

###

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

1/12/55

RELEASE: Immediately

MADISON, Wis.--Prof. A. E. Whitford, director of the University of Wisconsin's Washburn Observatory, will take a leave of absence from the Wisconsin campus to carry on research at the Mount Wilson and Palomar Observatories in California during the second semester.

Working with special photo-electric equipment and the large telescopes there, he will further his investigation of the light of distant galaxies--light which originated some 500 million years ago and has taken until now to reach earth.

Analysis of such light brings testimony on how things were in the universe at that remote time, Prof. Whitford explained, and comparison of this light with that from nearby galaxies may gain us some knowledge of how galaxies age.

The research will be supported through Wisconsin Alumni Research Foundation funds.

-0-

The Wisconsin astronomer, accompanied by his wife and three children, will leave for Pasadena in late January.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

1/19/55

RELEASE: Immediately

MADISON--"Stories About the Winter Stars" is the subject for the public lecture-demonstration which will be given this Friday evening (Jan. 21) at the University of Wisconsin Planetarium.

Jack Slowey, UW astronomy department staff, will take over the lecture-projection duties.

This year the planetarium shows are presented for the pleasure of Madison area people on every other Friday evening while the University is in session, and record crowds have been turning out for them.

Each performance starts promptly at 7:30, and no one is admitted once it has begun because of the necessity of maintaining darkness, Prof. A. E. Whitford, UW Washburn Observatory director, emphasized.

If the crowd of latecomers is large enough, a repeat performance is begun at 8:30.

The planetarium, a 1953 installation on the campus, is in the east wing of Journalism Hall. Entrance to it is gained through the Observatory Drive door opposite Science Hall.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

4/6/55

RELEASE: Immediately

University of Wisconsin Prof. A. E. Whitford, director of Washburn Observatory, was among a group of scientists meeting last week at the University of Michigan to discuss plans for a national astronomical observatory.

On second-semester leave from Wisconsin to further his research in photoelectric measurement of starlight, he made the trip east from his present quarters at Mount Wilson and Palomar Observatories in California especially to serve on the National Science Foundation panel.

The Wisconsin scientist is a member of the foundation's advisory panel for astronomy as well as of the organization's national observatory panel.

Before returning to the west coast, he stopped off at Madison for an April 1 visit with Washburn colleagues and other Wisconsin friends.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

4/28/55

RELEASE: Immediately

MADISON--Prof. C. M. Huffer will lecture on the Milky Way at the public lecture-demonstration in the University of Wisconsin Planetarium this Friday evening (April 29).

Reservations for Boy Scouts, Girl Scouts, and other groups will fill the Planetarium to capacity and no additional guests can be accepted for this week's lecture, the Washburn Observatory astronomer announced.

For those who planned to attend the lecture thisweekend, Prof. Huffer suggested instead attendance at the May 13 or May 27 performance when a new subject, "Saturn and Its Rings," will be presented.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

5/12/55

RELEASE: Immediately

MADISON--"Saturn and Its Rings" will be the subject for the Friday evening (May 13) public lecture-demonstration at the University of Wisconsin Planetarium, Prof. C. M. Huffer of the UW's Washburn Observatory announced today.

Prof. Arthur D. Code will present the lecture, beginning at 7:30 in the east wing of Journalism Hall.

Persons who plan to attend will find seats when they present themselves at the door this weekend, Prof. Huffer said. Last week reservations for groups were so numerous that only patrons with reservations could gain admittance.

####

WIRE NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

5/12/55 RELEASE: Immediately

MADISON--There'll be neither pink lemonade nor cotton candy at the fair to be held Saturday (May 14) in the Wisconsin High School gymnasium on the University of Wisconsin campus.

Instead of concession stands, side shows, and barkers, there will be such impressive wares as hyperboloids, tesseracts, and serious students.

The first Wisconsin High School Mathematics and Science Fair will feature projects made by junior high and high school students in the state. Joseph Kennedy, mathematics teacher at Wisconsin, says entries are expected from students in Fond du Lac, Fort Atkinson, Arena, Columbus, and Wauwatosa.

Students will set up their projects in the gymnasium Saturday morning before the opening at 9:30. The show will continue to 3 p.m. It is open to the public without charge.

Exhibitors will receive a certificate of participation, but no other awards will be made. Kennedy explains that the awarding of prices often discourages an average student who could profit greatly from such projects.

The exhibits, for the most part, Kennedy says, demonstrate mathematical and scientific principles beyond that studied in classes and show ingenuity in construction.

A humble oatmeal box and elastic thread demonstrate the academic-sounding hyperboloid. A student operating it can change the elastic pattern within the box.

The tesseracts, showing a three-dimensional perspective view of four-dimension cubes, are made of balsa wood from airplane kits, and are fragile and delicate.

-more-

5-12-55

What looks like a miniature roller coaster illustrates the curve of quickest descent. From the top of two slotted pieces of wood, one a straight line, the other a clycloid curve, marbles are released to run down the chutes--and the cycloid curve provides the faster ride.

There's an interesting chart on the results of chance in throwing dice. There are lacy, curve stitching designs mounted on heavy mat board and also used in mobiles--frail, angles of wood, threaded in gay colors and geometrical designs, to hang from a golden cord.

Wisconsin High School student guides will be available to direct spectators to the exhibits and to the visits at the Observatory for tours at 10 and 10:30 a.m., demonstrations in the Planetarium at 10 and 11 a.m., and to the departments of botany, biochemistry, chemistry, physics, and zoology.

And who won't need a pink lemonade after such extensive coverage of the Wisconsin campus?

####

FEATURE STORY

6/22/55

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE: Immediately

MADISON--Like all new sky discoveries, 1955e is having its share of attention at the University of Wisconsin's Washburn Observatory.

These nights, through the 15-inch refracting telescope, University astronomers are watching curiously the new comet with the tail. Research Asst. Theodore Houck has photographed Mrkos, as it is also called, in honor of the Czechoslovakian scientist who first observed the new body last week. And those with very good eyes are also using eyes alone to catch a faint sight.

For the next few evenings, at 8 or 9 p.m., Mrkos will lie 20 degrees above the northwestern horizon, between the stars Delta Aurigae and Xi Aurigae, UW Astronomer Arthur D. Code says.

Brightness is the remarkable feature of 1955e or Mrkos, according to Prof. Code:

"New comets average about 10 yearly-1955e is the fifth discovered this year," he points out. "At any one time there may be a number that can be seen or photographed with a large telescope, but it is infrequent that one is bright enough to be seen with the naked eye."

Comets, like our planets, are cold bodies, moving around the sun, he explains. Their orbits are highly flattened, eccentric, and it is only when their paths bring them close to the sun, that they become warm, and brighten through reflected sunlight and incandescent gases.

-more-

The bright tail or nebulous train which many of the comets, including 1955e, show, are gases evaporating as the body nears the sun. The tail is directed away from the sun, a matter of the gases being pushed away by light and particles coming from the sun.

Comets come by their name through the Latin word coma, meaning long-haired or tailed, Prof. Code points out. By comparison with our planets all comets are small, he says.

"Even the largest ones would be less thanone-ten-thousandth the mass of the earth."

He hazards a guess that the head of the comet might measure 20,000 miles in diameter, "but this is just a swarm of little particles." He also thinks that 1955e is "probably of the order of 60 million miles away" and is "probably moving through space at the rate of 50 miles a second."

By contrast with a star, a comet shows a diffused spot of light, he declares.

Most famous of the periodically appearing bodies is Halley's Comet, which put in an appearance in 1909 and 1910. This early 1900's showy skypiece, which oldsters still remember, was so bright it could be seen even in the daytime. At the present time, Prof. Code says, Halley's Comet has reached the point in its orbit which is the furthest away from the sun. The comet will return within our sight in 1986.

"We have passed through the tails of comets several times--of Halley's Comet once"--the Wisconsin astronomer says, "and when we do, we get a good meteoric shower."

For those persons who want to locate Mrkos from their own sites, the astronomer adds this helpful hint: "Find the North Star (end star in the Little Dipper's handle), then imagine a plumbline dropped from there to the horizon. At midnight, Mrkos will lie exactly below the North Star at a point above the horizon about one-fifth of the distance between the horizon and the North Star itself."

-more-

However, the comet is easier to see immediately after dark when it is higher in the sky, he suggests.

If the weather is clear, Washburn Observatory will be open Thursday evening, June 23, from 9 to 10:30 p.m. so that the public can take a peak at 1955e through the big 'scope.

"We also have some smaller telescopes we can use, if the group grows large, Prof. Code offers.

####

CUT LINES

Dutto Sheet

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

6/22/55

RELEASE: Immediately

See astronomy Department

Washburn Observatory

Pix

CUTLINE #1

University of Wisconsin astronomers, giving a large share of their attention these nights to the new comet, 1955e, offer this sky diagram for others who wish to see the bright body with the tail, discovered last week by a Czechoslovakian scientist.

1955e or Mrkos, as the comet is also called to honor its discover, is shown as it will appear these nights at 8 p.m., lying 20 degrees above the northwestern horizon, near the star Delta Aurigae.

New comets appear on an average of 10 yearly, UW astronomer Prof. Arthur D. Code points out, but few are bright enough to be seen with the naked eye, as is 1955e.

####

CUT LINES

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

6/22/55

RELEASE: Immediately

See Astronomy Dept.

Washburn Observatory

CUTLINE #2

This bright dot of light with a tail streaking behind it (just below center) is the new comet, 1955e--also called Mrkos--discovered last week by a Czechoslovakian scientist.

Research Asst. Theodore Houck, one of the University of Wisconsin's Washburn Observatory staff, photographed the small body rotating around the sun in an eccentric orbit, with a hand camera attached to the observatory's 15-inch refracting telescope.

The exposure was for 20 minutes at F 4.5.

####

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

7/28/55

RELEASE: Immediately

By VIVIEN HONE

MADISON, Wis.--Be star-minded while on vacation, University of Wisconsin astronomers suggest.

That summer trip to the mountains or country, out where it's clear and away from city lights, is an ideal occasion for naked-eye observation of the heavens, they say.

Here is what to look for in the summer sky, according to Prof. Arthur D. Code of UW's Washburn Observatory staff:

THE MILKY WAY: Appearing as a broad flat band of light, it stretches across the sky from northeast to south, brightening as it approaches the horizon. This is actually a thin, disc-shaped great cloud of stars with curved arms--a kind of giant pinwheel. Early in the evening, at the present time, is the best time for viewing it.

The earth and sun are part of this great spiral galaxy or star system, and so are all of the following constellations, bright stars, and planets prominent in the summer heavens.

"All of the planets mentioned are near to us," Prof. Code points out. "All of the stars are relatively so."

Among the easy-to-find constellations and stars there are:

THE BIG DIPPER: Lying west of the Pole or North Star around which it swings, the Dipper constellation will appear as though hanging by its handle, the bowl down, and during the forepart of the evening, it will move under the Pole Star above the northern horizon.

-more-

<u>VEGA</u>: One among three bright stars in a great triangle, it lies directly overhead in the early evening. White and near the zenith, it is the brightest star you can see. It is two and one half times larger than our sun. Vega is the great star in the constellation Lyra.

<u>DENEB</u>: The second of the stars marking the points of the bright triangle is a white supergiant, lying to the east of Vega. This is "of the order of 100 times larger than our sun," Prof. Code declares. It is also the top star in the vertical line of the constellation called the Northern Cross.

<u>ALTAIR</u>: Marking the third point of the triangle, it lies about 30 degrees south by 20 degrees east of Vega. Somewhat more like our sun, but bigger and brighter it is also a white star, the brightest in the constellation Aquila.

<u>ARCTURUS</u>: This is one of the nearest of the "cool red giants," about 30 times the size of the sun. It shines very brightly in the west.

<u>CORONA BOREALIS</u>: A near neighbor of Arcturus, the constellation resembles the small "c" of our alphabet.

Planets, by contrast with the above bright stars, Prof. Code points out, are very near and, like the earth, are small, cold, and revolve about the sun. They are bright, not by light of their own making, but by the light of the sun which they reflect. The planets Venus and Saturn are the brightest objects of the summer sky, "just because they are so near," the UW scientist explains.

<u>VENUS</u>: Traverses a path very near to the sun's, rising at the present time about one hour before the sun and setting one hour before sunset. Ardent sky-watchers will have to stay awake until the still dark morning hours or rise before dawn to catch sight of Venus.

<u>SATURN</u>: More adapted to the timetables of vacationers, this very bright planet lies about 30 degrees above the southwestern horizon, early in the evening. Sinking ever lower, it sets about midnight. Saturn, circled by rings, is the most spectacular of the planets. With a good pair of binoculars, the rings can be seen.

-more-

"The moon was new on July 19 and will become full on Aug. 3," Prof. Code adds for the information of vacationers bent on astronomy.

For the star-minded Madison area residents with no immediate prospects of mountains and open country, he offers the facilities of Washburn Observatory--a chance to view the summer skies through the UW's 15-inch refracting telescope.

"Visiting nights are every first and third Wednesday evening of the month, from 8 to 10 p.m.--provided it's clear, of course," Prof. Code says.

####

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

3 Aug 55

RELEASE: Immediate

MADISON, Wis.--So you think you're hot, with present temperatures from a blistering sun hovering in the 90s?

Then consider the star which University of Wisconsin astronomers this week discovered is "of the order of 50,000 degrees Fahrenheit at its surface." Placed at the same distance from the earth as the sun, it would raise the earth's temperature to 14,000 degrees.

Located in the constellation Scorpio, "it is probably as luminous as any of the known stars in our own galaxy or star system," Prof. Arthur D. Code of the UW Washburn Observatory staff said. "The supergiant radiates about half a million times as much energy as our sun."

Code and Research Asst. Theodore Houck, who are especially known for their work on the Milky Way, have determined that this star in Scorpio is comparable in luminosity--intrinsic brightness--to the very brightest blue stars in the Magellanic Cloud, a stellar system outside of our own galaxy.

The luminosity of a star, Code explained, is a measure of the total energy radiated,1and depends upon both star size and star temperature.

"In this case," he added, "the star is both very hot and very large. In our galaxy, there are stars hotter but somewhat smaller, and stars of almost comparable luminosity that are cooler but larger."

The Wisconsin astronomers arrived at these torrid tips on the giant blue star through photo-electric and spectrographic analysis, determining the luminosity of total energy output by comparison with that of the bright blue stars in the Magellanic Cloud .

(more)

"The spectrum," Prof. Code said, explaining this method of analysis,"is essentially the rainbow of the starlight produced by the prisms of the spectrograph. The spectrum of this star very closely matches the spectra of some of the bright blue stars in the Magellanic Cloud. Determination of the distance to each of these compared objects revealed the extremely high luminosity."

The University of Wisconsin is known as a pioneer in the photo-electric measurement of stars and in development of automatic methods of stellar computations. This information about the blue giant in Scorpio is only a minor result in a large investigation of high luminosity of blue stars, Code indicated.

Wiping his brow in the 90-degree,humid Washburn Observatory today, he offered a final word on the giant:

"If it were in the position where the sun is, we would see it as covering a quarter of the sky."

But there is little sense in speculating on how we would see the star if it were in that position, he pointed out, for "of course we would all be vaporized."

##

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

9/10/55 Immediately

MADISON, Wis.--A $200,000 gift which will bring major fulfillment of long-needed, modern astronomical facilities at the University of Wisconsin was accepted from the Wisconsin Alumni Research Foundation (WARF) by University regents Saturday.

The WARF funds will cover construction of a new 36-inch reflecting telescope, a main research observatory, and two adjacent buildings; and purchase of a 40-acre hilltop site somewhere within a 15 to 20 mile radius of the home campus at Madison.

The new telescope will provide five times the light-gathering power of the present 15-inch refracting 'scope which has served the greater part of a century as the major instrument at the UW's Washburn Observatory. The mirror for the new telescope was bought by the University several years ago and does not come within the plans for use of the WARF monies.

WARF's gift will permit Wisconsin to modernize and replace obsolescent equipment and provide tools for astronomical research equal to those available at other Midwestern universities, Prof. A. E. Whitford, director of Washburn Observatory, pointed out.

The astronomy department is now conducting a survey of suitable land, he indicated. The country station will have clearer skies, Wisconsin astronomers explain, avoiding the problems of city lights and industrial smoke which Washburn now contends with.

-more-

The two buildings to be constructed near the main research observatory will house a 12-inch reflecting 'scope for graduate student use and a heating plant and also will provide resident quarters for a graduate student caretaker.

It is hoped that the new facilities will be completed in time for the 80th anniversary of Washburn, which will take place in 1958. The venerable stone building atop Observatory Hill, center for astronomical study at the University, was constructed in 1878. It and the 15-inch telescope were the gift of Cadwallader C. Washburn, an early governor of Wisconsin.

There have been no major capital investments in astronomical buildings or instruments since then.

Headquarters for the astronomy department will remain on the campus at Madison, staff members said. They also said the planetarium, installed two years ago in the east wing of Journalism Hall, will also remain at its present site to serve primarily as a teaching aid for astronomy students.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/4/55 vh

RELEASE: Immediately

The stars and a welcoming hand are out again at the University of Wisconsin Planetarium.

"The first public lecture-demonstration of the 1955-56 season will be given this Friday evening (Oct. 7) at 7:30," Prof. A. E. Whitford, director of the University's Washburn Observatory, announced. "The subject--'Stars of Autumn.'"

The Planetarium--big white canvas "sky" and a projector--was installed two years ago in the east wing of Journalism Hall. Purchased primarily as a teaching aid for students of astronomy, the mechanism gives the illusion of the real sky and stars for any season and latitude. It thus minimizes the handicap which bad weather places on observations of the sky.

Shortly after the Planetarium was established, a program of lecture-demonstrations for the public was inaugurated by the astronomy department. Since then, hundreds of Wisconsin citizens have had a chance to learn more about astronomy through this modern visual aid.

All scheduled for Friday evenings at 7:30, the following public lectures are on the fall program:

Oct. 7--"Stars of Autumn"; Oct. 21--"The Moon"; Nov. 4--"The Milky Way"; Nov. 18--"The Galaxies"; Dec. 2--"Stars of the Long Winter Night."

Members of the University department of astronomy will present the lectures.

-more-

10-4-55

ad one--planetarium

Doors will close at 7:30, Whitford said, because effectiveness of the demonstration depends on maintaining a darkened room, making it impractical to admit latecomers.

There is seating capacity for 60 persons under the canopy. Whitford suggested that groups of 10 or more wishing to attend the lecture give advance notice by telephoning Washburn Observatory, 5-3311, extension 2551.

He also called attention to the fact that the public may view the stars through Washburn Observatory's 15-inch telescope on the first and third Wednesday nights of each month, providing the sky is clear.

On these Visitors' Nights, a long standing service of the Observatory, the hours are from 7:30 to 9:30 p.m. Visitors are given a chance to see two or more objects through the telescope, Whitford pointed out, and to hear informal explanations on each subject.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/31/55 vh

RELEASE: Immediately

Gamma Alpha, graduate student scientific fraternity, will exam the stars when it meets at 8 p.m. Thursday at the University of Wisconsin Washburn Observatory.

Included in the plans for the evening, with Astronomy Profs. A. E. Whitford and C. M. Huffer as hosts, are a demonstration of the method for measuring the light intensity of a star--and a guided tour through man-made sky and stars, the University Planetarium.

This is an open meeting and all interested men graduate students are invited to attend, Gamma Alpha announced. Members planning the meeting also said there will be refreshments.

####

WIRE NEWS

11/12/55

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE: Immediately

MADISON--The University of Wisconsin is going to take its chickens off University Ave.

That was decided Saturday by the University regents when they determined locations for five new structures for the University.

When the chicken yards were first established on the College of Agriculture campus fronting on University Ave., the area was not heavily built-up. Since that time, homes and apartments have crowded into the area and the chickens, with their early-morning serenades, have generated an increasing amount of protest from the neighbors.

The University has been seeking funds for some time to move the chickens, and last month, the State Building Commission appropriated $220,000 for a new Poultry Research Building, which the regents Saturday decided to locate at a site east of the Seeds Building on the College of Agriculture campus. The regents also agreed to put a new Genetics Barn in the same area. The State Building Commission provided $110,600 for this structure, and the University received an additional $19,000 in fire insurance funds to cover the loss of the old Genetics Barn which burned last July 22.

Another project for which the State Building Commission provided planning funds also was included in the site determinations. The regents authorized the preparation of preliminary plans and specifications for a new heating plant to be

(more)

ad one--chickens

11-12-55

located in the block bounded by Mills, Charter, Dayton, and Spring Sts. The Building Commission provided $200,000 for planning and land-purchase for the new heating plant.

In other actions on sites for new buildings, the regents located the new Home Economics Pre-School Laboratory northwest of the Home Management House and northeast of Agricultural Hall, and authorized purchase of some 40 acres of land a mile-and-a-half northwest of Pine Bluff for a new Observatory site.

The regents will purchase the hilltop, which rises 1,100 feet above sea level, from Mr. and Mrs. Joseph E. Solvie, Mt. Horeb, for $4,000. The Observatory, to be built with funds supplied by the Wisconsin Alumni Research Foundation, will be on County Trunk S, about 15 miles west of the Capitol.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

11/16/55 vh

RELEASE: Immediately

"Galaxies" will be the subject of the Friday evening public lecture demonstration at the University of Wisconsin Planetarium.

Prof. C. M. Huffer of the Washburn Observatory staff will give the lecture which begins at 7:30.

He described the galaxies as "dim, rather hazy objects in the sky, the most distant things that can be seen with the naked eye."

"Their nature as vast stellar systems like the clouds of stars which form the Milky Way will be shown by photographs taken with large telescopes," he said.

The bi-weekly Friday evening Planetarium performances are presented for the pleasure of Madison area people. They are open to the public without charge.

Entrance to the Planetarium, in the east wing of Journalism Hall, is gained through the door on Observatory Drive, opposite Science Hall.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE: Immediately

11/30/55 vh

Prof. A. E. Whitford, director of Washburn Observatory, will deliver the lecture for the Friday evening public lecture-demonstration at the University of Wisconsin Planetarium.

The astronomer will talk on "Stars of the Long Winter Night," beginning at 7:30.

He said that special emphasis will be given to the stars of the Orion region, and pictures of the stars in their surroundings as photographed by large telescopes will be shown.

The Dec. 2 lecture on a program of bi-weekly public Planetarium performances is the last before the University's Christmas recess begins.

Entrance to the Planetarium, located in the east wing of Journalism Hall, is gained through the door on Observatory Drive, opposite Science Hall.

####

	PROJECT		ESTIMATED COST
MEDICAL SCHOOL (Contd.)			
Infirmary:	Remodel former garbage room into office space	$ 1,500	$ 3,900
RADIO & TELEVISION STATIONS			
600 N. Park:	Remodel and install acoustical materials in TV broadcasting room.	500	
	Close off corridor from studios	350	
Radio Hall:	Install window between corridor and transmitter room.	460	
	Install partition between transmitters and operator's quarters.	1,800	
	Install wall around tunnel area.	710	
	Construct a storage platform	250	4,070
CONTINGENT:			3,830
	TOTAL		$55,000

8. That, upon recommendation of the Director of the Agricultural Extension Service, the President of the University and the Director of the Agricultural Extension Service of the University of Wisconsin be authorized to sign an agreement with the Federal Extension Service, United States Department of Agriculture, providing for group life insurance coverage, on a voluntary basis, of Cooperative Agricultural Extension employees of the University of Wisconsin, as provided under the Federal Employees' Group Life Insurance Act of 1954, Public Law 598, 83rd Congress, with two-thirds of the cost of the premiums of such coverage to be paid by the employees and with one-third of the cost of the premiums to be paid by the University from Cooperative Extension Service funds made available to the University by the Federal Government.

9. That the administrative officers prepare a report to the Regents regarding the salary structure at the University including faculty and civil service and all other expenses, for consideration in preparing the 1956-57 budget and the budget requests for the 1957-59 biennium.

10. That, subject to the approval of the Governor, the purchase of the following described property adjacent to the site being acquired for the new observatory, from John R. and Rebecca C. Barton, Madison, Wisconsin, for a consideration of $2,000, chargeable as follows:

$1,000	From appropriation made by the Wisconsin Alumni Research Foundation for astronomy
$1,000	From Gift or Trust Funds as determined by the President of the University,

be approved in accordance with the option dated December 8, 1955:

Prt S½ NE¼ SW¼ W of Hwy 12 acres more or less, Sec. 16 and
Prt NW¼ SW¼ commencing SE corner of the N 225.6 ft to point

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

12/10/55 Immediately

MADISON--Preliminary plans to double the seating capacity of the University of Wisconsin Memorial Union Cafeteria with a $300,000 addition financed by the Union were approved by University regents Saturday.

The regents authorized preparation of final plans and specifications, but asked for continued study of the possibility of eliminating a surface delivery dock, and conferences with the University of Wisconsin Foundation which gave the University land adjacent to the Union.

The regents approved the immediate installation of a service elevator in the dining-room wing of the Union ~~and awarded a contract for the work to Berman-Kern Elevator Co., Madison~~, for $8,621, which also will be financed by the Union.

The new addition will not only double the seating capacity of the Cafeteria, but also will provide two Cafeteria service counters instead of the present single "food line," thus speeding service for student diners.

Included in the plans are three additional rooms which may be used for private dining by Cafeteria patrons, enlarged coat space, washrooms, and expanded kitchen facilities.

The Union kitchen was designed almost 30 years ago to serve about 3,000 meals per day, and the Union must now be prepared to serve 8,000 to 9,000 meals a day to meet the demands of increasing enrollments, Prof. Porter Butts, Union director, explained.

(more)

12-10-55

He said the addition would enclose the existing open waste dock and replace the present Quonset huts on the open deck, thus improving the building's appearance from the lakeshore and from the public mall which is planned when the old YMCA is removed.

In another building action Saturday the regents allotted $55,000 from the $100,000 appropriated Oct. 27 by the State Building Commission for remodeling University buildings. The work will improve 22 different structures on the campus, with major projects in the Education Building, where additional funds are needed for completion of offices and classrooms on the first floor, and King Hall, where additional laboratory space will be furnished.

Among the projects is conversion of the Slichter House, Madison family home of the late Dean Charles Sumner Slichter at 636 N. Frances St., to Extension Division office space. Slichter wqs dean of the UW Graduate School from 1920 to 1934. The home was given to the University by his four sons: Sumner H. Slichter, Harvard professor of economics, Louis B. Slichter, University of California professor of geophysics, and Allen and Donald Slichter, both Milwaukee businessmen.

In other actions on University construction, the regents Saturday:

1. Awarded an $83,421 contract to C.A. Hooper Co., Madison, on low bid for the extension of the steam service conduit on Linden Dr. between the Stock Pavilion and the Dairy Barn and Seed House on the College of Agriculture campus;

2. Authorized extension of the Residence Halls parking lot 150 feet east of Tripp Hall, to be paid for by Residence Halls student parking fees;

3. Approved location of a "penthouse" on Babcock Hall for drying equipment for research on milk drying and similar spray-drying applications and study;

4. Purchased, subject to the approval of the governor, 13 acres of land next to the new observatory site near Pine Bluff from Prof. and Mrs. John R. Barton of Madison for $2,000 to be financed from gift funds;

5. Voted to locate the Law-Sociology Building at the site of the present Law School.

(more)

At their November meeting, regents delayed decision on the Law-Sociology Building location and asked for a study of the possibility of putting the structure in some area where it ultimately might be joined by dormitories to form a special Law Quadrangle.

The University Campus Planning Commission re-studied the problem and recommended that the old Law School be replaced at its present location, since its library there could be then incorporated into the new structure, thus providing a considerable fund saving.

###

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

1/17/56 RELEASE: Immediately

EDITORS: This is the second of two articles on historic clocks at the University of Wisconsin.

By VIVIEN HONE

MADISON--University of Wisconsin astronomers want no part of astrology--the pseudo-science claiming men's destinies are controlled by the stars--but they are proud of the period when the stars, Washburn Observatory, and University clocks were teamed to set the pace for many Badgers.

This was back in the 1880s, when the newly constructed observatory on the campus at Madison became the "custodian" of time. In those young years of the University, time had to be determined locally. There was no National Bureau of Standards or Naval Observatory at Washington, D. C. to flash the minute and seconds. And if there had been, there was no radio to make such immediate communication possible.

Important instrument then for guiding the comings and goings of an orderly, time-conscious public was a Howard-make clock, purchased and installed as part of Washburn's equipment in 1882. The five-foot timepiece, mounted on an iron back and firmly screwed to a stone pier, was set to Chicago mean time, then "practically the standard time for the whole state of Wisconsin," and was considered eminently satisfactory.

"For its special purpose, I regard its arrangements as well nigh perfect," Edward S. Holden, early director of Washburn, wrote in an 1883 report for the Observatory.

-more-

The clock delivered a break circuit signal every two seconds to a switchboard in the Observatory. From here the signal was relayed over an electrical wire strung to seven clock-equipped key points for Madison civic life: the offices of S. L. Sheldon, the Western Union Telegraph Co., the State Bank, Wisconsin State Journal, First National Bank, Supreme Court of Wisconsin, and the Park Hotel.

"Clocks along this line have their hands set hourly from the observatory," by the Dudley system, Holden wrote.

The Howard mean timepiece also delivered faithfully each day--"except Sunday"--a 10 a.m. signal to Wisconsin railways, Holden reported. Presumably this was by a signal delivered over private lines.

The University's less than 500 collegians as well as Wisconsin locomotives made track according to the Howard clock. A special line from the observatory led to the office of UW Pres. John Bascom in Main Hall (Bascom Hall) and connected with a clock there. The latter, controlled and set daily by the Howard, rang an electric bell in each classroom ten minutes before each hour and on the hour.

At the bottom of Bascom Hill, students also quickened or slowed their steps according to time in the tower--the Assembly Hall (Music Hall) clock. And they curtailed the walk on Willow Drive, the canoe trip to Picnic Point, as the tower clock bell rang across the night, warning of coed curfew hour. The belfry clock was monitored by wire from the Howard timepiece at the Observatory.

However, the Howard and all its satellite instruments spotted about the town and campus were merely handmaidens of an older, master timepiece at Washburn. This was the Hohwu, a sidereal clock, installed in 1881. The astronomy department's earliest and most important chronometric instrument, it was set to measure the days and nights by the stars themselves.

Based on a pier of sandstone some 67 inches high--and with this pier enclosed, the large cased instrument was further protected by enclosure in a wooden glassfronted closet. An attachment for sending an electrical current every two seconds to a chronograph or sounder was included.

-more-

Observations by which the clock was set were made in the West or, as it was then called, Meridian Circle Room. The room, with a movable, shuttered roof, could be opened to the sky. At a point in its center, the meridian circle, the transit instrument for the time-revealing look at the stars, was bolted to pier-heads. That point--longitude 89 degrees and 24½ minutes west of Greenich and latitude 43 degrees four minutes--given as the official reading for the Observatory--was then one of the most precisely located spots in Madison.

Prof. C. M. Huffer, a member of the 1955 astronomy department staff, describes the actual time-taking process:

"You pick a standard star, watch it cross the field of the 'scope and finally reach the meridian. If, when it reaches this point, the sidereal clock reads the same as the figures for the right ascension, your clock is correct."

The sidereal clock had it correction determined from this sighting on the stars on an average of once every three days, Observatory records show, and all other clocks, including the Howard, were converted from these computations to Chicago mean time.

Time became less complex in manner of operation, no longer a matter of local choice and responsibility, in 1884. By international agreement, standard time zones were marked off around the globe, each 15 degrees or one hour wide. All places falling within a certain zone were then expected to use the standard meridian of the zone. All of Wisconsin lay within the Central Standard time area, and the Howard clock was therefore converted for Central Standard reading.

Today at Washburn or elsewhere at any radio-equipped spot, it takes only a flick of the wrist to tune in the time as broadcast from the National Bureau of Standards at Washington, D. C. The seconds tick off like the telltale heartbeat--and every five minutes are interupted by a voice announcement of time.

At the UW Service Building, a master clock now controls the timepieces in many campus buildings and rings all class bells, Richard R. Knoff, electrical

-more-

engineer in the Buildings and Grounds department, says. He points out that the master, an IBM installation, "is electrically driven, and equipped with an auxiliary spring movement which takes over if the power is off."

The clocks controlled by it are of the old type, minute impulse system. In other buildings, an IBM electronically-controlled system with individual master clocks in each building unit, guides students in their appointed hours.

At Washburn, the Howard and sidereal clocks, ticking away as faithfully as ever they did when the Observatory was the official horological voice, are treasured for their part in the past, but are less vital to University public service.

"We use the sidereal clock to set a telescope," Huffer says. "And the Howard? Why just like any other office clock--to tell the time."

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

2/8/56 vh

RELEASE: Immediately

Observatory

Washburn

MADISON--The stars are out again at the University of Wisconsin Planetarium --and the focus is on Jupiter....

The first of the lecture-demonstrations in the second semester program open to the Madison area public will be given on Friday evening (Feb. 10) at 7:30, A. E. Whitford, director of the University's Washburn Observatory, announced today.

The doors will be closed at 7:30 and latecomers will not be admitted, he said, pointing out that it is not practical to admit anyone. The effectiveness of the demonstration depends on maintaining a darkened room.

UW Astronomy Prof. C. M. Huffer will present "Jupiter and Its Moons." He said that this largest of the planets, which lies in the constellation Leo the Lion, is in a good position for naked-eye viewing. The lecture-demonstration will show how the planet looks through the large telescopes.

The complete program for the second semester Friday evening performances at the Planetarium (east wing of Journalism Hall) is as follows:

Feb. 10--"Jupiter and Its Moons," Prof. Huffer

Feb. 24--"Jupiter and Its Moons, Prof. Huffer

March 2--"The Moon," Prof. Arthur D. Code

March 16--"The Moon and Easter," Prof. Code

April 13--"Venus and Mercury," Prof. Whitford

April 27--"Venus and Mercury," Prof. Whitford

May 4--"Saturn and Its Rings," Technical Asst. Jack W. Slowey

May 18--"Saturn and Its Rings," Mr. Slowey

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

Washburn Observatory

2/22/56 vh

RELEASE: Immediately

Guests of the University of Wisconsin will see Jupiter and its moons this Friday evening at the Planetarium and hear Astronomy Prof. C. M. Huffer tell about this largest of the planets.

The Friday performances for the benefit of the public are presented twice monthly. They begin promptly at 7:30 in the east wing of Journalism Hall and since effectiveness of the show depends upon darkness, latecomers will not be admitted.

Hundreds of Madison area people have learned about the stars since the Planetarium was installed and the public service program was inaugurated in 1953. Primarily used as a teaching aid for astronomy students, the man-made sky and projector guarantee observations, regardless of weather.

Seating capacity is for 60 persons, Prof. A. E. Whitford, director of Washburn Observatory said and suggested that groups of 10 or more wishing to attend together telephone the observatory: 5-3311, extension 2551.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

3/1/56 vh

RELEASE: Immediately

Prof. Arthur D. Code will present "The Moon" at the lecture-demonstration in the University of Wisconsin Planetarium Friday evening (March 2).

Beginning at 7:30, the Washburn Observatory astronomer will show motions of this earth satellite and aspects of its physical nature while his audience watches beneath the Planetarium "sky."

The Friday evening performances are scheduled approximately twice monthly during the semester for the benefit of the star-minded Madison public. All interested persons are invited to attend.

The Planetarium is housed in the east wing of Journalism Hall--and entrance is gained through the Observatory Drive door opposite Science Hall.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

4/2/56 vh

RELEASE: Immediately

The man who has "done more than anyone else to unravel the spiral structure of the Milky Way" will deliver a lecture at the University of Wisconsin on April 11.

Dr. W. W. Morgan of the University of Chicago's Yerkes Observatory, Williams Bay, will talk on "The Structure of Galaxies" at 8 p.m. in 119 Science Hall. The lecture will be highlighted with photographs which Dr. Morgan has made during observations.

The scientist's pioneer methods in exploring space have led to new insights in astronomy, Prof. A. E. Whitford, director of the UW Washburn Observatory, said. He pointed out that research on the Milky Way carried on for the past several years at Wisconsin and the journey of a UW research team to South Africa for observations stemmed from pioneer work done by Dr. Morgan.

With the exception of short periods of time spent on a visiting professorship at Lick Observatory, University of California, the distinguished astronomer has spent his whole professional life in teaching and research at Yerkes.

His lecture is scheduled to be given on the evening of the Madison Astronomical Society annual dinner. Dr. Morgan will be a guest at the dinner, following which society members will attend the lecture in a group.

All persons interested are invited to hear Dr. Morgan, described as not only an able scientist but "a gifted popular expositor."

The talk is sponsored jointly by the UW astronomy department and the committee on all-University lectures.

####

WIRE NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

4/7/56

RELEASE: Immediately

MADISON--Historic Washburn Observatory, built in 1878 as a gift from a former governor of Wisconsin, C. C. Washburn, may become an Alumni House on the University of Wisconsin campus.

Last year the Wisconsin Alumni Research Foundation gave the University funds for a new observatory, to be constructed west of Madison away from the distracting lights and the haze of the city.

University regents Saturday referred a request from the Wisconsin Alumni Association for use of the building to the University Campus Planning Commission for study. The Alumni Association proposes the addition of a wing to the old structure, and considerable remodelling, but retention of much of the present "feel" of the building.

In other actions on University buildings and grounds, the regents:

1. Authorized dedication of Arboretum lands for a roadway and asked the State Highway Commission to provide a pedestrian undercrossing between Arboretum lands which are located on both sides of the South Beltline which is to be widened to a four-lane highway;

2. Approved preliminary plans and authorized bidding on construction of an Administration Building at Upham Woods to be built with gift funds;

3. Transferred $45,000 to the equipment budget and $5,000 to the maintenance budget from the contingent budget of the intercollegiate athletics department to provide equipment for Camp Randall Memorial and for maintenance work at the Field House;

-more-

ad one--Winterble property

4. Renewed an agreement with Carl Bernard for the operation of the University Boathouse this year on the same terms he had last year;

5. Voted to ask state officials for permission to retain Temporary Building 16 at the corner of Babcock and Linden Drives and

Temporary Building 12 near the corner of Charter St. and Linden Dr.;

6. Authorized construction of a temporary addition to the Solar Energy Laboratory, to be built with $3,000 gift funds;

7. Awarded a contract for the repair of up to 8,000 square feet of area in the University Heating Station's coal bunkers to the Cement Gunite Corp., Milwaukee, for $4,808 plus 91.6 cents per square foot of area in excess of 6,000 square feet;

8. Accepted an offer of $1,651 from the Allen Wrecking Contractors, Madison, for Temporary Buildings 1, 2, and 3 at the corner of Park St. and University Ave.;

9. Approved fees not to exceed $1,000 for Carl L. Gardner and Associates, Chicago, for planning work; and $7,060 for Mead and Hunt, Inc., Madison, for engineering and survey services in connection with the development of the University Hill Farms area;

10. Approved agreements with Joseph Nunn and Associates, Los Angeles, for engineering services on the new observatory; with Eugene H. Phillips and Eugene H. Eble, Hales Corners, for architectural services on a new milk drying tower addition to Babcock Hall; and with Weiler and Strang and Associates, Madison, for architectural services on alterations and additions at the Memorial Union.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

4/9/56 vh

RELEASE: Immediately

Dr. W. W. Morgan, distinguished staff member of Yerkes Observatory, Williams Bay, will talk on "The Structure of Galaxies" in an illustrated public lecture at the University of Wisconsin Wednesday (April 11).

Dr. Morgan's success about four years ago in demonstrating the spiral-arm structure of the Milky Way has won him wide acclaim in the astronomical world, UW Astronomy Prof. A. E. Whitford said. The director of Washburn Observatory added that Morgan has since been a leader in a world-wide campaign to extend our knowledge of these spiral arms.

The lecture will be given at 8 p.m. in 119 Science Hall and will be presented under sponsorship of the UW astronomy department and the committee on all-University lectures.

Dr. Morgan's skill as a popular and semi-popular lecturer and the fine photographic illustrations which he has prepared make his lectures "both instructive and enjoyable to the non-specialist," Whitford said.

The astronomer has spent most of his professional life in research and teaching on the University of Chicago staff at Yerkes Observatory, Williams Bay. He has strong ties with Wisconsin's Washburn Observatory staff members who have joined with him in carrying out Milky Way research. In 1953 a UW research team journeyed to South Africa in this joint program.

Preceding his lecture, the astronomer will attend the annual dinner of the Madison Astronomical Society. Society members will then attend the lecture in a body.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

4/11/56 vh Immediately

Eyes will focus on Venus and Mercury when the Friday evening lecture-demonstration at the University of Wisconsin Planetarium is given F~~riday evening~~ (April 13) at 7:30.

A. E. Whitford, director of the UW Washburn Observatory, will present the lecture on the two planets.

Venus--now a bright object in the west--is in a good position for early evening observation, Prof. C. M. Huffer pointed out, and "Mercury will lie between Venus and the sun during the month of May."

The lecture-demonstration will show the audience how to view the planets as well as cover the physical nature of Venus and Mercury and present a run-down of the spring constellations.

All persons interested in the stars are invited to attend the semi-monthly Friday evening performances at the Planetarium.

Entrance to the Planetarium--in the east wing of Journalism Hall--is through the door on Observatory Drive. The lecture will start promptly at 7:30, and since darkness is required for successful demonstration, the doors will not be opened to admit late-comers.

####

Observatory, Washburn

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

9/5/56

RELEASE: Immediately

An opportunity for the public to observe Mars through telescopes at the University of Wisconsin Washburn Observatory was announced today by Charles M. Huffer, professor of astronomy.

The observatory will be open from 8:30 to 11 p.m. Friday, Sept. 7, and on Monday and Tuesday, Sept. 10 and 11. On Friday Mars will be the closest it ever comes to the earth.

"Mars," Huffer said, "is an especially difficult object to see and only general features can be observed."

On Friday Mars will be 35,125,000 miles from the earth, the minimum closest distance. "This phenomenon occurs once every 17 years," Huffer explained.

Scientists can see Mars best from locations in South Africa where it will be directly overhead.

"In its orbit around the sun," Huffer said, "Mars completes one cycle once every 687 days while the earth moves around the sun once every 365 days."

###

Observatory — Washburn

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

9/6/56 RELEASE: Immediately

MADISON--The planet Mars will pose for a "close-up" this weekend and the public is invited to join astronomers in viewing the performance through telescopes at the University of Wisconsin's Washburn Observatory.

Mars will be the nearest it ever comes to the earth--a matter of some 35 million miles, according to Albert E. Whitford, chairman of the UW department of astronomy. This phenomenon occurs once every 17 years. Mars, sometimes called the "red planet," can be seen on the southeastern horizon.

In order for the public to observe the planet, Washburn Observatory will be open on Friday, Monday and Tuesday, Sept. 7, 10 and 11 from 8:30 p.m. to 11 p.m.

"Observations of the planet from Washburn will depend on the tranquility of the air," Whitford said. Under average conditions, he said, a telescope of moderate size, such as the observatory's 15-inch instrument, will show Mars as clearly as a larger one. The best location for observation of the planet will be in South Africa where Mars will be directly overhead.

Whitford said Mars is similar in many respects to the earch. It revolves about the sun, is slightly flattened at the poles, has polar ice caps and regular seasonal changes like the earth.

In size Mars is 4,200 miles in diameter, a little more than one-half the size of the earth. Its day is 24 hours and 37 minutes long and requires 687 days to complete its orbit around the sun.

-more-

Its surface features have been studied and mapped extensively by astronomers. Some features are permanent and others appear to change. Scientists believe that Mars cannot have a rough surface since no mountains are visible.

Mars temperature variation ranges from 50 degrees Fahrenheit at noon to about a minus 90 degrees at night.

Its southern polar cap receeds in the late summer and at this time of year almost disappears. Observers have noted that Mars is covered by a blue haze that occasionally clears. Yellow clouds, thought to be dust, and thin cloud formations have also been seen.

Vegetation in the lowest form might exist on the planet. This is represented by visible dark areas which remain unchanged. These areas cannot be bodies of water or they would reflect light at certain angles. The dark areas are thought to be forms of life similar to the earth's mosses, lichens, or algae, or some other low forms of plant life that can live in limited atmosphere.

The most controversial features of the Martain landscape are markings that originally were called canals by an Italian observer in 1877.

"These elusive canals have been thought by some to connect the large dark areas visible on Mars," Whitford explained. Some astronomers have called these "irrigation canals" but the best observations with large telescopes do not substantiate this theory, he said.

"Astronomers will have to do a great deal more observation of Mars in order to prove that these canals do not exist," Whitford said.

####

Observatory, Washburn

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

9/8/56 RELEASE: Immediately

MADISON, Wis.--The University of Wisconsin is applying for a $1,005,000 grant from the National Institutes of Health to help finance a $2,010,000 research wing on Service Memorial Institutes, the Medical School building on the Madison campus.

The application for federal funds was approved by University regents Saturday along with a number of other University building actions. If the federal fund is granted, it would have to be matched by a fund made up of a $750,000 grant from the Wisconsin Alumni Research Foundation, $55,000 in private gifts to the Medical School, and a $200,000 state appropriation.

The research wing would complete the Service Memorial Institutes, located on the corner of Charter St. and Linden Dr. A $1,609,152 instructional addition to the building, financed by a State Building Trust fund, is now under construction.

In other actions on University buildings Saturday, the regents:

1. Agreed that when and if new and better instructional quarters are available for the astronomy department, the Washburn Observatory building should be used as "an attractive home for University alumni" without changing materially the outside appearance of the old building;

2. Approved, subject to OK by Governor Kohler and the state director of purchases, a $250,000 expansion by the Wisconsin Alumni Research Foundation of the quarters the University rents for its Primate Laboratory; the new addition to house a special federal research project on the effects of radiation, with rent to be paid from "overhead" funds on federal contracts;

-more-

3. Approved final plans and specifications for a $125,000 pre-school laboratory and authorized their executive committee to award contracts when the bids are opened Sept. 20;

4. Approved preliminary plans and authorized preparation of final plans and specifications for the Pine Bluff Research Observatory and the addition to Sterling Hall;

5. Authorized the razing of Chadbourne Hall to make way for a new dormitory on the corner of Park St. and University Ave., and the razing of a wooden temporary building, T-15, on Linden Dr., and an old store building at 201 N. Randall Ave.;

6. Awarded a $9,939.11 contract to Sam Parisi, Middleton, for sidewalks and related work at the Camp Randall Memorial indoor practice building;

7. Rented, for $20 per month, to Phi Chi fraternity, two vacant lots for parking purposes at the southeast corner of Spring and Brooks Sts;

8. Approved parking in the area between the Memorial Union and the Armory during the period the Union is being remodelled;

9. Awarded a $1,425 contract for sanitary sewer construction at Charmany Farm to M. J. Zavada, Verona; a $1,475 contract for cab stand construction near Bascom Hall to J. H. Findorff and Son, Madison; and a $1,976 contract for curbs in the Bacteriology Building parking lot to Vogel Brothers, Madison;

10. Awarded a $24,900 contract to J. R. Sutton, Madison, for general construction and a $698 contract to Robert J. Nickles, Madison, for electrical work on the new disposal and incinerator rooms for the Veterinary Control Laboratory;

11. Awarded $50,171 in remodelling contracts for work on the Kenwood campus of the University of Wisconsin--Milwaukee.

-more-

Four Milwaukee firms will do the Kenwood campus remodelling. Dahlman Construction Co. was given a fixed fee contract for general construction not to exceed $34,600; The Maag Co., up to $5,748 for heating work; O. A. Waskow Co., up to $3,554 for plumbing; and George F. Rohn Electric Co., up to $6,269 for electrical work.

In another action, the regents added to the University Campus Planning Commission membership the provost, vice provost, and the deans at the University of Wisconsin--Milwaukee.

####

Observatory - Washburn

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/2/56 vh

RELEASE: Immediately

That big red planet Mars, which came to within 35 million miles of the earth in September, will be the subject of the first of the autumn series public lecture-demonstrations at the University of Wisconsin Planetarium.

The show on Friday evening (Oct.5) at 7:30 will give Madison area citizens a chance to hear about the stars and visit them on the "indoor sky." The Planetarium was installed at the University in 1953 and is used primarily as a modern teaching aid for astronomy students. But lecture-demonstrations for the public were inaugurated almost immediately and have been continued through each school year since then.

The subject of the first Planetarium performance, Mars, came closer to the earth on Sept. 7 than at any other time in the past 32 years, and it will never be any brighter than then during the remainder of the 20th century. Prof. A. E. Whitford, director of the UW's Washburn Observatory, said today that "even though Mars has receded slightly from its position of nearest approach on Sept. 7, it is still very brilliant in the southern sky these autumn evenings."

Whitford will handle the lecture assignment Friday evening and will tell about and demonstrate such Martian phenomena as the maria or seas and the famous canals.

The complete program for the first semester Planetarium showings is as follows:

Oct. 5 and 19--"Mars," presented by Prof. Whitford

-more-

Nov. 2 and 16--"The Moon," John Bahng, teaching assistant

Nov. 30 and Dec. 14--"Galaxies," Instructor Theodore Houck

The Planetarium is located in the east wing of Journalism Hall. The entrance is on Observatory Drive, approximately 150 feet west of North Park St., at the Memorial Union.

All performances will begin at 7:30 and all guests are asked to be in their seats at this time. "It is not practical to admit latecomers," Prof. Whitford explained, "since the effectiveness of the demonstration depends on maintaining a darkened room."

In announcing the program for the Planetarium, the astronomy department also pointed out that Washburn Observatory will continue to be open to the public on the first and third Wednesday nights of each month, providing the sky is clear. Hours for looking through the 15-inch telescope are from 7:30 to 9:30 p.m.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/18/56 vh

RELEASE: Immediately

Madison area residents will have a last chance of the season to learn more about Mars when the University of Wisconsin Planetarium holds another public lecture demonstration Friday evening (Oct. 19).

The University astronomy department has scheduled observations of Mars through Washburn Observatory telescopes and devoted the first Planetarium lectures of the fall to the big red planet in recognition of a 1956 event.

On Sept. 7 the planet came within 35 million miles of the earth. It reaches such a point of nearest approach once in every 17 years, Prof. A. E. Whitford, chairman of the astronomy department, said.

Whitford will deliver the 7:30 lecture in the east wing of Journalism Hall, telling about such Martian phenomena as the maria or seas and the famous and controversial "canals."

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

11/28/56 vh Immediately

Visitors at the University of Wisconsin Planetarium's lecture demonstration Friday (Nov. 30) will see and hear about the galaxies, Washburn Observatory announced today.

Prof. A.E. Whitford, director of the observatory, explained that the galaxies are vast swarms of stars far beyond the stars of our own Milky Way. A few of these swarms can be seen with the naked eye, he said.

Instructor Theodore Houck will tell the audience about the galaxies and show photographs of them, made with the help of large telescopes.

The performance in the east wing of Journlaism Hall, Observatory Drive, will begin promptly at 7:30 p.m. and because darkness is essential to successful demonstration, doors will not be opened to admit latecomers.

Everyone interested in the story of the sky is welcome at these public performances scheduled throughout the academic year by the University.

####

Observatory—Washburn

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

12/8/56 vh

Immediately

MADISON, Wis.--Improved facilities for astronomy at the University of Wisconsin advanced another step Saturday when the Board of Regents approved final plans and specifications for a new research observatory to be located 15 miles west of Madison.

The regents also authorized advertisement for bids for the construction.

The long-needed modern building to house advanced astronomical study, together with a 53-acre site and a new telescope, is being made available through a $200,000 gift to the University from the Wisconsin Alumni Research Foundation.

The new 'scope--a 36-inch reflecting instrument--is under construction at the firm of Boller and Schwens, S. Pasadena, Calif.

Plans and specifications call for a one-story brick building, approximately 45 by 45 feet, with concrete foundation and a basement. It will include a 25-foot steel dome, an observing floor, and small apartment quarters for a graduate student caretaker.

The new country station is to be built on land which the University purchased early this year on County Trunk T, a mile and one half northwest of Pine Bluff. On this open hilltop, surrounded by low-lying woods and pastureland, the astronomers will have an unobstructed view of the skies, free of smoke and city lights problems.

-more-

The new telescope is expected to be delivered sometime late in the summer of 1957, and when in operation will provide five times the light-gathering power of the University's Washburn Observatory telescope, a 15-inch refracting instrument in use for the greater part of a century.

The country station is expected to be in operation by late 1957. WARF's gift for modernizing and expanding thus will lift Wisconsin to a point equal with other midwestern universities possessing astronomical research equipment.

####

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

2/4/57 vh Immediately

The second semester schedule of public demonstrations at the University of Wisconsin Planetarium was announced today by the University.

During the spring season, these subjects will be given on the following Friday evenings at 7:30 p.m., A.E. Whitford, director of Washburn Observatory, said:

Feb. 15 and March 1, "Gaseous Nebulae"; March 15 and 29, "Jupiter and Its Moons"; April 12, "The Moon and Easter"; May 3 and 17, "Saturn and Its Rings."

The Planetarium is located in Journalism Hall. Entrance to it is gained at the east end of the building on Observatory Drive, some 150 feet west of N. Park Street at the Memorial Union.

Prof. Whitford said also that Visitors' Nights on the first and third Wednesday of each month will continue at Washburn Observatory. From 7:30 to 9:30 on these nights the public will have an opportunity to see sky objects through the 15-inch telescope. Informal explanations will be given of each subject.

Visitors' Nights will not be held unless the sky is clear.

Seating capacity at the Planetarium is for 60 persons and groups of 10 or more wishing to attend a demonstration should give advance notice by telephoning the Observatory--ALpine 5-3311, extension 2551, Whitford emphasized.

Additional information about Planetarium demonstrations or Visitors' Nights also may be obtained at this number.

####

FEATURE STORY

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

NR
Washburn Observatory

4/18/57

RELEASE: Immediately

By VIVIEN HONE

MADISON--This year's Easter date--April 21--carefully learned, millions of Western Christians have been looking forward to the coming Sunday, but for the world's astronomers, University of Wisconsin scientists included, the day is counted only as a number: 2,435,950.

...And it's not because astronomers like best to deal with "astronomical" figures.

"People have been having trouble with setting the Easter date ever since the early days of Christianity," explained C.M. Huffer, Wisconsin professor of astronomy. "We avoid the problem and other matters of time as it is reckoned on the Gregorian calendar by using a simple system called the Julian Day."

By such a method, he pointed out, time started in the dim past of a January 1, exactly 4,713 years before Christ. And each succeeding day is merely one unique and added number in the progressive series.

The scientists were not always left to chart the days this freely and separate from civil and religious events, the UW astronomer said.

"Making the yearly decision on when Easter would occur was one of the chief duties of astronomers during the Middle Ages," Prof. Huffer added.

Here are the major conflicts on which their problem rested--conflicts which ever since have made astronomers wary of the Easter question:

-more-

In the very earliest days of Christianity, the Hebrew Passover was accepted as the time for commemorating Christ's Resurrection, but controversy eventually arose in deciding when the Passover fast ended and the Easter began. By and large, the Christians of Jewish descent accepted the fast as terminating on the 14th day of the Passover moon, at evening, and the Easter as following immediately thereafter, regardless of the day of the week. On the other hand, the Christians of Gentile descent insisted on identifying Sunday, the first day of the week, with the Resurrection and without reference to the day of the Passover month.

The discord continued into the year 325, when the Council of Nicaea declared that Easter thereafter would be kept on Sunday, the same date, throughout the world, and that the correct date for this event would be calculated as the first Sunday following the first full moon following the vernal equinox.

So much for decisions, formulas, and the calendars by which these decisions were to be reached--the calendars were far from accurate instruments for reconciling man's measured ways with the movements of the spheres.

The week, as Prof. Huffer pointed out, has nothing to do with astronomical patterns. And the earth, in its revolution around the sun, makes the circuit in approximately 365 and one-fourth days, not in the commonly accepted 365. Moreover, the moon travels once around the earth in approximately 27 and one-third days--not in the accepted 29, 30, or 31--and the full moons occur at intervals of 29 and one-half days. Adding further to these complications, is the fact that while the vernal equinox (the time when the sun crosses the equator and day and night are of equal length) occurs at a given instant, the local time of the equinox varies in different longitudes.

-more-

Complication upon complication has arisen through the mounting years in attempts to work with periods of time which have no common ground for measurement; there have been frequent revisions and reforms of the calendar, and all have been compromise in terms of the Easter date.

Today, Eastern Christians, using an old Roman calendar system, celebrate the Resurrection before, after, and only rarely on our Easter date, Prof. Huffer said. But Christians of the Western world observe the day as calculated from the Gregorian calendar, a reform of the earlier Roman one.

"As we celebrate it today, our Easter will always fall on a Sunday," Prof. Huffer declared, "but the date may vary as much as a month, falling always somewhere between March 25 and April 25."

This Easter wandering continues to present its complications in matters of modern civil life, the Wisconsin professor pointed out. For instance, at the University, it has made impossible the fixing of a rigid spring vacation period that would always include the Resurrection Sunday.

To compromise with dilemma, officials in recent years have keyed each recess to the Easter date, scheduling it to begin on Good Friday, wherever its position on the calendar, and to continue through Easter and the week following.

University astronomers have supplied this list of Easter dates for the next 10 years: 1958--April 6; 1959--March 29; 1960--April 17; 1961--April 2; 1962--April 22; 1963--April 14; 1964--March 29; 1965--April 18; 1966--April 10; 1967--April 2.

There is a great wish among nations today that the Easter time be fixed, Prof. Huffer indicated--and on his part, the wish is duplicated.

"If I had my choice, I'd select a later date when the weather would be better."

Meantime, until that fortunate day of settlement arrives, a joyous Easter to all--or as the stargazers at Washburn Observatory say, 2,435,950.

###

Observatory - Washburn

CUT LINES

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

4/30/57

Immediately

MADISON-- With tail flaming, Comet Arend-Roland made this brilliant display Monday night for University of Wisconsin astronomers--and other Madison watchers.

The recently discovered luminary was first sighted in November in Belgium. It is so new that astronomers don't know whether it will return periodically or make this single appearance.

When the skies have not been overcast, good viewing has been possible in the Madison area since Tuesday, April 23. Look for it first about 9 p.m. in the direction north northwest and about 20 degrees above the horizon, Washburn Observatory staff members said. "It will probably be around for a few more nights--and will be visible all night."

The photograph of Comet Arend-Roland was taken at 9:30 C.D.T. by John Bahng, UW teaching assistant in astronomy. He used a Leica camera strapped to the eye-end of Washburn's 15-inch scope and made a 15-minute exposure at F 3.5.

Note stars visible through the tail. In silhouette are the telescope tube and sides of the Washburn dome opening.

#####

MADISON NEWS

Observatory, Washburn

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

8/9/57 vh

RELEASE: Immediately

MADISON, Wis.--The Perseids, annual display of shooting stars, have already begun and will be at their height on the evening of Aug. 12, A. E. Whitford, director of the University of Wisconsin's Washburn Observatory, said today.

"The shooting stars will appear to radiate from the constellation Perseus--to be found low in the northeastern sky in late evening, below the well-known W, Cassiopeia. As the night wears on, Perseus climbs higher and will be almost overhead by dawn."

The meteors will fall in many directions. Given good atmospheric and other sky conditions, viewers could see as many as 100 in an hour, but Prof. Whitford pointed out that a moon, very near full, will brighten the sky and make conditions less than ideal.

Nonetheless, Washburn Observatory will hold a skywatch on Observatory Hill, beginning at 9 p.m. Monday (Aug. 12). The junior division of the Madison Astronomical Society has organized the watch. Observers anywhere need only a good view of the northeastern sky to organize watch parties of their own.

All meteoric showers originate from comets--are swarms of fine particles or debris dropped way from the comets and left behind in their paths. We are treated to a star shower only when the earth crosses a comet orbit and thus intercepts these particles.

The Perseids are the debris left behind by Comet 1862 III, last seen in 1862 but predicted for re-appearance in 1984, Prof. Whitford said. Most of the

-more-

add one--shooting stars

particles are no bigger than a grain of sand and are a distance of 50-75 miles from the observer when seen. As they travel toward the earth at a speed of 20-40 miles per second, friction with the atmosphere sets them burning.

####

MADISON NEWS

Observatory, Washburn

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE: Immediately

10/1/57 jfn

MADISON--You're invited to go along on a "trip" to the moon.

Opening demonstrations on the "indoor sky" at the University of Wisconsin Planetarium this semester will feature the moon on Friday evenings, Oct. 4 and 18. Topics for the remainder of the autumn schedule include the galaxies on Nov. 1 and 15, and the planet Venus on Dec. 6.

Each demonstration will show the constellations of the season and the changing aspects of the sky as seen from different parts of the earth.

The Friday evening performances are open to all interested persons. The demonstrations begin promptly at 7:30 and since effectiveness of the show depends upon darkness, latecomers are not admitted. The Planetarium is located in the east wing of Journalism Hall.

Seating capacity is for 60 persons. Groups of 10 or more wishing to attend should give advance notice by telephoning the Washburn Observatory, Alpine 5-3311, Ext. 2551.

The 15-inch telescope on Observatory Hill continues open to the public on the first and third Wednesday nights of each month from 7:30 to 9:30, providing the sky is clear.

###

Observatory, Washburn

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

10/5/57 mcg

October 5, 1957

MADISON, Wis.--Prof. Arthur D. Code of the California Institute of Technology, a former member of the University of Wisconsin faculty in astronomy, will return to the campus July 1 as professor of astronomy and director of the Washburn Observatory.

In approving his appointment, UW regents Saturday paid tribute to the outstanding teaching effectiveness, research leadership, and instrumental knowledge which will enable Prof. Code to carry out the special responsibilities of bringing the new Pine Bluff Observatory into operation.

Code was a member of the UW staff from 1952 until June, 1956, when he went to Cal Tech. Nationally known as a pioneer in the photo-electric measurement of stars and in development of automatic methods of star computations, he was trained at the University of Chicago and Yerkes Observatory, Williams Bay, Wis.

He will replace Prof. Albert E. Whitford, director of Washburn Observatory since 1948. Dr. Whitford will become director of the University of California's Lick Observatory at Mt. Hamilton next July. Holder of both M.A. and Ph.D. from Wisconsin and a member of the National Academy of Sciences, Dr. Whitford has been a member of the UW faculty since 1935.

In other personnel actions, the regents:

Approved appointment of Robert F. Roeming, professor of French and Italian at UW-M, as acting associate Dean of the College of Letters and Science at UW-M for the academic year 1957-58;

Approved appointment of Warren W. Clark, emeritus professor in the Agricultural Extension Service, on a special service contract to work on exhibits for the agricultural Extension program during November and December, 1957, and February through June, 1958;

-more-

Add one--Personnel items

Approved appointment of George C. Sellery, emeritus Dean of the Graduate School and professor of history, to do research in the history of the University on a part-time basis from Sept. 1, 1957, to June 30, 1958;

Accepted resignations of Pieter Singelenberg, associate professor of art history, and George A. Cavender, professor of labor education in the Extension Division School for Workers;

Approved leaves of absence for Prof. Walter A. Morton, department of economics, for the first semester; for Prof. John T. Salter, department of political science, for the first semester; and for Prof. Ralph K. Huitt, political science, to enable him to join the Washington staff of Sen. William Proxmire.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/17/57 vh

RELEASE: Immediately

Washburn Observatory

MADISON--The moon, in spite of man-made versions still the earth's major satellite, will be the subject of the University of Wisconsin's Friday evening (Oct. 18) Planetarium lecture-demonstration.

Instructor Theodore E. Houck of the UW astronomy department staff will be lecturer for the evening, beginning at 7:30.

Public lecture-demonstrations of astronomical phenomena have been a feature at the Planetarium since it was installed in the fall of 1953 to serve primarily as a modern teaching aid for astronomy students.

Demonstrations for the 1957-58 year will show constellations of the season and changing aspects of the sky as seen from different parts of the earth. In addition, a selected topic will be singled out for more detailed attention.

Subjects for the fall lectures presented twice monthly, will also include galaxies and the planet Venus.

Everyone interested in the story of the sky is welcome to attend without charge. Audience capacity under the man-made sky is 60 persons. Large overflows are accommodated by a second show immediately following the first.

###

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

10/5/57 mcg

October 5, 1957

MADISON, Wis.--Prof. Arthur D. Code of the California Institute of Technology, a former member of the University of Wisconsin faculty in astronomy, will return to the campus July 1 as professor of astronomy and director of the Washburn Observatory.

In approving his appointment, UW regents Saturday paid tribute to the outstanding teaching effectiveness, research leadership, and instrumental knowledge which will enable Prof. Code to carry out the special responsibilities of bringing the new Pine Bluff Observatory into operation.

Code was a member of the UW staff from 1952 until June, 1956, when he went to Cal Tech. Nationally known as a pioneer in the photo-electric measurement of stars and in development of automatic methods of star computations, he was trained at the University of Chicago and Yerkes Observatory, Williams Bay, Wis.

He will replace Prof. Albert E. Whitford, director of Washburn Observatory since 1948. Dr. Whitford will become director of the University of California's Lick Observatory at Mt. Hamilton next July. Holder of both M.A. and Ph.D. from Wisconsin and a member of the National Academy of Sciences, Dr. Whitford has been a member of the UW faculty since 1935.

In other personnel actions, the regents:

Approved appointment of Robert F. Roeming, professor of French and Italian at UW-M, as acting associate Dean of the College of Letters and Science at UW-M for the academic year 1957-58;

Approved appointment of Warren W. Clark, emeritus professor in the Agricultural Extension Service, on a special service contract to work on exhibits for the agricultural Extension program during November and December, 1957, and February through June, 1958;

-more-

Approved appointment of George C. Sellery, emeritus Dean of the Graduate School and professor of history, to do research in the history of the University on a part-time basis from Sept. 1, 1957, to June 30, 1958;

Accepted resignations of Pieter Singelenberg, associate professor of art history, and George A. Cavender, professor of labor education in the Extension Division School for Workers;

Approved leaves of absence for Prof. Walter A. Morton, department of economics, for the first semester; for Prof. John T. Salter, department of political science, for the first semester; and for Prof. Ralph K. Huitt, political science, to enable him to join the Washington staff of Sen. William Proxmire.

###

MADISON NEWS Observatory, Dept. of

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/31/57 vh

RELEASE: Immediately

MADISON--Guests at the University of Wisconsin's Friday night Planetarium performance (Nov. 1) will "visit" the galaxies with the help of Prof. C. M. Huffer.

Appearing dim and hazy to the naked eye the galaxies are actually vast stellar systems like the cloud of stars which form the Milky Way. Prof. Huffer will illustrate the lecture with demonstrations on the Planetarium canvas "sky" and photographs taken through large telescopes.

The bi-weekly Planetarium performances begin promptly at 7:30 p.m. and because total darkness is required, doors are not opended to admit latecomers. The public may attend without charge.

The Planetarium is housed in the east wing of Journalism Hall, opposite Science Hall on Observatory Drive.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

11/14/57 vh

RELEASE: Immediately

MADISON--Prof. A. E. Whitford, director of Washburn Observatory, will deliver a lecture on galaxies at the Friday evening (Nov. 15) lecture-demonstration at the University of Wisconsin Planetarium.

The performance, open to the public, will begin at 7:30 in the east wing of Journalism Hall, Observatory Drive.

Guests will hear details about vast stellar systems such as the Milky Way, will see galaxies on the Planetarium "sky", and will view photographs of galaxies taken through large telescopes.

###

Washburn Observatory

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

12/5/57 vh

RELEASE: Immediately

MADISON--The planet Venus, now an exceedingly brilliant object in the southwestern twilight sky, will be the subject of the University of Wisconsin Planetarium's Friday evening lecture-demonstration, Dec. 6.

Prof. A.E. Whitford, who will deliver the 7:30 lecture, said that since the advent of Sputnik I and II, skywatchers frequently mistake Venus for one of the man-made satellites.

With the aid of the Planetarium projector, the astonomer will explain details of the motions of Venus. He will also show photographs of the planet as seen through large telescopes.

The Friday lectures are a public service of the University, permitting Madison area citizens to share the learning of the astronomy staff and the visual instruction which the Planetarium provides.

The Dec. 6 lecture-demonstration is the last in the first semester series. The Planetarium will be closed during Christmas recess, but will resume the public program as the second semester gets under way.

###

MADISON NEWS Washburn Observatory

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

12/10/57 vh

RELEASE: Immediately

MADISON--Sputnik II will spin over the Madison area this week and residents will have several opportunities to see the Russian earth satellite--if they are willing to get up early, and if the weather is clear.

University of Wisconsin astronomer C. M. Huffer said today that weather predictions look unfavorable, but if conditions are good, Sputnik II will be seen in the morning sky on four days, Thursday through Sunday.

"Look to the northwest sky near the horizon," he directed. "The satellite, as bright as a first magnitude star, will be traveling from north to south at a low altitude, never more than 30 degrees, and it will disappear before reaching the southern horizon."

He listed this schedule for appearance on Central Standard Time, based on a table supplied by the Smithsonian Institution Observatory, Cambridge, Mass.:

Thursday, Dec. 12---------------------------------6:39 a.m.

Friday, Dec. 13-----------------------------------6:24 a.m.

Saturday, Dec. 14---------------------------------6:10 a.m.

Sunday, Dec. 15-----------------------------------5:55 a.m.

Sputnik will take approximately a minute to arch across the sky, and the times given above apply to the point of maximum altitude on each appearance, Prof. Huffer said. He cautioned that the schedule may not be exact. Watchers should allow for a variation of as much as five minutes on either side of the scheduled time.

Prof. Huffer also warned that because of the expected low altitude, observations may be hindered by clouds or haze.

##

U.W. NEWS

12/11/57 vh

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE: Noon, Friday, Dec. 13

MADISON, Wis.--Astronomy research at the University of Wisconsin was guaranteed greatly increased facilities today as the National Science Foundation announced a $3-million dollar grant to the Association of Universities for Research in Astronomy (AURA).

Wisconsin is a member of AURA. The grant will pay for large telescopes, construction of a national observatory on an ideal site, and for operation and maintenance of the observatory.

The funds were formally given and a contract signed at a meeting of AURA's board of directors in Phoenix, Ariz. today. UW Vice Pres. A.W. Peterson and A.E. Whitford, director of Wisconsin's Washburn Observatory and chairman of the UW astronomy department, are the Badger representatives on the board.

Wisconsin, a charter member, joined AURA early this fall, paying membership fee of $10,000 with money given by the Wisconsin Alumni Research Foundation. Other members of the non-profit corporation include Indiana University, Ohio State, Harvard, Princeton, and the Universitites of Chicago, Michigan, and California.

AURA would provide these institutions having first-ranking astronomy departments--schools mainly in the east and middlewest--with the most up-to-date shared facilities through group action and a combining of funds and personnel. It would do for astronomy research what the Midwest Universities Research Association (MURA) is attempting to do for research in high energy physics.

"The weather in this part of the country and in the east is not advantageous enough for observation to justify great investments in observatories and telescopes," Prof. Whitford explained when Wisconsin joined AURA. "Joined together, we can provide a facility that no single one of us could afford.

-more-

"And if this can be placed in the finest site remaining in the U.S., it will offer to astronomers anywhere in the country the opportunities thus far existing only in the Far West."

The foundation also pointed out today that the new national observatory will be open for research to all qualified astronomers, whether or not affiliated with member universities.

In addition to signing the contract with the National Science Foundation, the AURA board considered matters on a site for the observatory. A site survey supported by NSF has been in progress for some time. Prof. Whitford of Wisconsin has been active in setting up the survey, which has been carried on by an advisory panel of astronomers with headquaters at the University of Michigan.

After extensive studies of the entire southwestern area, the search for an ideal location has been narrowed to five possibilities, the foundation announced today: Kitt Peak, southwest of Tucson; Summit Mountain, south of Williams; Chevalon Butte, south of Winslow; and the Hualapai Mountains, south of Kingman--all in Arizona; and also Junipero Serra, west of King City, Calif.

Final selection of location and the construction of the observatory buildings await completion of the tests which will extend well into 1958.

Other universities are expected to join AURA as the project develops, the foundation indicated.

###

Washburn Observatory

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

12/20/57 vh

RELEASE: Immediately

MADISON--Russia's second earth satellite will make some afternoon appearances in the Madison area beginning Saturday, according to Prof. C. M. Huffer of the University of Wisconsin Washburn Observatory.

He said that if the weather is clear, Sputnik II will appear approximately at the following times calculated by the Smithsonian Institution Observatory at Cambridge, Mass.:

Saturday, Dec. 21----------------------------6:49 p.m.

Sunday, Dec. 22------------------------------6:28 p.m.

Monday, Dec. 23------------------------------6:07 p.m.

Tuesday, Dec. 24-----------------------------5:46 p.m.

Wednesday, Dec. 25---------------------------5:25 p.m.

Thursday, Dec. 26----------------------------5:04 p.m.

In the afternoon appearances the satellite will be traveling from the southwest to the northeast, passing directly overhead at an angle of 31 degrees on Monday, Dec. 23. Before the 23rd, it will pass west of overhead and after the 23rd east of overhead.

Prof. Huffer cautioned that there may be some slight variation in the time for appearance as calculated.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

1/20/58 vh

Immediately

MADISON--Sputnik II will be seen in the Madison area on two evenings this week if the weather is clear, astronomers at the University of Wisconsin Washburn Observatory said today.

The satellite is predicted to pass overhead around 7:17 Tuesday evening (Jan. 21), Prof. A. E. Whitford said. It will be traveling from northwest to southeast. Since it will be close to the earth's shadow, it may not be visible throughout the entire passage.

Sputnik is also scheduled to appear on Thursday evening (Jan. 23) at 7:14, but will not pass directly overhead this time. It will appear in the west and travel south.

Too far to the east and in the shadow of the earth, it will not be visible Wednesday evening, Prof. Whitford pointed out.

##

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE: Immediately

2/18/58 vh

MADISON--The moon, earth's only natural satellite, will be the subject of the first lecture in the University of Wisconsin Planetarium second semester series, the UW department of astronomy announced today.

Prof. C. M. Huffer will take over the assignment, scheduled for Friday evening, Feb. 21, at the usual 7:30. The lectures are presented for the Madison area public. The Planetarium is located in the east wing of Journalism Hall on Observatory Drive.

Now that space travel has begun, our natural satellite has especial interest for the world. Lecture guests will see the moon as a thin new crescent in the winter sky this week.

Prof. Huffer will tell about its motions and physical nature including mountains, seas, and craters.

The moon lecture will be repeated on March 7.

The Friday lecture schedule for the second semester is as follows:

March 21----------------------"The Moon and Easter"

April 18 and May 2------------"Jupiter and Its Moons"

May 16------------------------"Saturn and Its Rings"

The Washburn Observatory will continue its program of open house on the first and third Wednesday nights of each month, whenever the sky is clear. During the 7:30 to 9:30 period, visitors have an opportunity to look through the Washburn telescope and to hear informal explanations of sky objects.

###

[Observatory, Washburn]

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

3/4/58 vh

RELEASE: Immediately

MADISON--"The Moon" will be the subject again at the University of Wisconsin's Planetarium lecture-demonstration Friday evening (March 7).

The public is invited to hear Prof. A.E. Whitford tell about the moon, its motions and prominent physical characteristics: mountains, seas, and craters. With the world aroused to the possibilities of space travel and talking of trips to the moon, earth's only natural satellite has increasing interest for skywatchers.

Accompanied by demonstrations on the indoor "sky," the talk is one of five scheduled as a public service for the UW's second semester.

All lectures begin at 7:30 in the Planetarium quarters in the east wing of Journalism Hall, Observatory Drive.

##

MADISON NEWS

[Observatory Washburn]

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

3/5/58 vh

RELEASE: Immediately

MADISON--Dr. Zdenek Kopal, widely-known astronomer and mathematician, will present a lecture on comets at the University of Wisconsin Wednesday, March 12.

The lecture, beginning at 8 p.m. in 22 Commerce Bldg., is offered to the public under joint sponsorship of the Madison Astronomical Society and the University.

Persons interested in the two newly discovered comets--Arend-Roland and Mrkos--which were seen in Madison during 1957, will find the lecture especially rewarding, Prof. C.M. Huffer, UW astronomer and secretary of the Madison Astronomical Society pointed out.

Dr. Kopal came to the Wisconsin campus last July as a visiting staff member of the Army Mathematics Center. He is on leave of absence from the University of Manchester, England, where he heads the department of astronomy.

The visiting scientists is especially known for his work in numerical analysis and in the field of eclipsing binary or twin stars. He and Prof. Huffer have collaborated for some years in studies of the eclipsing paired stars.

A native of Prague, Czechoslovakia, Kopal came to America in 1938 and worked for some 13 years at the Massachusetts Institute of Technology and the Harvard Observatory. He has headed astronomy studies at Manchester since 1951.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

3/12/58 vh

Immediately

MADISON--Last chances to see Sputnik II are in order for Wisconsin....

If the sky is clear and if there is a willingness to rise before dawn, Badgers may see the Russian satellite five early mornings beginning Thursday, A.E. Whitford, director of the University of Wisconsin's Washburn Observatory, said today.

He also said that at the present rate of descent, Sputnik II should make its last revolutions around the earth on April 17. Therefore the morning passages and an evening one on March 20 will probably be the last visible in Wisconsin.

Whitford listed the following times for morning passage, based upon predictions prepared by the Smithsonian Astrophysical Observatory:

Thursday, March 13------------------------4:55 a.m. C.S.T.
Friday, March 14--------------------------4:45
Saturday, March 15------------------------4:34
Sunday, March 16--------------------------4:22
Monday, March 17--------------------------4:08

All of the above passages will be from northwest to southeast, Prof. Whitford pointed out, and on the earlier dates the Russian satellite will pass close to the horizon. Because it will be so far away it will have a brightness not much greater than the stars in the handle of the Little Dipper, Polaris excepted.

A projection of the Smithsonian was quoted by Whitford for the evening passage of Sputnik II on March 20. The time is 6:55 p.m. (observers should allow about five minutes for a margin of error in all predictions) and the passage will be from southwest to northeast in a path east of the zenith and about half way from zenith to the horizon.

Unless the incandescent phase of the final descent occurs over North America, this will be a final sight, Whitford said. However, the March 20 view in Wisconsin should be a bright moment. The Wisconsin astronomer said Sputnik II would then appear "the equal of the brightest stars."

###

WIRE NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

3/14/58 vh

RELEASE: Immediately

MADISON, Wis.--Kitt Peak, a 6,875-foot elevation near Tucson, Arizona will be the site of the new national observatory in which the University of Wisconsin has a stake, the UW astronomy department confirmed today. Washburn

Announcement of the final site selection came from the National Science Foundation which made a $3-million dollar grant last December for construction of the observatory, purchase of large telescopes and a site, and for operation of the new facility.

The grant was made to the Association of Universities for Research in Astronomy (AURA). Wisconsin is a charter member of AURA, a non-profit corporation of learned institutions organized to forward astronomy studies through the sharing of funds, personnel, and up-to-date facilities.

Other members include Indiana University, Ohio State, Harvard, Yale, and the Universities of Chicago, Michigan, and California. All have had experience in operating observatories and have strong programs in research and graduate instruction in astronomy. New members are expected to join the organizations as the project develops.

Choice of the site for the national observatory some 40 miles southwest of Tucson in the Quinlan Mountains is the result of a three-year survey which considered some 150 possible locations in the southwest. Prof. A.E. Whitford, director of Wisconsin's Washburn Observatory, has been an advisory panel member of AURA and has been active in site survey planning.

Earlier in the search he explained: "If this observatory can be placed in the finest site remaining in the U.S., it will offer to astronomers anywhere

-more-

in the country the opportunities thus far existing only in the ..far west."

He said today that the national facility is now assured of construction on a 70-acre flatland at the summit of Kitt Peak.

The Papago Indians on whose reservation the mountain is located have given their consent to use of the site for scientific purposes. The peak is sacred to the Papagos.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

3/20/58 vh

RELEASE: Immediately

MADISON--Last appearances of Sputnik II visible in the Madison area are now taking place in the evenings, the University of Wisconsin astronomy department reported today.

According to predictions, the Russian satellite will fall to earth in April and will not be seen in Wisconsin after this week.

Prof. C. M. Huffer of the UW Washburn Observatory listed the following times for the appearances, but cautioned that observers should allow several minutes on either side of the times given for possible sighting.

Thursday, March 20.................7:37 p.m. CST

Friday, March 21...................7:10

Saturday, March 22.................6:40

All passages will be from southwest to northeast and will be at a relatively low altitude, the highest reaching a point of 32 degrees above the western horizon, Huffer said. He also pointed out that absorption of the earth's atmosphere will dim brilliance somewhat, but if visibility is good, the satellite should appear as bright as many of the "naked eye" stars.

###

MADISON NEWS

Observatory Washburn

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

3/20/58 vh

RELEASE: Immediately

MADISON--"The Moon and Easter" will be the subject of the Friday evening (March 21) public lecture demonstration at the University of Wisconsin Planetarium.

The lecture, beginning at 7:30, occurs on the date of the vernal equinox, Prof. A.E. Whitford said, and appropriate to the occasion, Dr. Whitford will tell his audience about the astronomical problems that have occurred throughout the Christian ages in fixing the Easter date.

Entrance to the Planetarium in the east wing of Journalism Hall is on Observatory Drive across from Science Hall.

The Friday lecture, scheduled as a series of six for the second semester, are a public service feature to give the Madison area community a chance to learn about astronomy through the University's modern teaching facility.

###

WIRE NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE: Immediately

6/10/58 gr

MADISON, Wis.--Wisconsin Alumni Association members have elected three new directors to the governing board of the worldwide organization, and re-elected seven other directors, Executive Director John Berge announced Tuesday night.

New directors are Robert Angus, Ft. Atkinson; Grafton Berry, Rhinelander; and Prof. William B. Sarles (2237 Hollister Ave.), Madison.

Re-elected were Don Anderson (801 Magdeline Dr.) and John G. Jamieson (2135 Chamberlain Ave.), both of Madison; Gordon Connor, Wausau; Lloyd Larson, Milwaukee; Charles O. Newlin, Chicago; Mrs. John A. Schindler, Monroe; and John C. Wickhem, Janesville.

A semi-annual meeting of the Association board will be held Saturday at 9:30 a.m. in the Memorial Union, followed by a meeting of the Association membership at 10:30 a.m.

The agenda for both meetings includes progress reports on the proposed Wisconsin Alumni House, an alumni headquarters which will be located in the present Washburn Observatory in the center of the campus.

The directors will also name a new president to succeed Dr. John A. Keenan, New York City packaging executive.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE: Immediately

6/19/58 vh

MADISON, Wis.--A large number of the nation's professional astronomers will trek to the University of Wisconsin campus on the monthend for the 100th meeting of the American Astronomical Society.

Approximately 200 are expected to attend the four-day conference, June 29-July 2, during which the UW will dedicate its new $200,000 research observatory at Pine Bluff and celebrate 80 years of astronomy on the Madison campus.

The group will hear a dedicatory address for the new facility given by UW Emeritus Prof. Joel Stebbins, the society's annual Henry Norris Russell Lecture, presented this year by Dr. Walter Baade, and some 56 contributed and invited papers.

Dr. Baade is a distinguished staff member of Mount Wilson and Palomar Observatories in California. Prof. Stebbins, a pioneer in photo-electric techniques for the measurement of starlight, retired from the directorship of Wisconsin's Washburn Observatory in 1948 and since then has continued his research at California's Lick Observatory.

The society, counting one third of its membership as research astronomers, met last at Madison 12 years ago. Sessions for this year's gathering on the Wisconsin campus will be held at both the Memorial Union and the Wisconsin Center Bldg; A. E. Whitford, director of Washburn Observatory, said.

He also indicated that the public will be welcome to sit in at all sessions where lectures are given or papers are read and will be welcome to attend the dedication ceremonies at the Pine Bluff Observatory on Monday evening, June 30.

Details of the society's program will be announced later.

###

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

6/28/58 vh Immediately

MADISON, Wis.--State and University of Wisconsin officials in the company of some 150 to 200 professional astronomers will formally launch operations at the University's new research observatory at Pine Bluff on Monday (June 30) in a twilight dedication.

The formal opening of the $200,000 country station with its 36-inch modern telescope, some 15 miles west of Madison, marks new opportunities for astronomy at Wisconsin and points to a record of Wisconsin work in the field now 80 years long.

Planned to coincide with the national meeting on the Badger campus of the American Astronomical Society, June 29-July 2, the event will give not only the public but many of the nation's top minds in astronomy an opportunity to inspect the station and 'scope. The latter is uniquely designed and equipped to fit the needs of Wisconsin research.

Gift funds from the Wisconsin Alumni Research Foundation supported the construction of the station and auxiliary buildings, purchase of the reflecting telescope, and acquisition of a 53-acre hilltop site near County Trunk P, one and one half miles northwest of the village of Pine Bluff. Ground was broken in April 1957, the installation was largely ready to function by early spring of this year, and finishing touches have been in progress to the present.

The dedication will open at 8 p.m. with remarks by Prof. A. E. Whitford, chairman of the UW department of astronomy and director of Washburn Observatory. UW President-Elect Conrad A. Elvehjem will speak for the University, Walter A.

-more-

Frautschi for the Wisconsin Alumni Research Foundation, and George E. Watson, state superintendent of public instruction, for the UW Board of Regents.

Joel Stebbins, UW emeritus professor of astronomy, will deliver the dedicatory address: "Washburn Observatory, 1878-1958." The former Wisconsin faculty member pioneered studies on the Badger campus in the photo-electric measurement of starlight. Today's department carries on in this tradition and is well-known for its work in the field.

Final event of the program will be the presentation of a key for the country observatory to Prof. Arthur D. Code who will succeed Prof. Whitford to the directorship of Wisconsin astronomy studies on July 1. Prof. Whitford leaves the UW campus to assume directorship of Lick Observatory, California, one of the nation's largest astronomical facilities, after 32 years at Wisconsin.

The new station at Pine Bluff is the first major improvement for advanced astronomical studies at Wisconsin since studies began in 1878. In that year Washburn Observatory, the gift of a former early governor, Cadwallader C. Washburn, was completed. It housed another gift from Washburn, a 15-and one-half inch refracting telescope, then considered one of the most up-to-date instruments of its kind and in size exceeding Harvard University's 'scope by one half inch. Ever since then, this workhorse of the skies has been in operation at Wisconsin but today it is no longer the envy of other schools.

WARF's gift extends Washburn activities into the country where city lights and haze are no barrier to observation, and begins a significant new era of astronomy studies for Wisconsin.

better

The modern equipment places the Badger school among the fifth equipped Midwestern institutions offering graduate astronomy studies.

##

PROGRAM
of the
ONE HUNDREDTH MEETING
of the
AMERICAN ASTRONOMICAL SOCIETY

file

WASHBURN OBSERVATORY
UNIVERSITY OF WISCONSIN
MADISON, WISCONSIN
JUNE 29-JULY 2, 1958

PRESIDENT
PAUL W. MERRILL

PRESIDENT-ELECT
G. M. CLEMENCE

VICE-PRESIDENTS
S. CHANDRASEKHAR A. N. VYSSOTSKY

SECRETARY
J. A. HYNEK

TREASURER
FRANK K. EDMONDSON

COUNCILORS
HORACE W. BABCOCK
JAMES G. BAKER
GUILLERMO HARO
JOHN F. HEARD
JOHN B. IRWIN
SIDNEY W. MCCUSKEY
ALLAN R. SANDAGE
CARL K. SEYFERT
ALBERT G. WILSON

EX-PRESIDENTS
ROBERT R. MCMATH DONALD H. MENZEL

PROGRAM

(Central Daylight Time)

Sunday, June 29

9:30 a.m.	U. S. National Committee for I. A. U. Meeting. Chamberlin House Lounge, Kronshage Dormitories.
2:00-10:00 p.m.	Registration. Kronshage Hall Desk.
2:15 p.m.	Council Meeting. Chamberlin House Lounge, Kronshage Dormitories.
7:00 p.m.	Meeting of Members of Committee on Education. Kronshage Dormitories.
8:00-10:00 p.m.	Reception. Washburn Observatory.

Monday, June 30

8:30 a.m.	Registration. Lobby of Wisconsin Union.
9:00 a.m.-12:00 noon	Welcome. President E. B. FRED, *University of Wisconsin.* Play Circle, Wisconsin Union.
	Session for Papers. Play Circle, Wisconsin Union.
12:15 p.m.	Society Photograph.
2:00- 4:30 p.m.	Conference: "Analysis of Composite Radiation from Stellar Systems," sponsored by the National Science Foundation. Play Circle, Wisconsin Union. Moderator: A. E. WHITFORD, *Washburn Observatory, University of Wisconsin.*
	"The Spectra of Galaxies," W. W. MORGAN, *Yerkes Observatory, University of Chicago.*
	"The Mass-Luminosity Ratio in External Galaxies," GUIDO MUNCH, *California Institute of Technology,* and *Mount Wilson and Palomar Observatories.*
	"Population Inferences from Star Counts, Surface Brightnesses and Colors," W. A. BAUM, *Mount Wilson and Palomar Observatories.*
	"Energy Distribution Curves of Galaxies," A. D. CODE, *California Institute of Technology,* and *Mount Wilson and Palomar Observatories.*
5:15 p.m.	Leave for Pine Bluff. Picnic supper and inspection of Observatory.
8:00 p.m.	Dedication program. Address, "The Washburn Observatory, 1878-1958," JOEL STEBBINS.

Tuesday, July 1

9:00 a.m.	Business meeting. Wisconsin Center, Room 210.
	Report of the Committee on Education.
-12:00 noon	Session for papers. Wisconsin Center, Room 210.
2:00 p.m.- 4:00 p.m.	Session for papers. Wisconsin Center, Room 210.
4:00 p.m.	Meeting of U. S. Astronomers attending I. A. U. General Assembly, August 13-20, 1958 in Moscow. Wisconsin Center, Room 227.
6:00 p.m.	Society Dinner. Great Hall, Wisconsin Union.
8:30 p.m.	Russell Lecture: "Galaxies and Stellar Evolution," DR. WALTER BAADE, *Mount Wilson and Palomar Observatories.* Wisconsin Union Theater.

Wednesday, July 2

9:00 a.m.-12:00 noon	Session for papers. Wisconsin Center, Room 210.

ANNOUNCEMENTS

REGISTRATION on Sunday afternoon and evening will be at Kronshage Hall Desk. On Monday, a registration desk will be maintained in lobby outside the meeting room in the Wisconsin Union.

MAIL AND TELEGRAMS should be addressed in care of Washburn Observatory, University of Wisconsin, Madison 6, Wisconsin. The telephone number is ALpine 5-3311, Extension 2551.

INFORMAL CLOTHING and walking shoes will be appropriate for the picnic supper and dedication program at Pine Bluff on Monday evening. Those who wish to avail themselves of the pier facilities at Kronshage Dormitories are reminded to bring swimming suits; a life guard will be on duty.

A WOMEN'S PROGRAM has been planned. On Monday afternoon, there will be a boat ride on Lake Mendota. On Tuesday, there will be a trip to a Cornish settlement at Mineral Point, with a luncheon at Pendarvis House. The return trip will be via Taliesin, the Frank Lloyd Wright home near Spring Green. Arrangements for these excursions will be made at the time of registration.

FUTURE MEETINGS. The next meeting of the AAS, the 101st, a Christmas meeting, will be held at the University of Florida, Gainesville, Florida, December 27-30, 1958. The 102nd meeting will be at the University of Rochester, April, 1959; the 103rd, at the University of Toronto, August 30-September 2, 1959; the 104th, the University of Denver, December, 1959; the 105th, the University of Pittsburgh, April, 1960; the 106th, Mexico City, August, 1960; the 107th, Philadelphia, Christmas, 1960; and the 108th, on the Island of Nantucket, Massachusetts, June, 1961.

NOTICE TO MEMBERS OF THE AMERICAN ASTRONOMICAL SOCIETY. Members of the American Astronomical Society who are also members of the American Association for the Advancement of Science are qualified for automatic *fellowship* in the A.A.A.S. Dr. Raymond L. Taylor, Associate Administrative Secretary A.A.A.S., writes, "It will be appreciated if members of the American Astronomical Society who are currently A.A.A.S. members and do not have an A.A.A.S. fellowship certificate will advise the A.A.A.S., 1515 Massachusetts Avenue, NW, Washington 5, D.C."

This is of some importance because in the A.A.A.S. only "Fellows are eligible to serve as officers, members of the Board of Directors or Council, or as elected members of section committees."

PROGRAM OF PAPERS

Subject to the approval of the Council,
the following papers are placed on the program:

Monday, June 30, 9:00 a.m. - 12:00 noon

Play Circle, Wisconsin Union

1. Report on the Kitt Peak Observatory, A. B. Meinel, *National Astronomical Observatory.*
2. A Six-Cell Pulse Photoelectric Photometer, W. A. Hiltner, P. Pesch and R. H. Miller, *Yerkes Observatory.*
3. Rocket Astronomy in the Far Ultraviolet, J. E. Kupperian, Jr. and Herbert Friedman, *U. S. Naval Research Laboratory.*
4. Ultraviolet Nebulae in Virgo and Orion, A. Boggess III, J. E. Kupperian, Jr., J. E. Milligan, *U. S. Naval Research Laboratory.*

5. Stellar Flux Measurements at 2700A, A. BOGGESS III and L. DUNKELMAN, *U. S. Naval Observatory.*
6. Four Photoelectric Sequences for the Southern Hemisphere, BART J. BOK and PRISCILLA F. BOK, *Mount Stromlo Observatory.*

SHORT INTERMISSION

7. Expansion versus Contraction in the Evolution of a Star Cluster, IVAN R. KING, *University of Illinois Observatory.*
8. Some Observations of T Tauri Stars for Polarization Effects, EDWIN B. WESTON, *Department of Astronomy, Amherst College.*
9. Abundance in Population II K Giants, H. L. HELFER, *Mount Wilson and Palomar Observatories* and G. WALLERSTEIN, *California Institute of Technology.*
10. Composition of B Stars, L. H. ALLER, A. BOURY, *University of Michigan Observatory* and JUN JUGAKU, *University of Kyoto.*
11. An Analysis of the Composite Spectrum of the Large Magellanic Cloud, GERARD DE VAUCOULEURS and ANTOINETTE DE VAUCOULEURS, *Lowell Observatory.*
12. The Magnitudes, Colors, and Motions of Stars of the Spectral Class R, GORDON LEE VANDERVORT, *Leander McCormick Observatory, University of Virginia.*
13. Photoelectric Spectrophotometry of A Stars, R.C. BLESS, *University of Michigan Observatory.*

Tuesday, July 1, 9:00 a.m. - 12:00 noon

Wisconsin Center, Room 210

Annual Business Meeting: Election of Officers and Report of Council.
Report of the Committee on Education.

SHORT INTERMISSION

14. The Doppler Widths of Solar Line Profiles, BARBARA BELL, *Harvard College Observatory* and ALAN S. MELTZER, *Rensselaer Polytechnic Institute.*
15. Lifetime of Pores Found on Solar Photographs Taken from the Stratosphere, J. D. BAHNG, *Princeton University Observatory.*
16. Observation of Solar "Points", ORREN C. MOHLER and HELEN W. DODSON, *McMath-Hulbert Observatory.*
17. The Calculation of Line Profiles in a Stratified Atmosphere, L. R. DOHERTY, M. L. HAZEN, D. H. MENZEL, *Harvard College Observatory.*
18. Crochet-Associated Flares, HELEN W. DODSON and E. RUTH HEDEMAN, *McMath-Hulbert Observatory.*
19. Red Coronal Line Intensities from Climax, 1942-1955, MARIANNE C. BRETZ and DONALD E. BILLINGS, *High Altitude Observatory, University of Colorado.*
20. Hα Profiles and Opacity of Small Flares, D. E. BILLINGS, *High Altitude Observatory, University of Colorado.*
21. Hydromagnetic Equilibrium Configurations, L. WOLTJER, *Yerkes Observatory, on leave from Leiden Observatory.* (introduced by S. Chandrasekhar)
22. Radiative Transfer of Resonance Lines in Finite Atmospheres, J. C. BRANDT, *Yerkes Observatory.* (introduced by Joseph W. Chamberlain)
23. Electron Densities in the Orion Nebula, DONALD E. OSTERBROCK, *Mount Wilson and Palomar Observatories* and EDITH FLATHER, *California Institute of Technology.*
24. The Spectrum of the Nebulosity at AE Aurigae, G. H. HERBIG, *Lick Observatory, University of California.*

Tuesday, July 1, 2:00 p.m. - 4:00 p.m.

Wisconsin Center, Room 210

25. The Binary System X Ophiuchi, J. D. FERNIE, *Goethe Link Observatory, Indiana University.*
26. Evolutionary Changes in Spectroscopic Binaries of Early Type, OTTO STRUVE, *Leuschner Observatory, University of California.*
27. Apsidal Motion in H.R. 8800, R. M. PETRIE, *Dominion Astrophysical Observatory.*
28. A Wave-Length Study of the Spectrum of HD 188001, 9 Sagittae, ANNE B. UNDERHILL, *Dominion Astrophysical Observatory.*
29. Victoria Spectrographic Observations Obtained at the 1955-57 Eclipse of Epsilon Aurigae, KENNETH O. WRIGHT, *Dominion Astrophysical Observatory.*
30. The Eclipsing System, SZ Piscium, G. A. BAKOS and J. F. HEARD, *David Dunlap Observatory.*

SHORT INTERMISSION

31. Interpretation of the Radial-Velocity Variations of R Hydrae, G. J. ODGERS and R. S. KUSHWAHA, *Dominion Astrophysical Observatory.*
32. The Structure and Evolution of Super-Luminous Stars, A. D. CODE, *Mount Wilson and Palomar Observatories* and T. E. HOUCK, *Washburn Observatory, University of Wisconsin.*
33. Distant Dwarf M Stars in the Direction of the North Galactic Pole, A. D. WILLIAMS and VICTOR M. BLANCO, *Warner and Swasey Observatory, Case Institute of Technology.*
34. A New Classical Cepheid of Unusually Long Period, VV 48, WALTER J. MILLER, S. J., *Fordham University Astronomical Laboratory* and ARTHUR A. WACHMANN, *Hamburg Observatory.*
35. Line Profiles for the Classical Cepheid SV Vulpeculae, ROBERT P. KRAFT, DAVID C. CAMP, J. D. FERNIE, CHOKO FUJITA, WILLIAM T. HUGHES, *Goethe Link Observatory, Indiana University.*

Wednesday, July 2, 9:00 a.m. - 12:00 noon

Wisconsin Center, Room 210

36. Changes in Speed of Rotation of the Earth as Determined by the Moon and by Atomic Standards, WILLIAM MARKOWITZ and R. GLENN HALL, *U. S. Naval Observatory.*
37. On the Nature of the Meteoritic Debris at the Arizona Meteorite Crater, JOHN S. RINEHART, *Smithsonian Astrophysical Observatory and Harvard College Observatory.*
38. High Altitude Collection of Extraterrestrial Particulate Matter, PAUL W. HODGE and JOHN S. RINEHART, *Smithsonian Astrophysical Observatory and Harvard College Observatory.*
39. Identification of Micrometeorites, CURTIS L. HEMENWAY and ERNEST F. FULLAM, *Dudley Observatory.*
40. Interpretation of Responses of a Meteorite Detector on a Rocket, CARL A. BAUER, *Pennsylvania State University.*
41. On the Lunar Dust Layer, FRED L. WHIPPLE, *Harvard College Observatory* and *Smithsonian Astrophysical Observatory.*
42. An Observation Concerning Mean Radiant Paths of Photographic Meteor Showers, FRANCES W. WRIGHT, *Harvard College Observatory.*
43. Photoelectric Spectrophotometry of the Heads of Three Comets, WILLIAM LILLER, *University of Michigan Observatory.*

SHORT INTERMISSION

44. Report on the IGY Photographic Program of Satellite Tracking, KARL G. HENIZE, J. A. HYNEK, FRED L. WHIPPLE, *Smithsonian Astrophysical Observatory.*
45. Report on MOONWATCH Program, LEON CAMPBELL, JR., *Smithsonian Astrophysical Observatory* and ARMAND N. SPITZ, *Spitz Laboratories and Smithsonian Astrophysical Observatory.*
46. Physical and Dynamical Studies of Orbiting Earth Satellites, ROBERT THOMPSON, RICHARD TOMLINSON, ROBERT HOBBS, RICHARD SOCASH, GORDON GRANT, *Case Institute of Technology.*
47. Earth Satellite Orbital Characteristics from Single-Station Radio Observations, GORDON S. GRANT, *Warner and Swasey Observatory, Case Institute of Technology* and R. W. BURHANS, P. S. FAY, *Chemical and Physical Research Division, Standard Oil Co., Cleveland, Ohio.*
48. Problems of Artificial Satellites, PAUL HERGET, *Cincinnati Observatory.*
49. Exact Expressions for the Effect of Atmospheric Resistance on an Artificial Satellite During One Revolution, DONALD A. MACRAE, *David Dunlap Observatory.*
50. Analysis of Lunar Methods in Geodetic Astronomy, R. K. C. JOHNS, *Laboratory for Electronics, Boston, Mass.*
51. Psychological Brightness Reduction of Simulated Flashes from a Polyhedral Satellite, RAYMOND H. WILSON, JR., *Naval Research Laboratory.*

The following members and guests have indicated that they will be present at the Madison Meeting:

Abt, Albers, Aller, Bahng, R. H. Baker, Mrs. Baker, Bauer, Billings, Bless, Boggess, Mrs. Boggess, Bok, Mrs. Bok, Brandt, Branley, Mrs. Branley, Bretz, Campbell, J. M. Chamberlain, Mrs. J. M. Chamberlain, J. W. Chamberlain, Chandrasekhar, Clemence, Mrs. Clemence, Crull, de Vaucouleurs, Mrs. de Vaucouleurs, Dimitroff, Doherty, Donn, Edmondson, Mrs. Edmondson, Eichhorn, Mrs. Eichhorn, Federer, Fernie, Goldberg, Mrs. Goldberg, G. S. Grant, R. G. Hall, Hallam, Mrs. Hallam, Heard, Mrs. Heard, Heiser, Hemenway, Henriksen, Mrs. Henriksen, Herbig, Herget, Mrs. Herget, Hertz, Hill, Hiltner, Hobbs, Hodge, Houck, C. M. Huffer, Mrs. C. M. Huffer, R. C. Huffer, Mrs. R. C. Huffer, Hughes, Hynek, Mrs. Hynek, Irwin, Mrs. Irwin, Johns, Kane, Mrs. Kane, E. Kane, Jr., Keller, Ketchum, Mrs. Ketchum, Kimball, Mrs. Kimball, I. R. King, Kraft, Kuiper, Mrs. Kuiper, Lawrence, Mrs. Lawrence, Liller, Linnell, Lovell, Mrs. Lovell, MacRae, Mrs. MacRae, H. Malitson, Mr. Malitson, M. W. Mayall, McCuskey, Meinel, Meltzer, Mrs. Meltzer, P. W. Merrill, Mrs. Merrill, W. J. Miller, Morgan, Mulders, Mrs. Mulders, Neff, Nunn, Osterbrock, Perkin, Prendergast, Dodson-Prince, Prince, Rinehart, Roach, Mrs. Roach, Savedoff, Sears, C. M. Sitterly, Slowey, Spitz, Stebbins, Miss J. Streeter, Struve, Thorndike, Van Biesbroeck, Vandervort, Mrs. Vandervort, A. N. Vyssotsky, Wachmann, Wallerstein, Weaver, Weston, L. White, Whitford, Mrs. Whitford, A. D. Williams, R. H. Wilson, Jr., Woltjer, F. W. Wright, K. O. Wright, Mrs. K. O. Wright, A. S. Young.

J. A. HYNEK
Secretary

Cambridge, Mass.
May 19, 1958

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

6/30/58 vh

Immediately

MADISON, Wis.--The dedication of the University of Wisconsin's new research observatory at Pine Bluff took place here Monday night appropriately with more than 150 of the nation's professional astronomers and many of the Madison public on hand to witness the event.

Inauguration of the country observatory with its modern 36-inch reflecting telescope heralds a new era of astronomical research at Wisconsin. The Wisconsin Alumni Research Foundation donated $200,000 in late 1955 so that the University could purchase the 'scope and the 53-acre site, and construct the red brick domed main building and two smaller structures. Until the gift was made, Wisconsin scientists were confronted with continuing use of the 80-year-old, 15-and-one-half inch refracting scope at Washburn Observatory as their main tool.

The new instrument at the site, escaping the city lights and haze which handicap observation, is a long focus, Cassagrainian optical design, especially suited for the studies of very distant stars and galaxies and the photo-electric measurement of starlight for which Wisconsin is known.

UW Emeritus Professor Joel Stebbins, member of the staff of Lick Observatory, delivered the dedicatory address. Director of the UW Washburn Observatory from 1922-48, he pioneered photo-electric techniques for astronomical research studies. He told the crowd "the new specially designed spectrograph at the bluff is the largest that has been attached to a telescope of this size and with the scanning attachment it gives a unique opportunity for spectrographic analysis of both stars and nebulae."

-more-

Add one--Dedication of new research observatory

He outlined the history of astronomy studies at Wisconsin, the contributions of Wisconsin faculty, and pointed out that most of the variable stars discovered here will continue to vary for a long time to come. He observed also that it is the fate of scientists to see new studies make their own first studies obsolete, and he expressed the hope that the new observatory "will do its share in rendering obsolete what has gone before."

He predicted, for Wisconsin, accomplishment of a much needed new determination of the temperature scale of stars and indicated the quality of astronomy study at Wisconsin by stating that "all of the directors of Washburn Observatory have been members of the National Academy of Sciences (highest honorary American science organization to which an individual can be elected).

In conclusion he said: "It is a far reach from the simple methods of astronomical observation in 1878 to the rather complicated procedures of today, but whatever the direction that research takes at the Washburn Observatory, we can be sure that its value will be limited only by the imagination and energy of the staff. We wish our successors good observing and of the nights to come, we trust that many will be both clear and dark on the new Observatory Hill."

A surprise highlight of the program was the unveiling of a portrait of Prof. Stebbins, painted by another former UW professor with the same sir name: Roland S. Stebbins. Jo Ann Stebbins, Green Bay, a granddaughter of the former director, unveiled the portrait.

State, University, and Wisconsin Alumni Research Foundation officials who took part in the program included UW President Elect Conrad A. Elvehjem, representing the University; Walter Frautschi representing WARF, and George E. Watson, state superintendent of public instruction, representing the UW Board of Regents. Prof. A.E. Whitford, director of Wisconsin astronomical studies since 1948, gave the opening remarks.

-more-

Add two--Dedication of new research observatory

After guiding the plans and construction of the new observatory to completion, Whitford appeared at the dedication as his last official duty at Wisconsin. This week he will leave for California to assume his new post at the head of the second largest observatory in the nation, Lick Observatory on Mount Hamilton. The second director of Wisconsin's Washburn Observatory to become director of Lick, he will be succeeded by Arthur D. Code. Code, a former Wisconsin staff member, has resigned his post at the California Institute of Technology to return to the Madison campus.

The dedication was planned as a highlight of Wisconsin's celebration of 80 years of astronomy on the Wisconsin campus. It was also arranged as an important event within the program of the 100th meeting of the American Astronomical Society. Between 150 and 200 members of the society began their sessions on the campus Sunday.

Before the dedication, they picnicked in a grove at the edge of the hilltop observatory site. After the ceremonies, they and the public inspected the big dome and telescope on the top floor, a library and offices, a darkroom, bunkroom and kitchen on first, and a machine shop in the basement.

The scientists, including many of America's most important minds in astronomy, will hear Dr. Walter Baade deliver the annual memorial Henry Norris Russell Lecture on Tuesday night (July 1) at 8:30 p.m. Baade, staff member of Mount Wilson and Palomar Observatories, and one of the world's greatest astronomers, will talk on "Galaxies and Stellar Evolution" in the Wisconsin Union Theater. The public is invited to attend.

Some 56 contributed and invited papers are scheduled to be given during the four-day meeting which will end on Wednesday.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE: Immediately

8/28/58 vh

Washburn Observatory

MADISON, Wis.--The University of Wisconsin's new Pine Bluff Observatory is the subject of a feature article in the September issue of Sky and Telescope.

The monthly, leading magazine for amateur astronomers, is published at Harvard College Observatory, Cambridge, Mass.

The Wisconsin Alumni Research Foundation (WARF) provided the $200,000 for the new station, its 53-acre site 15 miles west of Madison, and its key instrument--a 36-inch reflecting telescope. When the observatory was dedicated in June, the UW was lifted to a point equal with any other Midwest university in the matter of modern astronomical research tools.

Sky and Telescope publishes five photographs of the Wisconsin facility and tells how it is uniquely equipped for photo-electric and photo-spectrographic studies of difuse nebulae and extragalactic systems.

The feature also includes historical details on Wisconsin's still functioning first observatory, Washburn, on the Madison campus.

###

NATIONAL SCIENCE FOUNDATION
Washington 25, D.C.

Washburn Observatory

FOR PRESS, RADIO & TV, NSF-58-169
Telephone: STerling 3-2140, Ext.486

FOR RELEASE
November 9, 1958

NATIONAL SCIENCE FOUNDATION ANNOUNCES FUND ALLOCATIONS FOR NATIONAL ASTRONOMICAL OBSERVATORY

Funds in the amount of $4 million have been allocated to the Association of Universities for Research in Astronomy, Inc. (AURA), for the construction of a solar telescope, the National Science Foundation announced today. These funds bring to a total of $7,545,000 the amount that has been allocated thus far for the erection and operation of a national astronomical observatory on Kitt Peak in the Quinlan Mountains of Southwestern Arizona. An additional $1 million has been appropriated by the Congress to the National Science Foundation for transfer to the Bureau of Public Roads for construction of an access road to the observatory site.

The solar instrument will be an 80 x 60-inch solar telescope. The 80-inch diameter refers to the light gathering flat at the top of the tower, and the 60-inch diameter refers to the size of the image-forming mirror. This 60-inch mirror will have a focal length of about 300 feet, and the size of the image of the sun at the focal plane will be approximately 32 inches. The solar telescope will be several times larger than any now in existence. Its focal length will be about twice that of the famous 150-foot tower telescope on Mount Wilson.

Stellar instruments at the observatory will consist initially of a 36-inch telescope of the reflector type, and an 80-inch, ultramodern, relatively high-speed reflecting telescope with auxiliary instrumentation, which is expected to use light from the stars very efficiently.

Selection of Kitt Peak as the site for the new observatory was announced by the Foundation on March 14, 1958, following intensive site studies. AURA, Inc., subsequently moved its headquarters from Phoenix to Tucson, where it has rented temporary quarters pending the acquisition of land for its permanent headquarters. These will include, in addition to office space, instrument, optical, and electronic shops.

Construction operations at the site have been awaiting final action on the lease which the Papago Indians have let to the National Science Foundation. With the approval of the lease by the Secretary of the Interior, as required by law, the way is now clear for work to begin. The lease was signed earlier by Alan T. Waterman, Director of the National Science Foundation, and Mark

-more-

Manuel, Chairman of the Papago Tribal Council.

Kitt Peak, a mountain sacred to the Papago Indians, is on their reservation. Legislation permitting the Indians to enter into a lease with the National Science Foundation for the use of their land was enacted by the Congress and approved by the President last August.

The lease permits the National Science Foundation the use of 2,400 acres on and surrounding Kitt Peak for "as long as the land is used for astronomical study and research and related scientific purposes." In consideration of these rights, the Foundation has agreed to pay the Papagos $25,000 for access rights to the site and $10 per acre per annum for approximately 200 acres to be used for development of the facilities. Payment for the right to use approximately 2,200 acres of a protective perimeter area is at the rate of 25¢ per acre per annum. The Indians will also have the right to use space on the site for the sale of their arts and crafts. The Papagos are noted for their basket-weaving, which is done with the fibers of desert plants.

AURA, Inc., has awarded a subcontract for the construction of the 36-inch instrument to Boller and Chivens, South Pasadena, California, in the amount of $69,000. The contract for the telescope building and dome has been awarded to Murray J. Shiff Construction Company, Tucson, in the amount of $112,700. Construction of the building will begin shortly and is expected to be completed within a year to fifteen months.

The Corning Glass Works has a contract with AURA, Inc., in the amount of $115,000 for the delivery of a pyrex blank for the 80-inch reflector. Delivery is expected sometime during the summer of 1959.

AURA, Inc., was incorporated in the State of Arizona, October 28, 1957, and presently comprises the following universities: California, Chicago, Harvard, Indiana, Michigan, Ohio State, Wisconsin, and Yale. These universities have had experience in operating large observatories and have strong programs of research and graduate instruction in astronomy. Directors-at-Large are: Carl Seyfert, Professor of Astronomy, Vanderbilt University, and Director of the Arthur J. Dyer Observatory; and Peter Van de Kamp, Professor of Astronomy, Swarthmore College, and Director of the Sproul Observatory. As the project develops, it is expected that other universities and individuals will be added to AURA, Inc.

-- 30 --

From George Richard
Wisconsin Alumni Association

11/3/58

FOR IMMEDIATE RELEASE

MADISON, Wis.--An Alumni House "home" for more than 100,000 former University of Wisconsin students is proposed for a beauty spot on the Madison campus.

The University of Wisconsin Foundation, a fund-raising arm of the University, is directing its 1958 Annual Alumni Fund appeal--now underway--toward raising $225,000 from alumni contributions to convert historic Washburn Observatory into an alumni headquarters.

The foundation also accepts gifts for various other University projects which normally would not be financed by legislative appropriations.

Construction on the Alumni House will begin in 1959 after the University astronomy department has completed its move into new quarters--a move made possible by building grants from the Wisconsin Alumni Research Foundation.

Dr. John A. Keenan of New York City, chairman of the board of the Wisconsin Alumni Association and chairman of the Alumni House campaign, has predicted that the project should be completed by the end of next year. He noted that James Bie, campaign director, is now organizing local alumni committees throughout the nation. These committees will spearhead the fund-raising project.

The Alumni House, like similar buildings on many other college campuses, will be a headquarters and office for alumni services and also will serve as a hospitality center for returning alumni. The site on Observatory Hill commands a sweeping view of the western campus area and adjacent Lake Mendota.

"The Alumni House will be one place on campus we can call 'home,'" according to Sam Ogle of Milwaukee, president of the Wisconsin Alumni Association. "Our own building at the heart of the campus will give alumni proper recognition and identity and will epitomize our ideal of service to our Alma Mater."

According to University Pres. Conrad A. Elvehjem, himself a Wisconsin alumnus, "This project is one of the most stimulating enterprises ever undertaken by our Association."

###

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

11/12/58 vh Immediately

Wash Burn Observatory

MADISON, Wis.--University of Wisconsin expectations of carrying on important research in astronomy with the largest solar telescope ever conceived progressed to certainty with recent announcement by the National Science Foundation of a $4-million allocation to the Association of Universities for Research in Astronomy (AURA).

The funds will be used to construct a 60-inch reflecting solar telescope at the national observatory soon to be built on Kitt Peak in the Quinlan Mountains, Arizona, and to be shared by all astronomers in the U.S.

AURA was incorporated in October, 1957, and includes as members the following universities: Wisconsin, California, Chicago, Harvard, Indiana, Michigan, Ohio State, and Yale. All have strong programs of research and graduate instruction in astronomy. To date, $7,545,000 has been allocated by NSF for the new facility to be built on Papago Indian lands in southwestern Arizona.

The $4-million dollar solar telescope will be several times larger than any solar instrument now in existence. An 80-inch flat mirror will catch the sunlight at the top of a solar tower, and will reflect it to a 60-inch mirror. The 60-inch measurement refer to the diameter of the telescope's image-forming mirror. The 'scope's focal length, approximately 300 feet, will be twice that of the famous 150-foot tower telescope on Mount Wilson, California. The image of the sun at focal plane, will be approximately 32 inches.

Other stellar instruments at the observatory will include a 36-inch 'scope of the reflector type and an 84-inch ultra-modern, relatively high speed''scope with auxiliary instrumentation.

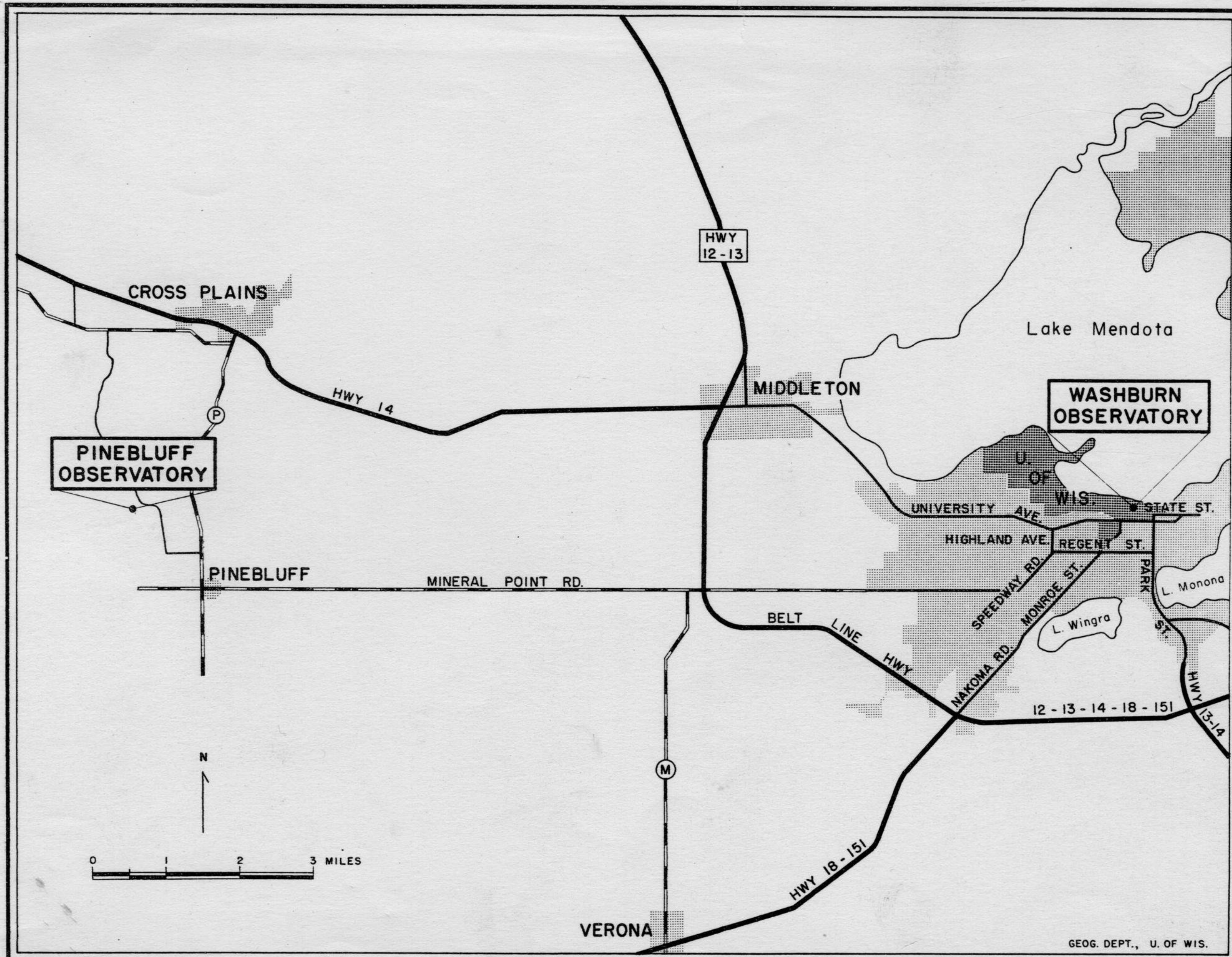
-more-

The Corning Glass Works will deliver a pyrex blank, the base for what will ultimately be giant image-forming mirror. A contract in the amount of $115,000 calls for delivery sometime during the summer of 1959.

Construction of the observatory will begin as soon as all legalities for leasing of the lands from the Papago Indians have been cleared. The lease permits NSF the use of 2,400 acres on and surrounding Kitt Peak for "as long as the lands is used for astronomical study and research and related scientific purposes."

It is expected that as the work of AURA develops, other universities and individuals will be added to the organization's membership.

###



HWY 12-13
CROSS PLAINS
HWY 14
MIDDLETON
Lake Mendota
WASHBURN OBSERVATORY
PINEBLUFF OBSERVATORY
U. OF WIS.
UNIVERSITY AVE.
STATE ST.
HIGHLAND AVE.
REGENT ST.
PINEBLUFF
MINERAL POINT RD.
SPEEDWAY RD.
MONROE ST.
PARK ST.
L. Monona
L. Wingra
BELT LINE HWY
NAKOMA RD.
HWY 13-14
12 - 13 - 14 - 18 - 151
N
0 1 2 3 MILES
HWY 18 - 151
VERONA
GEOG. DEPT., U. OF WIS.

File?

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

3/7/59 rt March 7, 1959

MADISON--University of Wisconsin regents Saturday authorized erection of two temporary classroom-office buildings at the Kenwood Campus and renewed lease of space in the Wisconsin Tower Building at the Downtown Campus to help meet the critical space situation at the University of Wisconsin-Milwaukee.

The two temporaries, each 50 by 120 feet in size, will be erected immediately west of the Campus Elementary School on the Kenwood Campus. Together they will provide 12 to 14 classrooms and 15 offices at a cost estimated at $96,000. Their construction will be paid by funds allocated by the State Building Commission.

The Tower Building leases will provide 6,727 net square feet of space on the second floor at an annual rental of $22,000, and 2,645 square feet on the 11th floor at an $8,400 rental. The 11th floor space rental is at the rate now being paid for the space by the University; the second floor space rental is an increase of $925.10 over the current annual rental.

In other actions affecting University buildings, the regents:

1. Authorized their executive committee to award contracts for a new superintendent's residence at the Ashland Branch Experiment Station;

2. Authorized advertisement for bids on remodeling the Barnard Hall meat shop in connection with the new Chadbourne Hall kitchen development;

3. Awarded a $46,700 contract for installation of a new 24-inch Lake Mendota water intake to replace two present intakes to Central Contracting Corp., Oshkosh, the low bidder;

-more-

add one--buildings and grounds.

3-7-59

4. Authorized the University of Wisconsin Foundation to remodel the Washburn Observatory for a new Alumni House, subject to approval of plans by the regents and approval of the project by the State Building Commission; and

5. Confirmed award of a $155,906 contract to J. P. Cullen and Son, Janesville, another of $149,666 to Hyland Hall and Co., Madison, and one for $73,730 to Capital Electric Co., Madison, all for work on the service tunnel for the new Steam Generating Plant.

In two other actions, the regents clarified their procedures for the federal financing through loans of the third Married Student Apartment projects. Included in one was a request to the legislature to clarify the laws regarding self-amortizing projects such as the apartments, dormitories, the Memorial Union, and athletic facilities.

###

U. W. NEWS FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

6/9/59 rt RELEASE: Tuesday, June 9

MADISON--The request of the University of Wisconsin Alumni Association to abandon its plans for remodeling Washburn Observatory as an Alumni House was approved Tuesday by University regents.

The regents requested the UW Campus Planning Committee to work with the Association in recommending an alternative location to the regents. Alumni voted Saturday to change plans because, among other reasons, most of the space provided by remodeling the Observatory would be under ground.

One alternative suggestion already made is to locate the Alumni House near or as a part of the Wisconsin Center.

In other actions on University buildings and grounds Tuesday, the regents:

1. Approved a $215,000 schedule of costs for remodeling the main building and construction of a temporary prefabricated building at the University of Wisconsin-Milwaukee, Kenwood campus;

2. Requested the Coordinating Committee to approve an application to the State Building commission for an additional $573,000 for the UW-M Science Building, which would bring total funds for its construction to $2,767,500;

3. Approved preliminary plans and specifications for a new building for the Extension Center to be located between Appleton and Menasha which will be constructed by Outagamie and Winnebago counties, but advised the counties that although the University has requested state appropriations for equipment for the new center, "such funds have not been appropriated at this time";

4. Requested the State Public Service Commission to grant permission for erection of a small tower on the bed of Lake Mendota 1,000 feet west of Second Point

-more-

and 2,000 feet out into the lake for meteorological and zoological measurements in and over the lake; the tower to be a triangular steel structure, much like a television tower, extending about 20 feet above the water;

5. Awarded, subject to the approval of the governor and the state chief engineer, contracts for construction of an addition to Enzyme Institute Research building, the Agricultural Engineering Shops, the marsh pump house, and for site work for the new Steam Generating plant; and authorized their executive committee to award contracts on Barnard Hall alterations for case work and the Enzyme Institute addition;

6. Granted an easement to the Wisconsin Telephone Co. for wires and a deed to the City of Madison for streets at University Hill Farms, and agreed to the sale of a lot to the Attic Angels Association for a nursing home in the Park Addition;

7. Confirmed their Executive Committee's request to the State Building Commission approval of an $18,000 remodeling project in the basement of Bradley Memorial Hospital for a radioactive isotope laboratory, and for a $64,000 remodeling project in the attic of the Student Infirmary for a cancer research laboratory, both projects to be financed by gift funds.

Low bidders on the Enzyme Institute addition included: Fritz Construction Co., Madison, $251,825 for general construction; Industrial Materials Co., Madison, $11,885 for refrigeration work; Welch Plumbing Co., Madison, $60,353 for plumbing; H. Toussaint, Inc., Madison, $119,597 for heating, ventilating and air conditioning; and Topp Electric Co., Inc., Madison, $40,239 for electrical work.

Low bidders on the Agricultural Engineering Shops included H. A. Sylvester and Robert Morgan Co., Madison, $70,546 for general construction; Kilgust Heating Co., Madison, $18,300 for heating and ventilating; Anderson Plumbing Inc., Madison, $16,886.21 for plumbing; and Berman Electric Co., Madison, $9,737 for electrical work.

add two--buildings and grounds

Low bidders for remodeling the main building and construction of a prefabricated building at the University of Wisconsin-Milwaukee were George Kotzke, Milwaukee, $93,718 for general construction; O. A. Waskow, Milwaukee, $16,534 for plumbing; Lonn Brothers, Milwaukee, $24,824 for heating and ventilating; and Reliance Electric, Milwaukee, $14,150 for electrical work.

The regents authorized the Wisconsin State Agencies Building Corp. to award the site work for the new Steam Generating Plant to Monona Road Construction Co. whose low bid was $33,128.

The low bid for general construction and electrical work in connection with moving the marsh pump house, $10,228, was submitted by Samuel Thut, Madison.

###

MEMO

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE

TO:

Vol. XI No. 1 1 July 1959

REGENTS at their June meeting delayed approval of a budget for next year because the State Legislature has not taken final budget actions.

The group approved promotion of 194 faculty members, raising 51 to full professorships, 75 to associate professorships, 67 to assistant professorships, and 1 to an assistant professorship with tenure. Promotions for 38 at UW-M were included. Emeritus status for 15 retiring faculty members was also approved.

Regents also accepted the largest annual research grant in history from WARF, a total of $1,690,352 to be incorporated into the 1959-60 budget. It includes grants-in-aid of $1,472,012 to be apportioned by the research committee of the Graduate School, $105,000 to support pre-doctoral fellowships in basic research, $18,000 for Haight Fellowships, $15,000 for symposia and lectures, $12,000 for the Slichter professorship, $15,000 for the University Press, and for amortization of three research buildings constructed with WARF aid--$3,817 for chemistry, $20,608 for the Enzyme Institute, and $28,915 for Chemical Engineering. With the addition of next year's grant, the total of WARF's annual grants since 1928 reached $14,617,549.

They approved the appointment of Dr. Gernot B. Rath of the University of Bonn, Germany, as chairman of history of medicine in the Medical School, effective Jan. 1, 1960. Dr. Rath, who will have the rank of associate professor, is regarded as an international authority in the history of epidemics, anatomy in the Middle Ages, and medical writing in the 16th and 17th centuries.

Two major research programs in geophysics got the green light with acceptance of two NSF grants totaling $669,985, giving the University full responsibility for the over-snow traverse phase of the Antarctic research program formerly administered by the Arctic Institute of North America, and supporting two years of studies of the earth's crust.

UW SPACE NOTES

Twice in June Wisconsin pushed its boundaries into space: once with Monkey "Able," first space traveler to be recovered, who was drafted from the Primate Lab; and next with Vanguard III, which carried the Wisconsin-instrumented weather satellite. It failed to achieve a stable orbit, but the launching soon of an Army Jupiter will provide a second chance for Wisconsin scientists.

N O T F O R P U B L I C A T I O N

THE FUND FOR ADULT EDUCATION HAS ESTABLISHED AWARDS OF $1,000 each for the three best speeches or articles on public leadership in each of the years 1959 and 1960. Purpose is to "generate the best thinking on the nature of public leadership and on ways in which more adequate education can be provided to help prepare American leadership on every level of social, economic, and political organization to serve the general welfare." For further information, consult VP Fred H. Harrington.

UW SUMMER TRAVELERS ABROAD INCLUDE:
Prof. Jonathan Sauer (Bot) on Mauritius Island in the Indian Ocean, studying beach vegetation; Prof. John W. Thomson (Bot) in the central Arctic, collecting lichens; Prof. William G. Reeder (Zo) visiting labs in Europe; Prof. John T. Emlen (Zo) observing the behavior of gorillas in Africa; Prof. Peter R. Morrison (Zo) studying body temperature of mammals in South America; Prof. Hazel Alberson (Comp Lit) and Esther Weightman (Wis Hi) touring Mexico; Beth Arveson (Wis Hi) traveling in Russia with the Petrovich party; Prof. Robert C. Stauffer (Hist of Sci) in England to study before touring Europe; Drs. Nathan Smith and Harry Waisman (Pediatrics) reading paper at 9th Int'l Conference of Pediatrics in Montreal; Dr. Maxine Bennett (Surg) traveling in Europe; Prof. Gian Orsini (Comp Lit) and Dr. Margaret Orsini (Anatomy) visiting labs in Europe and relatives in Italy; Dr. Donald W. Smith (Med Micro) to deliver two papers on anti-TB in Florence, attend Int'l Union on TB in Istanbul, and visit British Isles and France; Dr. Robert M. Benjamin (Physiol) to attend 21st int'l physiology meeting in Buenos Aires; Prof. Harry D. Wolfe (Com) to work on book in Copenhagen; Prof. Erwin N. Hiebert (Hist of Sci) to serve as historian for Project Lake Ice near Arctic Circle, then to Europe for Int'l Congress of History of Science with Prof. Marshall Clagett; Prof. Jacob Korevaar (Math) to attend meetings of Netherlands Academy of Science and travel in Holland; Prof. Reid A. Bryson (Meteor) to Canada as principal investigator for Project Lake Ice; Prof. Werner Vordtriede (German) remaining for summer in Europe for research on Guggenheim Fellowship; Prof. Martin Joos (German) to Istanbul for U.S. State Dept. to brief teachers of English as foreign language; Prof. Clifford S. Liddle (Ed) to India as educational adviser to government; Prof. Harry M. Schuck (Com) on Petrovich tour of Russia; Prof. Einar Haugen (Scand) to Tokyo for English language exploratory committee of Japan; Dr. F.E. Shideman (Pharmacol and Toxicol) to Ecuador on team of specialists conducting nutrition survey; Profs. William Laughlin and Chester Chard (Anthro) to Southampton Island to study Eskimos; Prof. Milton Barnett (Anthro) studying reception of solar cooker among Mexican Indians; Profs. Lois Fisher and Bettina Bjorksten (music) on music and culture tour of Europe; Prof. Frederic G. Cassidy (English) in Jamaica compiling linguistic atlas; Prof. Merritt Y. Hughes (English) representing UW and reading paper for Int'l Assn. of University Professors of English; Instructors Joan Larsen and

[Washburn Observatory]

TRAVELERS, CONTINUED

Charles Forker (English) doing research in English libraries; Instr. Frank Horlbeck (Art Hist) studying European medieval architecture; Prof. Menahem Mansoor (Hebrew) conducting party on study project in Biblical lands; Prof. Eugene Cameron (Geol) investigating mineral deposits in Canada; Prof. Warrington Colescott (Art Ed) conducting educational art tour of Europe; Prof. Dean Meeker (Art Ed) continuing studies in Europe on creative printmaking. Prof. Jost Hermand (German) traveling in Europe; Prof. Harold E. Kubly (Com) also traveling in Europe; Teaching Asst. Raymond Bigger (English) teaching at a Quaker workcamp in France.

THE STATE HISTORICAL SOCIETY was commended by the State Legislature for its part in establishment of the Circus World Museum at Baraboo, which the Society will operate "to perpetuate the memory and preserve the history of the 'World's Greatest Shows' for generations to come." Solons also designated July 1, 1959, as "Circus Day" throughout Wisconsin.

HONORS HAVE COME TO:

Prof. Van R. Potter (Oncol), awarded the honorary degree of Doctor of Science by South Dakota State College; Instr. John N. Colt (Art UW-M) who won the $1,000 Gimbel prize and the Milwaukee Art Center's medal of honor for his painting "Cove," purchased by the center for $500; Prof. Harold Altman (Art UW-M) who was awarded a prize of $250 by the Boston Art Festival national drawing competition for his "Cityscape"; Cass F. Hurc (coord special classes, Engr Institutes) elected secretary-treasurer of the Wisconsin Society of Professional Engineers; Prof. Floyd W. Duffee (Chm Ag Engr) who was given the Cyrus Hall McCormick Gold Medal for outstanding achievement in agricultural engineering by the American Society of Agricultural Engineers. The society's John Deere Gold Medal went to UW Alumnus Fred R. Jones, former chairman of ag engineering at Texas A and M.

HELP A DESERVING STUDENT STAY IN SCHOOL DEPARTMENT:

Hundreds of students on the campus for Summer Sessions are besieging the office of Marion Tormey, director of the Student Employment Bureau, for part-time jobs. They will clean the attic or the basement, paint, scrub, type, baby-sit, do lab work, walk the dog, mind the cat, mend the roof, mow the lawn. The bureau has two phone numbers: Alpine 5-3621 or Alpine 5-3311, ext. 2340, and a staff to answer your rings from 7:45 a.m. to 4:30 p.m., Monday through Friday.

THE MADISON ASTRONOMICAL SOCIETY may fall heir to the little observatory on the hill, dear to generations of student stargazers. If Gov. Nelson signs the bill, already passed by both Senate and Assembly, the miniature building will be moved to the society's site on the Fitchburg Road.

CALENDAR OF EVENTS (July 1-14)

1 Toynbee Film Lecture, Discussions on the Middle East, weekly for five weeks, Aud., Wisconsin Center, 7:30 p.m.

1 UW-M Lecture, "German Psychology before World War II," Dr. Herman Weil (psychology), Kenwood Union Lounge, 8 p.m.

2 Lecture, "The Public Man Looks at the Teaching of Speech," Hon. Wayne Morse, U.S. senator, Oregon, Great Hall, 11 a.m.

2 UW-M Lecture, "The Classical Spirit in Contemporary Literature," Dr. Frederic Will (classics), Penn State University, Kenwood Campus Aud., 11:30 a.m.

2 UW-M Summer Evenings of Music, Union Lounge, 8:15 p.m.

2-4 Wisconsin Players, "Two Gentlemen of Verona," Union Theater, 8 p.m.

3-5 Movie Time, "Bell, Book & Candle," Play Circle, 12 M-10 p.m.

4 Music Clinic Concert, Stock Pavilion, 3 p.m.

4 Union 4th of July Party, afternoon and evening.

5 Music Clinic Concert, Stock Pavilion, 3 p.m. and 7:30 p.m.

6 Union Forum on the Contemporary Scene, "Education in Orbit," Lindley J. Stiles, Great Hall, 7 p.m.

6 Music Clinic Faculty Recital, Union Theater, 7:30 p.m.

6 UW-M Summer Evenings of Music, Marietta House, 8:15 p.m.

7 UW-M Lecture, "Today's Headlines--Tomorrow's History," Richard Applegate, NBC newsman & specialist on communism in Asia, Union Lounge, 11:30 a.m.

7 UW Band Concert, Union Terrace, 7:30 p.m.

7 Graduate Recital, Rose Van Arsdel, pianist, Music Hall, 8 p.m.

8 Tea for Visiting Faculty and Faculty Women, President's House, 130 N. Prospect Ave., 3-5 p.m.

9 UW-M Lecture, "The Ideas of the American Avant-Garde," John Ferren (art), Queen's Coll., N.Y., internationally known abstract-expressionist painter, Kenwood Campus Aud., 11:30 a.m.

9 Music Clinic Concert, Stock Pavilion, 8 p.m.

9 UW-M Summer Evenings of Music, Union Lounge, 8:15 p.m.

10 UW-M Lecture, "Trends in Wis. Politics," Leon Epstein (political science), UW-Madison, Union Lounge, 9:30 a.m.

10 Music Clinic Concert, Stock Pavilion, 8 p.m.

10-12 Movie Time, "Gigi," Play Circle, 12 noon-10 p.m.

11 Music Clinic Honors Convocation, Stock Pavilion, 11 a.m.

11 Music Clinic Grand Finale Concert, Stock Pavilion, 3 p.m.

13 University Forum on the Contemporary Scene, "Facts of Life on Cancer," Robert J. Samp, Great Hall, 7 p.m.

13 UW-M Summer Evenings of Music, Marietta House, 8:15 p.m.

14 UW-M Recital, Bob Gibson, singer--Amer. & English folk ballads, guitarist & recording artist, Union Lounge, 11:30 a.m.

NEW EXHIBITS:

Art Education, rotating exhibits by master's degree candidates, Art Education Galleries.

Memorial Library, beginning July, "Books That Changed Men's Minds," 2nd Floor Display Cases.

UW-M Union, through July 17, paintings by John Ferren.

Observatory

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

11/2/59 vh

RELEASE: Immediately

MADISON--Madison people are viewing the stars again on the University of Wisconsin's man-made "sky."

The Friday night public lecture-demonstrations at the UW Planetarium have been scheduled for the first semester, 1959-60, Arthur D. Code, chairman of the department of astronomy, announced this week.

Members of the Madison public who wish to attend the 8 p.m., Nov. 6, lecture on "The Planets" should take the Sterling Hall elevator to the sixth floor of the new wing, then follow the stairs directly in front of the elevator to the roof, Dr. Code pointed out.

The Planetarium, formerly housed in Journalism Hall, and other astronomical equipment were installed on the roof when the astronomy department opened new quarters this fall on the sixth floor of the Sterling wing.

Each demonstration shows on the indoor "sky" the constellations of the season and the changing aspects of the sky as seen from different parts of the earth. In addition, a selected topic is singled out for more detailed attention.

Code also announced that Visitors' Nights at Washburn Observatory have been resumed and are being held the first and third Wednesday nights of each month, providing the sky is clear. From 7:30 to 9:30 p.m. on these evenings, the Madison public can see two or more objects through Washburn's 15-inch telescope, and hear informal explanations of each object viewed.

more---

add one--astronomy visitors

The dates and subjects for the first semester Planetarium program are as follows: Nov. 6--"The Planets"; Nov. 20--"The Moon"; Dec. 4--"Galaxies"; and Jan. 8--"Orion and the Winter Constellations."

Prof. Code suggested that persons planning to attend the Planetarium shows arrive in good time for the 8 p.m. performances. It is not practical to admit latecomers, he said, since the effectiveness of the demonstrations depends on maintaining a darkened room. Doors are closed at 8 p.m.

Planetarium capacity is 75 persons. Code suggested that groups of 10 or more wishing to attend should give advance notice by telephoning the observatory: AL-5-3311, Ext. 2551.

###

ＵＷ NEWS

Bldg. folder

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

RELEASE:

3/7/59 vh March 7, 1959

MADISON--The student observatory which has aided University of Wisconsin astronomy studies for 79 years may become the property of Madison's young stargazers if a Board of Regents request is granted.

In a resolution Saturday, the Regents asked the State Legislature to empower them to give the 45-foot, domed, wooden building, situated just east of Washburn Observatory, to the Madison Astronomical Society. The gift would benefit the junior members, known as the Madison Junior Astronomical Society.

Both amateur groups have enjoyed close ties with the University's astronomy department and Washburn Observatory. The department has encouraged and actively helped their interests. Prof. C. M. Huffer has been the long-time secretary of the senior society.

The Regents pointed out that the building must be vacated soon when the astronomy department moves out of Washburn and into new quarters on the sixth floor and roof of the new Sterling Hall wing. A new student observatory and also the Planetarium, removed from Journalism Hall, will go into operation on the Sterling Hall roof, probably within the next few weeks.

If the request is granted, the old student observatory will be removed at the society's expense to a site at the grounds of the Bjorksten Research Laboratories on the Fish Hatchery Road. The building will be used for a clubhouse, workshop and observatory. The young astronomers, all under 18 years of age, already have a small building there with both a four-and one-half inch and a 10-inch 'scope.

"We would be pleased to have the building given to the society," Prof. Huffer, speaking for the University, said.

-more-

add one--Student Observatory

He indicated that the helping hand which his department has tried to give to amateur groups is of general benefit to the science of astronomy, and in the case of the juniors, "we believe future generations of astronomers and students of astronomy will come from such organizations."

Washburn Observatory was constructed in 1878, and the student observatory a year or two later. Prof. James Craig Watson, first director of Washburn, undertook its construction in 1880 at his own expense so that students might have an observatory for their own use and the major instrument at Washburn might be free for more advanced purposes, especially research.

He died before it was completed and ex-Gov. Cadwallader C. Washburn, who had donated funds for the main observatory, saw to it that the student building was completed and equipped with a transit and a six-inch refracting instrument.

Later the six-incher was replaced with a 12-inch' 'scope. Both of these instruments will be installed at Sterling.

The 79-year-old building was modernized somewhat in recent years. As it stands today it includes a transit room, an entrance way, and the metal-covered dome.

###

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

9/20/60 lkl

RELEASE: Immediately

MADISON---Star-gazers will have an opportunity to increase their knowledge of the heavens at 7:30 p.m. Friday, Sept. 23, when the University of Wisconsin department of astronomy presents the first in a series of six public lectures.

Prof. Arthur D. Code announced Tuesday that the lectures will be given in the UW Planetarium, located on the sixth floor of Sterling Hall. The opening lecture is entitled "Autumn Skies."

Each demonstration will depict on the indoor planetarium "sky" the constellations of the season and show the changing aspects of the sky as seen from different parts of the earth.

The UW Planetarium was moved to the roof of the new wing of Sterling Hall last year. To get to the Planetarium, visitors should take the Sterling Hall elevator to the sixth floor, and follow the stairs directly in front of the elevator to the roof.

Prof. Code also announced that Visitors' Nights at the Washburn Observatory on Observatory Hill are the first and third Wednesday nights of each month, providing the sky is clear. The public is invited to view two or more objects through the 15-inch telescope and hear informal explanations about the objects seen. The observatory will be open from 7:30 to 9:30 on these evenings.

The remainder of the lecture program announced by Code is as follows: Oct. 7 "The Planets"; Oct. 21 "The Milky Way"; Nov. 4 "The Moon"; Nov. 18 "Galaxies"; and Dec. 2 "Winter Skies."

-more-

add one--star gazing

Persons who wish to attend the lectures should arrive before the 7:30 starting time. Because effectiveness depends upon maintaining a darkened room, the doors are closed promptly at 7:30 p.m., and latecomers are not admitted.

Since the Planetarium seats only 75 persons, Code suggested that groups of 10 or more who wish to attend the lectures should give advance notice be telephoning the onservatory: AL 5-3311, Ext. 2551.

##

add one--star gazing

Persons who wish to attend the lectures should arrive before the 7:30 starting time. Because effectiveness depends upon maintaining a darkened room, the doors are closed promptly at 7:30 p.m., and latecomers are not admitted.

Since the Planetarium seats only 75 persons, Code suggested that groups of 10 or more who wish to attend the lectures should give advance notice be telephoning the onservatory: AL 5-3311, Ext. 2551.

##

MADISON NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

1/31/61 vh

RELEASE: Immediately

MADISON--Now that the second semester is underway, the stars are out again at the University of Wisconsin Planetarium.

The UW astronomy department Tuesday announced the following program of Friday evening public demonstrations, showing constellations of the season and changing aspects of the sky as seen from different parts of the earth:

Feb. 3--"Winter Skies"; Feb. 17--"The Conjunction of Jupiter and Saturn"; March 3--"The Geometry of Eclipses"; March 17--"Spring Skies"; March 24--"The Moon and Easter"; April 7--special demonstration for school children; April 21--"Observing the Stars with Field Glasses"; May 5--"Observing the Stars with Telescopes"; and May 19--"Satellites--Real and Artificial."

All performances, free to the public, will occur on Friday evenings and will begin promptly at 7:30 p.m.

The Planetarium is located on the roof of the new wing of Sterling Hall. Visitors should take the elevator to the sixth floor and follow the stairs directly in front of the elevator to the roof.

The astronomy department also called attention to Visitors' Night at Washburn Observatory. From 7:30 to 9:30 p.m. on every first and third Wednesday night of the month, provided the night is clear, guests may look at sky objects through the 15-inch telescope. Informal explanations are given for each subject.

###

Observatory

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

1/15/62 vh

RELEASE: Immediately

MADISON, Wis.--A $415,000 contract between the University of Wisconsin and the National Aeronautics and Space Administration, approved by UW regents at their January meeting, has spotlighted the mounting effort of Wisconsin in space astronomy research.

The $415,000 support from NASA is a token of larger things to come. It will be included in a pending contract for $1,180,902, Washburn Observatory officials said, which is expected to carry forward work on Wisconsin's experimental "package" aboard an orbiting astronomical observatory.

When the pending contract is completed, the federal government will have assigned more than $1.5 million to Wisconsin for space astronomy research.

The UW entered the federally supported research program in 1959. Harvard, Princeton, the Smithsonian Institution and NASA's Goddard Space Laboratories also are associated with Wisconsin for various research projects.

UW studies were then begun to examine possibilities for measuring the ultra-violet light of the stars with special equipment mounted on orbiting space satellites and an X15 rocket plane. At the very high altitudes which these vehicles may be expected ultimately to reach, escape from the obscuring earth atmosphere should be possible and ideal, very accurate recordings of the ultra-violet starlight realized.

Wisconsin established its Space Astronomy Laboratory in 1960. At this branch of Washburn Observatory the OAO and X15 developments and other experimental studies are in progress.

LAND GRANT COLLEGES & STATE UNIVERSITIES 1862-1962

-more-

Add one--space astronomy

Wisconsin will share space equipment with the Smithsonian Institution in the first of three satellites planned as the earliest launchings of the OAO program. In October, 1961, Arthur D. Code, director of Washburn, announced that the Cook Research Laboratory of Cook Electric Co., Morton Grove, Ill., had been selected to build the highly specialized "package" with its telescopes, spectrometers and other electronic devices which Wisconsin will place on board the space craft. Approximately three quarters of a million dollars will go to the Cook Laboratory for its construction efforts.

Wisconsin hopes to see the first satellite launched in 1963. It is expected that observations from the X15 will be carried out this year.

The UW Space Laboratory staff says that in later developments of the OAO program it will be possible to equip a space vehicle with a single telescope measuring as much as 36 inches in diameter and able to guide on a star to an accuracy of a tenth of a second of arc.

###

Observatory
Washburn

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON 6, WISCONSIN

10/30/62 vh

RELEASE: Immediately

WALLOPS ISLAND, Va.--An Aerobee-Hi rocket carrying University of Wisconsin experimental instruments for astronomy lifted from a NASA launching pad at Wallops Island, Va., late Monday night (Oct. 29), reached an altitude of 132 miles during its mission, and fell into the Atlantic some 63 miles east of the launching site.

Arthur D. Code, director of the UW Washburn Observatory, said that the flight, completed in a little less than eight minutes, was a necessary preliminary to the orbiting astronomical observatories which the UW expects to place in operation above the earth's obscuring atmosphere.

The Wallops Island preliminary was one of several evidences that Wisconsin astronomers are moving steadily forward in the large federally supported space program which they entered in 1959.

Wisconsin's 75-pound instrument "package," mounted in the nose-cone of the rocket, was designed, Code said, "especially to measure the distributions of early-type stars and to test the mechanical and electronic components of instruments which will be duplicated in the planned-for flying observatories."

Some 15 inches in diameter and 36 inches high, the package held three telescopes and three photo-electric photometers capable of measuring the ultra-violet light of the stars in four separate wave lengths. The package also held electronic installations for transmitting the data by radio to the ground.

-more-

At 50 miles above the earth, the protecting cover of the nose-cone was blown off and Wisconsin's instruments went to work. By means of an altitude control system, the rocket first pointed toward the star Gamma Cassiopeia, then at Delta Persei. Finally a conical scanning of the sky was made before the rocket began its descent.

The Space Astronomy Laboratory of the UW Washburn Observatory and the laboratory at Cook Electrical Co., Morton Grove, Ill., both created parts for the "package" which fell, still attached to the rocket, and was not expected to be recovered.

On hand at the Wallops Island site to install instruments and observe flight performance were the following Washburn Observatory men: Director Code; Theodore Houck, director of the Space Astronomy Laboratory; Prof. Robert Bless; and William Reining, an electronics technician.

Wisconsin, in cooperation with other institutions of learning, entered the large federally supported program for space astronomy research with two primary goals:

1) to design and successfully place in operation "flying" observatories which would orbit the earth at altitudes well above the blanket of atmosphere, permit unobscured photometric observations of ultra-violet light, and transmit the data being gathered to earth;

2) to design and place on board an X15 high altitude rocket plane an experimental instrument "package," also for the measurement of ultra-violet star-light. Instruments and records on the plane would have the advantage of recovery with the return of the craft to its base.

The UW established its Space Astronomy Laboratory in 1960 with development of the OAO and X15 space research among its most important endeavors. Wisconsin will share equipment space with the Smithsonian Institution on board the first of three orbiting observatories planned for early phases in the National Aeronautics and Space Administration program.

-more-

Add two--astronomy rocket

Revised estimates now place the date for launching of the first OAO sometime in 1964. The X15 is expected to begin all-out flights with UW instruments on board by April of 1963. It is expected that by this time, the plane will have attained heights of 80 miles above the earth.

"We're beginning to assemble the experiments we've been working on for the past two or three years," Code said.

He explained that preparations for the research from the OAO have required the making of two instrument "package" models--the first or prototype and the second or actual flight model. The prototype, Code said, has been completed, has passed centrifuge tests at Washington, D.C., and acceleration and qualification tests at Cook Electric.

Units including seven telescopes and spectrometers will be coming to Wisconsin soon for assembly and approval, and sometime after the first of the year, if all goes well, will be shipped to NASA's Space Flight Center at Greenbelt, Md., for more extensive testing.

"We've already started work on the flight model at Madison," Code said.

Progress on the X15 project has included a number of preliminary flights of the rocket plane with one small UW photometer aboard. The first of these flights was made in April of this year. These will continue, one or two a month, Code said, until the X15 has reached high enough into space for the full-scale observations to begin.

Contrary to procedure with the OAO, no prototype precedes the actual flight model "package" for the X15.

"The X15 flight equipment is now in existence," Code said. "We recently accepted delivery of the stabilized platform on which our cameras will go, and this has been tested and shipped to Edwards Air Force Base. Our Space Lab has made the four cameras for the X15 and when these have been further tested, they will be fitted into the aircraft."

##

Observatory
Washburn

U.W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON, WISCONSIN 53706

RELEASE:

9/2/64 vh Immediately

WALLOPS ISLAND, Va.--University of Wisconsin research instruments in astronomy, riding an Aerobee-Hi rocket, were lifted some 125 miles high late Tuesday night (Sept. 1) before plunging into the Atlantic as scheduled, 60 miles east of the Wallops Island, Va., launching site.

The successful flight of Wisconsin instruments, completed in less than eight minutes, was a necessary preliminary to the planned for launching of an orbiting astronomical observatory, Prof. Arthur D. Code, director of Wisconsin's Washburn Observatory, pointed out. If all goes well, Wisconsin, in cooperation with the National Aeronautics and Space Administration, will attempt to place the OAO high above the earth's obscuring atmosphere sometime in 1965.

The rocket launched Tuesday was the second of such preliminaries. An Aerobee-Hi with UW instruments in its nosecone successfully completed its mission in November, 1962, after a launching from the Virginia site. Both rockets, according to Prof. Code, carried instrument packages designed to measure the distribution of early-type stars and to test the mechanical and electronic components of instruments which will be duplicated on the OAO.

Tuesday's rocket carried eight photoelectric photometers and electronic equipment for transmitting the starlight data to ground stations. After relaying its information, the instrument package fell into the Atlantic, still attached to the rocket.

-more-

Wisconsin, one of five institutions cooperating in a many faceted research project, entered the large federally-supported space program in 1959. Her research team of Washburn Observatory astronomers has the major objective of studying ultra-violet starlight with the advantage of instruments carried to very high altitudes. The blanket of air immediately surrounding the earth for many miles out bends and scatters the light and prohibits measurements in the finest detail. At heights above 100 miles, it is hoped this problem can be overcome.

Wisconsin also is working toward this goal of ideal observation through space instruments by designing and placing on board an X15 rocket plane another instrument package. The X15, unlike a rocket, returns to its base with instruments intact.

Sometime this year or next an X15 is scheduled to soar upward to place Wisconsin's more advanced instruments in operation.

An important milestone in development of the orbiting Astronomical Observatory was reached this past June when the 500-pound instrument load for the flying observatory was delivered to Wisconsin astronomers by the Cook Electric Co., Morton Grove, Ill. This represented five years of planning and construction and close to $2 million spent in development. For the next year this model and a prototype will be exposed to simulated flight conditions.

With luck, the flight model will be inserted into a carrier craft now being readied at the Grumman Aircraft Corp., Bethpage, N.Y., and shot into space by an Atlas Aegena rocket from Cape Kennedy sometime in 1965. Instruments from the Smithsonian Institution also will be on board the carrier.

Prof. Code pointed out that development of a space vehicle with a single telescope measuring as much as 36 inches in diameter is planned as part of the OAO program. This telescope will be able to guide on stars to an accuracy of one tenth of a second of arc.

-more-

Add two--UW rocket

The telescopes in the present OAO package measure eight and 16 inches in diameter.

Members of the Washburn Observatory space team on hand at Wallops Island when the Wisconsin rocket reached above the earth's atmospheric blanket included Director Code, Profs. Theodore E. Houck, director of the UW Space Astronomy Laboratory, Robert C. Bless and John F. McNall.

###

Observatory, Washburn

U. W. NEWS

FROM THE UNIVERSITY OF WISCONSIN NEWS SERVICE, MADISON, WISCONSIN 53706

11/5/64 vh

RELEASE: Immediately

MADISON, Wis.--Four Russian scientists--astronomers and specialists in optical instrumentation--will visit the staff and facilities of the University of Wisconsin's Washburn Observatory at Madison beginning Monday (Nov. 9).

Their four-day get together with Wisconsin astronomers is part of an inter-academy exchange program being carried out by the American National Academy of Sciences and the Academy of Sciences of the USSR.

The visiting scientists are Vladimir B. Nikonov, head of the stellar physic. section, Crimean Astrophysical Observatory; N. N. Mikhelson, senior scientific associate at the Main Astronomical Observatory of the Academy of Sciences, Leningrad; A. R. Gorshkov, also a senior scientific associate at the Main Astronomical Observatory and a consultant of the State Optical Instrument Plant, Leningrad; and B. K. Ioannisiani, consultant at the Main Stronomical Observatory and section head at the State Optical Instrument Plant, Leningrad.

The Russians arrived in the U. S. in late September for a two-month tour of American institutions concerned with astronomy. They have already visited western observatories such as Lowell at Flagstaff, Arizona, and Lick, Mount Wilson, and Palomar in California. They will visit the University of Chicago's Yerkes Observatory at Williams Bay, Wis., just prior to arrival at Madison. Harvard's astronomical facilities and staff will also be visited before the scientists leave for home shores in late November.

Russia and the U. S. are perhaps the two leading nations in astronomical research, UW Prof. Robert Bless, astronomy, pointed out as the coming visit of the scientists was announced. The Russians have a long tradition of studies in astronomy and their Pulkova Observatory at Leningrad is one of the oldest and most important observatories in Europe.

##

uw
news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Observatory -
Washburn

Release: Immediately 11/17/66 vh

MADISON, Wis.--A dogged team of University of Wisconsin astronomers has reached another milestone in the rough course of space pioneering.

Prof. Theodore E. Houck of Wisconsin's Washburn Observatory team said Thursday the experimental package for a second orbiting astronomical observatory (OAO) has been accepted by the University from its builder, Cook Electric Co. of Morton Grove, Ill. and that "we hope to see a successful orbiting sometime in 1968."

The 500-pound assembly of telescopes and highly complex electronics designed by the Wisconsin men will be turned over to the National Aeronautics and Space Administration's Goddard Space Flight Center for approximately a year of testing. Ultimately it will be put aboard a spacecraft and lifted above the atmosphere via an Atlas Agena rocket. The blanket of air which surrounds the earth has hampered land-based observations for centuries.

The second OAO was already in the making when the first was orbited at Cape Kennedy last April. It took on new importance after a malfunction in the power system of the first "flying" observatory dashed initial hopes for "a new window on the universe."

The recently completed research equipment essentially duplicates the first OAO package. It contains seven telescopes and spectrometers, and once again the mission will be to observe young hot stars and measure their light which is largely

- more -

ultra-violet. Comparative studies of this energy output could lead to new knowledge about the lifespan of stars and possibly about the beginning and evolution of the entire universe.

Houck stressed the quality of versatility which is found again in the newer "package." Like a ground-based observatory, the "flying" one will be capable of being used in many astronomical problems, he pointed out.

"All the things we wanted to do with OAO-1 we now hope to do with OAO-2," the Washburn Observatory researcher said.

Wisconsin alone among the institutions taking part in the federally supported orbiting observatories program has been assigned space on two separate satellites. In a previous schedule of launch for the first four OAOs, Wisconsin "packages" were to be placed on number one and number three. Revised plans call for Wisconsin's second OAO to go second in the launching order for the series.

Wisconsin's originally assigned research partner, the Smithsonian Institution's Astrophysical Observatory, remains the same. When instruments from the Smithsonian are loaded into one end of a nine-foot long hexagonal spacecraft and Wisconsin's instruments placed at the other end, the entire assembly will again constitute the largest and most complex of the satellites attempted by the U.S.

Washburn Observatory's space team includes Profs. Arthur D. Code, director of Washburn, Theodore E. Houck, and Robert C. Bless, and John McNall and Tim Fairchild, project associates.

###

uw
news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Release: Immediately 12/12/66 jh

Observatory-
Washburn

MADISON, Wis.--A $140,000 grant to the University of Wisconsin for investigation and study of ultraviolet stellar spectra was announced Monday by the National Aeronautics and Space Administration.

The grant will continue support for space astronomy studies carried out by Wisconsin's Washburn Observatory over the past several years, including investigations made by means of the X-15 experimental plane and the Aerobee-Hi sounding rockets.

Members of Washburn's space astronomy team include Prof. Arthur D. Code, director of Washburn; Prof. Theodore Houck, director, and John McNall, assistant director of the Space Astronomy Laboratory; Prof. Robert Bless; and Tim Fairchild, a project supervisor.

###

uw news
From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571
Release: Immediately 3/24/67 vh

EDITORS NOTE: Louise Webster is the daughter of Mr. and Mrs. D. E. Webster of 3 Smith Street, Walkerville.

MADISON, Wis.--She makes no claims, but others will tell you that Louise Webster, a quiet, dark-eyed young "Aussie" on the Madison campus, is the University of Wisconsin's first woman teacher in astronomy.

They will also point out that she is the first woman to earn a Ph.D. in astronomy from Australian National University.

Appointed to the Washburn Observatory staff last fall, the Down Under newcomer spends half her working hours in teaching--largely classes in introductory astronomy. The other half is devoted to research in nebulae, the gaseous clouds that lie between and sometimes around the stars. Wisconsin's wide reputation for work in nebulae weighed heavily in bringing Louise Webster from half a world away to begin her professional career on the Madison campus. "This department is the best in my field," she declared.

Her presence here can also be explained as a logical step in women's recently earned place in scientific enterprise. Wisconsin opened a new $200,000 country observatory, equipped with a modern 36-inch reflecting telescope, in 1958.

A climb in enrollment including enrollment of women also began in this period and by 1963 Wisconsin had granted its own first Ph.D. to a woman in astronomy. Competence, not gender, was the measuring stick as Louise Webster became another milestone in Washburn Observatory history this fall. "She's very good. We're happy she's here," said Prof. Donald Osterbrock, chairman of astronomy studies.

- more -

Add one--Woman astronomer

Astronomy presents no special handicaps for women, least of all observations with the big telescopes, as Instructor Webster sees things. The "big eyes" are about as fully automatic as is practical, she pointed out, but she conceded that "a little knowledge of electronics is helpful."

Instruments such as Washburn's 36-inch 'scope and auxiliary equipment at Pine Bluff--"among the most progressive in photo-electric techniques," according to the instructor, are the familiar mechanisms of her profession. She trained at Mount Stromlo Observatory, now attached to Australian National University. Here at this largest observatory in the southern hemisphere are photo-electric facilities as well as telescopes, the largest being a 74-inch reflector.

Australia has made important contributions in optical astronomy, Louise Webster said, "and our radio astronomy is among the world's best."

Other members of the Washburn Observatory staff point out that in proportion to her population (11,000,000) "Australia is exceedingly active in astronomical science." That nation, too, is working in space astronomy.

However, because of a somewhat isolated geographical position, the Down Under country offers limited opportunities to young astronomers for meeting prominent outsiders in the field; for this reason among others, it is very much oriented toward the U.S.

"I find it very stimulating to be here in a country where the greatest percentage of the world's astronomers is gathered," Miss Webster said. "Almost every student receiving his Ph.D. from Mount Stromlo has spent one or more years in the U.S.," she added.

###

uw news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Observatory Washburn

Release: Immediately 9/27/67 ss

MADISON--Washburn Observatory, an astronomy research post of the University of Wisconsin, will hold a fall open house from 2-5 p.m., Sunday, Oct. 8, at Pine Bluff Observatory.

The $200,000 research station which opened in 1958, will show visitors several telescopes of different sizes. An observatory staffer will give a lecture discussing the instruments and some current observatory projects. Afterward, small groups of guests will be taken around the observatory to view the telescopes at close range.

The observatory is located 15 miles west of Madison on Observatory Road. To get there, follow Mineral Point Road to the village of Pine Bluff. Turn right into Highway P, then left at its intersection with Observatory Road.

The bright metal dome of the observatory is visible on the hilltop to the left.

###

uw
news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Observatory
Washburn

Release: Immediately 1/24/68 vh

MADISON--Christopher M. Anderson will join the University of Wisconsin's Washburn Observatory staff shortly to teach, carry out research, and work in instrument design.

The 26-year-old assistant professor of astronomy, a native of New Mexico, holds a bachelor's degree from the University of Arizona and will claim a Ph.D. from Cal Tech before his duties for Wisconsin begin with the second semester.

###

uw news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Release: Immediately 5/23/68 vh

MADISON--Three University of Wisconsin astronomers will be on the federal proving grounds at White Sands, N. M., for the scheduled 1 a.m. launch Saturday of an Aerobee-Hi rocket bearing a research "package" from the University's Washburn Observatory.

They will be particularly concerned with a new device, not present on the four previous rockets launched in Wisconsin's space astronomy program--an attitude control system permitting the ground-based astronomers to select positions favorable for observations.

"The attitude control system allows us to point the rocket anywhere we wish in the celestial sphere," explained the assistant director of Washburn's Space Astronomy Laboratory, John McNall.

Like all four previous research "packages" sent aloft by Aerobee-Hi's, Saturday's load will contain telescopes and photometers constructed to receive and record ultra-violet starlight, McNall said, as well as a radio system for transmitting data to ground stations. Like the others, its purpose is the unraveling of the mysteries of young, hot stars from heights well above the earth's obscuring atmosphere.

Like number four, number five will be equipped with a parachute to make recovery of the "package" possible.

- more -

Add one--rocket launch

Since 1959, when Wisconsin joined the National Aeronautics and Space Administration in a space program for astronomical research, Washburn Observatory has attempted experiments by means of rockets, X-15 high altitude planes, and an orbiting astronomical observatory. By early 1967, three rockets carrying Wisconsin instruments had been launched and had reached altitudes well in excess of 100 miles.

When these three experiments had been carried out, Prof. Robert Bless pointed out: "We've observed ultraviolet radiation from many stars on these first flights and have a fair amount of data. Now we're after data from more stars and over a broader spectral range."

Launchings from both southern and northern hemisphere sites are planned in the newer Wisconsin studies of the stars via rockets, McNall said.

Washburn Observatory staff men who will be present for the rocket five launching include Prof. Robert Bless, Wolfgang Haupt, research associate, and Donald Michalski, electrical engineering specialist.

###

uw news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Release: Immediately 8/22/68

By VIVIEN HONE

MADISON--An Aerobee-Hi rocket carrying instruments for two separate areas of University of Wisconsin space research is scheduled to be launched from the U.S. Department of Defense proving grounds at White Sands, N. Mex. on Friday (Aug. 23).

For Wisconsin astronomers, the nighttime shot represents the third launch in their expanded program of research by rocket. When this expansion began in 1967, Prof. Robert Bless of the Washburn Observatory staff said: "We've observed ultraviolet radiation from many stars on the first flights and have a fair amount of data. Now we're after data from more stars and over a broader spectral range."

A Washburn research associate, Dr. Wolfgang Haupt, says of the coming Friday attempt: "Our objectives are the same as before--looking at young hot stars down to the fifth magnitude."

For Wisconsin physicists, again sharing research space on an Aerobee-Hi with Washburn scientists, Friday's rocket means another chance to probe for x-rays from stellar sources.

"Our hope is to see sources of x-rays and establish their positions, intensities, and spectra," explained research associate Dr. Alan Bunner.

The 61-pound scientific "package" to be lifted above the earth's obscuring atmosphere for Washburn holds nine telescopes--three covering the range of around 1,200 Angstroms and six covering the range of 2,000--4,000 A's.

-more-

The 47-pound load for the space physicists includes two detectors or proportional counters with mechanical collimators. The counters have thin plastic windows and are fitted with an argon methane gas mixture.

As in the past, a radio system for transmitting data received to ground stations and parachutes for recovery of the scientific instruments will be part of the freight.

Wisconsin joined the National Aeronautics and Space Administration in a space astronomy program in 1959 and has since worked to observe stars in the ultraviolet by means of rockets, an x-15 plane and an orbiting observatory. To date, the rockets have been the most successful as a transportation means.

Wisconsin physicists, led by Prof. William L. Krauschaar, joined the astronomers to share rocket space when the expanded program began last year.

On hand at White Sands for the Friday shot will be the following men from the Madison campus: from the Space Astronomy Laboratory--Prof. Bless, Dr. Haupt, Don Michalski, an electronic engineer, and Charles Piper, an electronic technician; and from the space physics group--Dr. Bunner and graduate students Dan McCammon, Tom Palmieri, and Phil Coleman.

# # #

uw
news

From The University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: (608) 262-3571

Observatories
Washburn

Release: Immediately 2/9/77 cmb

(EDITORS: This corrects an earlier release on the schedule for public viewing at Washburn Observatory)

STAR GAZING OFFERED FOUR NIGHTS A MONTH

MADISON--Star gazers can view Cassiopeia's throne or Orion's belt through Washburn Observatory's 15-inch telescope every first and third Monday and Wednesday of the month.

The telescope on Observatory Hill will open at 7:30 p.m., providing the sky is clear.

The University of Wisconsin-Madison astronomy department staff and members of the Madison Astronomical Society will give informal explanations.

###

University of Wisconsin Space Programs

With the opening of the Space Age in the late 1950s, the University of Wisconsin, in cooperation with the National Aeronautics and Space Administration, established several programs of research on the Madison campus to be forwarded through space flight activities. As extensions or additions to these originals, space programs are now being vigorously pursued by Wisconsin scientists in astronomy, meteorology, engineering and physics.

Space Astronomy

Washburn Observatory experimenters, among the first to recognize the possibilities in space flight, have planned and designed research instruments which, carried above the earth's obscuring atmosphere, could reveal new knowledge of young hot stars--and possibly even the key to the orgin and development of the universe--through observations of the ultraviolet light which such stars emit. In the past three years their efforts have yielded data gained with instruments mounted on rockets and on an experimental X15 plane. Six such rockets have been launched to date, all from Northern Hemisphere sites, and more are planned to be sent aloft from both Northern and Southern Hemisphere launching grounds.

In one of the most ambitious of space astronomy ventures, the Wisconsin scientists are today nearing the countdown for a second orbiting astronomical observatory. A first OAO, launched at Cape Kennedy in 1966, defeated Wisconsin research attempts when a power failure developed. The largest, heaviest, and most automated scientific satellite ever undertaken by the U.S., the "flying" observatory due this fall will carry 11 telescopes (7 for Wisconsin) and a wealth of electronic equipment as it goes into circular orbit some 480 miles above the earth.

Space Physics

In Wisconsin's space physics explorations, the experimenters are concerned with learning more about x-rays, gamma rays, and the solar wind. It is known that some celestial objects, as yet unidentified, emit large amounts of x-radiation.

- more -

On two occasions, August, 1967, and September, 1968, our physicists, sharing rocket space with our astronomers, have sent instruments aloft which may reveal how x-rays originate and establish with certainty how general is the phenomenon of enormous x-ray output from stellar sources.

A satellite x-ray experiment for Wisconsin is now scheduled for flight in 1970. It will be flown on a Saturn rocket as part of NASA's Apollo Application program. Also scheduled in the x-ray space investigations is a Tomahawk rocket to be launched from Wallops Island, Va., early next year.

And still another space physics instrument will be launched, this time to learn more about the solar wind. Following discovery of the wind, one of our scientists set about developing a detector for deuterium, the heavy isotope of hydrogen found in that wind. This instrument, now completed, has been approved for flight on two of NASA's interplanetary Monitoring Platform Satellites.

Space Meteorology

No examination of space science is complete without a salute to the men in the department of meteorology and the Space Science and Engineering Center and to the milestones they have laid down. Beginning with the launch of Explorer VII in 1959 and continuing with a series of Tiros satellites, this group has obtained the heat budget of the earth, has learned that the solar energy absorbed in tropical regions is considerably higher than previous estimates, and that the atmosphere and ocean currents redistribute this excess heat through the mechanism of weather.

With cameras mounted on a geosynchronous satellite, launched in 1966, they have photographed the entire Pacific hemisphere continuously from space and have viewed the tropics and associated weather motions as a single entity.

Launched the following year, another Applications Technology Satellite carried cameras for meteorology which are capable of photographing the earth in full color. The photographs they have provided, as opposed to non-color views, make it far easier to distinguish land from clouds, sea, and muddy river discharge. Out of of the experiment, rough estimates of cloud altitudes were made possible, measurements of cloud motions were obtained, and moving pictures of severe weather situations were accomplished. From such pictures it is possible to pinpoint widely separated wind currents which, in combination, created the severe storm.

Because the geosynchronous platform permits continuous observations of the weather below, a whole series of new experiments concerned with small scale motions of the atmosphere, for instance, thunderstorms and convective cloud organization, is seen for the future.

Astronaut

In August, 1967, the National Aeronautics and Space Administration named a 30-year-old University of Wisconsin astronomer to the ranks of American spacemen. Astronaut Robert Parker was due for promotion to the rank of associate professor on Wisconsin's Washburn Observatory staff when the naming took place. His five years of experience on the Madison campus had included teaching, research and supervision of Washburn's major research facility, the Pine Bluff country observatory.

Parker faced a long period of training before any flights for NASA would be attempted, but it seemed likely then and seems likely now that he will ride an Apollo or post-Apollo in search of new knowledge of the universe. And it is not outside the realm of possibility that he will carry out experiments identified with his own campus. Though Parker has not been directly associated with Wisconsin's space astronomy efforts, he is thoroughly familiar with the program and its aims.

As American space exploration continues, research institutions will be applying to NASA to have their experiments flown in manned satellites, Parker predicted, "and if Wisconsin applications are accepted, I might very well be running one for Washburn."

###

uw news

From The University of Wisconsin News and Publications Service, Bascom Hall, Madison 53706 • Telephone: (608) 262-3571

Release: Immediately 5/14/69 vh

MADISON--Two new pieces of research equipment will be on view when the University of Wisconsin's Pine Bluff Observatory holds its annual open house Sunday afternoon from 2 to 5 p.m.

When hung on the back of Pine Bluff's 36-inch telescope, the recently installed image tube can produce, with very short exposure, acceptable photographs of faint celestial objects. Previously Wisconsin astronomers have been limited to recording the starlight with a photoelectric scanning spectrometer, resulting in a graph. They are using the image tube to study the properties of galaxies.

When attached to the 16-inch telescope, a new interferometer can measure the separation between close-together stars. The instrument has been provided by the University's space physics group and is being used by them for the studies at Pine Bluff.

Staff members of Washburn Observatory and graduate students in astronomy will be on hand to explain the research that goes on at Pine Bluff and the instruments which make this possible. All interested persons are invited to attend.

The route is as follows: West on Mineral Point Road to Pine Bluff village; north on Highway P for one half mile to Observatory Road; left on this road for a mile or more. The observatory will be visible on hilltop to the left.

###

uw news

From The University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone: (608) 262-3571

Observatory Washburn

Release: Immediately

1/16/73 mn/dh

MADISON--The credit requirement for a journalism degree from the University of Wisconsin-Madison has been reduced from the long-standing 124 credits to 120 credits.

Director of the School of Journalism and Mass Communications, Prof. Harold L. Nelson, said the new ruling will be in effect for graduates in May, 1973.

The change brings the school in line with the number of credits required for graduation in other departments in the College of Letters and Science.

-00-

MADISON--"The Planet Jupiter: Almost a Star" will be the topic of a free lecture-demonstration by the University of Wisconsin-Madison astronomy department this Friday at 7:30 p.m.

Astronomers have recently theorized that life may be possible on Jupiter, the largest planet in our solar system.

Groups planning to attend the session, slated for the planetarium atop Sterling Hall, are urged to give advance notice by calling the department at 262-3071.

-00-

MADISON--The University of Wisconsin-Madison's 15-inch telescope on Observatory Hill will be open to the public from 7:30-9:30 p.m. the first and third Wednesdays of each month providing the sky is clear.

Informal explanations for sighted objects will be given by UW staff members.

###

uw
news

Observatory

From The University of Wisconsin-Madison / University News and Publications Service, Bascom Hall, Madison 53706 / Telephone: (608) 262-3571

Release: Immediately 6/22/73 hh/bb/bb

NEWS BRIEFS FROM THE MADISON CAMPUS

MADISON--Washburn Observatory on the University of Wisconsin-Madison campus will open for two additional observing nights per month this summer, the department of astronomy has announced.

During the school year, free public observing sessions have been set for the first and third Wednesdays of each month. Clear weather permitting, they will be held every Wednesday evening from 9 p.m. to 11 p.m. during July and August.

The observatory is located on the UW campus, on Observatory Dr., overlooking Lake Mendota. Entrance is on the south side of the building.

UW-Madison astronomer Blair D. Savage says those attending the observing sessions have been able to see phenomena including the moon, planets, and clouds of illuminated interstellar gas with the aid of the observatory's 15-inch refracting telescope.

- o -

MADISON--The University of Wisconsin-Madison zoology department will show a series of four films Tuesday. The series, including the films "High Arctic Biome," "Tropical Rain Forest," "The Mountain Gorilla," and "Population Ecology," will begin at 7 and 9 p.m. in Room 168 of the Noland zoology building.

The films are free and intended for a general audience.

- o -

MADISON--Prof. Donald W. Crawford has been named chairman of the University of Wisconsin-Madison philosophy department for the next year. He received his Ph.D. from the UW in 1965 and has been on the staff since 1968.

Crawford's main work is in aesthetics and the philosophy of art. He replaces Prof. Haskell Fain.

###

uw
news

From The University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: (608) 262-3571

Observatory
Washburn

Release: Immediately 1/31/77 cmb

WINTER STAR GAZERS INVITED TO USE WASHBURN OBSERVATORY TELESCOPE

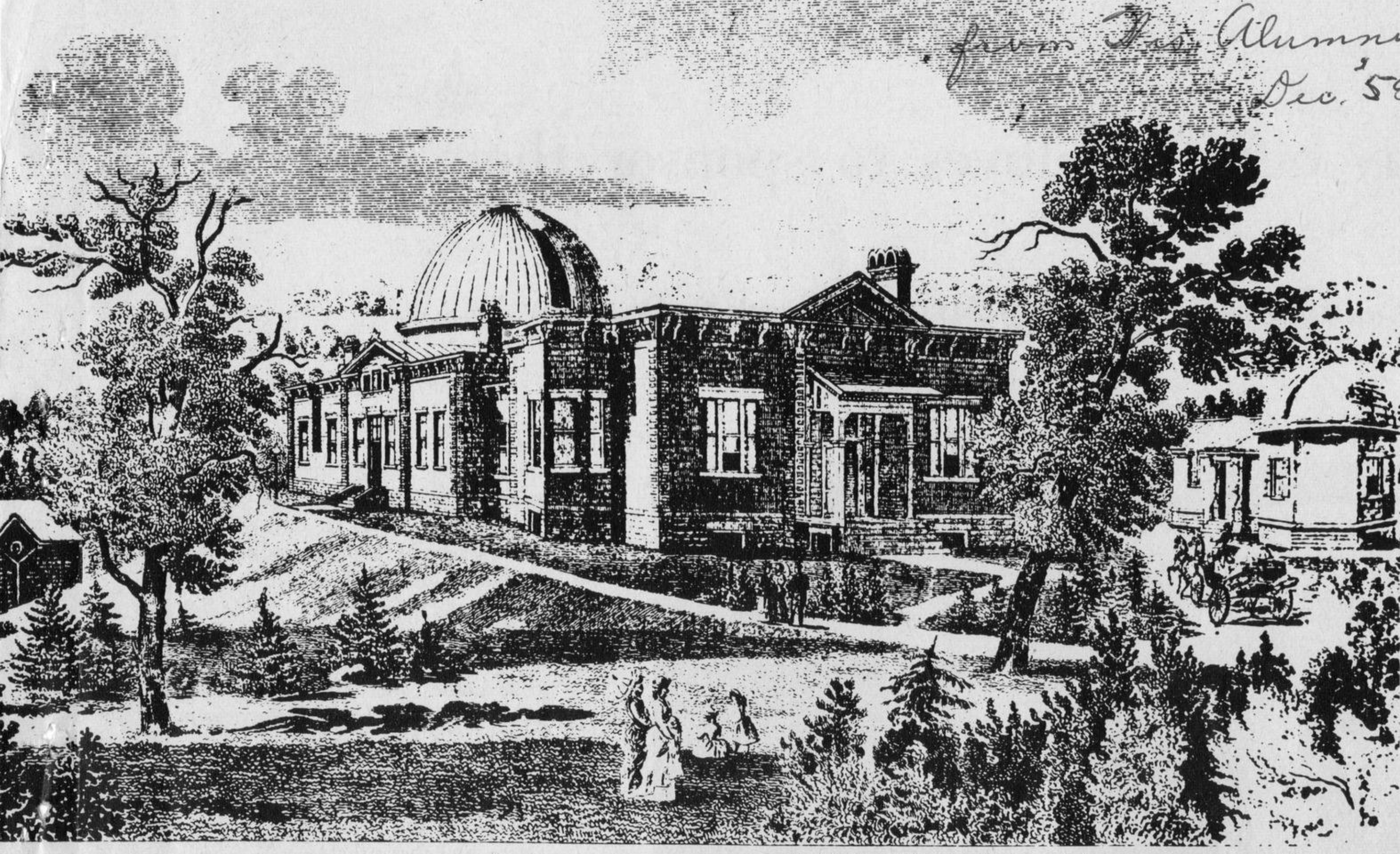
MADISON--Star gazing isn't only a summer sport. Clear winter nights are perfect for watching the Big Dipper and Orion's Belt.

The 15-inch telescope in Washburn Observatory on Observatory Hill will be open from 7:30 to 9:30 on Monday and Wednesday evenings providing the sky is clear.

The University of Wisconsin-Madison astronomy department staff and members of the Madison Astronomical Society will give informal explanations.

###

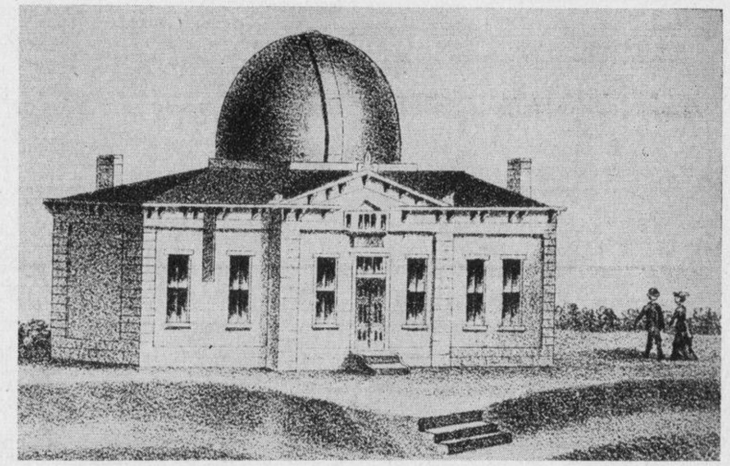
File [Washburn Observatory]
from Wis. Alumnus
Dec. '58



ARCHITECT'S SKETCH OF WASHBURN OBSERVATORY, 1881

By Joel H. Stebbins

Emeritus Professor, Astronomy
Former Director, Washburn Observatory
Now staff member, Lick Observatory



OBSERVATORY BEFORE EAST WING WAS ADDED IN 1881

Washburn Observatory: a History

"THE SITE OF the Observatory was selected by the Hon. C. C. Washburn upon one of the hills of the University Park, about 2000 feet west of the main entrance to the grounds. There are few finer sites in the world for quiet beauty. To the north is Lake Mendota, some four miles wide and ten long, a beautiful basin with verdant banks usually sloping gently to the water, but in places high and bold. To the east lies the town of Madison, embowered in trees. Between the College buildings and the town lies the University Park, with the College buildings and the *Campus*. To the south the country is lower than the Observatory site and is gently undulating to a range of hills some ten miles away. No better site could have been selected, situated as it is in the midst of a green plain, and protected on all sides from encroachment."

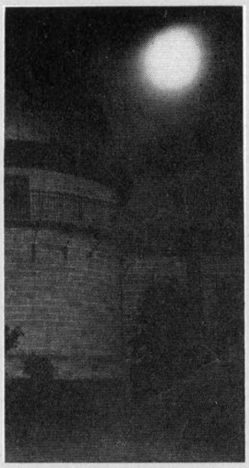
So read a description in Volume 1 of the Washburn *Publications*, published in 1881. Much of it—not *all* of it, since encroachment indeed has taken place—is as true today, more than three quarters of a century later.

The circumstances surrounding the development of Washburn Observatory, one of the very first large gifts made to the University of Wisconsin, are particularly interesting.

In the later years of the nineteenth century American colleges and universities were beginning to give more importance to the study of science. In the 1880's, as a consequence, a number of astronomical observatories sprang up around the country. It was a few years earlier, however, that President John Bascom began looking around for a possible donor of an observatory at Wisconsin. When the subject came to the attention of Governor C. C. Washburn, who was on the Board of Regents, he told Bascom that he would take care of the Observatory.

Cadwallader C. Washburn was a prominent figure in Wisconsin at the time. Before becoming governor he had been a lawyer and a business man, and he retained heavy interest in a new flour mill at La Crosse. Early in the morning of the very day that he was to meet with the University Regents to fix the site of the new Observatory, private word came to him that the flour mill in La Crosse had blown up. This catastrophe would have been bad enough at any time, but just then it was not clear whether or not the explosion of flour dust would be covered by fire insurance. As the story goes, Governor Washburn concluded that his business credit would be better if he went through with the Observatory gift than if he stopped. So he kept the appointment and the Observatory was located on the Hill where it now is.

The establishment of the new Observatory was an event of scientific importance in the Mid-West. An order for the main telescope was placed with Alvan Clark and Sons of Cambridge, Massachusetts; specifications were that the instrument should be larger and more powerful than the telescope at the Harvard College Observatory. The aperture of the Harvard telscope was 15 inches, and the aperture of the Washburn telescope accordingly turned out to be 15.6 inches. When it was erected in early 1879 it was third in size in the United States, being exceeded in aperture only by the Dearborn 18½-inch refractor in Chicago and the 26-inch instru-



Observatory Hill: fabled in story and song

ment at the U.S. Naval Observatory in Washington. Presently, the 15.6 inch ranks in aperture somewhere below fiftieth, I believe, since so many refractors and reflectors have materialized in the intervening years.

Washburn Observatory was further distinguished by its location, being further west than any observatory of pretensions in the country.

Appointment of the first director of Washburn Observatory had an interesting background. In 1854, the German astronomer, Francis Brünnow, came to the University of Michigan to take charge of the Observatory and department of astronomy. Brünnow brought with him the methods of a German university and lectured in broken English to despairing and diminishing classes until James Craig Watson was his only student. Watson had been largely self-taught before he entered college, but in due time he succeeded Brünnow at Michigan, and from Watson and his students developed the principal school of astronomy in the country at that time. Fully half of the leading American astronomers of the succeeding academic generations were trained at Michigan. Watson's own contributions to astronomy were mainly the discovery of a score or more of minor planets and the production of his classic treatise on *Theoretical Astronomy,* the best work in English on the subject for many years. The late Professor Comstock once told me that he considered Watson to be the cleverest astronomer he had ever known; his only shortcoming was that he dispersed his energies over too many fields.

When Watson accepted an invitation to come to Wisconsin he was probably influenced partly by the conditions of work, partly by the size of telescope (it was three inches larger than the one at Michigan) and not least by the attraction of the residence on Observatory Hill. President Bascom, who was living there at the time, was to move to the new president's house on Park Street.

Just before coming to Madison, Watson had gone to Wyoming to observe the solar eclipse in July, 1878. During the darkness of totality he used his telescope to sweep the sky around the sun for the possible discovery of an unknown planet inside the orbit of Mercury. At the time he was pretty sure he had found two such objects not shown on the star maps of the region. Such was his enthusiasm that when he came to Madison he built from his own means the Watson Solar Observatory, a little stone building that long was a landmark down the hill below the main Observatory. From the cellar of this building a 12-inch tube led underground to a pier on top where a siderostat mirror could reflect any spot of the sky near the sun through a long-focus objective to an eyepiece below. Watson did not live to give this device a thorough trial, but later under Director Holden it was found to have no advantage over an ordinary telescope.

Watson also built the long-lasting Students' Observatory with his own funds. But all of Watson's plans were cut short by an attack of pneumonia which took him off at the early age of forty-two, after only two years of service and before he had opportunity to make any scientific observations with the telescopes.

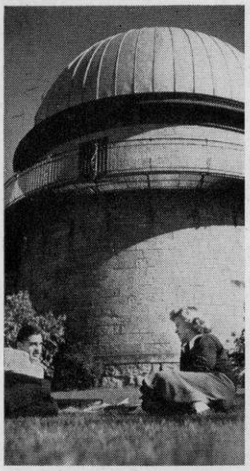
The next director of Washburn Observatory was Edward S. Holden, a skillful administrator who left in 1886 after four years to become director at Lick Observatory on Mount Hamilton, California. Following Holden to Washburn was George Cary Comstock, who until his retirement in 1922 served the University for 35 years—15 of them as first dean of the Graduate School. Astronomically speaking Prof. Comstock was a specialist in the observation and investigation of double stars; those students who came under his influence will remember, too, his dignified and austere bearing and his masterly command of the English language. To me personally he was a constant inspiration.

It was my privilege to succeed Prof. Comstock, and to be in turn succeeded in 1948 by Albert E. Whitford. It was the latter who saw through the shift from Washburn to the new Pine Bluff Observatory earlier this year, just before his departure for Lick Observatory, where he is now director. Since July 1, 1958, the director of Wisconsin's Observatory has been Prof. Arthur D. Code.

Down through the years, everyone connected with the Observatory has been impressed with the "quiet beauty" which its founders found so charming. And it is not easy for the Observatory now to give up this magnificent site. But a common fate of observatories everywhere is to suffer from the growth and encroachment of the communities where they are established.

So, too, at Washburn. As the disturbance from nearby buildings, the smoke, and the city lights increased, it was evident that the days of the Observatory were numbered. Prof. Comstock once told me that he thought the Observatory and residence would last as long as he would. This was about 1910; he retired

(continued on page 30)


look photo

the 80-year history of Washburn Observatory

(continued from page 22)

a dozen years later and his prediction has been amply fulfilled.

There is one particular advantage that the Observatory has gained by its location at the heart of the campus. That is the convenient contact with other departments of the University, especially physics, from which we have drawn facilities, ideas and, best of all, personnel. I hope this interchange will continue far into the future.

When the Observatory was founded, the methods of observational astronomy were practically all visual; astronomers actually looked through their telescopes. Later, of course, photography supplanted visual observations. At the Washburn Observatory the whole field of photographic research was skipped, and we jumped directly from visual to photoelectric methods. For the past thirty-five years the energies of the staff have been confined to the application of the photoelectric cell to astronomical observations. Among the fields of investigation have been the detection of small variations in the light of stars, studies of eclipsing and pulsating stars, measurements of magnitudes and colors of stars, and studies of interstellar material from the effects of selective absorption of light in space. My colleague, Prof. Morse Huffer, has been associated in all this work from the beginning, and Prof. Whitford was involved in it for about twenty-five years.

It was Prof. Whitford who engineered an epoch-making event at Wisconsin. He combined a photocell and an amplifier in a vacuum tank, mounted it on a board, and pointed it through a tube out of a basement window at the Pole Star. After successful measures of Polaris, the device was transferred to the 15-inch refractor, where it worked without difficulty.

We used to say that this photometer, alone without a telescope, would detect a candle a mile away. Once we tried it with a real candle at a real mile by lighting a standard candle on Picnic Point, across the lake from the Observatory. We found that, with no optical aid except a blank tube to eliminate stray light, the photocell not only would give a conspicuous response in galvanometer current when exposed to the candle, but would show a detectable effect when the light was cut down to the equivalent of a candle at seven miles. On the 15-inch refractor the limit of detection would be a candle at about one hundred miles. Now with the new installation on the 36-inch reflector at Pine Bluff we should be able to detect a candle at 1000 miles.

For many years the Observatory here acted as a volunteer weather station, but this service long ago was taken over by a regular U.S. Weather Bureau Station on the campus. In the beginning the Observatory used to sell correct time to the local railroads (at Lick they gave it away) but these arrangements have been superseded. Nowadays, if you know how, you can have Bureau of Standards time by short-wave radio every second of the twenty-four hours.

Our modest telescope and deteriorating site have frequently made it advantageous for our staff to take some of our equipment to observatories with larger telescopes and better skies. We have had the privilege of sending guest investigators to Lick, Yerkes, Mount Wilson, Palomar, Lowell, McDonald, Victoria in British Columbia and the Cape, Pretoria and Bloemfontein in South Africa. Of these expeditions, the longest-continued have been those to Mount Wilson, where for twenty-five years we have gathered the most significant observational data discussed at Washburn.

In the above listing of some of the world's foremost observatories, we also can trace a line of descendants. When Holden moved from Madison to Mount Hamilton, he took with him many of the ideas and methods developed here. The first set of *Reduction Tables for Mount Hamilton* were computed in advance by Comstock at Madison, and in a way the Lick Observatory is an enlarged edition of Washburn Observatory. As is well known, the Yerkes Observatory was more or less a copy of Lick, and then from Yerkes under Hale came in succession Mount Wilson and Palomar. The Washburn Observatory can well be proud of its descendants, but we must not forget our immediate ancestor, the Observatory at Michigan. We have done particularly well by the Lick Observatory; we furnished its first director, and now we have sent another. We also gave Lick Gerald Kron and Olin Eggen for the staff there.

While our Observatory was from the beginning primarily a research department, its responsibilites in a teaching university have not been neglected. An elective course in general astronomy has always been available, as well as courses in practical astronomy and navigation. Wisconsin has never specialized in the training of graduate students in astronomy, probably because a student can learn more where a staff has eight or ten members rather than one or two, but especially because the equipment available here did not lend itself to the solution of many promising observational problems. However, in the past ten years the number of advanced students has been increasing, and with the new telescope and additions to the staff we can look forward to more young astronomers trained at Wisconsin.

Over the years the Observatory has received numerous small grants from outside research funds. It is probably true that during our 80 years we have either had a grant from, or have been turned down by, practically *every* outside agency that has funds for research in astronomy. But best of all has been the aid of the Wisconsin Alumni Research Foundation, which, through the University Research Committee, has furnished continued support, culminating in this new Pine Bluff Branch Station. Had it not been for this support, in fact, we should not have remained on the astronomical map.

We are too near in time, space, and person to estimate objectively the permanent value of the researches in astronomy at Wisconsin. All the directors of the Washburn Observatory have been members of the National Academy of Sciences, which should indicate that the work has been at least of temporary interest. It is the fate of most scientific work to be superseded, and ours will be no exception. The accurately observed positions of stars on the celestial sphere, and of double stars in their orbits, will remain of permanent value. Most of the variable stars discovered here will continue to vary for a long, long time, but new studies will make the first studies obselete. A star once found to be reddened by interstellar material will remain in that condition, although it may grow brighter or dimmer on its own. We trust that the new Observatory will do its share in rendering obsolete what has gone before.

So the new Station is only a beginning. On modern standards the Pine Bluff telescope is not a large one—some of our sister institutions had 36-inch telescopes fifty years ago; we have only taken up the slack of the first thirty years of the Observatory. A radio observatory would make the present plant look small indeed. Nevertheless, if the staff can not do good and important work with the modern instrument in the favorable location, they could not do it anywhere. We wish our successors good observing, and of the nights to come we trust that many will be clear and dark on the new Observatory Hill.

*

(This article is part of an address at the dedication of the Pine Bluff Station of Washburn Observatory, June 30, 1958.)

alumni news

Before 1900

Thomas G. NEE '99, retired chairman of the board of the Acme Wire Co., has moved from Hamden, Conn., to Milwaukee.

1900–1910

Lina JOHNS '01, long-time Dodgeville high school teacher and area historian, recently celebrated her 88th birthday there.

S. S. HUEBNER '02, a president emeritus of the American College of Life Underwriters, has returned from a 40-thousand mile lecture trip on insurance subjects throughout Japan, the Philippines, Australia and New Zealand. He lives at Merion Station, Pa.

Two '06 classmates, Arthur B. MELZNER of Billings, Mont., and Louis DONOVAN took a vacation trip recently in Glacier National Park.

Minnesota Sen. Hubert Humphrey paid high tribute on the Senate floor to the efforts of Christian P. NORGORD '06 in connection with the latter's efforts to secure congressional approval of the succesful humane slaughter bill. Norgord is retired from his American Humane Association position and lives in Chapel Hill, N. C.

Lee H. HUNTLEY '08 has resigned as chief engineer of the Brazos River Authority, Mineral Wells, Tex., after 51 years in engineering.

Mrs. Julia MURRAY '09 Zimmerman (W. S.) indicates she is planning to come back to the campus for her Golden Anniversary reunion next year. She lives in Whittier, Calif.

"The Loom Has a Brain." That's the newest book by Herman BLUM '08 of Philadelphia, and it touches upon many interesting parts of textile history, including the role played by Blum and President Coolidge in the naming of rayon. The chairman of the board of Craftex Mills Inc. is also having published a book called "Know Our Presidents" which we haven't yet seen.

Col. J. W. SPROESSER '09, former president and chairman of the board of the Merchants National Bank in Watertown, Wis., has retired and is living in Atlanta, Ga., where he served on active duty during World War II. Col. Sproesser was Watertown's first city council president under the city's council-manager system. He remains an avid Braves and Badger fan.

Robert Y. WALKER, Sr., 09 is a consultant and oil operator in Houston.

1911–1920

Hartwick M. STANG '16, M. D. in Hayward, Wis., has retired from practice.

Henry A. CHRISTIE '11 has retired from the Raymond Concrete Pile Co. and is living in East Orange, N. J.

W. R. WOOLRICH '11 has retired as dean of the University of Texas College of Engineering after many years in administration, including a period as chief scientific officer of the American Embassy in England, and research. He has written more than 100 papers and reports.

Dr. Paul BOUTWELL '12, professor emeritus of chemistry at Beloit and director of research and development for Dell Food Specialties Co.—recently honored as one of America's outstanding teachers—was also honored by Beloit College, which granted him an honorary degree at the same time UW President Conrad A. ELVEHJEM '23 received a similar distinction.

In Whittier, Calif., spending the winter with their son and daughter-in-law (R. S. C. WOLCOTT '39 and Martha McAFEE Wolcott '39) are Mr. and Mrs. R. D. WOLCOTT '13 and '15. The senior Wolcotts, we believe, had been living in Sarasota, Fla.; what turnabout is this—Floridians spending a winter in the West?

Philip SALISBURY '14, editor and publisher of *Sales Management* magazine in New York, was main speaker at the fall convocation of the UW Journalism School in October.

W. H. LOERPABEL '15 has retired from his position with the American Smelting and Refining Co. and is living in Tucson, Ariz.

America Illustrated, the Russian-language magazine published by the U. S. Information Agency and distributed in the Soviet Union, recently featured a story on Jack TRANTIN '15 and his unique Waunakee foundry at which he makes special kinds of steel.

Metropolitan Milwaukee has encroached upon the area near Howard T. GREENE's '15 Brookhill Farms near Genesee Depot and the farm's dairy herd has been sold. The firm's special dietary milk enterprise, however, will be continued, using milk from other farms.

Ferdinand BICKEL '15 recently retired as an explosives expert with the DuPont Co., and we'd soon like to tell you a lot more about his interesting life work.

The *Milwaukee Journal* recently told the story of Mr. and Mrs. James HEVENER '17 of St. Paul, who habitually spend their vacations in the Memorial Union on the Madison campus.

James G. DICKSON '17, UW plant pathology professor, has been named president of one of the largest scientific organizations in the U. S.—the American Institute of Biological Sciences.

A special UW journalism research award has been named for the late Raymond BILL '17, business magazine publisher and editor.

Evan P. HELFAER '20, president of the Lakeside Laboratories, Milwaukee, was featured in a "Business in Person" profile in the *Milwaukee Journal.*

1921–1930

Ralph L. JOURDAN '21 is vice-president of American Smelting and Refining Co. in the New York office.

Joseph J. LISKOVEC '21 is serving as president of the La Crosse board of education; he also is a member of the La Crosse library board of trustees.

Harold A. HOVDE '21, superintendent of the county home and hospital at Wyocena, has retired.

Curtis HATCH '22 has resigned as head of the 28,000 member Wisconsin Farm Bureau Federation.

Dr. Loyal DURAND, Jr., '24 and family are back at the U. of Tennessee after a year as a visiting professor in economic geography at the University of Hawaii.

Ralph E. PETERSON '22 of Berlin has relinquished his position as a director of the Wisconsin Farm Bureau.

The Rt. Rev. Arthur C. LICHTENBERGER '22 has been elected presiding bishop of the Protestant Episcopal church and will headquarter in New York to rule over a denomination of 3,163,000 members with 7,290 parishes and organized missions.

Arthur TOWELL '23 is head of the Madison advertising firm which bears his name and which received a number of awards given by the Affiliated Advertising Agencies Network.

The editor of the Waukegan *News Sun,* George G. CRAWFORD '23, was named Lake County Newsman of the Year.

Vicente Albano PACIS '25 has been selected director of public relations for SEATO, the Southeast Asia Treaty Organization. He expects to reside in Bangkok, Thailand, during the next one or two years and to travel through member countries.

Mrs. Ruby Lake Jones and Joseph T. WOLTERS '25 were married and plan to live in the Oakland area.

Robert B. REYNOLDS '26, after reaching retirement age at Hollingsworth and Whitney Div. of Scott Paper Co., joined the Alabama College faculty at Montevallo, Ala., as a professor of chemistry.

Dr. Ralph N. TRAXLER '26 is supervisor of asphalt research at Texaco's Port Arthur–Port Neches, Texas, research laboratories.

A recent visitor to his home town of Wisconsin Dells was Lawrence D. BARNEY '27, American president of the international pharmaceutical firm of Hoffman, La Roche, Inc.

The federal judge who has been involved in Madisonville, Ky., school integration questions is Henry L. BROOKS '27.

Dr. Cyrus G. REZNICHEK '28 was elected speaker of the Congress of Delegates of the Wisconsin Academy of General Practice.

Dr. E. O. SCHALLER '28 is new associate dean at the New York University School of Retailing.

Engineer William Z. LIDICKER' 27 has been in Taipei, Formosa, for his New York firm of Tibbett, Abbott, McCarthy and Stratton.

Also in Taipei, for the J. G. White Engineering Corp., has been John GODSTON '28.

Dr. Delbert L. GIBSON '28 has joined the UW Extension staff to teach French at Green Bay, Sheboygan and Manitowoc Extension Centers.

Donovan EASTIN '29 has left his post as executive director of the Wisconsin Neurological Foundation in Madison to become advertising manager of the Dayton Co. of Minneapolis.

Felix QUIRINO '29 is reliability coordinator of Convair, a division of General Dynamics Corporation, at Fort Worth.

Eldon J. CASSADAY '30 has a state department assignment at the U. S. Embassy in Caracas, Venezuela.

1931–1940

Appointed judge of Dane County Court was Carl FLOM '31.

Dr. Morris WEE '31, pastor of Madison's Bethel Lutheran Church, journeyed to the Bible lands in Israel to gather sermon material.

Dr. Doris JOHNSON '32, director of the department of dietetics at Grace–New Haven Community Hospital, New Haven, Conn., has been named president-elect of the American Dietetic Association. She is the author of several books and a number of papers on cookery and dietetics.

Winston BROWN '33, superintendent of schools for Waukesha county, is president-elect of the National Association of County and Rural School Superintendents.

Alan D. FREAS '33 is now assistant to the director of the U. S. Forest Products Laboratory in Madison.

William A. NOSIK '33, M. C., is president of the Ohio State Neurosurgical Society and editor in chief of the Cleveland Academy of Medicine *Bulletin.*

An Exceptional Civilian Service Award for "outstanding service to the United States government" the highest civilian decoration awarded by the Secretary of the Air Force—was awarded to Robert O. BLAU '34. "The success of his scientific achievements has received international recognition," the citation stated. Blau resides at Alexandria, Va., and is formerly of Madison.

Warren D. LUCAS '34 has been named Dane County Circuit Court commissioner.

Among county agricultural agents cited for outstanding contributions to agriculture at the National County Agents Association meeting were Wayne NETTLETON '33, Crandon, J. W. CLARK '37, Madison, and Michael DROZD '35, Port Washington.

Dr. L. L. SANFORD '34 is a chest specialist at the U. S. Veterans Chest Clinic in Pittsburgh.

Ruth WERNER '34, an associate professor in the school of social science at Western Reserve university, is on leave of absence for a year to attend the University of Chicago.

Leo H. SCHOENHOFEN '36, senior vice-

The ~~100 Years~~ on Observatory ~~Hill~~ Today

In 1878, Rutherford Borchard Hayes was president; the telephone was just invented; and land surrounding Lake Mendota was isolated and "protected on all sides from encroachments." In 1878, the Washburn Observatory opened.

At the time, the telescope, with a 15.6-inch aperture, was the third largest in the United States and the Observatory was a major scientific advancement for so "western" a university.

~~Now~~ Washburn Observatory's the telescope ~~does not~~ no longer ranks among the nation's top 50, and astronomers no longer rely solely on visual methods for research. But the American Astronomical Society ~~[illegible]~~ gathered there recently 28 as a part of the UW-Madison Astronomy Department's recognition of Washburn Observatory's centennial.

The Observatory's members pioneered work in photoelectric astronomy — minutely accurate measurements of light from stars — and astronomical satellite design in collaboration with NASA.

Though the Astronomy Department has moved to newer facilities, the bustle of research remains.

The stately limestone structure now houses the Institute for Research in the Humanities, a group of about 20 scholars concentrating on inter-related topics in literature, languages, history, and philosophy.

But the Observatory did not close when the Astronomy Department opened its Pine Bluff station in 1959. The will of the Observatory's founder, Cadwallader C. Washburn, stipulated that the facilities be open to the public two nights a month — a condition still obeyed.

At least two Wednesdays a month, if the sky is clear, observers can gaze at the stars, beginning at 9 p.m. during the summer.

Washburn, Wisconsin governor from 1872-1874, donated the Observatory funds after UW President John Bascom originated the idea. Not only did the building precede a rash of observatories constructed in the 1880's, but, Wisconsin astronomers proudly note, three directors of the internationally known Lick Observatory in California came directly from Washburn.

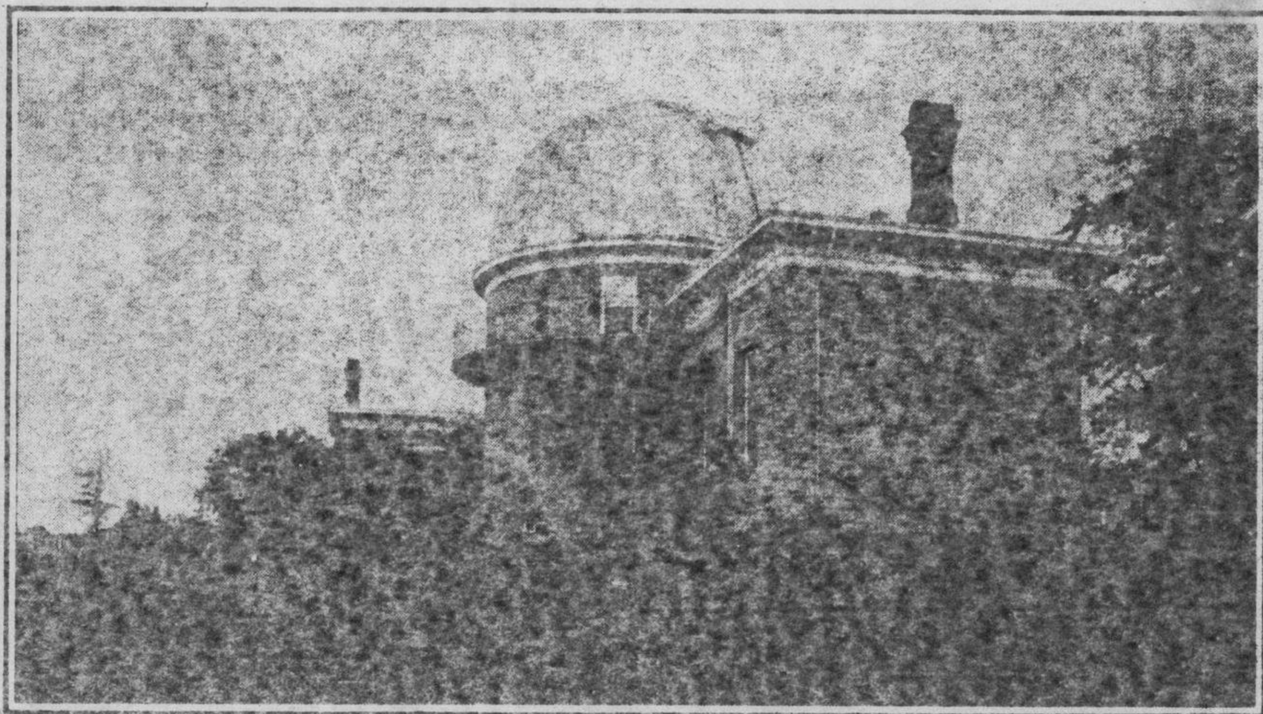
The building still retains the architectural aura of 100 years ago, with its bay windows, high ceilings, and imposing lake view. Though the multiplying city lights have blunted the telescope's clarity, the Observatory's hilltop position still gives the impression of being "protected from encroachments," as the site was described by one of the Observatory's first directors.

At one time, the Observatory also acted as a volunteer weather station and sold the correct time to the railroads.

Research in the Humanities Institute has redirected Washburn Observatory's focus "from the heights to the depths," according to one Institute member.

Rather than gazing at the sky, many research topics look toward the past — in archeology and ancient history. For example, one Institute member produces a newsletter on ancient inscriptions and archeological finds.

The Washburn Observatory: 100 years old, and still open monthly for public sessions of star-gazing.



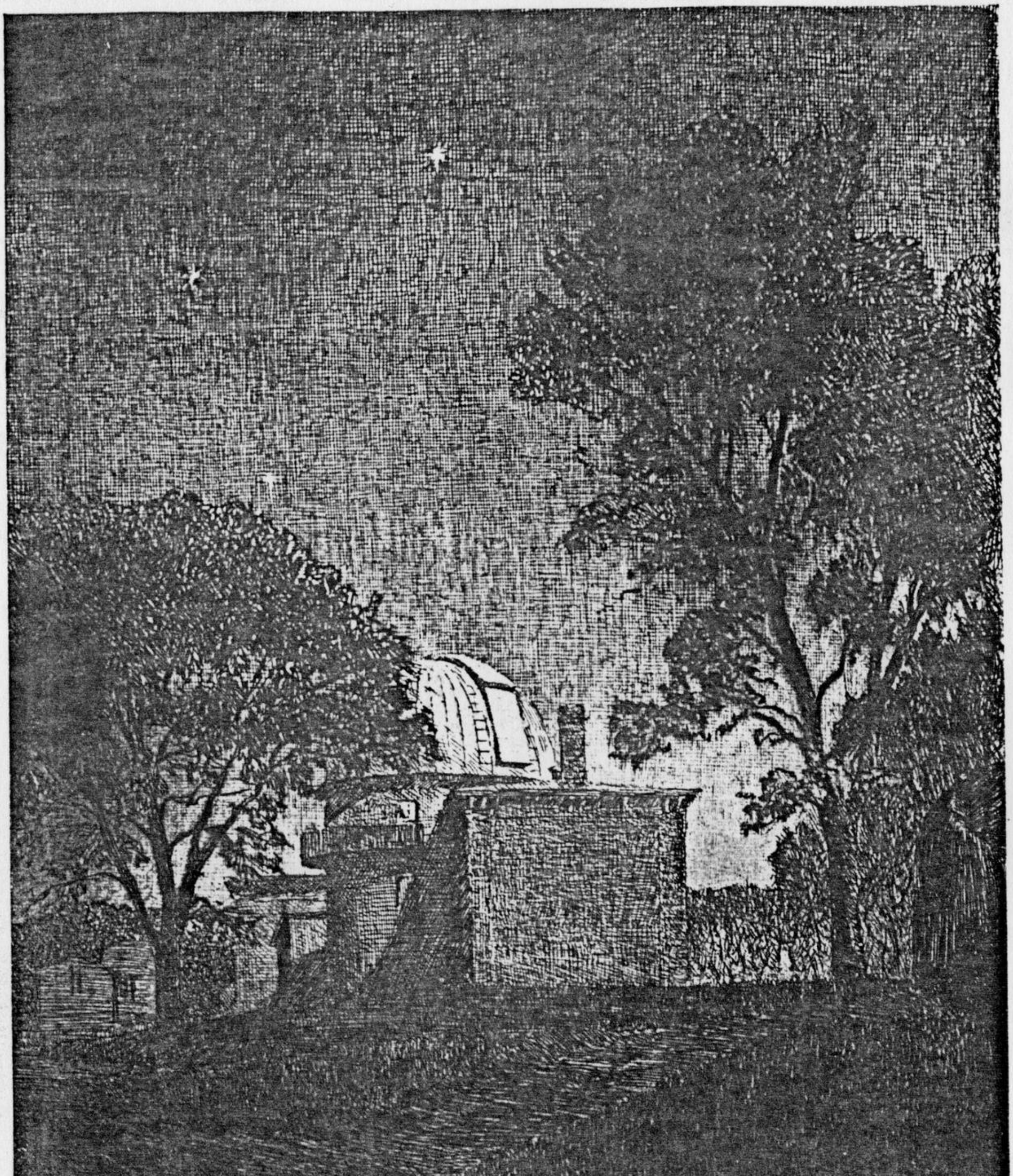
WI. Alumnus
Jan. 1959

[Songs]
[It's Dark On Observatory Hill]

Observatory Hill

"It's Dark on

It's dark on Observatory Hill;
Come on, let's pretend we're Jack and Jill.
We'll stroll to the hilltop where college sweethearts go
To look at the lights of the campus down below
We'll learn what astronomy is for,
We'll learn what the stars can have in store,
I know in advance the moon may mean romance
When it's dark on Observatory Hill;



"Observatory Hill"

And I'd like to recite you a poem that I wrote—
It tells why I think you're wonderful.
And from afar we can hear a sweet guitar
While voices are harmonizing.
You don't have to know arithmetic
To figure why you and I would click.
My heart tells me this: your lips were meant to kiss
And it's dark on Observatory Hill.

REMEMBER THAT catchy little song? It appeared on the American popular music scene back in the 'thirties, and achieved a considerable amount of popularity.

It helped Ozzie Nelson and Harriet Hilliard on their rise to fame (you know, they're *Ricky's* parents!)

Paul Whiteman played it. He dedicated his rendition to the University of Wisconsin, where Observatory Hill is about as romantic and lovely as any other such height in all the world.

But did the song really mean *our* Observatory Hill?

A letter to the writer of the lyrics provided the answer. The author was Johnny Burke (who, with his collabobator, Harold Spina, also turned out such hits as "Annie Doesn't Live Here Anymore"); he *had* been a student on the University of Wisconsin campus in the late 'twenties.

Johnny answered the question about the song's origin like this:

> "I wish I could tell the world in more ways than a song how wonderful the University of Wisconsin is. It has made me very proud to know that 'It's Dark on Observatory Hill' met with approval on the Wisconsin campus.
>
> "I have a secret world to which I move quite often under the pretense of sleep and there I re-enroll at Wisconsin."

Like Johnny, many of us Badgers recall that same Observatory Hill as the focus point for *our* secret campus world. It is this identification of Observatory Hill with the University of Wisconsin that has led to one of the most significant projects in University history—building on that site of an Alumni House, a home for the far-famed Wisconsin spirit.

Some time ago, your editor was listening to a recent recording of "It's Dark on Observatory Hill" (in an RCA–Victor Album called Flirtation Walk, with the voices of Walter Schumann). Later he tried to write down the lyrics. But, even allowing for his poor memory, it was strange that they came out like this.

Come back to Observatory Hill;
Come back, every Badger Jack and Jill.
Let's build an Alumni House where we can all come home
To recapture memories of the campus that's our own.
We'll contemplate old Lake Mendota's view
The same way we always used to do
I know for a fact you'll be glad that you've come back
To Wisconsin's Observatory Hill.
I'd like to tip you off to an idea that I've got
It tells how you can help
To make this dream of ours come true.
It's simple, it's fascinating!
Just brush up on your arithmetic,
Give the button on your fountain pen a click.
Write a check today and send it on its way
For our house on Observatory Hill.

Reprinted from BULLETIN AMERICAN ASTRONOMICAL SOCIETY, Vol. 15, No. 1, 1983
Printed in U. S. A.

Washburn Observatory
University of Wisconsin at Madison
Madison, Wisconsin 53706

I. PERSONNEL

Anderson continues to be a member of the STARLAB Joint Science Working Group. STARLAB is an idea for a 1-m-class Shuttle/Space Platform general purpose telescope, planned as a joint U.S., Australian, and Canadian project.

Churchwell continued to serve as a member of the NRAO Users' Committee.

Code began his duties as President of the AAS. He continues as a member of the Space Telescope Wide Field Camera team.

Mathis received his second U.S. Senior Scientist Award from the Alexander-von-Humboldt Foundation of the Federal Republic of Germany. He spent the summer of 1982 in Bonn at the Max-Planck-Institut für Radioastronomie.

Savage continued as a member of the Space Telescope High Resolution Spectrograph science team. He is also a member of the science definition team for the Far Ultraviolet Spectroscopic Explorer (FUSE).

Mark H. Slovak for the University of Texas joined the research staff of the observatory in September 1981. He has been involved with studies of symbiotic stars and development of data reduction software.

You-Hua Chu from the University of California of Berkeley and the University of Illinois joined the research staff in May 1982. She is studying the 30 Doradus region in the Large Magellanic Cloud.

David P. Huenemoerder was awarded the Ph.D. degree. He studied field horizontal branch stars and currently has a research position at Pennsylvania State University.

Nancy A. Oliversen received the Ph.D. degree. Her thesis concerns emission-line intensity variations in the symbiotic stars. She is working at CSC/GSFC.

Doherty completed his term as Department Chairman. Savage was appointed chairman in September 1982.

II. MADRAF

The Midwestern Astronomical Data Reduction and Analysis Facility (MADRAF), which is a cooperative project of eight Midwestern universities (University of Toledo, Michigan State, Ohio State, Indiana, Illinois, Northwestern, Yerkes Observatory, and Wisconsin) is now fully operational. The Facility, which is directed by Anderson, has a VAX 11/780 computer, PDS microdensitometer, Grinnell Image Processor, and various associated peripherals. Simkin of Michigan State has installed on the system a version the general data reduction program developed at Mount Stromlo. This program is called ROO (*R*educed *O*bservations *O*ptionally) since it gives the user a wide variety of options. The Facility has developed a highly versatile PDS operations program which commands the microprocessor in the PDS from the VAX. The Facility has recently (September 1982) installed a large Winchester disk drive with 500 Mbyte of storage, a Floating Point Accelerator, and several new graphics devices. Cudworth (Yerkes) reports that the MADRAF PDS is now producing the best astrometric results of any machine he has ever used. Slovak is working on MADRAF software, particularly graphics utilities, echellogram reduction techniques, and IUE data reduction interfaces. Inquiries about use of MADRAF by astronomers not associated with the eight universities are invited.

III. RESEARCH

A. Instrumentation and Data Processing

Bless continued as Principal Investigator for the High Speed Photometer which will be flown on NASA's Space Telescope. The completed photometer was sent to Goddard Space Flight Center in July for acceptance testing which is expected to be completed by the end of 1983.

Code, Nordsieck, Anderson, Bless, and Michalski continue in the development of two NASA-funded ultraviolet spectropolarimetry experiments, an Aerobee sounding rocket payload and a Shuttle payload, WUPPE (Wisconsin Ultraviolet Photo-Polarimeter Experiment). The WUPPE is a 0.5-m Cassegrain telescope feeding a Monk-Gillieson spectropolarimeter with wavelength range 1400–3200 Å and resolution 4–40 Å. It is one of the three UV telescopes in the STAR (Shuttle Telescopes for Astronomical Research) payload, which is to be flown a number of times in 1985–1987. WUPPE targets include Comet Halley, interstellar polarization, circumstellar polarization, diffuse reflection nebulae, white dwarfs, and QSO's.

Ebbets and Savage have devoted a considerable effort to planning the laboratory testing and calibration of the Space Telescope High Resolution Spectrograph (HRS). The HRS will be used to obtain high-resolution spectral data at ultraviolet wavelengths from selected astronomical objects while in near-Earth orbit. Two 512-channel Digicon detectors will be used to collect the data. The spectrograph is in an advanced state of development. Testing will occur over the interval September 1982–February 1983. Ebbets is now located at the test site (Ball Brothers Research Corporation in Boulder, Colorado).

Nordsieck has completed upgrading the Washburn Observatory public and educational viewing equipment. A beam splitter can divert part or all of the telescope beam from the 15.5-in. refractor to a low-light-level 1SIT RCA video camera, preceded by various filters and lenses. The object being observed may then be displayed on a monitor on the dome floor so that the astronomer may point out features of interest to the observing group as it waits for a view through the eyepiece. A digitial integral integrating memory is available to enhance faint diffuse objects and a video recorder may record objects for later display in the classroom. This equipment, funded by a matching grant from the

NSF Instructional Scientific Equipment Program and the university, is now used regularly for instructional viewing sessions and the regular bimonthly public viewing night.

B. Solar System

Roy V. Myers and Nordsieck have obtained polarimetry of Comet Austin (1982g) using the Pine Bluff Observatory 0.9-m Reticon grating spectropolarimeter. Simultaneous calibrated spectrophotometry with 6-Å resolution and polarimetry with 100-Å resolution between 5000 and 8000 Å were obtained on nine nights spanning Sun-comet-Earth scattering angles 50–105 deg, using a 5×10-arcsec slit centered on the nucleus. This pilot project is intended to evaluate the application of new instrumentation to cometary dust polarization studies and to study the scattering angle dependence of interplanetary dust, with an eye toward comparison with diffuse reflection nebulae.

C. Stars

Anderson and Oliversen continued their program of spectrophotometric observations of the symbiotic stars. The program uses the 0.9-m telescope at Pine Bluff and the intensified Reticon detector on either the echelle or low-dispersion Cassegrain spectrograph. The echelle/Reticon combination produces line profiles at a resolution of about 0.3 Å. The usual line observed is Hα, although some work on λ 4686, 5007, and 5876 has also been done. The low-dispersion data yield flux-calibrated spectra in the wavelength range 3800–6000 Å. The program continues to discover changes in the spectra of the symbiotic stars associated with various types of activity. The results were discussed in considerable detail by Oliversen at the August 1981 IAU symposium on symbiotic stars at the Haute Provence Observatory.

Anderson, Cassinelli, and Slovak have extended the discussion of the UV and x-ray observations of the symbiotic star AG Dra. The x-ray, UV, and optical photometry are well modeled with a cool giant, a hot (150 000 K), small (10 000 km) blackbody, and a weak nebular continuum.

Cassinelli and Jean Swank (GSFC) have completed a study of various coronal and shock models for the x-ray emission from OB supergiants. The predicted x-ray fluxes were folded through the response function of the solid-state spectrometer (SSS) on the *Einstein* observatory. The shock model of Lucy (1982) can provide a spectrum that fits well, but with model parameters that are outside the range expected. Most of the x rays would have to come from rare, very strong shocks, but to avoid strong variability there must be at least 25 shock segments in the wind at any time. The base coronal models of Waldron (1982) and Stewart and Fabian (1981) were also tested. With a very delicate adjustment of parameters these could also be made to fit the data. However, slight changes in parameters would lead to order-of-magnitude changes in the soft x-ray flux. The x-ray observations may well require that the hot stars have both base coronal zones and hot shocks embedded in the fast winds. Further constraints on the alternative models have been derived from the simultaneous UV and x-ray observations of OB supergiants by Cassinelli, Hartmann, Sanders, Dupree, and Myers (1982).

M. G. Wolfire and Cassinelli have initiated a study of the collapse of supermassive stars aimed at understanding the conditions that are necessary for the formation of stars such as R136a, the central object of the 30 Doradus nebula.

Churchwell continued his collaboration with Abbott (University of Colorado) and Bieging (University of California at Berkeley) on the measurement of mass-loss rates of early-type stars. In particular, a long-range project was initiated (2 yr or longer) to monitor radio flux variability at λ 6 and λ 2 cm and/or λ 21 cm of 4–5 of the most luminous O stars using the VLA. Four observing periods were assigned to this program during the year.

Bieging, Abbott, and Churchwell (Astrophys. J., in press) detected 6-cm continuum emission with the VLA from eight of 13 Wolf-Rayet stars searched. The derived mass-loss rates were about the same for all the detected stars; the mean value was $(2.0 \pm 0.6) \times 10^{-5}\ M_{\odot}\ \mathrm{yr}^{-1}$. $\dot{M}$ appears to be independent of luminosity, spectral type, and binary nature for the WR stars. All WR stars have $\dot{M}$ values well above the $(\dot{M}, L_{\mathrm{bol}})$ relationship of OB stars. The derived mass-loss rates imply momentum transfer in the wind which typically exceeds the stellar radiative momentum by more than a factor of 10.

Doherty, with Holm and Wu (CSC) [Publ. Astron. Soc. Pac. **94**, 548 (1982)], used IUE low-dispersion spectra of the carbon star RY Sgr to measure variations in the ultraviolet during the star's recovery from an episode of veiling. These variations are fit fairly well by extinction (absorption plus scattering) due to spherical graphite grains and amorphous carbon smoke. That extinction rather than pure absorption by these particles provides the better fit suggests that the circumstellar cloud is not spherically symmetric.

Doherty and Zeki Eker have obtained high-resolution spectra of Hα in several G and K dwarfs with the intensified Reticon detector and echelle spectrograph attached to the 0.9-m telescope at Pine Bluff. These observations are part of a new program to search for rotational variation in the Hα profiles of cool dwarfs. Eker and Doherty, using the Reticon and the Boller and Chivens spectrographs at 6-Å resolution, also obtained 4000–7000-Å spectra of HD 199178, an FK Comae star. They hope to determine the Balmer decrement of the emission component in the spectrum of this rapidly rotating G giant.

O. L. Lupie and Nordsieck are completing a 2-yr spectropolarimetric monitoring program of several O and B supergiants using the Pine Bluff Observatory 0.9-m telescope with dual array intensified Reticon detector and a low-resolution Lyot spectropolarimeter. Polarimetric and spectral information are obtained simultaneously in the wavelength range 4500–8000 Å. The presence of an intrinsic component of polarization is indicated by variability in both the degree and position angle in many of the program stars (e.g., κ Cas, P Cyg, χ^2 Ori, 9 Sge, α Cam, and λ Cep). The variations are approximately wavelength independent, and amplitudes range from 0.15% (λ Cep) to 0.45% (P Cyg), with day–week time scales. Obvious periodicity was established only for the eclipsing binary 29 CMa. No correlation was found between the polarization behavior and the Hα line equivalent width. The nature of the variability of both the degree and position angle of polarization apparently indicates a day–week time scale variability in the geometry of the electron scattering envelope. A model involving irregular mass loss in the form of short-lived "blobs" or streams within the steller wind is being investigated.

Savage, Cassinelli, Ebbets, and E. L. Fitzpatrick are studying the available IUE low- and high-dispersion data concerning R136a. Cassinelli, Mathis, and Savage have presented arguments that the object is a supermassive star with $M \sim 2000 M_{\odot}$. Support for this suggestion comes from the speckle interferometry measurements of Meaburn *et al.* [Mon. Not. R. Astron. Soc. **200**, 1P (1982)]. These data imply that R136a is smaller than 5×10^{-3} pc. The various ultraviolet observations have been used to search for variability, to produce a high-quality composite line spectrum, and to study the continuum energy distribution of this peculiar object. If R136a is a collection of stars, the new UV spectral line and continuum measurements can be explained if ~ 6 O3 stars, ~ 6 WN4, and ~ 15 O7 stars exist in a region ~ 1000 AU in extent. However, such a compact star cluster would not be able to power the nebula. The UV and optical data and ionization of the nebula are most easily understood if R136a is a single supermassive object.

Ebbets and Conti (University of Colorado) have obtained and analyzed a spectrum of R136a in the optical region 3700–6700 Å. Emission lines of Hα, He II λ4686, C IV, N IV, and possibly N V are present. The overall spectra morphology resembles that of a WN4.5 star. Balmer lines of Hγ–H11 are present in absorption and appear to have the same origin as the WN spectrum. Weak absorption lines of He I and He II are present. Their strengths are consistent with a 20% contribution to the optical luminosity of R136a by an unresolved group of several dozen O stars. Ebbets and Conti favor the single massive object interpretation of the spectrum. However, the possibility of a dense cluster of several dozen very luminous O-type supergiants cannot be excluded by the visual spectrum.

Chu has analyzed two high-dispersion echellograms (taken by N. Walborn) and a medium-dispersion image tube spectrogram of R136a. Between 3700 and 4800 Å, the spectral lines detected are: (1) stellar absorption—hydrogen Balmer series, He I singlet λ4387, He I triplets λ4471 and λ4026, and He II λ4541; (2) stellar emission—Ca II H and K lines, and He I λ3888. The H Balmer lines are several hundred km s^{-1} broader than those from O stars. The strengths of the He I and He II lines clearly indicate contaminations from cooler stars. High-quality and high-dispersion spectra of R136 and neighboring positions are needed to analyze quantitatively such contamination and determine the intrinsic spectrum of R136a. Plans are being made to carry out the required observations.

Ebbets and Savage obtained IUE low- and high-dispersion UV spectra of RWT 152 (Rubin, Westpfahl, and Tuve 1974). The star is faint ($V = 13$), lightly reddened, with a visual spectrum of type O5V. If it has an absolute magnitude consistent with normal Population I massive stars, it would lie 50 000 pc from the galactic center. However, the UV data imply the star is a small ($R_* / R_{\odot} \simeq 0.7$), low-mass ($M_* / M_{\odot} \simeq 0.6$) object with a luminosity of less than one percent of Population I main-sequence stars. The UV line profiles provide a useful way to distinguish between low- and high-luminosity O stars. This discrimination is often not possible on the basis of optical spectra alone.

Massa and Savage have obtained low-resolution IUE observations of O and B stars in NGC 6231 in order to determine their intrinsic UV energy distributions. The observations of the main-sequence cluster B stars are used to derive the wavelength dependence of the interstellar extinction toward the cluster and to verify that this dependence does not vary with position in the cluster. The extinction curve derived from the main-sequence B stars has been applied to the luminous cluster stars, revealing shallow intrinsic UV energy distributions. This effect may be the result of radiation backscattered by the luminous stars' winds which is affecting the temperature distribution in their outer atmospheres.

Fitzpatrick has detected photospheric absorption lines in the ultraviolet spectra of two Wolf-Rayet stars, HD 93162 (WN7) and HD 193793 (WC7), using data obtained with the IUE satellite. Neither of the stars has exhibited radial velocity variability which might indicate the presence of an OB companion. The lines, principally of Fe V, are narrow and unshifted in velocity, indicating their formation in a photospheric, rather than a stellar wind, region. If intrinsic to the WR stars, study of these lines may provide much needed information on the nature and structure of WR stars.

Huenemoerder completed a study of the ultraviolet and visual spectra of field horizontal branch stars (FHB) [University of Wisconsin Ph.D. thesis (1982); Huenemoerder, de Boer (Tübingen), and Code, submitted for publication in Astron. J.]. The FHB stars were compared with Population I stars and model stellar atmospheres. The FHB stars have weaker spectral lines and are brighter at wavelengths below 1800 Å than Population I stars of similar effective temperatures. The models for $\frac{1}{10}$ solar abundance are too bright shortward of 1600 Å to properly match the Population II energy distributions.

Code and de Boer continued studies of globular clusters utilizing IUE spectra. A number of blue horizontal branch stars have been observed in galactic globular clusters. These objects have the same photometric and spectrographic properties as FHB stars, indicating that FHB stars provide a satisfactory analog for the stars in globular clusters. Studies of the "blue" and "red" globular clusters in the Large Magellanic Cloud show that the bluest globulars in the LMC have metal abundances comparable with the early-type supergiants in the LMC (Code, "IUE Observations of Globular Clusters and Blue Horizontal Branch Stars," 24th COSPAR meeting on IUE and Einstein Results, Ottawa, 1982).

Koornneef (ESO), Meade, Wesselius (Groningen), Code, and vanDuinen (Groningen) compared OAO-2 photometry with UBV, ANS, and TD1 observations. The results are in Astron. Astrophys. Suppl. **47**, 341–418 (1982).

D. Interstellar Medium

Churchwell has continued his study of the relative abundances of interstellar molecules having C≡N bonds. A primary goal of this work is to lay a foundation upon which the chemical networks responsible for the formation of the cyanopolyynes can be understood. New observations of CN ($N=1$–0) toward cold dark clouds have been obtained by Churchwell and Bieging (University of California at Berkeley) (Astrophys. J., 1 February 1983) using the NRAO 11-m telescope. CN was detected toward all six positions searched in Taurus but not toward L183 and B227 with a sensitivity equal to or better than the detections in Taurus. The hyperfine ratios of CN toward four locations in the Taurus cloud are near unity, consistent with large line optical depths. From the best estimates of CN column densities ($>6\times10^{13}$ cm^{-2}) in Taurus, it appears that CN fits the pattern of enhanced abundances of carbon-bearing molecules (particularly the cyanopolyynes) in the Taurus cloudlets relative to similar dark clouds outside Taurus.

Walmsley (Bonn), Churchwell, A. G. Nash, and E. L. Fitzpatrick [Astrophys. J. Lett. **258**, L75 (1982)] have investigated hyperfine anomalies of HCN ($J=1$–0) in cold dark clouds. Departures from LTE by 20% in the populations of the hyperfine levels of $J=1$ could explain the observations. In contrast to warm clouds associated with H II regions where the $F=1$–1 line is anomalously weak, in the cold clouds the $F=0$–1 line is anomalously strong. It is suggested that the anomalies may be a result of absorption by cooler overlying gas, as appears to be the case for HCO^+.

Nash, Churchwell, and Walmsley (1983, in preparation) have estimated relative abundances of HCN, HNC, and HC_3N in seven cold dark clouds and two warm molecular clouds from high spectral resolution observations of HCN, $H^{13}CN$, HNC, $HN^{13}C$, and HC_3N near 90 GHz using the NRAO 11-m telescope. All three molecules appear to have enhanced abundances in Taurus relative to other similar dark clouds outside Taurus. It is also found that on average the column density ratio $N(\mathrm{HNC})/N(\mathrm{HCN})>2$ in the cold Taurus clouds and 0.2 in warm molecular clouds. Chemical reasons for this are being explored.

Churchwell and Hollis (LASP/GSFC) (1983, in preparation) have taken advantage of the unique temperature sensitivity of symmetric-top molecules to measure the kinetic temperature profiles across the faces of the molecular clouds Orion, DR 21, and Sgr B2. The $J=5$–4 and $J=6$–5 transitions of CH_3CCH were measured at 1-arcmin intervals along N-S and E-W cross sections. A technique to determine separately the rotational excitation temperature, the kinetical temperature, the column density in the ground state, and the total column density is outlined and applied to the above clouds. The derived temperature profiles are interpreted in terms of cool-halo–warm-core models in which the heating is supplied by embedded hot stars, the existence of which is supported by infrared observations.

Mathis, Panagia (Bologna), and Mezger (Bonn) have estimated the radiation field of the Galaxy from 5 to 13 kpc from the center. They have also calculated the spectrum emerging from molecular clouds of various optical thicknesses which are immersed in this field. They find the dust deep inside the cloud is heated by the warm sheath of dust radiating on the outside of the cloud. The emergent spectrum is broadened by the presence of two kinds of grains, silicates and graphite, in the mixture they assumed.

Mathis studied the effects of scattering by dust inside nebulae, or close to nebulae, on the Balmer decrement. He finds the standard method of estimating the extinction in nebulae by comparing Hα with Hβ underestimates the amount of absorption in the nebula, and the standard method of dereddening other lines by use of the Balmer decrement is seriously in error for long-wavelength ($\lambda>0.8$ μm) lines. His work will be published in *The Astrophysical Journal*.

N. P. Odegard has devised a simple method for estimating the mean temperatures and mean densities in H II regions from two hydrogen recombination lines at quite different frequencies. The line strengths are discussed in connection with a rather simple model for the nebula, but numerical experiments with complicated model nebulae (i.e., objects filled with density fluctuations) show that the average values obtained apply to realistically complex objects. This work is part of his Ph.D. thesis.

Mathis has shown that the observed [O II]/[O III] and [S II]/[S III] ratios are powerful diagnostics for the stellar temperature and some ionic abundance ratios. The paper discussing sulfur, helium, and nitrogen will appear in *The Astrophysical Journal*. Other elements will be discussed.

Massa and Savage have obtained low-resolution IUE observations to supplement and verify ANS photometry of main-sequence O and B stars in the Cep OB3 association. The data have been used to produce extinction curves for 23 stars in the association. These reveal a progression of curve morphology which appears to be related to the proximity of the extincting dust to the associated molecular cloud. This effect may be related to a density dependence of the dust particles' size distribution.

Massa, Savage, and Fitzpatrick studied low-resolution IUE observations of stars known to have peculiar UV extinction parameters from ANS photometry. These data verify earlier results by Meyer and Savage [Astrophys. J. **284**, 545 (1981)] which imply that peculiar UV extinction is common. They find that dust can produce very peculiar UV extinction whether or not it is associated with dark clouds and that significant errors can result from dereddening even a moderately reddened star with a mean UV extinction curve. They also find that even for the most peculiar extinction curves studied, the position and shape of the λ 2175 absorption bump does not vary.

Fitzpatrick and Savage are obtaining high-resolution IUE spectra of early B supergiants in the Large and Small Magellanic Clouds in order to study the gas kinematics of clouds and to determine if evidence exists for Magellanic Cloud gaseous halos, analogous to that observed for the Milky Way. The relatively cool B-type supergiants are desirable for this study because they produce much smaller amounts of C^{3+} and Si^{3+} ions in their circumstellar environments than do O-type stars. Circumstellar absorption from such ions may mask absorption produced in a hot gaseous halo.

Fitzpatrick and Savage have obtained multiple high-resolution IUE spectra of the Small Magellanic Cloud star HD 5980. The coaddition of these spectra has produced high signal-to-noise interstellar data for this extragalactic line of sight. The observed absorption is very complex. Ultraviolet absorption components have been detected at 0, 85, 110, 140, 200, and 300 km s^{-1} LSR. H I 21-cm emission line data show that a 120-km s^{-1} absorption component is present which is unresolved in the ultraviolet. The regions sampled by the interstellar absorption lines include local Milky Way gas (0 km s^{-1}), the Milky Way halo (0 km s^{-1}), SMC "disk" gas (120 km s^{-1}), and SMC H II region gas (140 km s^{-1}). Some possible contributions to the absorption include a Galactic high-velocity cloud (85 km s^{-1}), the Magellanic Stream or an SMC halo (200 km s^{-1}), and an SMC supernova remnant (300 km s^{-1}).

Savage is studying the interstellar ultraviolet line spectrum of HD 36402 in the LMC. Six high-dispersion IUE spectra have been combined to produce a spectrum of much higher quality than previously analyzed. The data will be used to better define the relative element abundances in cool galactic halo gas.

Savage, Jenkins (Princeton), and Spitzer (Princeton) are studying the interstellar depletion of Cl, Mn, Fe, Mg, S, and P. The observational data are from the "Survey of Ultraviolet Interstellar Absorption Lines" obtained by the *Copernicus* satellite [Bohlin *et al.*, Astrophys. J. Suppl., in press (1983)]. The data will be used to gain new insights about the exchange of heavy elements between the solid and gas phase in interstellar space.

E. Extragalactic

Code and Welch (St. Mary's University) completed a study of the ultraviolet energy distributions of spiral and irregular galaxies [Astrophys. J. **296**, 1 (1982)]. On the average, later-type galaxies are significantly bluer in the ultraviolet than visual colors would imply. This reflects a recent history of more vigorous star formation. The local spectral luminosity density was determined and the contributions to the extragalactic sky background calculated. Unevolved galaxies can account for at most a few percent of the measured sky background; on the other hand, galaxy evolution can provide a significantly enhanced background.

Code presented a survey of the ultraviolet spectra of galaxies at IAU Symposium No. 104 in Crete, 30 August–2 September 1982.

John Davis (Brown Teledyne Corp., Huntsville), Code, Mathis, and Welch published a study of ultraviolet photometry of M31 and M33 [Astron. J. 87, 849 (1982)].

Savage and Fitzpatrick are investigating the ultraviolet extinction properties of dust in the core of the 30 Doradus Nebula in the Large Magellanic Cloud using low-resolution IUE observations. The purpose of the study is twofold. First, the shape of the extinction curve contains information on the nature of the obscuring dust. Second, the intrinsic energy distributions of stars in the nebula, including the core object R136a, may be determined once the extinction curve is known. First results indicate that the whole core is reddened by an extinction law resembling those previously determined for stars in the LMC. However, the deeply imbedded stars are additionally reddened by an extinction law similar to that seen in the Orion Nebula.

BLAIR D. SAVAGE
Chairman

Data Survey

(1) No. of faculty/staff: tenured or tenure-track 0 (M), 0 (F); post-doc 3 (M), 1 (F); res. assoc. 0 (M), 0 (F); other Ph.D.'s 0 (M), 0 (F).
(2) No. of graduate students: first year 1 (M), 0 (F); total 7 (M), 3 (F).
(3) No. of degrees awarded: terminal Master 0 (M), 0 (F); Ph.D. 1 (M), 1 (F).
(4) Employment of those in (3): post-doc 1 (M), 0 (F); res. assoc. 0 (M), 0 (F); tenure-track 0 (M), 0 (F); FFRDC 0 (M), 0 (F); govt. lab 0 (M), 0 (F); industry 0 (M), 1 (F); foreign 0 (M), 0 (F); other 0 (M), 0 (F).

JUN 15 1982

13

Observatories Washburn

EYE ON THE ENVIRONMENT

Astronomers Take Dim View of 'Light Pollution'

By Nancy Bryant

(Eye on the Environment is a service of the Institute for Environmental Studies at the University of Wisconsin-Madison).

Silently, one by one, in the infinite meadows of heaven, Blossomed the lovely stars, the forget-me-nots of the angels.

–Henry Wadsworth Longfellow

In Longfellow's day, virtually anyone could marvel at the brilliance of a sky full of stars.

Today that privilege is reserved for those who can escape the confines of the city, where artificial light floods the night sky with a milky luminescence that washes out all but the brightest stars.

Even leaving city lights behind is getting more difficult because as cities grow, their nighttime radiance also grows. That fact may be only mildly disappointing to romantic stargazers, but it is downright alarming to professional astronomers, who need the darkest and clearest of skies to do their work properly.

"It has become very, very difficult to find suitably dark sites left anywhere in the continental United States," says Lewis Hobbs, director of the University of Chicago's Yerkes Observatory in Williams Bay, Wisconsin. "There are still good, dark sky sites left, but there are really very few of them."

Hobbs says the distance to which astronomers can see in the universe depends directly on the darkness or brightness of the night sky.

Star or Galaxy

"Consider a star or galaxy which, in our imagination, is moved progressively farther and farther away, just like a candle receding into the distance," he says.

"Well, it becomes fainter the farther away it is. And if there is any light at all, natural or artificial, in the sky, eventually when the star or galaxy is far enough away, it becomes so faint that it simply disappears into the residual light of the night sky."

The light around Yerkes Observatory, which was built in 1895 near the western shore of Lake Geneva, threatened to interfere with the work of its astronomers so much by 1975 that they asked Williams Bay, a town of about 1,600 people, to enact and ordinance to control the use of new outdoor lights. The town complied.

Not all astronomers are as lucky. The University of Wisconsin built an obsevatory on what was then the far western edge of its Madison campus in 1878. Today the observatory is surrounded by both a much larger campus and a much larger city. It is no longer suitable for research and is used only by the public and undergraduate students.

Impossible to Use

"That was a good site once," says Robert Bless, a UW-Madison astronomy professor. "But of course now it's utterly impossible to use and has been impossible since the second world war, the light pollution has gotten so bad."

The university built a new research observatory in Pine Bluff, 18 miles west of Madison, in 1958. Christopher Anderson, also a UW-Madison astronomer, says that at that time, "If you looked after midnight towards the west from Pine Bluff, it was just as dark as any place you could find in the world."

But Anderson says the night sky at the new ovservatory is now five to 10 times brighter that it was in 1958, thanks to the continued expansion of Madison, the growth of other nearby towns, and the increased use of bright lights in rural barnyards.

(Fortunately, the work being done at the Pine Bluff observatory is not sensitive enough to have been seriously affected—so far—by light pollution, according to Anderson.)

It isn't surprising that astronomers have led a battle in several parts of the country against the phenomenon they call light pollution.

Perhaps the biggest single campaign has been waged in Arizona, home of the largest concentration of optical telescopes in the world. That state's dry, clear weather is ideal for observatories. But its fast-growing population threatens to change all that.

Arizona astronomers have persuaded four counties to enact laws to protect the darkness of the night sky.

Light-Control Code

"We have been encouraged by the governor to carry this (campaign) throughout Arizona to the extent that each county and incorporated city would have a light-control code," says William Robinson Sr., an illuminating engineer for Kitt Peak National Observatory near Tucson, which alson houses 19 optical telescopes.

The light-pollution codes usually require three things:

• that lights on athletic fields, tennis courts, parking lots, billboards, and similar facilities be turned off when the facilities are not being used;

• that new outdoor lights be shielded to direct their beams downward;

• that new outdoor lights, particularly streetlights, emit a limited range of color.

The benefits of the first two provisions are obvious. The last provision is important because astronomers can cope with one-color light much more easily than they can with multicolored light.

It so happens that low-pressure sodium-vapor lamps emit only yellow light, while older, more common mercury-vapor lamps emit five or six colors. Astronomers are encouraging communities to substitute the former for the latter.

Sodium-Vapor

"Sodium-vapor lamps put all the light pollution essentially into one spectral line," says Donald Osterbroch, former director of the Lick Observatory in San Jose, California. "We decided we could give up on that wavelength and use filters around it."

Lick Observatory successfully campaigned for a light-pollution code in San Jose. The city now has replaced 90 percent of its old streetlamps with sodium-vapor bulbs, which not only are better for watching stars but also, according to Kitt Peak's Robinson, burn 60 percent less energy than mercury-vapor lamps.

It appears that where they exist, new lighting codes are working.

"There has been a very slow increase, if any, (in light pollution) since the light ordinance was passed in Williams Bay," says Hobbs, of the Yerkes Observatory in Wisconsin.

Many astronomers believe the biggest obstacle to controlling light pollutionin places without local codes is that the public simply isn't aware of the problem.

"When we got the message to them (the people of San Jose) that the lights are hurting us, they were very receptive to doing something about it," says Osterbroch. "But it's hard to get the word out."

Washburn Observatory

Sandstone Structures Build Quarry Heritage

"On Wisconsin" Spring, 1982

Many of the University's historic buildings of cream colored stone are reminders of a pioneer Madison industry, quarrying.

Madison Sandstone was a popular local material when the University's first building, North Hall, was constructed in 1851. Ezra L. Varney, the mason, had been granted "the sole and exclusive right and privilege of digging for, mining and quarrying all stone" in an area in what is now Shorewood Hills.

"Madison cream colored stone is easily wrought, susceptible to the highest finish, and when placed in a wall presents a finer appearance than any other stone which we ever saw," the *Daily Argus and Democrat* said in 1853. After a visit to Madison in 1855, the world traveler, Bayard Taylor, praised its "soft, beautiful, cream colored stone, which furnishes the noblest building material." Taylor had been here for a UW lecture course, and sent a letter back east to Horrace Greeley's *New York Tribune*.

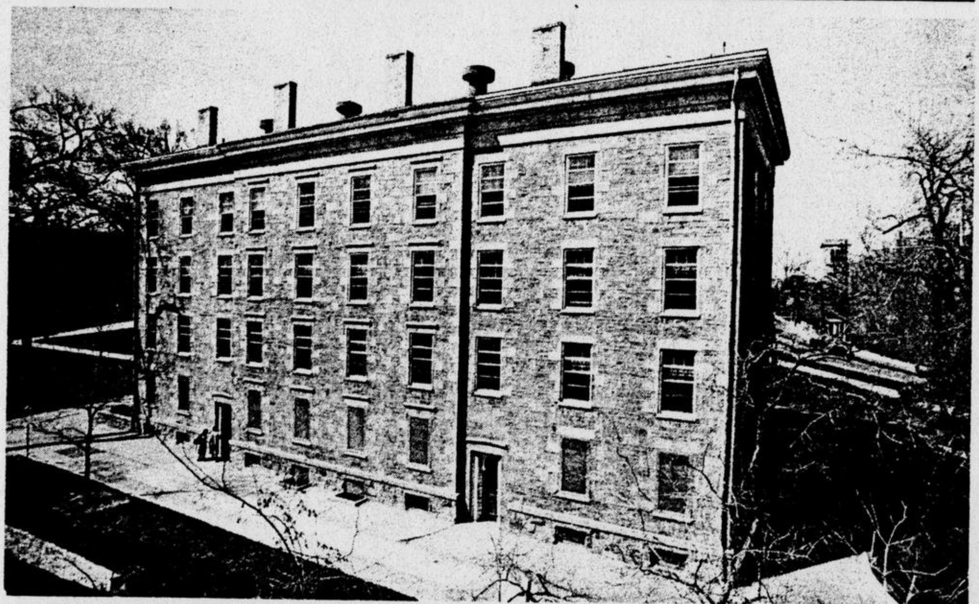
Some idea of the logistics needed for constructing an early sandstone building can be gained from an article about South Hall. The contractors, Bird and Larkin, "to-day, put onto the work 20 quarrymen, 15 stone cutters, and 24 teams for hauling stone," a contemporary newspaper reported. Stone came from one and a quarter miles from the building. The hall was completed in 1855 for $20,000. Bascom Hall, the work of another early Madison stone mason, James Livesey, followed in 1859.

The list of sandstone buildings spans almost the entire period of quarry activity in the city. Besides North, South, and Bascom Halls, they include Washburn Observatory, 1878; Music Hall, 1879; Radio Hall, 1888; Lathrop Hall, 1910; Birge Hall, 1910; Barnard Hall, 1912; Adams and Tripp Halls, Carson Gulley Commons, 1926; Field House, 1930; Mechanical Engineering, 1931; Carillon Tower, 1935; and Law School, 1939 section. Among buildings no longer standing are the first Science Hall and the original Chadbourne Hall. Although difficult to trace the stone to a particular quarry, the material for the University undoubtedly came from the Hoyt Park-Shorewood area quarries.

The quarries provided topics for University research and theses. "The stone has a very pleasing buff color, and when properly quarried and dressed serves as a very good building material," said Ernest Buckley in a Wisconsin Geological and Natural History Survey report in 1898.

Campus plans recognized the importance of early sandstone buildings. "The keynote of style should be taken from North and South Halls, the oldest and also the best of the University buildings. These afford a good suggestion of classical Renaissance which should be required as the pervading character of future construction. The best building material for this purpose is a stone of light color, preferably Indiana limestone or the cream color freestone found near Madison, or yellow brick," a 1909 plan by Warren P. Laird, Paul P. Cret, and Arthur Peabody said. Information about the plan was obtained from campus architect Gordon D. Orr, Jr.

Today, the sandstone structures are standing up well, according to G. C. McGinnity, mason shop supervisor. If repairs or replacements are needed, the University has a supply of stone, salvaged when several stone buildings were demolished. As an important part of the University's heritage, the stone structures can be maintained in good condition for many years.



North Hall, constructed of Madison Sandstone

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Observatory Washburn

Release: Immediately 1/14/83 mb

WASHBURN OBSERVATORY ADDS LIGHT AMPLIFIER

MADISON--A high-technology twist has been added to the 102-year-old tradition of public stargazing nights at the University of Wisconsin-Madison's Washburn Observatory.

In addition to its refracting telescope with a 15.6-inch lens, the observatory now features a low-light television camera and a digital integrating memory that are attached to the telescope. The new equipment, partially funded by the National Science Foundation, allows observatory visitors waiting to use the telescope to view the moon and stellar objects on a 17-inch black-and-white television screen.

The public can visit the observatory on the first and third Wednesdays of the month.

The TV equipment offers another advantage, according to astronomy Professor Kenneth Nordsieck. Nordsieck said the digital memory, which he helped design, allows the camera to pick up faint stellar objects that are not visible to the eye through the telescope.

DIM, as the device is known, collects light emitted by faint stars and projects that light onto the television screen. As a result, stars 10 times dimmer than detectable by eye with the telescope appear on the screen.

The television display also allows those waiting to use the telescope to orient themselves in the heavens before peering into the eyepiece.

- more -

The new camera equipment is not necessarily superior to the human eye, Nordsieck explained. Color vision and better resolution are among the eye's advantages.

Much of the Milky Way is visible in the winter sky, Nordsieck said. He added that observers usually catch a glimpse of a comet.

Public viewing, offered only when the sky is clear, begins at 7:30 p.m.

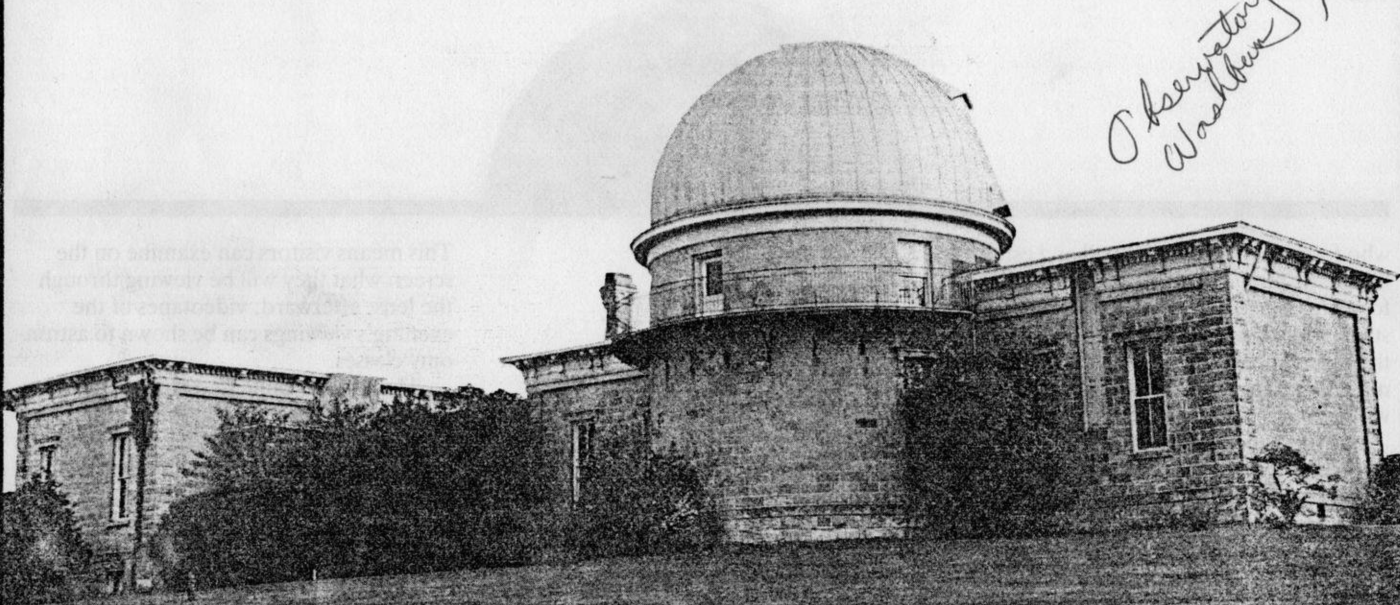
The observatory is not heated, so visitors should dress for the weather.

###

Dec

A CENTURY OF STARS

Observatory Washburn



The Washburn Observatory has been there for all of us to use for 102 years.

By Julie Jacob

For the past *102 years*, anyone strolling near Washburn Observatory on the first or third Wednesday of the month may have noticed the open dome that means public viewing is under way. One could walk in and spend an hour or so gazing at the sky. That was the wish of Cadwallader C. Washburn, Wisconsin's governor in 1871-73, who endowed it, and that's been the rule since he died. The idea of an observatory stretches back to 1869 when the Board of Regents remarked that no university could be considered first-rank without one. Eight years later the legislature passed a bill to "provide for the deficiencies in the university funds": $3000 was to be used annually for astronomical study if an observatory were built with private funds within three years.

And in 1877 President Bascom announced that a donor had been found; former governor Washburn would provide the money *if* the telescope's lens would be larger than the one at Harvard, which was fifteen inches in diameter. Washburn got to set the location, too, and he did so in a ceremony—although his mind might not have been on this honor at the time; the night before, he'd just learned, a flour mill he owned in Minneapolis had blown up. At any rate, he picked that lovely area 100 feet above Lake Mendota, a spot that the first issue of Washburn Publications described as a "place of quiet beauty...protected on all sides from encroachment."

The telescope was ordered from a firm in Cambridge, Mass. Its refracting lens turned out to be just six-tenths of an inch larger than Harvard's. Still, that was enough to make ours the third largest in the nation, exceeded only by the one at the US Naval Academy (twenty-six inches) and that at the Dearborn Observatory in Chicago (eighteen inches). The limestone building that houses it cost $48,000, and it contained an additional smaller instrument, three pendulum clocks, a few offices, and a modest library endowed by Washburn's friend, Cyrus Woodman. President Bascom lured James C. Watson from the University of Michigan as its first director. Although it meant leaving an excellent department to start one from scratch, the highly respected astronomer (he'd discovered twenty-two asteroids) couldn't resist the opportunity to work with a new and more powerful instrument.

Watson energetically supervised the finishing touches on the building and even got his friend Alexander Graham Bell to install two telephones. Apparently he saw the place as his private research facility, for he used his own money to have a smaller duplicate built nearby for student use; it was dismantled in 1960. Watson was an effective teacher, at least according to the Wisconsin State Journal, which commented that "his lectures are instructive and extremely interesting, which few college professors' are."

The observatory was versatile: it served as a weather station, it regulated the clocks on campus, and the astromony department was able to enlarge its coffers by charging the railroads for the correct time.

Watson died of pneumonia in November, 1880, to be succeeded by Edward Holden, of the Naval Academy. It was he

Julie Jacob, a senior in journalism, is an intern on the magazine this semester.

who followed Washburn's will and established the public viewing nights after the former governor died in 1882. But Holden stayed only four years before leaving for the presidency of the University of California. His successor, George Comstock, was with us for thirty-seven years, until 1922.

During these years, research kept to the time-honored method of looking at the heavens, but we pioneered among colleges a new method—photoelectric astronomy—when Joel H. Stebbins arrived from the University of Illinois immediately upon Comstock's departure. His relatively new approach measured the current of electrons emitted from photocells as they were exposed to magnified starlight. From this, astronomers could calculate the temperature, distance, and size of stars so accurately that Stebbins was the first person able to measure the distance, in light years, of our sun from the center of the Milky Way galaxy.

By the mid-'50s, Washburn Observatory was becoming obsolete as a research center. The lights of an expanding city and campus combined with polluted air to form a screen the old telescope was hard put to penetrate to a degree of scientific importance, and technologically advanced instruments could do so much more. WARF donated $200,000 to build a new installation in Pine Bluff, fifteen miles west of the city, and into it went a thirty-six-inch reflecting telescope with five times the light-gathering power of the old one. The astronomy department moved its offices to Sterling Hall

But its faculty keeps Washburn's promise. Prof. Kenneth H.Nordsieck supervises use of the telescope and a still-busy schedule, aided by faculty and grad students who take turns being "on call" for duty on those first and third Wednesday nights when the skies are clear. It isn't as though that were all Nordsieck has to do: he is co-principle investigator for WUPPE—Wisconsin Ultraviolet Photo Polarization Experiment—a ten-foot instrument that will be placed inside the space shuttle.

He describes the Washburn telescope as "in amazingly good condition." The lens and casting are the originals; the instrument is cleaned regularly and repainted (it's now a pleasantly unscientific pale blue) and improvements have been added; there are motors to turn and open the wood-and-canvas dome and to pull up the weights attached to the pendulum inside the base. When no one is using it it's kept, all twenty feet of it, pointed toward the North Star. The place isn't that easy to keep in good condition. Cold, heat, mildew, mice and dust can take their toll. (In fact, we are one of the few institutions that maintains a public service like this.) Last winter a low-light television screen and digital integrating memory were added with a National Science Foundation grant. This means visitors can examine on the screen what they will be viewing through the lens; afterward, videotapes of the evening's viewings can be shown to astronomy classes.

The Observatory was the weather station, it regulated the campus clocks, and the astronomers charged the railroads for the correct time.

The room is unheated to keep the lens from fogging, but even in the winter, about fifty people show up on any night it's open. Some are from the 500 students in general astronomy classes, and there are amateur astronomy buffs. Others are people who happened to be passing by. Viewings are informal. Jupiter, Saturn and double stars are the most popular, say faculty who answer the questions and focus the telescope.Nordsieck believes our national curiosity has been piqued by such programs as *Cosmos* and, of course, by the entire space era, and he reports that those who come in out of curiosity are truly amazed—the "real" sky simply can't be matched by anything a camera catches.

The Washburn Observatory seemed to me a quaint relic until I stopped in one warm evening early this semester; I'd enrolled in a basic astronomy class and I wanted to see what the place was like. The room was dark except for a single red safelight. A few people stood outside on the building's catwalk and hunted for constellations while they waited their turn at the telescope. Inside, we talked in almost reverent tones about Northern Lights and meteor showers. The TA on duty asked us casual questions to find out what basic knowledge any of us might have. She used a flashlight to check coordinates in her notebook each time she re-positioned the telescope.

Outside, cars moved past, headlights glided across the walls, the motor rumbled as the instrument rotated; all reminders of the busy today in which we live. Yet the first time I got the chance to reach out and touch the sky through the very telescope Cadwallader C. Washburn used, the faint points of light that were stars turned into glowing green and golden balls, some of them double; and there were nebulae and the shimmer of galaxies. I realized that this century-old telescope and its home still is, as the plaque above the door says, "a tribute to general science" because it shows us the beauties of space—"a place of quiet beauty...protected on all sides from encroachment." □

Spend a night with the stars at Washburn

Observatory Washburn

WI.Week 2/24/88

by Elizabeth McBride

If the stars seem to glow with extra intensity these winter nights, don't worry—it's not a figment of your chilled imagination.

Cold, dry air makes for exceptionally clear skies, and ice crystals high in the atmosphere refract light so that stars appear to twinkle more.

That makes winter prime time for stargazing, say the folks at the UW–Madison's Washburn Observatory. And twice a month, when the weather cooperates, they offer the best seat in town for the celestial show.

When skies are clear, the observatory opens its doors to the public, and volunteers train the 110-year-old telescope on some of the most interesting objects in the night sky.

The telescope was once the workhorse of UW–Madison's astronomy department. With it, UW researchers pioneered photoelectric astronomy—a means of measuring starlight electrically—and determined the size of our galaxy.

But the telescope traditionally attracted amateur stargazers as well, and in 1881 a schedule of public viewings was established so that scientists could work undisturbed on other nights.

"The planets really wow people," said Barbara Whitney, a graduate student in astronomy who volunteers time at the observatory. "Everything is so magnified you can even see the rings around Saturn."

This month, Venus and Jupiter are visible and offer exciting viewing, Whitney said. Jupiter, the largest planet in the solar system, is especially spectacular because of its colored bands and orbiting moons, four of which can be seen with the Washburn telescope.

The Orion nebula, a vast star-forming region of gas and dust lit up by bright stars, also is an astronomer's treat, Whitney said.

But Washburn provides visitors with more than a look at the heavens. When a slice of the domed ceiling is pulled back on a century-old system of pulleys, a sense of history pervades the room along with the frosty air.

When it was built in 1878, the Washburn telescope was the third largest in the country, its 15.6-inch-diameter lens constructed specifically to be superior to that of Harvard's 15-inch lens. The $3,000 price tag represented one-seventh of the university's state-provided budget.

Perched on a hillside 100 feet above Lake Mendota on the university campus, surrounded by orchards and a vineyard, the observatory became a major research facility. During the early decades of this century, UW astronomers developed the means to detect and measure starlight electrically using photocells. The method allowed them to derive fundamental data about the size, brightness and mass of stars.

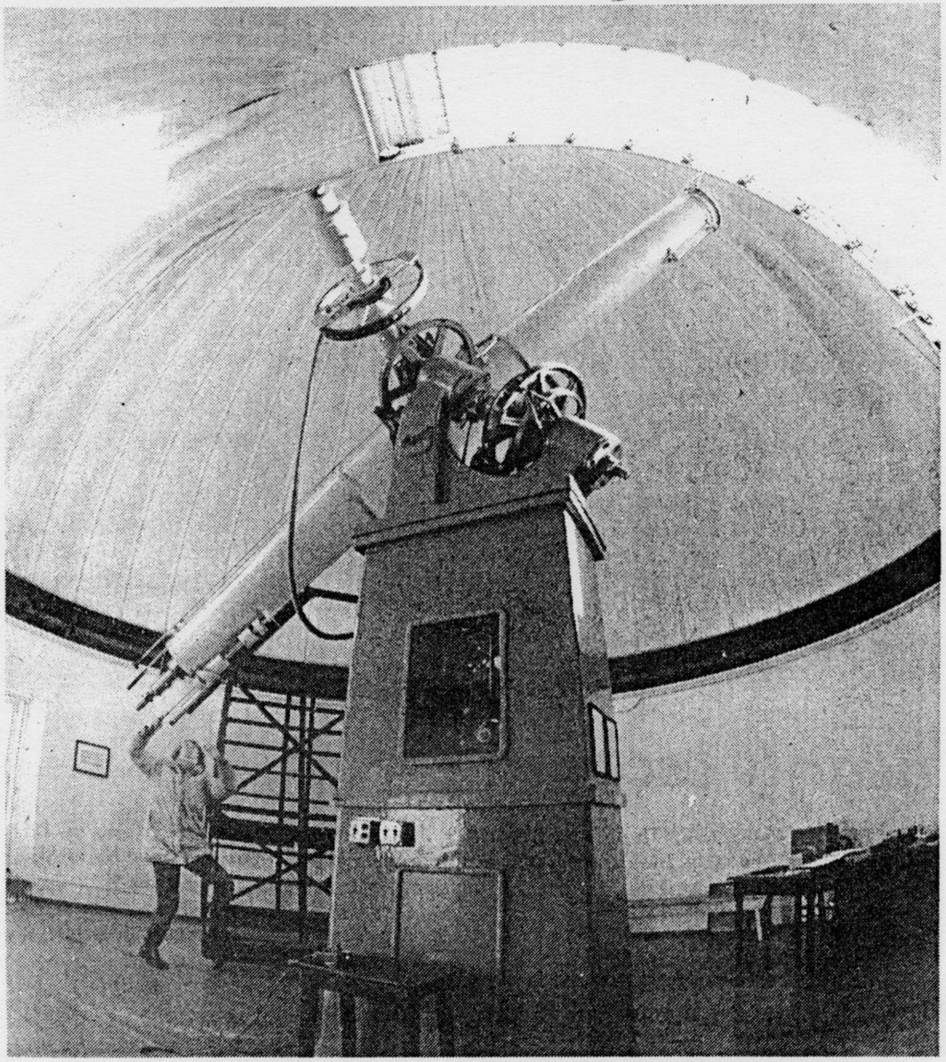
Photoelectric techniques also enabled a UW astronomer, Joel Stebbins, to calculate the size of our galaxy by measuring the effect of interstellar dust on the brightness of stars with known properties. His figures, worked out in 1932, still are accepted by astronomers today.

Washburn Observatory also maintained three pendulum clocks and, in the days before time was standardized, set local time for the city of Madison. The observatory controlled clocks at the state Supreme Court, Western Union, the Wisconsin State Journal, the Park Hotel, and in the university president's office, where it signalled the bells for the beginning and end of classes.

However, by 1958 the observatory's instruments were becoming obsolete, and the bright lights of the growing city and university forced UW astronomers to a new site at Pine Bluff, 15 miles west of Madison.

By that time, public viewings had become an institution. And although the instrument was no longer useful for research purposes, Washburn administrators realized it still offered amateur stargazers a unique experience.

"I feel like a sailor, here in the dark," said Whitney as she steered the telescope into position with what resembles a wooden ship's wheel. "There's a sense of discovery here that people can share."



VIEWING THE STARS—The Washburn Observatory holds public viewings on the first and third Wednesday evening of every month if skies are clear. Here astronomy graduate student and volunteer guide Barbara Whitney positions the observatory's telescope, which, when built, was the third largest in the United States.

Whitney warned, however, that the voyage is a cold one in the winter months; she advises visitors to dress warmly. The dome is unheated so that air currents don't distort the telescope's image.

Public viewings are free and are held on the first and third Wednesday of the month when skies are at least 75 percent clear. Winter hours are 7:30 to 9:30 p.m. Summer viewings begin at sunset.

Those who wish to know which planets and stars are likely to be visible can call the Celestial Connection, (608) 26A-INFO, for a tape-recorded message.

Washburn Observatory is on Observatory Drive, just west of Elizabeth Waters Hall. ■

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Observatories Washburn

Release: Immediately 2/11/88

CONTACT: Barbara Whitney (608) 262-3071

WASHBURN OBSERVATORY PRESENTS A NIGHT WITH THE STARS

By ELIZABETH McBRIDE
University News Service

MADISON--If the stars seem to glow with extra intensity these winter nights, don't worry -- it's not a figment of your chilled imagination.

Cold, dry air makes for exceptionally clear skies, and ice crystals high in the atmosphere refract light so that stars appear to twinkle more.

That makes winter prime time for stargazing, say the folks at the University of Wisconsin-Madison's Washburn Observatory. And twice a month, when the weather cooperates, they offer the best seat in town for the celestial show.

When skies are clear, the observatory opens its doors to the public, and volunteers train the 110-year-old telescope on some of the most interesting objects in the night sky.

The telescope was once the workhorse of UW-Madison's astronomy department. With it, UW researchers pioneered photoelectric astronomy -- a means of measuring starlight electrically -- and determined the size of our galaxy.

But the telescope has always drawn amateur stargazers as well, and in 1881 a schedule of public viewings was established so that scientists could work undisturbed on other nights.

"The planets really wow people," said Barbara Whitney, a graduate student in astronomy who volunteers time at the observatory. "Everything is so

-more-

magnified you can even see the rings around Saturn."

This month, Venus and Jupiter are visible and offer exciting viewing, Whitney said. Jupiter, the largest planet in the solar system, is especially spectacular because of its colored bands and orbiting moons, four of which can be seen with the Washburn telescope.

The Orion nebula, a vast star-forming region of gas and dust lit up by bright stars, also is an astronomer's treat, Whitney said.

But Washburn provides visitors with more than a look at the heavens. When a slice of the domed ceiling is pulled back on a century-old system of pulleys, a sense of history pervades the room along with the frosty air.

When it was built in 1878, the Washburn telescope was the third largest in the country, its 15.6-inch-diameter lens constructed specifically to be superior to that of Harvard's 15-inch lens. The $3,000 price tag represented one-seventh of the university's state-provided budget.

Perched on a hillside 100 feet above Lake Mendota on the university campus, surrounded by orchards and a vineyard, the observatory became a major research facility. During the early decades of this century, UW astronomers developed the means to detect and measure starlight electrically using photocells. The method allowed them to derive fundamental data about the size, brightness and mass of stars.

Photoelectric techniques also enabled a UW astronomer, Joel Stebbins, to calculate the size of our galaxy by measuring the effect of interstellar dust on the brightness of stars with known properties. His figures, worked out in 1932, still are accepted by astronomers today.

Washburn Observatory also maintained three pendulum clocks and, in the days before time was standardized, set local time for the city of Madison. The observatory controlled clocks at the state Supreme Court, Western Union, the Wisconsin State Journal, the Park Hotel, and in the university president's office, where it signalled the bells for the beginning and end of classes.

-more-

However, by 1958 the observatory's instruments were becoming obsolete, and the bright lights of the growing city and university forced UW astronomers to a new site at Pine Bluff, 15 miles west of Madison.

By that time, public viewings had become an institution. And although the instrument was no longer useful for research purposes, Washburn administrators realized it still offered amateur stargazers a unique experience.

"I feel like a sailor, here in the dark," said Whitney as she steered the telescope into position with what resembles a wooden ship's wheel. "There's a sense of discovery here that people can share."

Whitney warned, however, that the voyage is a cold one in the winter months; she advises visitors to dress warmly. The dome is unheated so that air currents don't distort the telescope's image.

Public viewings are free and are held on the first and third Wednesday of the month when skies are at least 75 percent clear. Winter hours are 7:30 to 9:30 p.m. Summer viewings begin at sunset.

Those who wish to know which planets and stars are likely to be visible can all the Celestial Connection, (608) 26A-INFO, for a tape-recorded message.

Washburn Observatory is on Observatory Drive, just west of Elizabeth Waters Hall.

###

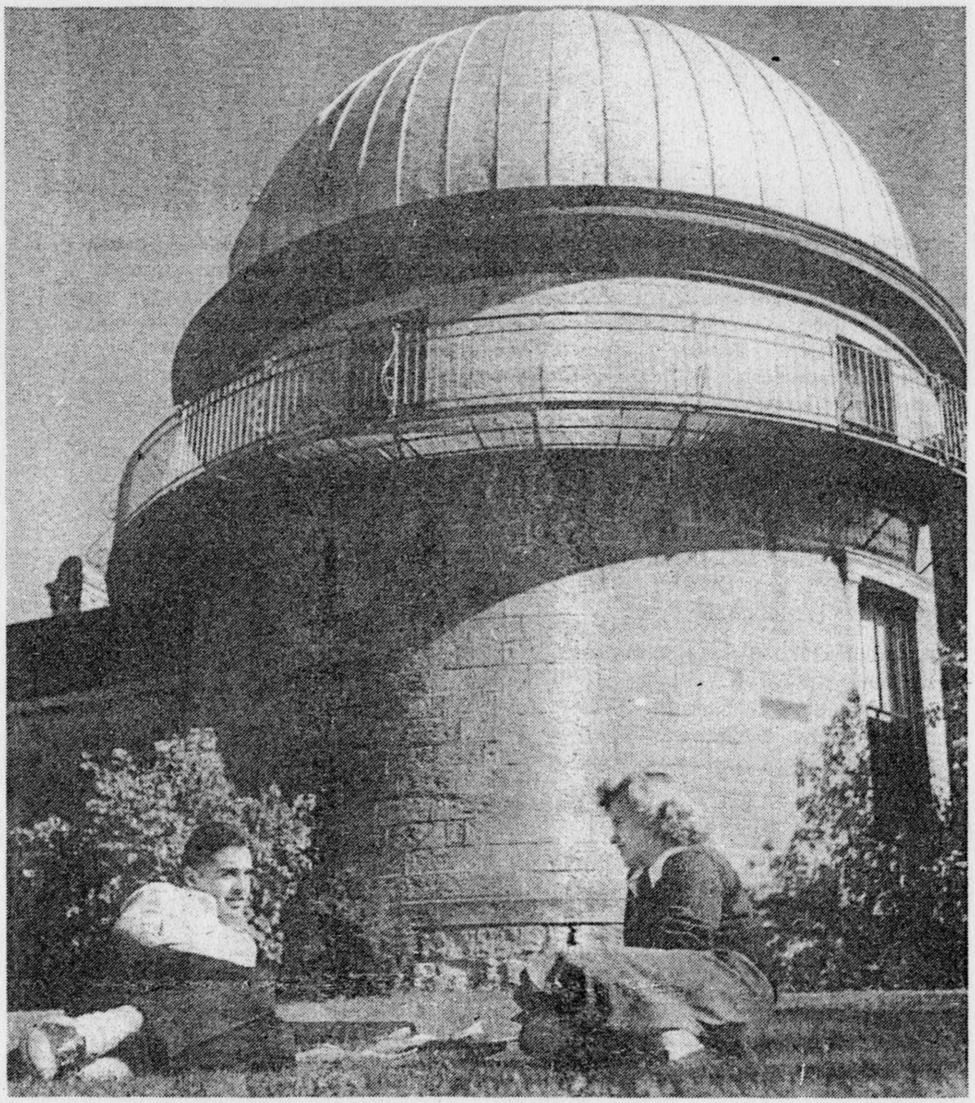
-- Elizabeth McBride (608) 262-9772

Observatory dome faces doom

Observat Washburn

WI. Week 6/29/88

by Terry Devitt



The dome of the Washburn Observatory, shown here in shinier days, is showing its age. It needs extensive refurbishing and may have to be replaced.

The dome of the Washburn Observatory, one of UW–Madison's most familiar and storied landmarks, needs extensive refurbishing and may even have to be replaced, according to campus planners and astronomers.

Parts of the dome—a rotating, wood-framed structure covered by a metal and canvas skin—are believed to be original and date from 1878 when the observatory was built with funds provided by Cadwallader C. Washburn, a prominent Wisconsin businessman and former governor.

"There are signs of rot and other problems, especially with the hatchway," said John A. Paulson, a UW–Madison architect. "At this point, it's not really possible to determine the extent of the damage."

Paulson said a detailed examination of the structure will be undertaken in July to gauge the extent of decades of wear and weathering. A preliminary investigation, he said, has shown that areas around the hatchway atop the dome and the track used to rotate it are rotting and need to be renovated.

Of particular concern is the observatory's hatchway, he said. "We're getting snow and water in all the time through the hatchway, which isn't quite airtight."

The observatory, which has been open for public viewing on the first and third Wednesday evenings of the month for more than a hundred years, will be closed to the public during the month of July.

Still in question is whether the 30-foot diameter dome will be refurbished or replaced. The cost of renovation is estimated at $50,000. A modern aluminum replacement, similar in appearance to the one now atop Washburn, would cost anywhere from $50,000 to $80,000.

The original dome, Paulson said, is a heavy structure made of large timbers and a conglomeration of unknown roofing materials, canvas and metal. It sits atop a narrow-gauge rail and can be rotated to track the stars and planets.

"There seem to be multiple roofs under the skin. Cutting through to see what's there will be like conducting an archeological survey," Paulson said.

A replacement aluminum dome would be lighter, easier to operate, require less maintenance and would last longer, said Robert C. Bless, a professor of astronomy and the author of a brief history of the Washburn Observatory.

"A new dome would look pretty much the same," he added. "It would be a little shinier, that's all."

However, the historical significance of the observatory and the fact that it is listed in the National Register of Historic Places may preempt any attempt to replace the dome.

Historically, the Washburn Observatory is one of the most significant buildings on campus. It was the birthplace of many important astronomical discoveries and contributed to others such as UW–Madison astronomer Joel Stebbins' 1932 determination of the size of our galaxy, a finding still currently accepted.

Washburn also witnessed the birth of a new age in astronomy when, in 1922, Stebbins first attached photosensitive electrical detectors to the eyepiece of the observatory's 20-foot-long telescope. The then-new electrical means of detecting starlight was described as one of the most significant technological developments in astronomy in this century.

Light pollution from a growing campus and city forced researchers to abandon the building for a newer, more remote observatory west of Madison at Pine Bluff in 1958. Washburn is now home to the UW–Madison Institute for Research in the Humanities.

But the domed observatory itself and the original 15.6-inch diameter telescope are still used by students and the public. The opening of the observatory twice a month for public viewing was instituted in 1881.

"My impression is that it's the oldest continuing public viewing arrangement in the country and possibly the world," said Bless. "There are others that did it earlier, but they've stopped."

Paulson said the fate of Washburn's dome awaits a thorough examination of the structure. He said any decision would be made in concert with the state's Historic Preservation Review Board.

Bless said that, in any event, something will have to be done with the dome. "Even if it were no longer used the dome would eventually give way." ■

uw news

From the University of Wisconsin-Madison / News Service, Bascom Hall, 500 Lincoln Drive, Madison 53706 / Telephone: 608/262-3571

Observatories
Washburn

Release: Immediately 6/16/88

CONTACT: Robert C. Bless (608) 262-1715, John A. Paulson (608) 263-3024

WASHBURN DOME DOOMED?

by Terry Devitt
University News Service

MADISON--The dome of the Washburn Observatory, one of the University of Wisconsin-Madison's most familiar and storied landmarks, needs extensive refurbishing and may even have to be replaced, according to campus planners and astronomers.

Parts of the dome -- a rotating, wood-framed structure covered by a metal and canvas skin -- are believed to be original and date from 1878 when the observatory was built with funds provided by Cadwallader C. Washburn, a prominent Wisconsin businessman and former governor.

"There are signs of rot and other problems, especially with the hatchway," said John A. Paulson, a UW-Madison architect. "At this point, it's not really possible to determine the extent of the damage."

Paulson said a detailed examination of the structure will be undertaken in July to gauge the extent of decades of wear and weathering. A preliminary investigation, he said, has shown that areas around the hatchway atop the dome and the track used to rotate it are rotting and need to be renovated.

Of particular concern is the observatory's hatchway, he said. "We're getting snow and water in all the time through the hatchway, which isn't quite airtight."

-more-

The observatory, which has been open for public viewing on the first and third Wednesday evenings of the month for more than a hundred years, will be closed to the public during the month of July.

Still in question is whether the 30-foot diameter dome will be refurbished or replaced. The cost of renovation is estimated at $50,000. A modern aluminum replacement, similar in appearance to the one now atop Washburn, would cost anywhere from $50,000 to $80,000.

The original dome, Paulson said, is a heavy structure made of large timbers and a conglomeration of unknown roofing materials, canvas and metal. It sits atop a narrow-gauge rail and can be rotated to track the stars and planets.

"There seem to be multiple roofs under the skin. Cutting through to see what's there will be like conducting an archeological survey," Paulson said.

A replacement aluminum dome would be lighter, easier to operate, require less maintenance and would last longer, said Robert C. Bless, a professor of astronomy and the author of a brief history of the Washburn Observatory.

"A new dome would look pretty much the same," he added. "It would be a little shinier, that's all."

However, the historical significance of the observatory and the fact that it is listed in the National Register of Historic Places may preempt any attempt to replace the dome.

"For many people, Washburn is a symbol of the university," said Paulson. "I'd like to see it restored. In the National Register of Historic Places there are a lot of buildings, but there aren't a lot of observatories."

Historically, the Washburn Observatory is one of the most significant buildings on campus. It was the birthplace of many important astronomical discoveries and contributed to others such as UW-Madison astronomer Joel Stebbins' 1932 determination of the still currently accepted size of our

-more-

galaxy.

Washburn also witnessed the birth of a new age in astronomy when, in 1922, Stebbins first attached photosensitive electrical detectors to the eyepiece of the observatory's 20-foot-long telescope. The then-new electrical means of detecting starlight was described as one of the most significant technological developments in astronomy in this century.

Light pollution from a growing campus and city forced researchers to abandon the building for a newer, more remote observatory west of Madison at Pine Bluff in 1958. Washburn is now home to the UW-Madison Institute for Research in the Humanities.

But the domed observatory itself and the original 15.6-inch diameter telescope are still used by students and the public. The opening of the observatory twice a month for public viewing was instituted in 1881.

"My impression is that it's the oldest continuing public viewing arrangement in the country and possibly the world," said Bless. "There are others that did it earlier, but they've stopped."

Paulson said the fate of Washburn's dome awaits a thorough examination of the structure. He said any decision would be made in concert with the state's Historic Preservation Review Board.

Bless said that, in any event, something will have to be done with the dome. "Even if it were no longer used the dome would eventually give way."

###

-- Terry Devitt (608) 262-8282

Projected fall enrollment gets back on track

WI. Week 8/23/89

By Chuck Nowlen

Fall enrollment at the UW–Madison is expected to decline by about 1,000 students this year, due largely to a projected sharp drop in the number of new freshmen.

UW–Madison Registrar Don Wermers said he expects total enrollment to be about 42,600, down from 43,641 last fall.

"The university remains on track in meeting its share of UW System enrollment reductions," he said.

UW–Madison Admissions Director David Vinson reported that fall freshmen enrollments were projected to be between 4,800 and 4,900—down about 1,000 (or 17 percent) from fall 1988–89.

Some of the decrease is due to a decline in the number of Wisconsin high school seniors, Vinson said. Admissions standards also were tightened this year for out-of-state applicants, he noted.

Overall, new freshman applications were down about 1 percent from last year, Vinson said. In-state applications fell about 4 percent, while out-of-state applications increased about 2 percent.

The out-of-state application numbers mean that, despite the tougher admissions standards, counselors outside of Wisconsin continue to regard UW–Madison as a "hot school" that is reasonably priced, Vinson said.

He noted that the overall enrollment drop would be in spite of a "significant increase" in the number of new transfer students. About 1,650 transfer students are expected to enroll at UW–Madison this fall, compared to 1,355 last year.

Applications from transfer students were up about 26 percent from last year, Vinson said.

"This is something we didn't expect, and we are not quite sure what caused it," Vinson said. "Transfer student applications had been going down steadily for the past four years."

Students are currently registering via the touchtone system, and as of Aug. 22, about 31,000 students had registered for Fall Semester classes. ■

Briefly . . .

WI.Week 8/23/89

Observatory Washburn

Union names membership director

The Wisconsin Union has announced the appointment of Christine Lutze as acting membership director.

Lutze is a 1985 UW–Madison graduate where she majored in journalism with an emphasis on public relations and advertising. Most recently she was a media specialist for American Breeders Service. Prior to that she was a public relations/advertising specialist for Systems for Health Care and a publications intern for the University of Wisconsin Foundation.

All UW–Madison students are automatically members of the Wisconsin Union upon payment of their segregated fees. Upon graduation, students can become lifetime members of the union for a one-time fee. Lifetime and Annual memberships are also available to the public. Graduation from the UW is not a requirement for Union membership.

Observatory to undergo repair

Public viewing nights at the Washburn Observatory will be suspended from Sept. 1 through the end of December while its historic dome is being renovated. The regular viewing schedule is expected to resume in January. The exact date of reopening or any delays will be announced on the observatory's hotline number, 262-WASH.

The observatory, which was built in 1875, is listed on the National Register of Historic Places. There are no records to indicate how many times the roof on the dome has been replaced, but John Paulson of the Department of Planning and Development says it should look like a newer version of the original when the work is completed. The State Historical Society has been involved in the project.

Paulson said the canvas on the inside will be replaced, repairs will be made in the wood sheathing and the dome will be recovered with lead-coated copper.

New law course debuts this fall

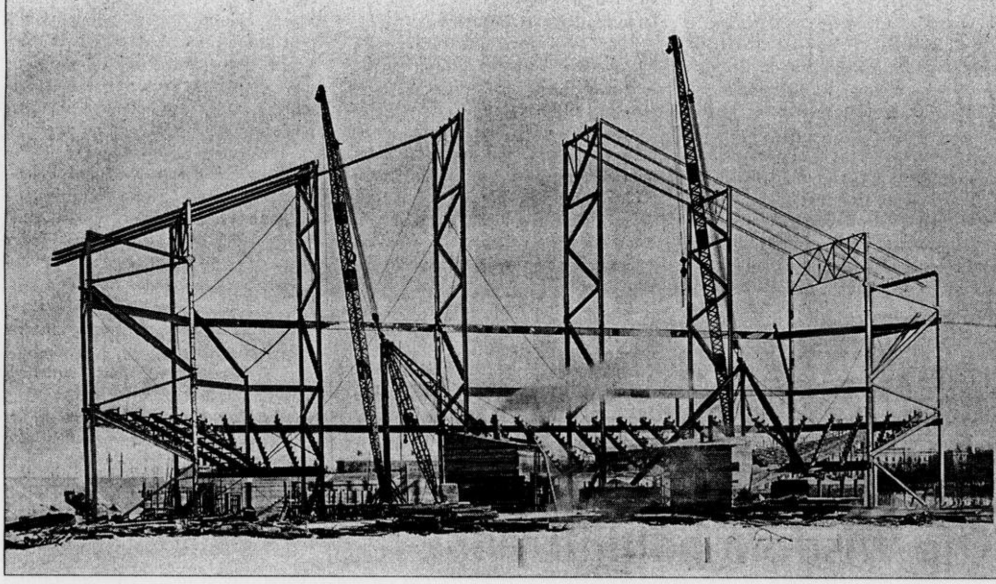
A new course offered by the UW Law School, "Social Theory and Law," integrating various social theories such as Marxism, post-structuralism, feminism, race theory and "superliberalism," will be taught this fall.

Using the underpinnings of critical legal thought, the course will then focus on legal questions surrounding these theories. Some of these questions will include: the role of rights in social change, the use of law to change gender relationships in the workplace, the effectiveness of anti-poverty lawyering, the relationship between legal education and racial, class and gender hierarchies; and the prospects for combining legal work and transformative politics.

The course, taught by Professor David Trubek, is open to both law students and graduate students, although enrollment is limited. The course meets the Law School Legal Process requirement. The pass-fail option is available.

Space— Washburn

Sesquicentennial snapshot



Workers erect a frame that would become part of the University of Wisconsin Field House. From its first commencement in 1931, held on an unfinished dirt floor, the Field House became the UW's archetypal meeting place. "The Barn" kept the rhythm of campus life, through freshman convocations and graduations, college basketball seasons, high-school tournaments and other momentous occasions. In 1941, UW's president gathered students there after the bombing of Pearl Harbor; another president did the same at World War II's end. Campus buildings like the Field House, the Stock Pavilion, the Red Gym and Union Theater were more than spacious venues; they showcased UW-Madison's magnetism for world leaders. The Union Theater was graced by Frank Lloyd Wright and Martin Luther King Jr.; the Field House by John F. Kennedy and Desmond Tutu; and the Stock Pavilion by Harry Truman. The new Kohl Center is continuing the tradition, hosting the 14th Dalai Lama of Tibet last spring. The opening of the Kohl Center ushered in semi-retirement for the Field House, but a few UW athletic teams will continue to raise the Barn into its next century.

Celebrate UW sesquicentennial with music

Barbara Wolff

Tickets to the 150th Anniversary Concert commemorating UW-Madison's first classes in 1849 will go on sale Wednesday, Dec. 9 at the Kohl Center and all Ticketmaster outlets.

Sponsored by American Family Insurance, the concert will be Sunday, Feb. 7 at 1 p.m. in the Kohl Center.

"This is the university and School of Music's way of sharing with the larger community," says John Schaffer, SOM director. He says concert organizers tried to include a cross-section of music popular throughout the university's 150-year history.

"During UW's first 50 years, people did a great deal of singing, so we have the Choral Union performing," Schaffer says. "Around the turn of the last century, marching bands were popular, so our marching band will present an interesting mix of marches and other band favorites. In the '30s and '40s, jazz was coming into its own. Our Jazz Ensemble will showcase that."

In fact, the Jazz Ensemble will present Duke Ellington's "The U-Wisc Suite," which the Duke composed during a residency here in 1972. The work has been performed only a few times in its 25-year history, according to Joan Wildman, a professor of music involved in the residency.

Schaffer says Tchaikovsky's "1812 Overture," performed by the UW Symphony, will be the concert's culmination. "The piece will be complete with cannon and fireworks," Schaffer says.

In addition to Ellington and Tchaikovksy, Beethoven and Mahler also will be represented in the concert. Spirituals, a history of university fight songs, "The Star-Spangled Banner," "The Bud Song" and, naturally, "On Wisconsin" will round out the program.

Tickets are $5 for adults, $3 for students and $2 for children 12 and under. Tickets are available at the Kohl Center. To order tickets by phone, call Ticketmaster at 255-4646.

Ticket revenues will be used for the undergraduate sesquicentennial scholarship fund. For more information about the concert, contact the UW-Madison School of Music, 263-1900. ■

SESQUICENTENNIAL QUIZ

Okay, once again let's test your knowledge of the university's rich history with the Wisconsin Week Sesquicentennial Quiz. This time, we're moving to the modern era — the 1970s and '80s. Sorry, there's no prize — just prestige and the smug satisfaction of being a sesqui-know-it-all.

Questions

1 What is UW biochemist Hector DeLuca known for?
2 What is Youngblood and how is it unique?
3 Why should skiers appreciate Marv Woerpel?
4 What is Wisconsin's state soil and how is it linked to UW-Madison?
5 Which UW athlete was a two-time Olympian in track and field?
6 What is the UW Solution?

Answers

1 UW scientist DeLuca determined how Vitamin D was converted into hormones that regulate calcium in the body, leading to treatments for osteoporosis.
2 Youngblood, opened in 1973 at Union South, is the only American Red Cross blood-donation center permanently located on a university campus.
3 In the 1970s Woerpel, a UW chemical engineering graduate, found a way to create snow in warm weather by "seeding" water with harmless bacteria.
4 Thanks to Francis Hole, the UW soil science professor who led a grassroots campaign in 1983, Antigo silt loam is Wisconsin's state soil.
5 Suzy Favor Hamilton, a Badger athlete from 1986-1990, is the winningest woman in NCAA track history, lifting UW-Madison into the national spotlight.
6 The UW Solution, invented in 1987 by surgeon Folkert Belzer and biochemist James Southard, is a preserving solution that dramatically increases the time an organ for transplant can survive outside of the body. It is used by hospitals worldwide. ■

FLASHBACK

HISTORICAL HIGHLIGHT

A gift by former Gov. **Cadwallader C. Washburn** made possible the 1878 construction of Washburn Observatory, whose telescope quickly became the nucleus of a long history of world-class sky watching. Washburn has seen its share of scientific breakthroughs over the years, such as the first real measurements of starlight, recorded there in the 1930s. Two newer observatories, one 15 miles west of Madison at Pine Bluff and another, the WIYN Observatory, atop Kitt Peak in Arizona, have added state-of-the-art equipment that provides an even better view of the stars, galaxies and mysteries in the cosmological zoo.

PEOPLE IN OUR PAST

"The Wisconsin School" may be the most influential school that never really existed. At the turn of the century, the "School" was shorthand for a cadre of economists who were making a profound mark on American labor. At their head was professor **Richard Ely,** who in 1886 published the nation's first book on labor relations. That book influenced a generation of thinkers who redefined government's role in the workplace. With such guidance, Wisconsin became a state of firsts: first income tax, first worker's compensation and first unemployment compensation. Later, "the Wisconsin School" would lead the nation in embracing child-labor and minimum-wage laws.

CAMPUS MEMORIES

"My most memorable professor at UW-Madison was **Dr. Dave Foster** of the Mechanical Engineering Department. I had Dave as a professor for two thermodynamics classes during the late '70s. Dave was always very enthusiastic about 'thermo' and was constantly providing real-world examples to back up theory.

"He even simplified the three laws of thermodynamics down to a level that I can still remember 20 years later:
"1 You can't win.
"2 You always lose.
"3 You can't even get out of the game.

"Dave was also pretty good about putting practical application questions on his exams for extra credit.

"There was also a story that Dave once told about his undergraduate days at UW. It seems that some unnamed students built a cinderblock dam in the doorway of one of the shower rooms on the third floor of Sullivan Hall. They then blocked the drain with paper towels, and turned on the water. When the water got three or four feet deep, everyone went for a swim. Some students even had diving masks on. Everything went great until the blocks toppled and the dam let loose. The door to the bathroom was open, and the resulting tidal wave rushed through the hallway, flooding the third floor, the second floor and parts of the first floor.

— Gary Jacobs, BS '81

To offer your memory, visit: www.uw150.wisc.edu/memories/

FOR MORE INFORMATION

If you have any questions regarding sesquicentennial planning, you may direct them to Peyton Smith, sesquicentennial coordinator, 265-3044, plsmith@mail.bascom.wisc.edu. The sesquicentennial office is in 96 Bascom Hall.

Space-Wash

NEWS

1 • 8 • 4 • 8 UNIVERSITY OF WISCONSIN–MADISON

Office of News and Public Affairs
28 Bascom Hall • 500 Lincoln Drive
Madison, Wisconsin 53706-1380

Phone: 608/262–3571
Fax: 608/262–2331

FOR IMMEDIATE RELEASE

October 11, 1999

NEWS BRIEFS FROM THE UNIVERSITY OF WISCONSIN-MADISON

-- Jaime Escalante to speak at Wisconsin Union Theater
-- Prolific author, science writer to be in residence at UW
-- Campus library sale offers thousands of books, records
-- Washburn Observatory closed for repairs

JAIME ESCALANTE TO SPEAK AT WISCONSIN UNION THEATER

CONTACT: Alden Oreck, 262-2216; azoreck@students.wisc.edu

MADISON -- Bolivian educator Jaime Escalante, whose work in a Los Angeles high school was featured in the film "Stand and Deliver," will speak at the University of Wisconsin-Madison in the debut of this year's Distinguished Lecture Series.

The event begins at 7:30 p.m. Thursday, Oct. 21, in the Wisconsin Union Theater, Memorial Union, 800 Langdon St.

In 1962, after a successful teaching career in Latin America, Escalante came to the United States, where he has established himself as one of the most renowned Latino educators. At Garfield High in East Los Angeles, he gained national fame by elevating the Advanced Placement Calculus program to a national level. In 1989, his class of 155 students passed the AP Calculus test, setting a Los Angeles city record.

This year, Escalante was one of three educators nominated to the United States Teaching Hall of Fame.

Escalante's appearance is sponsored by the UW Latin American and Iberian Studies Program, Centro Hispano, Associated Students of Madison and the Distinguished Lecture Series committee, one of 11 Wisconsin Union Directorate (WUD) student committees which develop, coordinate and promote more than 800 events annually at UW-Madison.

Spree -
Vlog

Free tickets will be available at the Union Theater Box Office for UW-Madison students and Wisconsin Union members Thursday, Oct. 14; the remainder of the tickets will be available to the public on, Monday, Oct. 18. Box office hours are 11:30 a.m.-5:30 p.m. weekdays, and 30 minutes past curtain time on days of events.

Upcoming speakers include political activist Angela Davis (Nov. 16) and conservative analyst William Kristol (Dec. 7). For more information, contact Alden Oreck, 262-2216; azoreck@students.wisc.edu.

# # #

-- Marc Kennedy, (608) 262-5079; mhkenned@facstaff.wisc.edu

PROLIFIC AUTHOR, SCIENCE WRITER TO BE IN RESIDENCE AT UW

CONTACT: Terry Devitt (608) 262-8282, trdevitt@facstaff.wisc.edu

MADISON — Robin Marantz Henig, a prolific author, columnist, essayist and writer of articles about science and medicine, has been named a 1999 Science Writer in Residence by the University of Wisconsin-Madison.

Henig, 46, has written seven books, including treatments of the life of monk and genetics pioneer Gregor Mendel, aging in women, senility, and emerging viruses. In addition, she has written scores of articles for such venues as the New York Times Magazine, Discover, the Washington Post, Family Circle, Good Housekeeping, Vogue and Ms., among others.

Henig has won numerous awards, including 1994 Author of the Year from the American Society of Journalists and Authors, the William Harvey Award from the American Medical Writers Association and the Howard Blakeslee Award in Science Writing from the American Heart Association. She is also a member of the Board of Contributors for the USA Today editorial board and is a board member of the National Association of Science Writers.

As a science writer in residence, Henig will spend a week on the UW-Madison campus beginning Monday, Oct. 18. She will give a free public lecture, "Writing 'The Monk in the Garden,'" on Tuesday, Oct. 18, at 4 p.m. in the Memorial Union (check Today in the Union for a room number). Her talk will focus on how she approached writing a book about the life of Gregor Mendel and the history of genetics in a way that is lively, literary -- and true.

Henig will spend most of her time on campus working with students, faculty and staff interested in science writing.

The Science Writer in Residence Program was established in 1986 with the help of the Brittingham Trust. It continues with the support of the UW Foundation and has brought to campus many of the nation's leading science writers, including three whose work subsequently earned them the Pulitzer Prize. The program is sponsored by the School of Journalism and Mass Communication, and the UW-Madison Office of News and Public Affairs.

CAMPUS LIBRARY SALE OFFERS THOUSANDS OF BOOKS, RECORDS

CONTACT: John Tortorice, (608) 265-2505; Don Johnson, (608) 262-0076

MADISON -- Nearly 15,000 books on a wide range of subjects and thousands of LP records will be on sale in a fund-raiser for the Friends of the University of Wisconsin-Madison Libraries scheduled October 20-23.

Faculty, staff, students and area residents donate the materials. The public sale helps fund an annual lecture series, special purchases for the library collections and a visiting scholar support program.

In the past two years, 14 libraries received $54,000 through a new specialized small-grant program for campus libraries supported by the book sale.

Among the subjects covered by the books to be available: American studies, architecture, art, foreign languages, history, literature, and religion.

The sale will be in 124 Memorial Library, 728 State St. A preview sale with a $5 admission will be held 5-9 p.m., Wednesday, Oct. 20. The regular sale, which is free, will be 10:30 a.m.-7 p.m., Thursday and Friday, Oct. 21-22; and 10:30 a.m.-2 p.m., Saturday, Oct. 23. On Saturday, items will be sold for $2 a bag.

WASHBURN OBSERVATORY CLOSED FOR REPAIRS

CONTACT: John Varda (608) 262-3071

MADISON — Due to a mechanical problem, the UW-Madison's Washburn Observatory will be closed indefinitely for repairs.

The observatory, perched on a hill overlooking Lake Mendota, is a familiar campus landmark. Although no longer used for research, the observatory is a popular campus destination two evenings a month when it is opened for public viewing.

The failure of a gear that helps control the opening and closing of the viewing slit in the observatory's dome means that the regular public stargazing sessions, held on the first and third Wednesday of each month, will be cancelled until repairs are made.

###

Space - Wagh

SHORTCUTS

To report news

Faculty and staff members are encouraged to report honors, awards and other professional achievements. Coverage suggestions and feedback also are welcome.
Campus mail: **19 Bascom Hall**
E-mail: **wisweek@news.wisc.edu**

To publicize events

Wisconsin Week lists events sponsored by campus departments, divisions and programs. We must receive your listing at least 10 days before you want it published. Upcoming publication dates are: Nov. 3 and 17, Dec. 8.
Campus mail: **19 Bascom Hall**
E-mail: **calendar@news.wisc.edu**

To find out more

- Vilas Hall Box Office: 262-1500
- Union Theater Box Office: 262-2201
- Film Hotline: 262-6333
- ConcertLine: 263-9485
- Elvehjem Museum of Art: 263-2246
- TITU: http://www.wisc.edu/union/

Daily news on the Web

Bookmark this site for regular campus news updates from the Office of News and Public Affairs.
- http://www.news.wisc.edu/wisweek

Weekly news by e-mail

Sign up for a weekly digest of campus news, with links to more information.
- http://www.news.wisc.edu/cgi-bin/newslists/wireadds

Delivery problems?

Not getting Wisconsin Week on time or at all? Our mailing list uses information from campus payroll records, so be sure your record is updated. For persistent delivery problems, check with your building manager to get the problem fixed. Call 262-3846 to get the paper you missed.

In this issue

Wisconsin Week
Vol. XIV, No. 14, October 20, 1999
Wisconsin Week, the official newspaper of record for the University of Wisconsin-Madison, carries legally required notices for faculty and staff.
Wisconsin Week (ISSN 890-9652; USPS 810-020) is published by University Periodicals, Office of News and Public Affairs, biweekly when classes are in session (17 issues a year). Send information to 19 Bascom Hall, 500 Lincoln Drive, Madison, WI 53706; phone: (608) 262-3846. E-mail:wisweek@news.wisc.edu.
Second-class postage is paid at Madison, WI 53706; Postmaster: Send address changes to Wisconsin Week, 19 Bascom Hall, 500 Lincoln Drive, Madison, WI 53706.
Subscriptions for U.S. mail delivery are $18 a year or $9 for six months. Send checks, payable to Wisconsin Week, to the above address.
Address changes
The Wisconsin Week labels are printed from the files of the UW-Madison Employee Compensation and Benefits Office. Send a Person File Information Form to revise employee addresses. Other addresses may be changed by correcting the label and mailing it to Wisconsin Week.
Editor: Tim Kelley
Designer: Jeffrey Jerred
Program assistant: Debby Sumwalt
Publications assistant: Eileen Gilligan
Director of periodicals: Cindy Foss
Editorial adviser: Amy Toburen
Contributing writers: Office of News and Public Affairs
Photographers: Jeff Miller, Brian Moore, Stephanie Judge
Distribution: UW-Madison Truck Service
Publication dates: Nov. 3, Nov. 17, Dec. 8

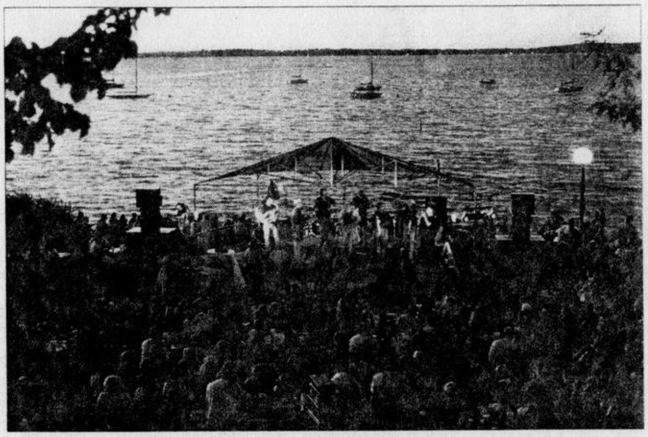
LEADERSHIP

Hospital chief named

Donna K. Sollenberger has been named president and chief executive officer of UW Hospital and Clinics. The first woman ever to head the hospital, she succeeds Gordon Derzon, who is retiring at the end of this year. The appointment takes effect Wednesday, Dec. 1.

"We are most impressed with the breadth and depth of Sollenberger's experience and qualifications," says Jack Pelisek, chair of the UW Hospital and Clinics Authority Board. "Her leadership at both City of Hope and M.D. Anderson Cancer Center, which yielded significant improvements in cost and operational efficiency, will be invaluable to the hospital."

"To be selected to lead the University of Wisconsin Hospital and Clinics is a great honor," Sollenberger says. "As an academic health care center, the UW Hospital and Clinics will be challenged with continuing to find ways to carry out its mission while facing declining revenues for its services. I look forward to working with Dr. Philip Farrell (dean of the Medical School), the physicians and staff."



New university calendar captures memorable campus images
This photo of the Memorial Union Terrace is among 14 full-color images of some of the most beautiful places on campus included in a new calendar produced in a unique partnership between the university and The University Book Store. More than $10 of the $12.95 retail price goes to the Chancellor's Undergraduate Scholarship Fund. The 14-by-20-inch wall calendars for the year 2000 are now available at all University Book Store locations. Each month's double-page spread in the "Memories for a Lifetime 2000 calendar" captures memorable moments in photos from the UW-Madison Office of News and Public Affairs. "Thanks to the generous support of The University Book Store, the Undergraduate Scholarship Fund is growing," says Peyton Smith, university sesquicentennial coordinator. For more information or to order by phone, call (800) 957-7052.

COMMUNITY

Books, records on sale during library fund-raiser

Nearly 15,000 books on a wide range of subjects and thousands of LP records will be on sale in a fund-raiser for the Friends of Libraries scheduled Oct. 21-23.

Faculty, staff, students and area residents donated the materials. The public sale helps fund an annual lecture series, special purchases for the library collections and a visiting scholar support program.

In the past two years, 14 libraries received $54,000 through a new specialized small-grant program for campus libraries supported by the book sale.

Among the subjects covered by the books to be available: American studies, architecture, art, foreign languages, history, literature and religion.

The sale will be in 124 Memorial Library, 728 State St. The sale will be 10:30 a.m.-7 p.m., Thursday and Friday, Oct. 21-22; and 10:30 a.m.-2 p.m., Saturday, Oct. 23. On Saturday, items will be sold for $2 a bag.

Washburn Observatory closed for repairs

Due to a mechanical problem, the Washburn Observatory will be closed indefinitely for repairs.

The observatory, perched on a hill overlooking Lake Mendota, is a familiar campus landmark. Although no longer used for research, the observatory is a popular campus destination two evenings a month when it is opened for public viewing.

The failure of a gear that helps control the opening and closing of the viewing slit in the observatory's dome means that the regular public stargazing sessions, held on the first and third Wednesday of each month, will be cancelled until repairs are made.

Parallel Press releases third book

Parallel Press, created last fall as an imprint of the General Library System, has released "Apparition," a collection of poems from award-winning Wisconsin author Max Garland.

Parallel Press specializes in soft-cover chapbooks — small-format, literary works. "Apparition" is the group's third book. Garland's poems discuss childhood ideas of God and love and his adult experiences of pain and passion.

Parallel Press is also publishing two more books over the next few months.

- "Sure Knowledge" by Elizabeth Oness will be released in November. Oness lives in La Crosse and is co-editor of Soundpost Press and director of marketing and development for Sutton Hoo Press.
- "Luck" by Marilyn Annucci will be available in January. Annucci, of Madison, teaches language and literature at UW-Whitewater.

Each book is $10 plus $3 shipping and handling. For more information, call 263-4929.

Space & Astro — Washburn

University Communications

News Releases

UNIVERSITY OF WISCONSIN MADISON

FOR IMMEDIATE RELEASE 10/11/99

NEWS BRIEFS FROM THE UNIVERSITY OF WISCONSIN-MADISON

- o Jaime Escalante to speak at Wisconsin Union Theater
- o Prolific author, science writer to be in residence at UW
- o Campus library sale offers thousands of books, records
- o Washburn Observatory closed for repairs

JAIME ESCALANTE TO SPEAK AT WISCONSIN UNION THEATER
CONTACT: Alden Oreck, 262-2216; azoreck@students.wisc.edu

MADISON -- Bolivian educator Jaime Escalante, whose work in a Los Angeles high school was featured in the film "Stand and Deliver," will speak at the University of Wisconsin-Madison in the debut of this year's Distinguished Lecture Series.

The event begins at 7:30 p.m. Thursday, Oct. 21, in the Wisconsin Union Theater, Memorial Union, 800 Langdon St.

In 1962, after a successful teaching career in Latin America, Escalante came to the United States, where he has established himself as one of the most renowned Latino educators. At Garfield High in East Los Angeles, he gained national fame by elevating the Advanced Placement Calculus program to a national level. In 1989, his class of 155 students passed the AP Calculus test, setting a Los Angeles city record.

This year, Escalante was one of three educators nominated to the United States Teaching Hall of Fame.

Escalante's appearance is sponsored by the UW Latin American and Iberian Studies Program, Centro Hispano, Associated Students of Madison and the Distinguished Lecture Series committee, one of 11 Wisconsin Union Directorate (WUD) student committees which develop, coordinate and promote more than 800 events annually at UW-Madison.

Free tickets will be available at the Union Theater Box Office for UW-Madison students and Wisconsin Union members Thursday, Oct. 14; the remainder of the tickets will be available to the public on, Monday, Oct. 18. Box office hours are 11:30 a.m.-5:30 p.m. weekdays, and 30 minutes past curtain time on days of events.

Upcoming speakers include political activist Angela Davis (Nov. 16) and conservative analyst William Kristol (Dec. 7). For more information, contact Alden Oreck, 262-2216; azoreck@students.wisc.edu.
# # #
-- Marc Kennedy, (608) 262-5079; mhkenned@facstaff.wisc.edu

PROLIFIC AUTHOR, SCIENCE WRITER TO BE IN RESIDENCE AT UW
CONTACT: Terry Devitt (608) 262-8282, trdevitt@facstaff.wisc.edu

MADISON - Robin Marantz Henig, a prolific author, columnist, essayist and writer of articles about science and medicine, has been named a 1999 Science Writer in Residence by the University of Wisconsin-Madison.

Henig, 46, has written seven books, including treatments of the life of monk and genetics pioneer Gregor Mendel, aging in women, senility, and emerging viruses. In addition, she has written scores of articles for such venues as the New York Times Magazine, Discover, the Washington Post, Family Circle, Good Housekeeping, Vogue and Ms., among others.

Henig has won numerous awards, including 1994 Author of the Year from the American Society of Journalists and Authors, the William Harvey Award from the American Medical Writers Association and the Howard Blakeslee Award in Science Writing from the American Heart Association. She is also a member of the Board of Contributors for the USA Today editorial board and is a board member of the National Association of Science Writers.

As a science writer in residence, Henig will spend a week on the UW-Madison campus beginning Monday, Oct. 18. She will give a free public lecture, "Writing 'The Monk in the Garden,'" on Tuesday, Oct. 18, at 4 p.m. in the Memorial Union (check Today in the Union for a room number). Her talk will focus on how she approached writing a book about the life of Gregor Mendel and the history of genetics in a way that is lively, literary -- and true.

Henig will spend most of her time on campus working with students, faculty and staff interested in science writing.

The Science Writer in Residence Program was established in 1986 with the help of the Brittingham Trust. It continues with the support of the UW Foundation and has brought to campus many of the nation's leading science writers, including three whose work subsequently earned them the Pulitzer Prize. The program is sponsored by the School of Journalism and Mass Communication, and the UW-Madison Office of News and Public Affairs.

CAMPUS LIBRARY SALE OFFERS THOUSANDS OF BOOKS, RECORDS
CONTACT: John Tortorice, (608) 265-2505; Don Johnson, (608) 262-0076

MADISON -- Nearly 15,000 books on a wide range of subjects and thousands of LP records will be on sale in a fund-raiser for the Friends of the University of Wisconsin-Madison Libraries scheduled October 20-23.

Faculty, staff, students and area residents donate the materials. The public sale helps fund an annual lecture series, special purchases for the library collections and a visiting scholar support program.

In the past two years, 14 libraries received $54,000 through a new specialized small-grant program for campus libraries supported by the book sale.

Among the subjects covered by the books to be available: American studies, architecture, art, foreign languages, history, literature, and religion.

The sale will be in 124 Memorial Library, 728 State St. A preview sale with a $5 admission will be held 5-9 p.m., Wednesday, Oct. 20. The regular sale, which is free, will be 10:30 a.m.-7 p.m., Thursday and Friday, Oct. 21-22; and 10:30 a.m.-2 p.m., Saturday, Oct. 23. On Saturday, items will be sold for $2 a bag.

WASHBURN OBSERVATORY CLOSED FOR REPAIRS
CONTACT: John Varda (608) 262-3071

MADISON - Due to a mechanical problem, the UW-Madison's Washburn Observatory will be closed indefinitely for repairs.

The observatory, perched on a hill overlooking Lake Mendota, is a familiar campus landmark. Although no longer used for research, the observatory is a popular campus destination two evenings a month when it is opened for public viewing.

The failure of a gear that helps control the opening and closing of the viewing slit in the observatory's dome means that the regular public stargazing sessions, held on the first and third Wednesday of each month, will be cancelled until repairs are made.

Version for printing

Retrieve release by month:

Space & Astro — Washburn

University Communications

News Releases

UNIVERSITY OF WISCONSIN MADISON

May 26, 2000

TO: Editors, news directors
FROM: Barbara Wolff, 608/262-8292
RE: Dedication of Washburn bust

May 26, 2000

TO: Editors, news directors
FROM: Barbara Wolff, (608) 262-8292; bjwolff@facstaff.wisc.edu

RE: Dedication of Washburn bust

A bronze bust of a pivotal figure in Wisconsin history will be dedicated at the University of Wisconsin-Madison Sunday, May 28.

Cadwallader C. Washburn a 19th century lumber baron, milling executive, member of Congress, governor and philanthropist, endowed a La Crosse public library, a Minneapolis orphanage and 55 acres in Madison for a Catholic academy which eventually evolved into Edgewood College.

In 1876, Washburn secured $3,000 from the Wisconsin legislature to fund an astronomy program at the University of Wisconsin. He also donated land overlooking Lake Mendota and $10,000 for an observatory featuring a then state-of-the-art refractor telescope. Washburn Observatory opened in 1876. Since 1959 the building has housed the UW-Madison Institute for Research in the Humanities.

Charles Gelatt of La Crosse commissioned the Washburn bust, cast by alum and sculptor Elmer Peterson. Gelatt and Peterson will join UW-Madison emeritus professor of astronomy Robert Bless, the observatory's unofficial historian, at the dedication ceremony starting at 2 p.m. at the observatory.

For more information, contact Paul Boyer, Humanities Research Institute director, (608) 262-3855.
###
Version for printing

Retrieve release by month:

Receive news releases by email

Space & Astro - Washburn

University Communications

News Releases

UNIVERSITY OF WISCONSIN MADISON

FOR IMMEDIATE RELEASE
6/12/01
CONTACT: Jim Lattis, (608) 263-0360, lattis@sal.wisc.edu

MARS IS BRIGHT TONIGHT: SPACE PLACE, WASHBURN PLAN PROGRAMS

MADISON -- This is the month when Mars reaches the most interesting part of its path through the sky -- for Earthlings, anyway.

Mars will reach the point in the sky directly opposite the sun -- the moment astronomers call "opposition." Mars is then closest to Earth and at its peak of size and brightness from Earth's point of view, says Jim Lattis, director of UW Space Place 1605 S. Park St., Madison.

Lattis will discuss Mars, opposition and other related information at a free public talk tonight, June 12, at 7 p.m. at Space Place.

Meanwhile, the Department of Astronomy will open UW-Madison's historic Washburn Observatory to the public for Mars viewing, if the sky is clear, on the nights of June 13-15. Visitors may view Mars through Washburn's large telescope.

Opposition occurs every 2.13 years, and some oppositions present better viewing opportunities than others. Lattis says this is the best opposition since 1988.

This week, look for Mars to rise in the southeast around 8:45 p.m. between Sagittarius and Scorpius, just east of the bright star Antares. Mars also is visible all night because it rises at sunset and sets at sunrise. Opposition will be Wednesday, June 13, but Mars will be glorious any time this month, Lattis says.

For more about Space Place, visit: http://www.sal.wisc.edu/spaceplace.
# # #
Version for printing

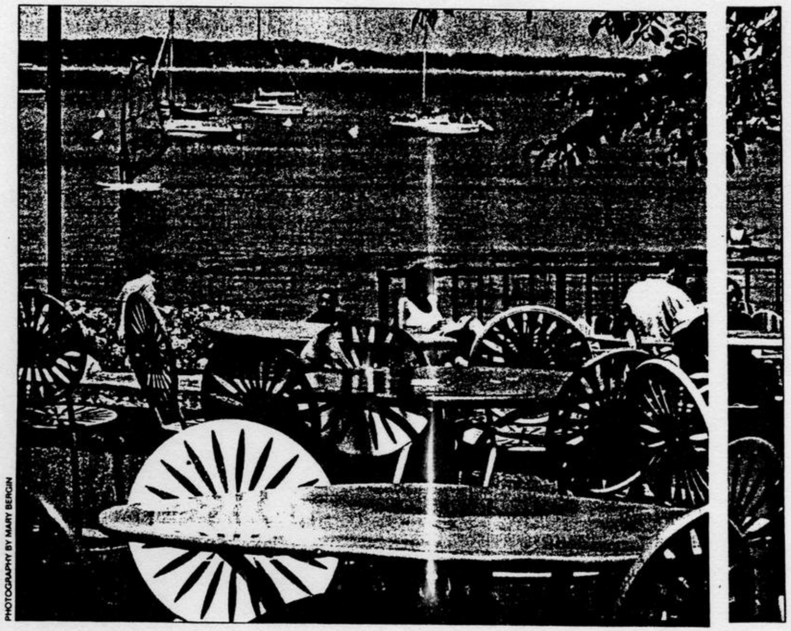
Space & Astronomy - Washburn observatory

OPEN Campus

University of Wisconsin-Madison has an attraction that goes beyond athletics and academics. Here's the scoop.

By Mary Bergin

HomeAway Sept/Oct 2003



PHOTOGRAPHY BY MARY BERGIN

THERE IS NO DEGREE OF difficulty when searching for hidden treasures on the University of Wisconsin-Madison campus. Beyond Big Ten sports and academic achievements, the university has many entertaining, educating and environmental attractions open to the public. Here are some examples of things to do and see (admission is free unless noted).

A major hub for activity on campus, the Memorial Union on Langdon Street has been around 75 years. A celebration is scheduled Oct. 4–5 to recognize the landmark. One of the events will include the unveiling of 6-foot-tall Union Terrace chairs, decorated by local artists.

The metal chairs, with their simple sunburst design, have become symbols of Memorial Union, which is a prime place to meet, eat, bowl, sail, view art, hear music and watch sunsets. The backdrop is pretty Lake Mendota.

FEEDING THE APPETITE

Even as the weather heats up, one place is always cool on campus—Babcock Hall Dairy Store. Last year more than 230,000 cones were sold; orange custard chocolate chip is a popular choice. The ice cream is made at the Babcock Hall dairy plant and sold throughout campus.

If the line at the student unions is too long, go to the dairy store at 1605 Linden Drive, which sells other dairy delights such as pesto havarti and jalapeno cheddar.

A much-desired dessert on campus is fudge-bottom pie—a graham cracker crust topped with a layer of fudge and vanilla custard. Now that school is back in session, the pie, served since the 1940s, will be easier to find at campus restaurants and delis.

PIECES OF THE PAST

An inexpensive way to spend a Sunday is to listen to chamber music at the Elvehjem Museum of Art, 800 University Ave. The 90-minute concerts begin at 12:30 p.m. and are broadcast on Wisconsin Public Radio. Sit and listen, or stroll through the museum's 11 galleries. Items in the permanent collection range from Frank Lloyd Wright furniture to ancient Egyptian and Roman sculpture.

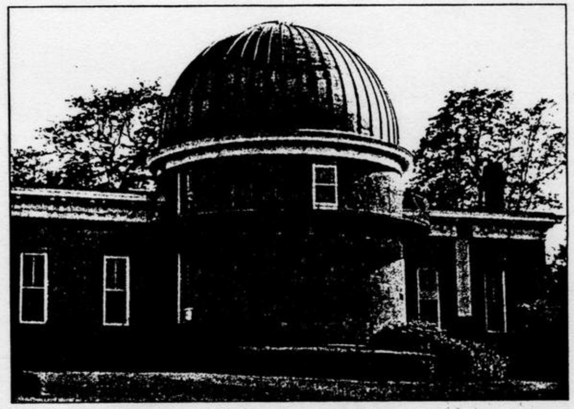
Meteorites and a mastodon skeleton are highlights at the Geology Museum, 1215 W. Dayton St. Some of the fossil, rock and mineral samples are unique to Wisconsin; others are from around the world. The re-created dinosaur skeleton, limestone cave and 6-foot-wide globe make particularly huge spectacles of themselves.

OUTDOOR OPTIONS

The UW Arboretum, 1207 Seminole Highway, has 1,260 acres that contain the oldest prairie restoration in the world, Curtis Prairie. There are other ecological communities, collections and effigy mounds at the arboretum. It's fine to hike, bike, run or ski on your own, but nature walks and lectures also are plentiful. The arboretum is open from 7 a.m. to 10 p.m. daily.

From early-morning jogs to romantic strolls at dusk, Picnic

con't



The Memorial Union on Langdon Street (left) is one of the university's most popular gathering places, thanks in part to the Lake Mendota backdrop and the scrumptious supply of Babcock ice cream. The Washburn Observatory (top), with its refractor telescope, provides a view that will leave you seeing stars while the dinosaur skeleton at the Geology Museum provides an impressive view of the past.

Point has long been a favorite destination for nature lovers. The half-mile peninsula on Lake Mendota is a pleasant place to escape from urban living.

Ornamental grasses are particularly beautiful in autumn at Allen Centennial Gardens, 620 Babcock Drive. The 2.5 acres, open from dawn to dusk, contain more than 20 types of gardens, from arbor and vines to a water garden. Something of beauty is in bloom during every season.

ABOVE AND BEYOND

Jupiter is one part of the galaxy that visitors might see during a visit to Washburn Observatory, 1401 Observatory Drive. The former research facility has been around since 1878. John Varla of the astronomy department calls it "a good way to look at the past, as well as look at the stars."

The refractor on the observatory's telescope was the nation's third largest when it was built. That is enough to see moon craters, or the rings of Saturn, depending upon weather quality and time of year. If the sky is 75 percent free of clouds, the building is open to the public for informal viewing sessions on the first and third Wednesday nights of the month. Situated 100 feet above Lake Mendota, this location arguably contains Madison's most scenic view. And that's without a telescope.

A good way to travel on a tight budget is to spend $8.50 for a ticket to the Wisconsin Union Travel Adventure Film Series. These narrated travelogues have been taking place at the Wisconsin Union Theater, inside Memorial Union, for more than 40 years. Last-minute tickets usually are available.

Destinations are India, Sept. 29 through Oct. 1; Western Canada, Oct. 27–29; Ireland, Nov. 17–19; Hawaii, Jan. 26–28, 2004; Morocco, March 8–10, 2004; and the Erie Canal, March 26–28, 2004. ■

MARY BERGIN lives in Madison and writes a weekly column "Roads Traveled," which appears in several Wisconsin daily newspapers.

A Bounty of Choices

High-quality music and theater performances are scheduled routinely at UW-Madison. Admission is charged unless otherwise indicated.

■ The fall Wisconsin Union Theater season has an international flair. The Mahotella Queens, whose traditional Zulu music also has hints of soul, gospel and hip-hop, perform Sept. 27. Tibetan Buddhist monks will perform ancient temple music Oct. 10. Vadim Repin, an acclaimed classical violinist from Russia, is here Oct. 24. Varttina, three Finnish women with platinum album sales, perform folk music with their acoustic band Nov. 15.

■ University Theatre has diversified greatly since its first production, *Peter Pan*, in 1932. Fall offerings include, *An Evening of One Act Performances*, Sept. 19–28; *The Memorandum* by Vaclav Havel, Oct. 17 through Nov. 1; and *Les Blancs* by Lorraine Hansberry, Nov. 7–23.

■ Highly regarded contemporary bands, from rock to reggae, typically perform at the Memorial Union and Union South on weekends. Admission is free; the late-night beat at Club 770 at Union South is alcohol-free.

■ The School of Music is the avenue for many other types of lyrical interludes. Three resident faculty ensembles—the Pro Arte String Quartet, Wingra Woodwind Quintet and Wisconsin Brass Quintet—have high visibility. Other options range from the sophisticated University Opera to the fun-loving Marching Band, with dozens of high-caliber choices in between.

BEFORE YOU GO

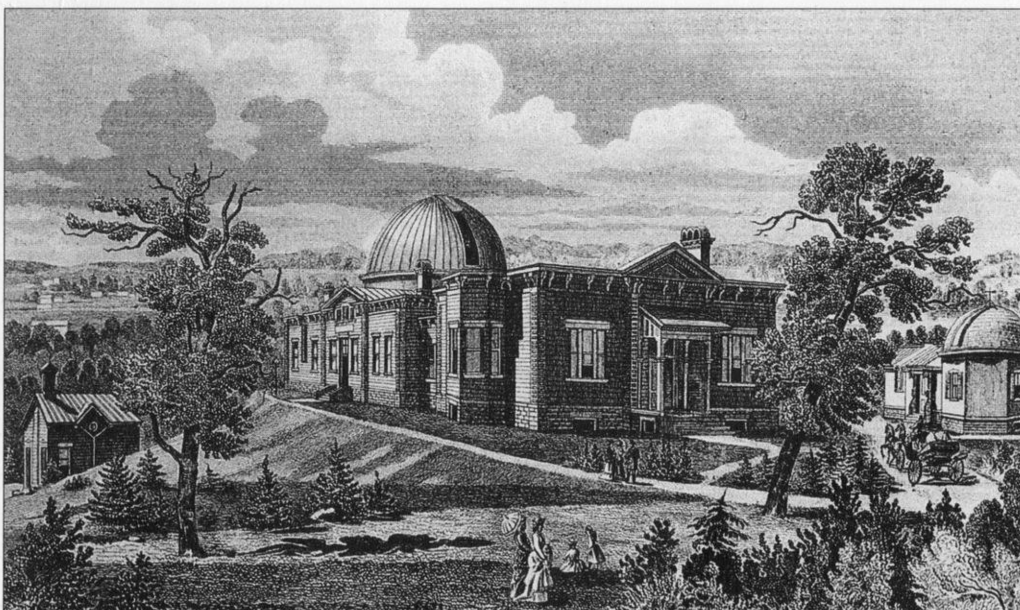
For more about UW-Madison activities, call the Campus Information and Visitor Center at (608) 263-2400 or go to *www.visit.wisc.edu/todo.html*.

FOR INFORMATION

- **Allen Centennial Gardens:** (608) 262-8406; *www.hort.wisc.edu/garden2001*
- **Babcock Hall Dairy Store:** (608) 262-3045; *www.wisc.edu/foodsci/store.html*
- **Elvehjem Museum of Art:** (608) 263-2246; *www.lvm.wisc.edu*
- **Geology Museum:** (608) 262-1412; *www.geology.wisc.edu*
- **Memorial Union:** (608) 265-3000; *www.union.wisc.edu*
- **UW Arboretum:** (608) 263-7888; *http://wiscinfo.doit.wisc.edu/arboretum*
- **UW School of Music:** (608) 263-9485; *www.wisc.edu/music*
- **University Theatre:** (608) 262-1500
- **Washburn Observatory:** (608) 262-9274; *www.astro.wisc.edu*
- **Wisconsin Union Theater:** (608) 262-2201; *www.wut.org*

WASHBURN OBSERVATORY

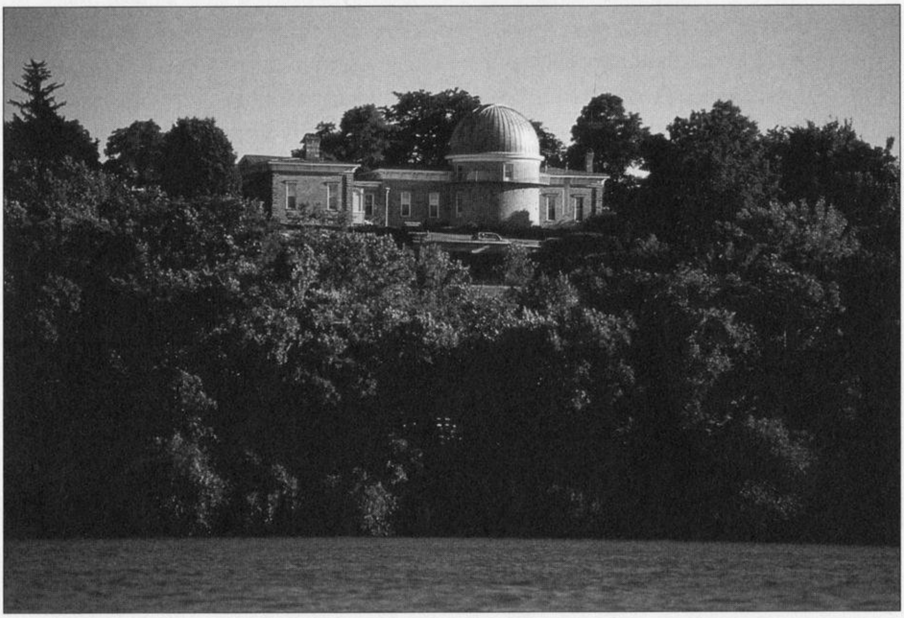
A SHORT HISTORY



Written and revised by Bob Bless and Jim Lattis
Department of Astronomy
University of Wisconsin–Madison

WASHBURN OBSERVATORY

A short history of UW–Madison's Astronomy Department, its facilities, and research



PHOTOGRAPH BY JEFF MILLER

Preface

The first version of this booklet was written by Professor Robert Bless for the centennial celebration of Washburn Observatory in 1978. That printing has been exhausted for some years, so we have updated and reissued this brief history for the UW–Madison Campus Open House of August 2000.

— Bob Bless & Jim Lattis, UW–Madison Astronomy Department

Visitor information

Washburn Observatory is situated at the summit of Observatory Hill, bordered by Observatory Drive, on the UW–Madison campus. Public observations at Washburn Observatory are offered *if the sky is mostly clear* on the first and third Wednesday evenings of the month (and typically every Wednesday in June and July). From April to October, viewing sessions begin at 9 pm, and at 7:30 pm in November through March. Call 262-WASH for updates and additional information. Visitors should note that the original Washburn Observatory building, except for the telescope and dome, is now occupied by UW–Madison's Institute for Research in the Humanities. The entrance for observatory visitors is on the south face of the building.

UW Space Place, the Astronomy Department's outreach center, is located at 1605 S. Park St. in Madison. Programs for the general public are offered at 7 pm on the second and fourth Tuesdays of each month and at 10 am on the second and fourth Saturdays of the month. Other visits are by appointment only. Call 262–4779 for information on current programs or to make an appointment.

A brief summary of information about the current sky and other astronomical news is available through the Celestial Connection at 262–4636.

Other UW–Madison contacts

Astronomy Department www.astro.wisc.edu

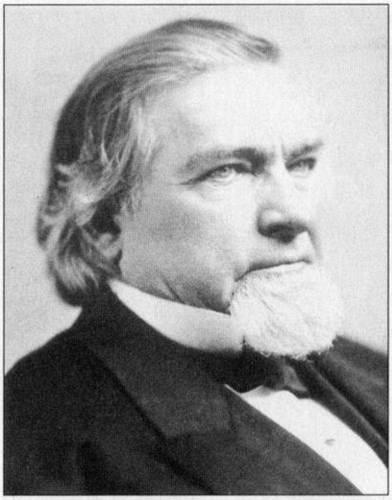
Space Astronomy Laboratory www.sal.wisc.edu

Space Place www.sal.wisc.edu/spaceplace

Physics Department www.physics.wisc.edu

Space Science and Engineering Center www.ssec.wisc.edu

Office of Visitor Services www.news.wisc.edu/welcome/visitor/



UW ARCHIVES

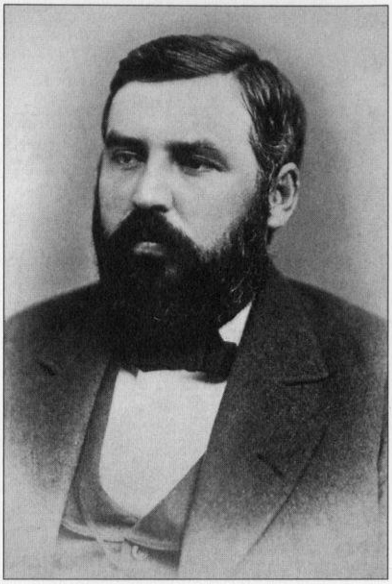
Wisconsin Governor Cadwallader C. Washburn

The Beginning: 1878–1922

It is not clear what prompted former Wisconsin Governor Cadwallader C. Washburn's interest in astronomy; perhaps it was comments by the University Regents in 1869 that no institution of higher learning could aspire to the status of a university without an observatory; or perhaps it had to do with the establishment in 1876 of a magnetic observatory at the University, the only one of its kind in the country at that time. In any case, in "An Act to permanently provide for deficiencies in the University fund income" (passed by the legislature on March 6, 1876) Washburn had included a provision which specified that "the sum of $3,000 annually shall be set apart for astronomical work and for instruction in Astronomy . . . so soon as a complete and well-equipped observatory shall be given to the University in its own grounds without cost to the State, provided that such an observatory shall be completed within three years from the passage of this act." Along with the stipulation that state residents should not be required to pay tuition, this was the only condition placed on the use of the money, which was raised by property tax.[1]

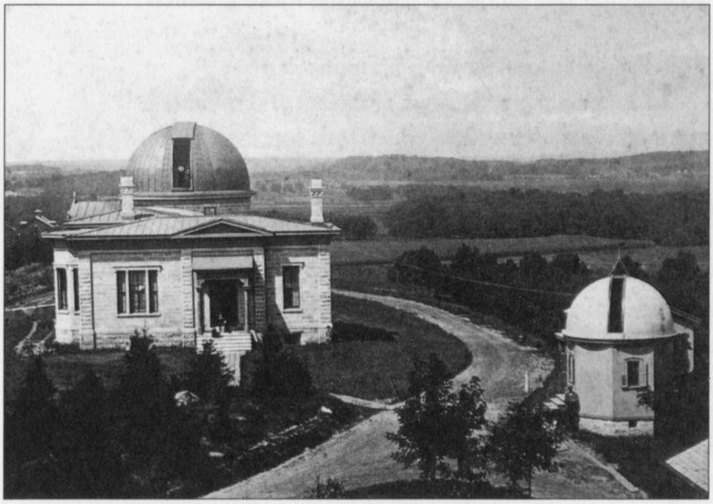
On Sept. 18, 1877, UW President John Bascom announced that Governor Washburn intended to meet the provisions of the act and provide a fully equipped observatory, including a telescope, which was specified to be larger than the 15-inch Harvard refractor. Washburn, a six-term member of Congress, Civil War Major-General, and Wisconsin governor in 1871–73, had been defeated in his try for re-election and so was devoting all his attention to his business affairs. On the day before he was formally to select the site for the new observatory, his flour mill in Minneapolis exploded, killing several workers. Nonetheless he kept his appointement with the Regents before setting off for Minneapolis, perhaps thinking that it would be wiser to present a confident appearance to the business world in the face of this disaster than to delay the donation of the observatory.[2] The observatory site was lovely—100 feet above Lake Mendota to the north, isolated from Madison to the east by the University campus, and surrounded by orchards and a vineyard.

Construction of the observatory began in May, 1878; the Clarks of Massachusetts were asked to build the telescope. With an aperture of 15.6 inches, it was then the third largest refractor in the U.S., after the 26-inch and 18-inch instruments at the Naval Observatory and Dearborn Observatory, respectively. (Including the European refractors dropped the Wisconsin instrument only one notch, through there were many larger reflectors at the time.)



James C. Watson

President Bascom wanted an active and prominent astronomer to become the Observatory's first director and found him in James C. Watson of the University of Michigan (then probably the country's most prominent school for astronomy).[3] Watson had an international reputation for his discovery of 22 minor planets and for his book *Theoretical Astronomy*, the standard work in English for many years. He had become controversial with his claims for the discovery of the intra-Mercurial planet, Vulcan, first predicted by Leverrier 20 years earlier to account for the then unknown relativistic perturbation of Mercury's orbit. To judge by contemporary newspaper accounts, Watson was wooed by Wisconsin and Michigan with an ardor nowadays reserved for football coaches. However, Wisconsin, with its newer and larger telescope, won the day, and, in Fall



Washburn and Student Observatory

1879, Watson occupied the Director's residence next to the Observatory, which had just been vacated by President Bascom.

With characteristic energy, Watson supervised the completion of the original structure, started work on the east wing (which included the Director's office), and with his own money began construction of the Students' Observatory, a short distance to the northeast of the main building, and of the Solar Observatory on the side of a steep hill south of the building. The former contained a small transit instrument and a 6-inch Clark refractor belonging to S.W. Burnham, then a court reporter in Chicago who came to Madison on weekends to search for double stars. (The Students' Observatory Dome was later transferred to Madison Astronomical Society, and is still standing, though unused, south of Madison. The 6-inch Clark continues service as one of the Astronomy Department's student telescopes.) Burnham's telescope was also to be used for instruction, enabling the 15-inch to be used for research. The Solar Observatory was intended for observations of the putative intra-Mercurian planets (Watson interpreting his 1878 eclipse observations as indicating two such objects). A 12-inch diameter underground tube led to a siderostat and long focus objective by which the sky near the sun could be examined visually. (The notion that such a device can enhance visiblity of objects near the sun dies hard and is still periodically revived.) Unfortunately, Watson did not live to complete these projects since he died suddenly in November, 1880, when he was only 42. This was a great loss to the University. In less than two years at Madison he had become known not only as a distinguished astronomer, but had established a reputation as an excellent teacher, which was recognized in the local press: "His lectures are instructive, and that too, which few college professors' are, intensely interesting."


Edward S. Holden

Watson's successor was Edward S. Holden who came to Wisconsin from the U.S. Naval Observatory in 1881. Although Watson had not had the opportunity to make any observations himself, the 15-inch was ready for research use by the Spring of 1881[4] and when Holden finished the first volume of the Washburn Observatory Publications (Sept. 30, 1881), a considerable amount of visual work was underway. The observers were Burnham (who, with his 6-inch telescope had recently returned from a visit to Mount Hamilton where he observed many double stars as a test of that site for the planned Lick Observatory), G.C. Comstock (later Holden's successor as Director), and Holden himself. These observations were primarily micrometer measurements of double stars, but also included catalogs of nebulae and of red stars, and observations and drawings of the comet of 1881.

By 1884, the Observatory was equipped and set on a course of research it was to follow for the next 40 years. In addition to the 15- and 6-inch Clark telescopes (the latter purchased from Burnham), the observatory had acquired an excellent 5-inch meridian circle constructed by the Repsolds of Hamburg, which was mounted in the west wing of the main building. All told, Washburn had given more than $65,000 to the Observatory, a very substantial sum in those days. In addition, Cyrus Woodman, like Washburn a New England expatriate, had long wished to associate his name with that of his friend and one-time law partner.[5] After Washburn's death, Woodman found his opportunity by endowing the Observatory with $5,000 to support an astronomical library, an endowment still in existence today. By 1884 the Woodman library was a substantial one counting 1,000 volumes and 600 pamphlets in its collection.

Three accurate pendulum clocks were also maintained, one for sidereal time, the other two for standard time. (Two of the clocks survive, one in working order.) The Observatory set local time in Madison by controlling various clocks in the city, including one at the state Supreme Court, the Western Union office, the Park Hotel, and the Wisconsin State Journal,[6] as well as a clock in the University President's office where it controlled bells signalling the beginning and end of class periods (then as now 50 minutes long). In addition the Observatory earned several hundred dollars a year by selling time to the Wisconsin railroads.

In 1880, the president of the Lick trustees had tried to interest Watson in becoming the director of the new California Observatory, but Watson died only a few months later before reaching any decision. Holden, the scientific advisor to the Lick trust, left Wisconsin to become the President of the University of California in 1885. He became the Director of Lick Observatory when the 36-inch refractor was completed three years later. For a little more than a year after Holden's departure, John E. Davis, the professor of physics whose enthusiastic research in electromagnetism had led to the establishment of the magnetic observatory at Madison, took charge of the Observatory. A permanent director was not appointed immediately after Holden's departure because President Bascom's essentially forced resignation was soon to take effect and a new president had yet to be found. In the summer of 1887, the geologist T.C. Chamberlin[7] became president of the University and in August of that year, G.C. Comstock, then at Ohio State, returned to Madison as Associate Director of Washburn Observatory, with Asaph Hall of the Naval Observatory as non-resident Director. This awkward arrangement, perhaps occasioned by Comstock's relative youth (he was 32 on his return to Wisconsin) or by his lack of a Ph.D. degree, ended a few years later and Comstock became the third Director of the Observatory, an office he held for years longer than anyone else. Comstock had been trained at Michigan by Watson, the latter bringing him to Wisconsin as an assistant astronomer in 1879. Except for two years as a professor of mathematics at Ohio State, Comstock's career was spent at Wisconsin. His astronomical work was that of precise, visual positional observations, a tradition begun by Holden. His first research, an accurate determination of the constant of aberration, along with an associated investigation of atmospheric refraction, quickly brought him to the attention of his peers. Throughout his long career he also measured visual binary stars, not only as objects of intrinsic interest, but also as a part of an investigation of the proper motion of faint stars. This work indicated that some stars were intrinsically faint (and not just far away) and was an early hint of the concept of giant and dwarf stars. An important colleague of Comstock's for nearly 30 years was Albert S. Flint, an expert in visual positional astronomy with the meridian circle. Flint died in 1923 with the reduction of the last ten years of his observational work unfinished; this work was held in such high regard that the Department of Meridional Astronomy of the Carnegie Institution undertook to complete it, finally doing so in 1938.

G.C. Comstock

Comstock was prominent in the professional activities of his day; he was involved in the founding of the American Astronomical Society in 1897 and served the Society for ten years as its first secretary, and as its President in 1925; he was the chairman of the AAS committee formed to coordinate the observations of Halley's comet in 1910. In 1899 Comstock became the first Wisconsin faculty member to be elected to the National Academy of Sciences and five years later was appointed the first Dean of Wisconsin's Graduate School, a position he held for 16 years.

The Stebbins-Whitford Era: 1922–1958

Since the founding of the Observatory, Washburn astronomers had relied entirely on visual techniques for their research, paying little attention to the rapidly expanding uses of photography in astronomy. This situation changed abruptly in 1922 when Professor Joel Stebbins left the University of Illinois to become the fourth Director of Washburn Observatory. For several years Stebbins had been trying to develop electrical means of detecting starlight, first with selenium cells and then beginning in 1913 with the more sensitive photocells. Dr. Jacob Kunz, a colleague of Stebbins's at Illinois, made these detectors in his laboratory while Stebbins tested them at the telescope. As these photocells were finally developed, they generally consisted of a quartz tube, the inside of which was coated with potassium hydride. Electrons emitted by this coating when it was exposed to light were collected at a ring anode kept at about +250 volts with respect to the coating, and the resulting current was detected by an electrometer. Two people were required—one at the telescope to set and guide on the stars and the other to measure the rate at which the string electrometer received an electrical charge from the photocell. Thus when Stebbins came to Wisconsin with his photocells the Observatory passed immediately from the 300-year old era of visual astronomy to that of the new-fangled techniques of photoelectric astronomy, with not even a passing glance at photographic astronomy.

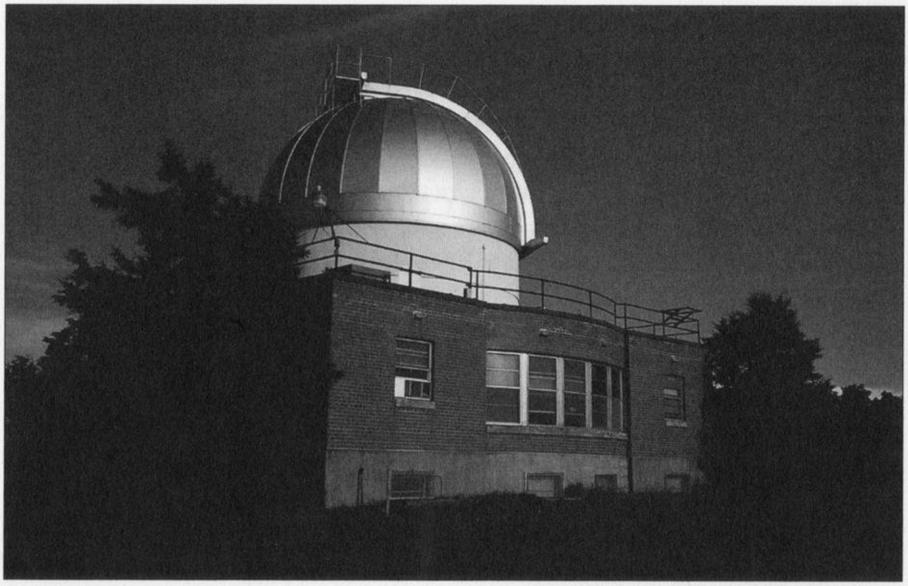
The Kunz tubes were very sensitive—more so than many modern photocathodes—but their use at the telescope with the delicate electrometers as detectors was difficult and required considerable experimental skill. The Lindemann electrometer, first used by Stebbins in 1927, improved this situation considerably since it could operate in any position, an obvious advantage at the telescope. However, the greatest improvement came in 1932 when A.E. Whitford at Washburn succeeded in constructing the first workable D.C. amplifier suitable for astronomical use. Although several people had attempted to use a new type of vacuum tube to amplify the feeble photoelectric currents, these attempts had not been successful because of fairly large random fluctuations in the amplified signal. Whitford solved this problem by enclosing the photocell and certain of the electronics in an airtight container which was then evacuated. This decreased the troublesome fluctuations to less than a tenth of their previous value and resulted in a fourfold increase in the sensitivity of the amplifier photometer compared to the older electrometer photometer. In addition, the two million-fold current amplification meant that the output signal could be measured by a galvanometer, a more rugged type of instrument than the electrometer; this simplified work at the telescope, and made it possible to attack an extremely wide range of problems. Stebbins first exploited one of the chief virtues of the photocell, i.e. its ability to detect small variations in the intensity of light, variations too small to be detected by eye or photographically. In particular, Stebbins and Huffer (who was awarded the first Wisconsin Ph.D. in astronomy and remained as a faculty member) found several spectroscopic binaries also to be eclipsing systems which enabled them to derive fundamental data concerning the sizes, brightnesses, and masses of these stars. They also determined accurate light curves of Cepheid variables and showed that essentially all very high luminosity red stars were intrinsically variable. Huffer continued to specialize in photoelectric photometry of variable stars until his retirement from the University in 1961.[1]

Immediately following Trumpler's demonstration in 1930 of the existence of dust between stars, Stebbins, Huffer, and Whitford investigated the distribution of the clouds of obscuring matter in our Galaxy by measuring the colors of more than 700 luminous, blue stars, another application to which the photocell was well suited. The observations were made at the 15-inch telescope using the photocell electrometer combination. Given the stringent demands photoelectric astronomy places on the quality of the sky and the relative scarcity of such skies in Madison, this program was a particularly impressive achievement. After 1933 the electrometer was replaced by Whitford's amplifier and the Washburn astronomers observed 600 more such stars with the large reflectors at Mt. Wilson. Thus began a program of research on interstellar matter which years later is still flourishing at Washburn. One of the highlights of this effort was Stebbin's determination in 1932 of the size of our galaxy by his measurement of the effect of interstellar dust on the brightness of the distance indicators Shapley had used in his work on this problem. Stebbin's result, that the sun is about 30,000 light years from the center of the Milky Way galaxy, the outer edge of which is about 50,000 light years from the center, was the accepted value for about five decades. This demonstration that our galaxy was about half the size previously thought, combined with the somewhat later Wisconsin photoelectric work which showed that our neighboring spiral galaxy in Andromeda was about twice as large as had been previously believed, removed the large and somewhat disturbing difference in size between these two spiral galaxies. A by-product of the early work on the colors of stars was the important result that the intrinsic brightness of the hot, luminous stars (useful as distance indicators) was two to three times greater than previously realized.

Another notable achievement of Washburn astronomers came in the 1940s when they showed that interstellar dust in various directions in space dimmed light of different wavelengths in a way that departed systematically from earlier results. In 1958, Whitford extended these investigations to the near infrared and published an extinction curve for interstellar matter that has scarcely been improved upon since. In this work the Wisconsin astronomers used the so-called six color photometry system, i.e. they measured the brightness of objects in six wavelength bands spaced from the violet to the near infrared. They devised this system for use on galaxies, in particular, as a means of determining the velocity of recession (the red-shift) of distant galaxies by measuring their colors over a wide spectral region. Using this system Stebbins and his colleagues not only determined accurate colors and magnitudes of galaxies, but also of globular star clusters, and of a wide variety of stars; from the latter they derived the color temperatures of stars that were the standard values for many years. This color system was one of the forerunners of modern photometric systems.

In the mid-thirties another important advance in the techniques of photoelectric astronomy occurred when Washburn astronomers began experimenting with the new photomultiplier detectors being developed by V.K. Zworykin at RCA. In this type of tube, electrons released from the light sensitive surface are not immediately collected as in a Kunz tube, but are first directed to a series of dynodes each of which releases 3 or 4 electrons for each electron incident upon it. In this way the initially weak photocurrent is increased by about one million times within the tube before it is sent to the amplifier. The first astronomical use of this detector was made in 1937 by Whitford and Kron in their automatic telescope guider. The Second World War interrupted this work, but by the late 1940's the RCA photomultiplier was in regular use at Washburn Observatory, along with pen chart recorders for the output signal. With these developments, astronomical photoelectric photometry had become a standard and practical technique for astronomers worldwide.

In 1948 Stebbins retired as Director of Washburn Observatory. More than any other astronomer he was associated with the development of photoelectric astronomy, beginning with instruments able to detect only the moon and ending with photoelectric measurements of faint galaxies. The achievements of his long and remarkably fruitful career were recognized by his colleagues by his election to the National Academy of Sciences in 1920, by his election as President of the American Astronomical Society in 1940, and in 1941 when he was recipient of the Bruce medal of the Astronomical Society of the Pacific. A.E. Whitford succeeded Stebbins as Director of Washburn. In the following decade research at Washburn continued along the directions set during the Stebbins era. (Perhaps the only departure was the Observatory's first venture into photographic astronomy which took place in 1956 when Code and Houck took photographs of the Milky Way in both the northern and southern hemispheres with a wide angle camera



Pine Bluff Observatory

developed at Yerkes Observatory during the war.) However, other aspects did change. For the first 70 years of its existence Washburn had remained a separate entity within the University. In 1948, however, it became part of the College of Letters and Science and by 1958 offered greatly expanded opportunities for advanced study in astronomy. Some astronomy had been taught at Wisconsin since the University was founded in 1849. In fact, J.W. Sterling, the University's first faculty member, was described as a professor of mathematics, natural philosophy, and astronomy. Throughout the University's early years, most juniors and seniors took nearly a year of astronomy. By the turn of the century several courses were given—general astronomy, celestial mechanics, practical astronomy, and astrophysics, and on an individual basis, graduate instruction. The total enrollment in these courses then was about 35. By the mid-thirties astronomy enrollments had increased to about 100, and by 1942 to more than 200, partially as a result of the war-inspired interest in navigation, which produced an enrollment of 80 students in the navigation course. In 1950 the first graduate courses in astronomy were listed in the UW catalog, and by the mid-fifties several advanced undergraduate courses as well as four graduate courses were offered.

Until this period only three astronomy Ph.D.'s had been awarded by the University (to C.M. Huffer, O.J. Eggen, and T.E. Houck), a graduate program being restricted by the limited course offerings and by an increasingly obsolescent telescope. In 1933 the 15-inch had been thoroughly refurbished, everything being replaced except the lens, tube, and declination axis. However, both Madison and the University were growing, producing more lights, smoke, and dust thus making astronomical research on Observatory Hill more and more difficult.[2] In a 1942 report to UW President Dykstra, Stebbins pointed out the need for a larger, modern telescope at a nearby, but better location. Whitford undertook the tasks of obtaining both a new country observatory and adequate space for offices, shops, library and instruction for the Department, which had outgrown its facilities in the original building. The former was realized in the mid-fifties, when the Wisconsin Alumni Research Foundation agreed to provide $200,000 for the construction of a new observatory at a dark sky site near the village of Pine Bluff, about 15 miles west of Madison. The 36-inch mirror was ground and polished at the Yerkes Observatory optical shop, and Boller and Chivens constructed the telescope.[3] A few years later they also provided a 16-inch reflector which replaced a 12-inch telescope in the smaller dome at Pine Bluff. The new observatory was dedicated on June 30, 1958 (at the 100th meeting of the American Astronomical Society); Joel Stebbins was the principal speaker. Suitable quarters for the Department were obtained in the new wing of Sterling Hall (the physics building), which was occupied by the astronomers in 1959. Finally, through Whitford's representation, Wisconsin was one of the original founding members of AURA which established and operates the Kitt Peak National Observatory. Thus when Whitfrord went to California in 1958 to become the Director of Lick Observatory, he left behind an observatory well provided in its research equipment, its physical quarters, and in its academic course offerings for advanced training in astronomy.

The Beginning of Space Astronomy: 1958–1978

A.D. Code, Whitford's successor as Director, was no stranger to Wisconsin, having served on the Washburn staff in 1951–53. On his return to Madison from California, Code was accompanied by a Caltech colleague, D.E. Osterbrock. Code and Osterbrock established what became the two primary strands of research at Washburn over the next twenty years—ultraviolet astronomy from space vehicles and the study of the properties of interstellar matter.

Osterbrock and his colleagues carried out extensive observations and theoretical calculations that helped to clarify the physical conditions—the temperatures, densities, chemical abundances, and dynamics—in diffuse nebulae, planetary nebulae, novae, and supernovae remnants. The work of this group also showed that the emission line spectra of galaxies could be understood by the same techniques used in the analysis of gaseous nebulae. Another significant result of this work, largely due to Mathis, was that the ratio of the abundances of hydrogen to helium in gaseous nebulae is constant not only in our galaxy, but also among nebulae in nearby galaxies as well. The large numbers of graduate students and of post-doctoral fellows who were associated with Osterbrock during this period comprise a significant fraction of the researchers in this field in the last decades of the twentieth century.

Subsequently, observational studies of interstellar matter at Wisconsin expanded into the ultraviolet spectral region (through the OAO–2, ANS, Copernicus, and IUE satellites) into the x-ray region (through work carried out by the Space Physics group at the University) and into the infra-red and radio regions of the spectrum.

Early in 1958, while he was considering a return to Wisconsin, Code was among scientists asked to comment on the possible astronomical uses of small satellites. Code responded with a suggested program of photometry in the ultraviolet (a region of the spectrum absorbed by the earth's atmosphere and, therefore, unobservable from the ground), which was a natural extension of both his own research and the traditions of Washburn Observatory. Late in that year Congress established the National Aeronautics and Space Administration, which quickly moved to begin the satellite program that evolved ultimately into the Orbiting Astronomical Observatory project. In 1959, Code, with the late T.E. Houck, formed the Space Astronomy Laboratory, this consisting of a small group of astronomers, technicians, and students within Washburn, who began to study in detail the possibilities and problems of UV astronomy.

Several smaller projects were undertaken, beginning with the flight of a sky brightness photometer carried aloft by a weather balloon. Though certainly not a 'space' instrument, this provided useful experience in building a light weight, self-contained photometer and telemetry system.[1] Subsequent programs involved NASA's X–15 experimental rocket plane (which seemed to combine the capability of near-rocket altitudes with that of accurate pointing, not then available on conventional research rockets), and Aerobee sounding rockets. Results from these early SAL programs in UV filter photometry showed that early reports, that hot stars radiated much less energy in the UV than was expected, were incorrect and that the predictions of theory were approximately right.

Most of the effort at the Space Astronomy Laboratory, however, was directed towards the construction of Wisconsin's half of the astronomical payload for the Orbiting Astronomical Observatory. The other half would be provided by the Smithsonian Astrophysical Observatory, and the 3,400 lb spacecraft by the Goddard Space Flight Center. The 500 lb Wisconsin payload contained seven reflecting ultraviolet-sensitive telescopes—four 8-inch and one 16-inch filter photometers, and two scanning spectrometers, along with their associated electronics. After the failure of the first OAO because of difficulties in the spacecraft power and guidance systems, two and a half years passed before OAO–2 was successfully launched on Dec. 7, 1968. The observatory could be pointed by ground command to any point in the sky to within one minute of arc and made to carry out any sequence of observations desired. It was the first true space observatory, and was in operation for 50 months. With OAO–2 Washburn astronomers observed over 1,000 objects including planets, comets, a great variety of stars, star clusters, and galaxies. The enormous amount of new data continued to yield useful results for several decades. Among OAO results are the discovery that comets are surrounded by huge hydrogen halos; evidence that at least some novae increase their UV brightness at the same time that their visible light is fading rapidly; and that galaxies are systematically brighter in the UV than expected from the visual colors of stars which make them up. OAO data have been used to investigate the physical properties of interstellar dust and to map the distribution of hydrogen near the sun; OAO data combined with measurements of the angular diamters of stars have enabled the first empirical determinations of the temperatures of the hotter stars.

Though UV astronomy and studies of the interstellar medium have become major activities of the Observatory, Washburn astronomers have pursued a wide variety of other astrophysical interests including observational studies of comets, planets, and the zodiacal light, and photometric measurements of the continua and spectral lines of stars of almost every type.

Theoretical work here has addressed problems in a broad range of fields including stellar interiors, the transfer of radiation in gaseous nebulae and in stars, stellar winds, the shapes of spectral lines in a variety of situations, studies of large telescope systems, and dynamics of galaxies.

Beginning with the Stebbins era, Washburn astronomers have devoted considerable effort to the design and construction of new instrumentation.[2] In addition to instruments already mentioned, there have been developed a variety of photoelectric spectrum scanning devices and also an echelle spectrograph, which makes it possible to carry out detailed studies of spectral lines without use of Coude optical systems. Development of the echelle spectrograph here began a revival of interest in this type of instrument for use in stellar astronomy. The first automatic, computer-operated ground-based telescope was designed and constructed by the late J.F. McNall (of the Space Astronomy Laboratory) who also was a co-designer, with members of Lick Observatory, of the image intensifier-image dissector detector, which was used at several observatories. The 36-inch telescope at Pine Bluff was refurbished and instrument hardware and software made so that Washburn instruments can easily be used at the Kitt Peak National Observatory.

As the number of staff and graduate students increased in the 1960s and new activities developed, the administrative demands on the director became increasingly time-consuming. Consequently, it was decided that upon Code's resignation as Director in 1969, this position would henceforth be rotated among staff. In 1973 Osterbrock left Wisconsin to become the Director of Lick Observatory, the third (after Holden and Whitford) from Washburn to do so.

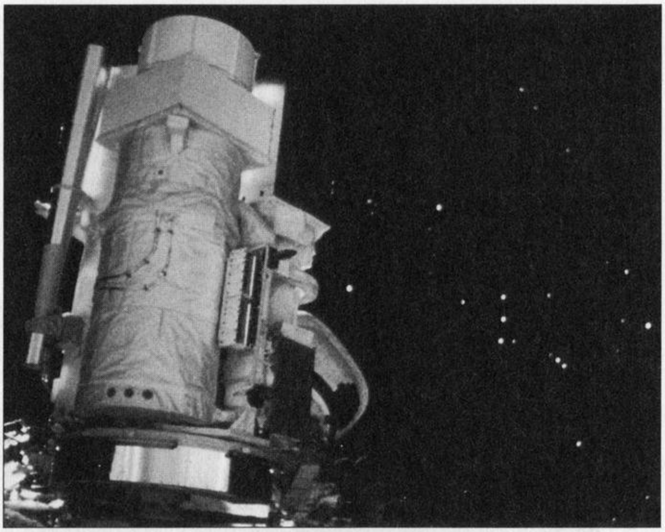
The Department did not escape the turbulence of the Vietnam war years; early on the morning of August 24, 1970, Sterling Hall was badly damaged by a bomb which killed one physicist and injured other occupants. By a stroke of good fortune, the last astronomer had left the building a few minutes before the blast. Unfortunately, departmental quarters and several research projects, including a just-completed Ph.D. thesis, were damaged extensively. Nearly half of the floor space had to be evacuated during the year of reconstruction.

At the close of Washburn Observatory's first century, older traditions of research, such as the properties of the interstellar medium and the development of innovative astronomical instrumentation, were still being pursued along with more recent activities such as space astronomy. But new directions were being established.

Reaching the New Millenium: 1978–2000

Space astronomy at UW–Madison received great impetus from two major and roughly contemporaneous projects stretching from the late 70s to the mid–90s. One was the Wisconsin Ultraviolet Photo-Polarimeter Experiment (WUPPE), and the other was the High Speed Photometer (HSP) for the Hubble Space Telescope. Both of these projects had broad impact on the structure and activities of SAL and the Astronomy Department.

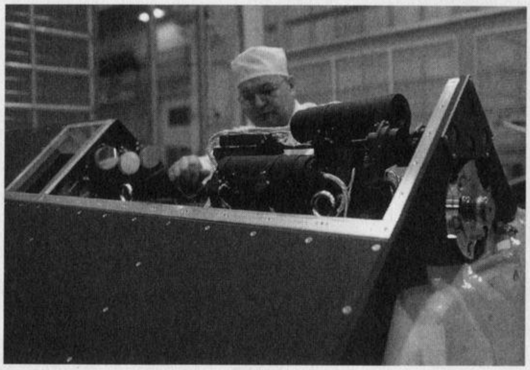
WUPPE was in response to NASA's plan to develop astronomical instruments for the space shuttle. NASA's "Project Astro" payloads would be carried into orbit by the shuttle and operated in the shuttle cargo bay by astronomers both on board the shuttle and on the ground. Basing their instrument on a spectropolarimeter originally designed by Nordsieck for ground-based use, SAL proposed an ultraviolet sensitive instrument mounted on a 0.5-meter telescope. This would allow for the first time the measurement of the degree of polarization of ultraviolet light from a large number and variety of celestial objects. Nordsieck was also accepted into the astronaut program and completed training to fly as one of Project Astro's orbiting astronomers, but as it happened did not fly. WUPPE was designed and constructed entirely at SAL and delivered to NASA in time for the scheduled launch of the Astro–1 mission in February of 1986. However, the disastrous explosion of the shuttle Challenger the month before delayed Astro–1 and caused the Astro missions to be cut from the original six to only two. Astro–1 eventually carried WUPPE into space on flight STS–35, 2–11 December 1990, and Astro–2, with Code as Principal Investigator, provided a second opportunity on STS–67, 2–18 March 1995. Ground-based optical polarimetric observations to complement WUPPE's in the UV were made at



WUPPE, located at the right edge of the instrument cluster, making astronomical observations from the Space Shuttle cargo bay.

Pine Bluff Observatory by an instrument called HPOL (Halfwave Polarimeter) on the 36-inch telescope. In the course of both missions WUPPE's ultraviolet polarization data showed that the composition of interstellar matter is more complex than had been suspected on the basis of optical observations, demonstrated that the polarization in the UV of the very rapidly rotating "Be" stars contradicted theoretical predictions, and discovered a bipolar matter flow in the famous binary star Beta Lyrae, which was only recently confirmed by observations in the radio part of the spectrum.

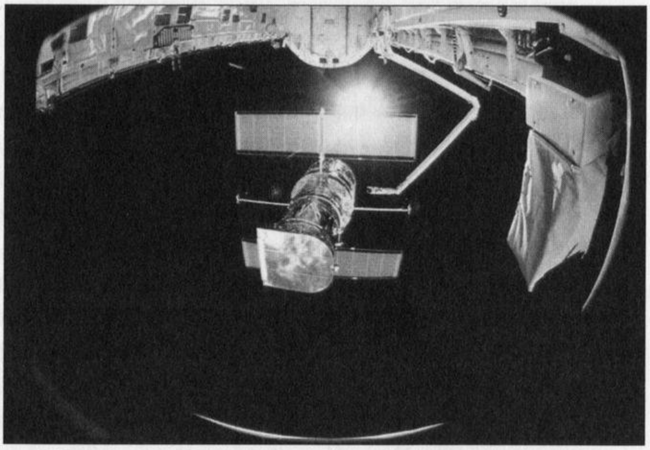
The High Speed Photometer came about in response to NASA's request in 1977 for proposals to supply the first set of science instruments for the Hubble Space Telescope. SAL, with Bless as the PI, proposed a simple but versatile package of photometers that would take advantage of HST's sharp, stable images to measure the rapid brightness fluctuations of many different kinds of celestial objects. HSP was designed and built by the Space Astronomy Laboratory and UW–Madison's Space Science and Engineering Center, the only one of the HST scientific instruments to be built on a university campus. HSP functioned as designed from the time of launch, 25 April 1990. However, the optical flaw of the HST's primary mirror, discovered after launch, produced badly degraded images that, combined with spacecraft pointing jitter, significantly compromised the scientific goals of the HSP team. HSP nevertheless did make some useful observations, for example, the most precise visible light profile yet made, as well as the first UV pulse profile, from the pulsar in the Crab Nebula. HSP was removed from the telescope and returned to Earth in December 1993 when NASA replaced it with the corrective optics package that finally achieved HST's originally advertised image quality for the remaining instruments. Washburn's astronomers have had many other connections to Hubble Space Telescope development, operations, and research. Savage, for example, was a member of the Goddard High Resolution Spectrometer group, Hoessel and Code were members of the Wide Field and Planetary Camera group, and Code served as acting director of the Space Telescope Science Institute in its earliest phase.



The High Speed Photometer is tested before launch.

As previously mentioned SAL gained early experience by building instruments flown on sounding rockets, which are suborbital and achieve only a few minutes of scientific observation time, but at a very small fraction of the cost of a typical orbital instrument. Such missions can be organized on relatively short notice. SAL's sounding rocket program, using solid-fueled successors to the Aerobees, was reinvigorated in 1988 by Nordsieck's WISP (Wide-field Imaging Survey Polarimeter) project, which was an outgrowth of WUPPE. WISP flew four times, with various modifications each time, and on one occasion (with Harris as PI) flew as part of a hastily organized multi-rocket campaign in 1996 to observe Comet Hale-Bopp. Even as WISP evolves into an instrument for solar system studies, a 30 times more sensitive version, called CUPID (Cosmic Ultraviolet Polarimetric Imaging Device), is being developed, as well as a far-UV successor to WUPPE called FUSP (Far Ultraviolet SpectroPolarimeter).

SAL continues to be active in pursuing innovative ways to do astronomy from space, both through sounding rockets and the development of new mission concepts. Nordsieck and Percival, for example, are leading the Star Tracker 5000 project, a pointing system for rocket, balloon, satellite, and even ground-based instruments that provides an order of magnitude improvement over existing devices. And Percival is applying his Progressive Image Transport (PIT) technique, an extremely efficient way to transfer digital images, to make it possible to use a distant telescope effectively from home. Joint projects with the UW–Madison Physics Department have explored new spectroscopic techniques (Spatial Heterodyne Spectrometer, Roesler, PI) and research in x-ray astronomy (McCammon and Sanders).



Hubble Space Telescope being deployed with the High Speed Photometer aboard.

Wisconsin's astronomers have not failed to follow in the 120-year Washburn tradition of public outreach and education. SAL, with the support of the Astronomy Department, created an education and outreach center for the community called UW Space Place, which opened in July 1990. In addition to the long-established viewing sessions with the Washburn telescope, Space Place offers free public programs related to space science and astronomy as well as workshops for school groups and school teachers so that everyone can discover and enjoy the fascinations of astronomy. Thousands of visitors from across Wisconsin now include Space Place in their visits to Madison. Space Place is also home to the now-retired WUPPE space telescope and to the full-scale engineering model of OAO–2, both of which are on public display. Since 1996, SAL, Space Place, and the Astronomy Department have run "Universe in the Park," a very popular program in which faculty, staff, and graduate students visit state parks every summer with portable telescopes. Under the direction of Wilcots, Universe in the Park has reached every corner of Wisconsin, offered programs at most of Wisconsin's state parks, and enabled hundreds of campers and park visitors to share in the fascination of astronomy by viewing and learning about the moon, planets, stars, and other celestial sights.

Ground-based astronomy has never languished at UW–Madison. PBO, for example, has been continuously a base of active research and a test bed for the development of new instrumentation. But until 1995 Washburn's astronomers had no choice but to compete with the rest of the astronomers in the world for access to the large reflectors at good sites that are today's best ground-based optical research instruments. That was changed by the 3.5-meter WIYN telescope, which was built by a consortium of Wisconsin (UW–Madison), Indiana University, Yale University, and the National Optical Astronomy Observatories. As a consortium member, Washburn's astronomers have a portion of the telescope's nights available to them. The WIYN telescope itself is located at Kitt Peak National Observatory, outside of Tucson, Arizona, but the telescope and its sophisticated instruments can be used remotely, so Washburn astronomers often need not leave Madison to observe with WIYN. WIYN produces the sharpest images of any telescope in North America. With WIYN, Washburn's traditional studies of the gas and dust between the stars have been extended to galaxies other than our own Milky Way. Also, star formation and the determination of the distance scale of the universe have been among major WIYN programs.

If current developments are any indicator, then the future of astronomy at Washburn Observatory is one of ever wider horizons. UW–Madison has recently joined a new consortium led by South African astronomers, the goal of which is to construct the Southern African Large Telescope (SALT). SALT will be a 10-meter optical telescope located at the South African Astronomical Observatory, Sutherland, Northern Cape Province. Its location in the southern hemisphere will, for the first time, give Wisconsin's astronomers regular access to the many unique objects of the southern sky, the neighboring dwarf galaxies called the Large and Small Magellanic Clouds, for example. An important contribution of the UW–Madison will be the major instrument for SALT, the prime focus imaging spectrograph being designed by Nordsieck and to be built at SAL. This instrument combined with the light gathering power of the telescope will make possible spectral observations of the most distant galaxies, while modern technology (e.g. PIT) will make it possible to access SALT's power without leaving Madison.

Within the last several years, Washburn astronomers have developed a new research direction: galaxies and observational cosmology. With WIYN and SALT, Wisconsin astronomers are well positioned to play an active role in some of the most exciting aspects of astronomy. The future of Wisconsin astronomy looks bright.

Afterword

Interested readers can learn more about UW's involvement in the Hubble Space Telescope project in Robert Smith's, *The Space Telescope* (Cambridge, 1989) and can learn about UW's role in the development of modern astronomical photometry in J. B. Hearnshaw's, *The Measurement of Starlight: Two Centuries of Astronomical Photometry* (Cambridge, 1996). (The cover photo of Hearnshaw's history features none other than Joel Stebbins himself.) James Watson's pursuit of Vulcan and the Washburn solar observatory are described in Richard Baum and William Sheehan's *In Search of Planet Vulcan: The Ghost in Newton's Clockwork Universe* (Plenum Press, New York: 1997).

Notes

The Beginning: 1878–1922

[1] In 1876 $3,000 represented one-seventh of the University's state-provided budget!

[2] This confidence was well-founded; when he died in 1881 his estate was valued at more than three million dollars.

[3] Bascom commented, ". . .it is the intention of the Legislature and of the Regents of the University. . . that the Observatory shall not be merely a monumental appendage to instruction, but shall be vigorously used in the general interests of science."

[4] This was the occasion of a newspaper notice on April 9, 1881 in which Holden emphasized the astronomers' need for uninterrupted nights when working, and that in return for the public's consideration of this matter, the telescope would be available on the first and third Wednesdays of each month to anyone interested in viewing celestial objects. This practice has been maintained to this day.

[5] Woodman had once suggested that he and Washburn donate money to establish a School of Agriculture at the University, an idea which did not appeal to Washburn.

[6] A Milwaukee newspaper, apparently skeptical of the value of astronomy, commented in 1882 on the time-keeping service of the Observatory: "It is hoped that in this way that the Washburn Observatory may be of . . . practical value to the community, and that the wise liberality of its founder . . . may be vindicated."

[7] Chamberlin later became well-known to astronomers for his work with Moulton on the planetesimal theory of the origin of the solar system.

The Stebbins-Whitford Era: 1922–1958

[1] He also served as secretary of the American Astronomical Society from 1946 to 1955.

[2] A song by Irving Berlin, "When It's Dark on Observatory Hill" indicated its use for other purposes.

[3] This instrument (along with an identical telescope now at McDonald Observatory) was the first to be built by this firm.

The Beginning of Space Astronomy: 1958–1978

[1] It also afforded Observatory staff and friends considerable excitement one soft summer evening as the 'launch' and flight proceeded from Second Point overlooking Lake Mendota.

[2] Partly to make the best use of the small telescopes and limited observing times available in Wisconsin.

Credits

This booklet was published by the Office of Visitor Services, produced by the Office of University Publications, with support from the UW Foundation. For information on other campus tours and customized visits, or to obtain additional copies of this or other Visitors Services publications, call 608/265-9500, or inquire by email: visitor@redgym.wisc.edu.

On the Cover:

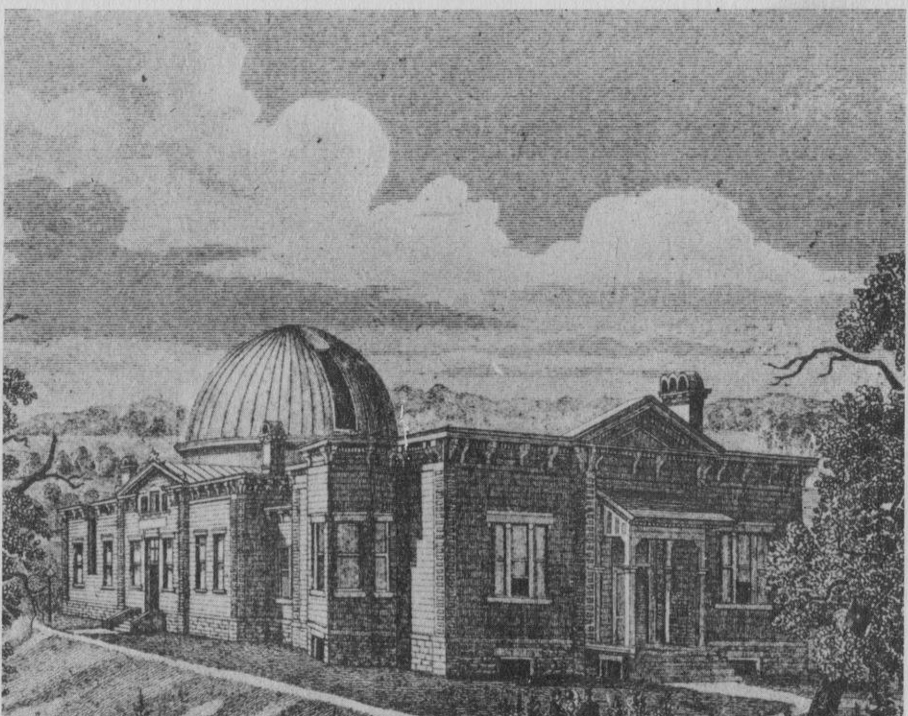
Washburn Observatory with Watson Solar Observatory and Students' Observatory, circa 1881.

VISITOR
SERVICES
University of Wisconsin-Madison

123 Red Gym
716 Langdon Street
Madison, Wisconsin 53706
608/265-9500

Washburn Observatory 1878-1978

University of Wisconsin-Madison



I

It is not clear what prompted former Wisconsin Governor C. C. Washburn's interest in astronomy; perhaps it was comments by the University Regents in 1869 that no institution of higher learning could aspire to the status of a university without an observatory; or perhaps it had to do with the establishment in 1876 of a magnetic observatory at the University, the only one of its kind in the country at that time. In any case, in "An Act to permanently provide for deficiencies in the University fund income" (passed by the legislature on March 6, 1876) Washburn had included a provision which specified that "the sum of $3000 annually shall be set apart for astronomical work and for instruction in Astronomy . . . so soon as a complete and well-equipped observatory shall be given to the University in its own grounds without cost to the State, provided that such an observatory shall be completed within three years from the passage of this act." Along with the stipulation that state residents should not be required to pay tuition, this was the only condition placed on the use of the money, which was raised by a property tax.*

On Sept. 18, 1877, UW President John Bascom announced that Governor Washburn intended to meet the provisions of the act and provide a fully equipped observatory, including a telescope, which was specified to be larger than the 15-inch Harvard refractor. Washburn, a six-term member of Congress, Civil War Major-General, and Wisconsin governor in 1871-73, had been defeated in his try for re-election and so was devoting all of his attention to his business affairs. On the day before he was formally to select the site for the new observatory, his flour mill in Minneapolis exploded, killing several workers. Nonetheless he kept his appointment with the Regents before setting off for Minneapolis, perhaps thinking that it would be wiser to present a confident appearance to the business world in the face of this disaster than to delay the donation of the observatory.+ The observatory site was lovely—100 feet above Lake Mendota to the north, isolated from Madison to the east by the University campus, and surrounded by orchards and a vineyard.

Construction of the observatory began in May, 1878; the Clarks of Massachusetts were asked to build the telescope. With an aperture of

*In 1876 $3000 represented one-seventh of the University's state-provided budget!

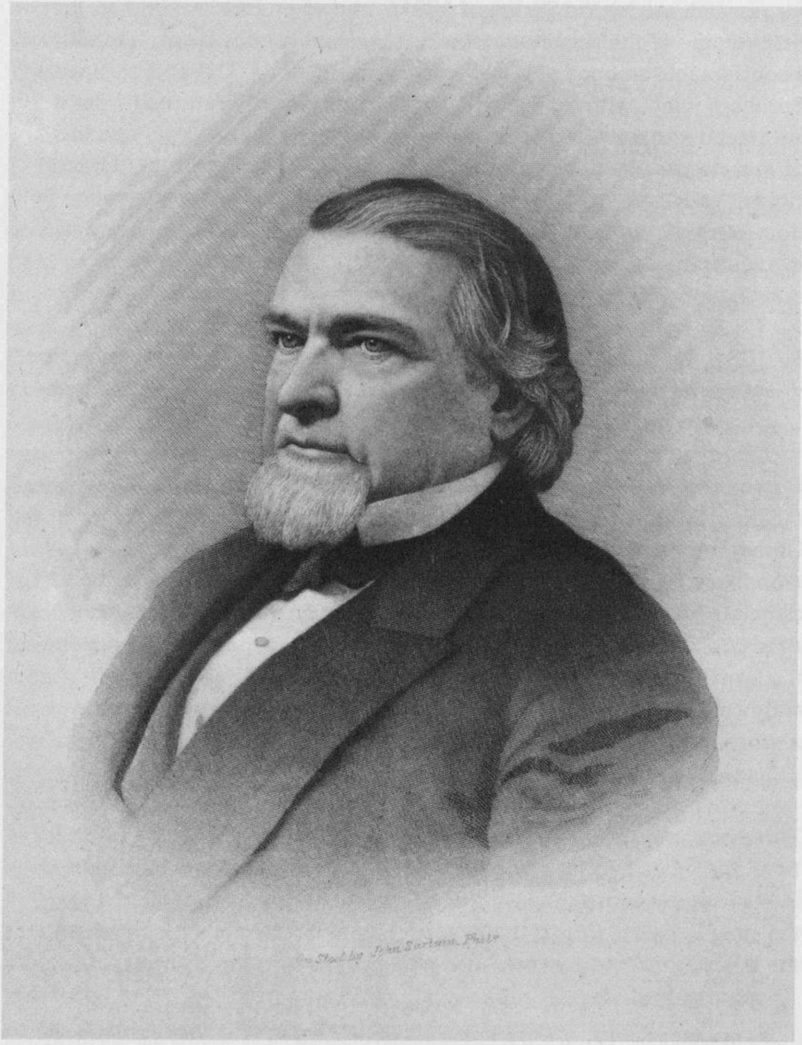
+This confidence was well-founded; when he died in 1881 his estate was valued at more than three million dollars.

15.6 inches, it was then the third largest refractor in the U.S., after the 26-inch and 18-inch instruments at the Naval Observatory and Dearborn Observatory, respectively. (Including the European refractors dropped the Wisconsin instrument only one notch, though there were many larger reflectors at the time.)

President Bascom wanted an active and prominent astronomer to become the Observatory's first director and found him in James C. Watson of the University of Michigan (then probably the country's most prominent school for astronomy.)* Watson had an international reputation for his discovery of 22 minor planets and for his book *Theoretical Astronomy,* the standard work in English for many years. He had become controversial with his claims for the discovery of the intra-Mercurial planet, Vulcan, first predicted by Leverrier 20 years earlier to account for the then unknown relativistic perturbation of Mercury's orbit. To judge by contemporary newspaper accounts, Watson was wooed by Wisconsin and Michigan with an ardor nowadays reserved for football coaches. However, Wisconsin, with its newer and larger telescope, won the day and in October, 1878, Watson occupied the Director's residence next to the Observatory, which had just been vacated by President Bascom.

With characteristic energy, Watson supervised the completion of the original structure, started work on the east wing (which included the Director's office), and with his own money began construction of the Students' Observatory, a short distance to the northeast of the main building, and of the Solar Observatory on the side of a steep hill south of the building. The former contained a small transit instrument and a 6-inch Clark refractor belonging to S. W. Burnham, then a court reporter in Chicago who came to Madison on weekends to search for double stars. This instrument was also to be used for instruction, enabling the 15-inch to be used for research. The Solar Observatory was intended for observations of the putative intra-Mercurial planets (Watson interpreting his 1878 eclipse observations as indicating two such objects). A 12-inch diameter underground tube led to a siderostat and long focus objective by which the sky near the sun could be examined visually. (The notion that such a device can enhance visibility of objects near the sun dies hard and is still periodically revived.) Unfortunately, Watson did not live to complete these projects since he died suddenly in November, 1880, when he was only 42. This was a

*Bascom commented, ". . . it is the intention of the Legislature and of the Regents of the University . . . that the Observatory shall not be merely a monumental appendage to instruction, but shall be vigorously used in the general interests of science."



Cadwallader C. Washburn

great loss to the University. In less than two years at Madison he had become known not only as a distinguished astronomer, but had established a reputation as an excellent teacher, which was recognized in the local press: "His lectures are instructive, and that too, which few college professors' lectures are, intensely interesting."

Watson's successor was Edward S. Holden who came to Wisconsin from the U.S. Naval Observatory in 1881. Although Watson had not had the opportunity to make any observations himself, the 15-inch was ready for research use by the Spring of 1881*, and when Holden finished the first volume of the Washburn Observatory Publications (Sept. 30, 1881), a considerable amount of visual work was underway. The observers were Burnham (who, with his 6-inch telescope had recently returned from a visit to Mount Hamilton where he observed many double stars as a test of that site for the planned Lick Observatory), G. C. Comstock (later Holden's successor as Director), and Holden himself. These observations were primarily micrometer measurements of double stars, but also included catalogs of nebulae and of red stars, and observations and drawings of the comet of 1881.

By 1884, the Observatory was equipped and set on a course of research it was to follow for the next 40 years. In addition to the 15- and 6-inch Clark telescopes (the latter purchased from Burnham), the observatory had acquired an excellent 5-inch meridian circle constructed by the Repsolds of Hamburg, which was mounted in the west wing of the main building. All told, Washburn had given more than $65,000 to the Observatory, a very substantial sum in those days. In addition, Cyrus Woodman, like Washburn a New England expatriate, had long wished to associate his name with that of his friend and one-time law partner.+ After Washburn's death, Woodman found his opportunity by endowing the Observatory with $5000 to support an astronomical library, an endowment still in existence today. By 1884 the Woodman library was a substantial one counting 1000 volumes and 600 pamphlets in its collection.

Three accurate pendulum clocks were also maintained, one for sidereal time, the other two for standard time. The Observatory set local time in Madison by controlling various clocks in the city, including one at the state Supreme Court, the Western Union office, the Park Hotel, and the Wisconsin State Journal,** as well as a clock in the University

*This was the occasion of a newspaper notice on April 9, 1881 in which Holden emphasized the astronomers' need for uninterrupted nights when working, and that in return for the public's consideration in this matter, the telescope would be available on the first and third Wednesdays of each month to anyone interested in viewing celestial objects. This practice has been maintained to this day.

+Woodman had once suggested that he and Washburn donate money to establish a School of Agriculture at the University, an idea which did not appeal to Washburn.

**A Milwaukee newspaper, apparently skeptical of the value of astronomy, commented in 1882 on the time-keeping service of the Observatory: "It is hoped that in this way that the Washburn Observatory may be of . . . practical value to the community, and that the wise liberality of its founder . . . may be vindicated."

President's office where it controlled bells signalling the beginning and end of class periods (then as now 50 minutes long). In addition the Observatory earned several hundred dollars a year by selling the time to Wisconsin railroads.

In 1880, the president of the Lick trustees had tried to interest Watson in becoming the director of the new California Observatory, but Watson died only a few months later before reaching any decision. Holden, the scientific advisor to the Lick trust, left Wisconsin to become the President of the University of California in 1885. He became the Director of Lick Observatory when the 36-inch refractor was completed three years later. For a little more than a year after Holden's departure, John E. Davis, the professor of physics whose enthusiastic research in electromagnetism had led to the establishment of the magnetic observatory at Madison, took charge of the Observatory. A permanent director was not appointed immediately after Holden's departure because President Bascom's essentially forced resignation was soon to take effect and a new president had yet to be found. In the summer of 1887, the geologist T. C. Chamberlin* became president of the University and in August of that year, G. C. Comstock, then at Ohio State, returned to Madison as Associate Director of Washburn Observatory, with Asaph Hall of the Naval Observatory as non-resident Director. This awkward arrangement, perhaps occasioned by Comstock's relative youth (he was 32 on his return to Wisconsin) or by his lack of a Ph.D. degree, ended a few years later and Comstock became the third Director of the Observatory, an office he held for years longer than anyone else. Comstock had been trained at Michigan by Watson, the latter bringing him to Wisconsin as an assistant astronomer in 1879. Except for two years as professor of mathematics at Ohio State, Comstock's career was spent at Wisconsin. His astronomical work was that of precise, visual positional observations, a tradition begun by Holden. His first research, an accurate determination of the constant of aberration, along with an associated investigation of atmospheric refraction, quickly brought him to the attention of his peers. Throughout his long career he also measured visual binary stars, not only as objects of intrinsic interest, but also as part of an investigation of the proper motion of faint stars. This work indicated that some stars were intrinsically faint (and not just far away) and was an early hint of the concept of giant and dwarf stars. An important colleague of Comstock's for nearly 30 years was Albert S. Flint, an expert in visual positional astronomy with the meridian circle. Flint died in 1923 with the reduction of the last ten years of his observational work unfinished; this work was held in such high regard that the Department of Meridional Astronomy of the Carnegie Institution undertook to complete it, finally doing so in 1938.

*Chamberlin later became well-known to astronomers for his work with Moulton on the planetesimal theory of the origin of the solar system.

Comstock was prominent in the professional activities of his day; he was involved in the founding of the American Astronomical Society in 1897 and served the Society for ten years as its first secretary, and as its President in 1925; he was the chairman of the AAS committee formed to coordinate the observations of Halley's comet in 1910. In 1899 Comstock became the first Wisconsin faculty member to be elected to the National Academy of Sciences and five years later was appointed the first Dean of Wisconsin's Graduate School, a position he held for 16 years.

II

Since the founding of the Observatory, Washburn astronomers had relied entirely on visual techniques for their research, paying little attention to the rapidly expanding uses of photography in astronomy. This situation changed abruptly in 1922 when Professor Joel Stebbins left the University of Illinois to become the fourth Director of Washburn Observatory. For several years Stebbins had been trying to develop electrical means of detecting starlight, first with selenium cells and then beginning in 1913 with the more sensitive photocells. Dr. Jacob Kunz, a colleague of Stebbins's at Illinois, made these detectors in his laboratory while Stebbins tested them at the telescope. As these photocells were finally developed, they generally consisted of a quartz tube, the inside of which was coated with potassium hydride. Electrons emitted by this coating when it was exposed to light were collected at a ring anode kept at about +250 volts with respect to the coating, and the resulting current was detected by an electrometer. Two people were required—one at the telescope to set and guide on the stars and the other to measure the rate at which the string electrometer received an electrical charge from the photocell. Thus when Stebbins came to Wisconsin with his photocells the Observatory passed immediately from the 300-year-old era of visual astronomy to that of the new-fangled techniques of photoelectric astronomy, with not even a passing glance at photographic astronomy.

The Kunz tubes were very sensitive—more so than many modern photocathodes—but their use at the telescope with the delicate electrometers as detectors was difficult and required considerable experimental skill. The Lindemann electrometer, first used by Stebbins in 1927, improved this situation considerably since it could operate in any position, an obvious advantage at the telescope. However, the greatest improvement came in 1932 when A. E. Whitford at Washburn succeeded in constructing the first workable D.C. amplifier suitable for astronomical use. Although several people had attempted to use a new type of vacuum tube to amplify the feeble photoelectric currents, these attempts had not been successful because of fairly large random fluctuations in the amplified signal. Whitford solved this problem by enclosing the photocell and certain of the electronics in an airtight container when was then evacuated. This decreased the troublesome fluctuations to less than a tenth of their previous value and resulted in a four-fold increase in the sensitivity of the amplifier photometer compared to the older electrometer photometer. In addition, the two million-fold current amplification meant that the output signal could be measured by a galvanometer, a more rugged type of instrument than the electrometer; this simplified work at the telescope, and made it possible to attack an extremely wide range of problems. Stebbins first exploited one of the chief virtues of the photocell, i.e. its ability to detect small variations in the intensity of light, variations too small to be detected by eye or photographically. In particular, Stebbins and Huffer (who was awarded the first Wisconsin Ph.D. in astronomy and remained as a faculty member) found several spectroscopic binaries also to be eclipsing systems which enabled them to derive fundamental data concerning the sizes, brightnesses, and masses of these stars. They also determined accurate light curves of Cepheid variables and showed that essentially all very high luminosity red stars were intrinsically variable. Huffer continued to specialize in photoelectric photometry of variable stars until his retirement from the University in 1961.*

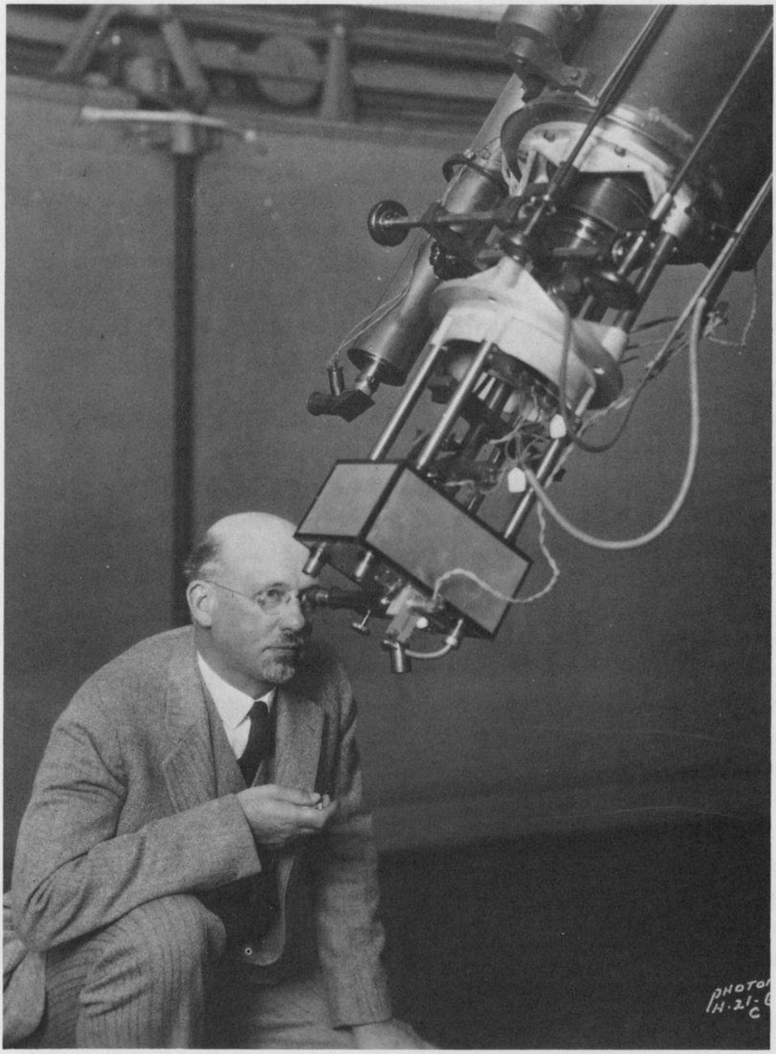
Immediately following Trumpler's demonstration in 1930 of the existence of dust between the stars, Stebbins, Huffer, and Whitford investigated the distribution of the clouds of obscuring matter in our Galaxy by measuring the colors of more than 700 luminous, blue stars, another application to which the photocell was well suited. The observations were made at the 15-inch telescope using the photocell electrometer combination. Given the stringent demands photoelectric astronomy places on the quality of the sky and the relative scarcity of such skies in Madison, this program was a particularly impressive achievement. After 1933 the electrometer was replaced by Whitford's amplifier and the Washburn astronomers observed 600 more such stars with the large reflectors at Mt. Wilson. Thus began a program of research on interstellar matter which 45 years later is still flourishing at Washburn. One of the highlights of this effort was Sebbins's determination in 1932 of the currently accepted size of our galaxy by his measurement of the effect of interstellar dust on the brightness of the distance indicators Shapley had used in his work on this problem. Sebbins's result, that the sun is about 30,000 light years from the center of the Milky Way galaxy, the outer edge of which is about 50,000 light years from the center, has scarcely been improved upon since. This demonstration that our galaxy was about half the size previously thought, combined with the somewhat later Wisconsin photoelectric work which showed that our neighboring spiral galaxy in Andromeda was about twice as large as had been previously believed, removed the large and somewhat disturbing difference in size between these two spiral galaxies. A by-product of the early work on the colors of stars was the important result that the intrinsic brightness of the hot, luminous stars (useful as distance indicators) was two to three times greater than previously realized.

*He also served as secretary of the American Astronomical Society from 1946 to 1955.

Another notable achievement of Washburn astronomers came in the 1940's when they showed that interstellar dust in various directions in space dimmed light of different wavelengths in a way which departed systematically from earlier results. In 1958, Whitford extended these investigations to the near infrared and published an extinction curve for interstellar matter which remains the standard against which other such determinations are measured. In this work the Wisconsin astronomers used the so-called six color photometry system, i.e. they measured the brightness of objects in six wavelength bands spaced from the violet to the near infrared. They devised this system for use on galaxies, in particular, as a means of determining the velocity of recession (the red-shift) of distant galaxies by measuring their colors over a wide spectral region. Using this system Stebbins and his colleagues not only determined accurate colors and magnitudes of galaxies, but also of globular star clusters, and of a wide variety of stars; from the latter they derived the color temperatures of stars which were the standard values for many years. This color system was the forerunner of modern photometric systems.

In the mid-thirties another important advance in the techniques of photoelectric astronomy occurred when Washburn astronomers began experimenting with the new photomultiplier detectors being developed by V. K. Zworykin at RCA. In this type of tube, electrons released from the light sensitive surface are not immediately collected as in a Kunz tube, but are first directed to a series of dynodes each of which releases 3 or 4 electrons for each electron incident upon it. In this way the initially weak photocurrent is increased by about one million times within the tube before it is sent to the amplifier. The first astronomical use of this detector was made in 1937 by Whitford and Kron in their automatic telescope guider. The Second World War interrupted this work, but by the late 1940's the RCA photomultiplier was in regular use at Washburn Observatory, along with pen chart recorders for the output signal. With these developments, astronomical photoelectric photometry had in essence achieved its modern form.

In 1948 Stebbins retired as Director of Washburn Observatory. More than any other astronomer he was associated with the development of photoelectric astronomy, beginning with instruments able to detect only the moon and ending with photoelectric measurements of faint galaxies. The achievements of his long and remarkably fruitful career were recognized by his colleagues by his election to the National Academy of Sciences in 1920, by his election as President of the American Astronomical Society in 1940, and in 1941 when he was the recipient of the Bruce medal of the Astronomical Society of the Pacific.



Professor Joel Stebbins

A. E. Whitford succeeded Stebbins as Director of Washburn. In the following decade research at Washburn continued along the directions set during the Stebbins era. (Perhaps the only departure was the Observatory's first venture into photographic astronomy which took place in 1956 when Code and Houck took photographs of the Milky Way in both the northern and southern hemispheres with a wide angle camera developed at Yerkes Observatory during the war.) However, other aspects did change. For the first 70 years of its existence Washburn had remained a separate entity within the University. In 1948, however, it became part of the College of Letters and Science and by 1958 offered greatly expanded opportunities for advanced study in astronomy. Some astronomy has been taught at Wisconsin since the University was founded in 1849. In fact, J. W. Sterling, the University's first faculty member, was described as a professor of mathematics, natural philosophy, and astronomy. Throughout the University's early years, most juniors or seniors took nearly a year of astronomy. By the turn of the century several courses were given—general astronomy, celestial mechanics, practical astronomy, and astrophysics, and on an individual basis, graduate instruction. The total enrollment in these courses then was about 35. By the mid-thirties astronomy enrollments had increased to about 100, and by 1942 to more than 200, partially as a result of the war-inspired interest in navigation, which produced an enrollment of 80 students in the navigation course. In 1950 the first graduate courses in astronomy were listed in the UW catalog, and by the mid-fifties several advanced undergraduate courses as well as four graduate courses were offered.

Until this period only three astronomy Ph.D.'s had been awarded by the University (to C. M. Huffer, O. J. Eggen, and T. E. Houck), a graduate program being restricted by the limited course offerings and by an increasingly obsolescent telescope. In 1933 the 15-inch had been thoroughly refurbished, everything being replaced except the lens, tube, and declination axis. However, both Madison and the University were growing, producing more lights, smoke, and dust thus making astronomical research on Observatory Hill more and more difficult.* In a 1942 report to UW President Dykstra, Stebbins pointed out the need for a larger, modern telescope at a nearby, but better location. Whitford undertook the tasks of obtaining both a new country observatory and adequate space for offices, shops, library and instruction for the Department, which had outgrown its facilities in the original building. The former was realized in the mid-fifties, when the Wisconsin Alumni Research Foundation agreed to provide $200,000 for the construction of a new observatory at a dark sky site near the village of Pine Bluff, about 15 miles west of Madison. The 36-inch mirror was ground and polished at the Yerkes Observatory optical shop, and Boller and Chivens constructed the telescope.+ A few years later they also provided a

*A song by Irving Berlin, "When It's Dark on Observatory Hill" indicated its use for other purposes.

+This instrument (along with an identical telescope now at McDonald Observatory) was the first to be built by this firm.

16-inch reflector which replaced a 12-inch telescope in the smaller dome at Pine Bluff. The new observatory was dedicated on June 30, 1958 (at the 100th meeting of the American Astronomical Society); Joel Stebbins was the principal speaker. Suitable quarters for the Department were obtained in the new wing of Sterling Hall (the physics building), which was occupied by the astronomers in 1959. Finally, through Whitford's representation, Wisconsin was one of the original founding members of AURA which established and operates the Kitt Peak National Observatory. Thus when Whitford went to California in 1958 to become the Director of Lick Observatory, he left behind an observatory well provided in its research equipment, its physical quarters, and in its academic course offerings for advanced training in astronomy.

III

A. D. Code, Whitford's successor as Director, was no stranger to Wisconsin, having served on the Washburn staff in 1951-53. On his return to Madison from California, Code was accompanied by a Caltech colleague, D. E. Osterbrock. Code and Osterbrock established what became the two primary strands of research at Washburn over the next twenty years—untraviolet astronomy from space vehicles and the study of the properties of interstellar matter.

Osterbrock and his colleagues carried out extensive observations and theoretical calculations which helped to clarify the physical conditions —the temperatures, densities, chemical abundances, and dynamics—in diffuse nebulae, planetary nebulae, novae and supernovae remnants. The work of this group also showed that the emission line spectra of unusual systems like quasi-stellar objects and the centers of active galaxies could be understood by the same techniques used in the analysis of gaseous nebulae. Another significant result of this work, largely due to Mathis, was that the ratio of the abundances of hydrogen to helium in gaseous nebulae is constant not only in our galaxy, but also among nebulae in nearby galaxies as well. The large numbers of graduate students and of post-doctoral fellows who were associated with Osterbrock during this period comprise a significant fraction of the current researchers in this field.

In recent years observational studies of interstellar matter at Wisconsin have expanded into the ultraviolet spectral region (through the OAO-2, ANS, Copernicus, and IUE satellites) into the x-ray region (through work carried out by the Space Physics group at the University) and most recently into the radio region of the spectrum with the research carried on by Washburn's newest staff member.

Early in 1958, while he was considering a return to Wisconsin, Code was among scientists asked to comment on the possible astronomical uses of small satellites. Code responded with a suggested program of photometry in the ultraviolet (a region of the spectrum absorbed by the earth's atmosphere and, therefore, unobservable from the ground), which was a natural extension of both his own research and the traditions of Washburn Observatory. Late in that year Congress established the National Aeronautics and Space Administration, which quickly moved to begin the satellite program that evolved ultimately into the Orbiting Astronomical Observatory project. In 1959, Code, with the late T. E. Houck, formed the Space Astronomy Laboratory, this consisting of a small group of astronomers, technicians, and students within Washburn, who began to study in detail the possibilities and problems of UV astronomy.

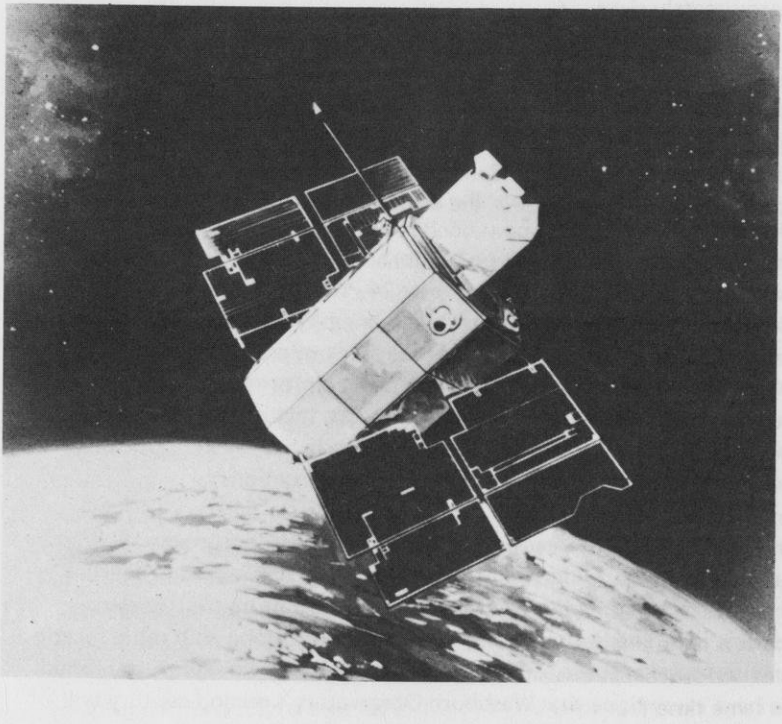
Several smaller projects were undertaken, beginning with the flight of a sky brightness photometer carried aloft by a weather balloon. Though certainly not a 'space' instrument, this provided useful experience in building a light weight, self-contained photometer and telemetry system.* Subsequent programs involved NASA's X-15 experimental rocket plane (which seemed to combine the capability of near-rocket altitudes with that of accurate pointing, not then available on conventional research rockets), and Aerobee sounding rockets. Results from these early SAL programs in UV filter photometry showed that earlier reports, that hot stars radiated much less energy in the UV than was expected, were incorrect and that the predictions of theory were approximately right.

Most of the effort at the Space Astronomy Laboratory, however, was directed towards the construction of Wisconsin's half of the astronomical payload for the Orbiting Astronomical Observatory. The other half would be provided by the Smithsonian Astrophysical Observatory, and the 3400 lb spacecraft by the Goddard Space Flight Center. The 500 lb Wisconsin payload contained seven reflecting ultraviolet-sensitive telescopes—four 8-inch and one 16-inch filter photometers, and two scanning spectrometers, along with their associated electronics. After the failure of the first OAO because of difficulties in the spacecraft power and guidance systems, two and a half years passed before OAO-2 was successfully launched on Dec. 7, 1968. The observatory could be pointed by ground command to any point in the sky to within one minute of arc and made to carry out any sequence of observations desired. It was the first true space observatory, and was in operation for 50 months. With OAO-2 Washburn astronomers observed about 1000 objects including planets, comets, a great variety of stars, star clusters, and galaxies. The enormous amount of new data obtained continues to yield useful results up to the present time. Among OAO results are the discovery that comets are surrounded by huge hydrogen halos; evidence that at least some novae increase their UV brightness at the same time that their visible light is fading rapidly; and that galaxies are systematically brigher in the UV than expected from the visual

*It also afforded Observatory staff and friends considerable excitement one soft summer evening as the 'launch' and flight proceeded from Second Point overlooking Lake Mendota.

colors of stars which make them up. OAO data have been used to investigate the physical properties of interstellar dust and to map the distribution of hydrogen near the sun; OAO data combined with measurements of the angular diameters of stars have enabled the first empirical determinations of the temperatures of the hotter stars.

Though UV astronomy and studies of the interstellar medium have become major activities of the Observatory, Washburn astronomers have pursued a wide variety of other astrophysical interests including observational studies of comets, planets, and the zodiacal light, and photometric measurements of the continua and spectral lines of stars of almost every type. Theoretical work here has addressed problems in a broad range of fields including stellar interiors, the transfer of radiation in gaseous nebulae and in stars, stellar winds, the shapes of spectra lines in a variety of situations, and studies of large telescope systems.



Orbiting Astronomical Observatory

Beginning with the Stebbins era, Washburn astronomers have devoted considerable effort to the design and construction of new instrumentation.* In addition to instruments already mentioned, there have been developed a variety of photoelectric spectrum scanning devices and also an echelle spectrograph, which makes it possible to carry out detailed studies of spectral lines without the use of Coudé optical systems. Development of the echelle here began a revival of interst in this type of instrument for use in stellar astronomy. The first automatic, computer-operated ground-based telescope was designed and constructed by the late J. F. McNall (of the Space Astronomy Laboratory) who was also a co-designer, with members of Lick Observatory, of the image intensifier-image dissector detector now used at several observatories. Recently the 36-inch telescope at Pine Bluff has been refurbished and instrument hardware and software made so that Washburn instruments can be easily used at the Kitt Peak National Observatory.

As the number of staff and graduate students increased in the 1960's and new activities developed, the administrative demands on the director became increasingly time-consuming. Consequently, it was decided that upon Code's resignation as Director in 1969, this position would henceforth be rotated among the staff. Osterbrock served in this capacity from 1969-1972, Bless from 1972-1976, and Mathis currently holds this position. In 1973 Osterbrock left Wisconsin to become the Director of Lick Observatory, the third from Washburn to do so.

The Department did not escape the turbulence of the Vietnam war years; early on the morning of August 24, 1970, Sterling Hall was badly damaged by a bomb which killed one physicist and injured other occupants. By a stroke of good fortune, the last astronomer had left the building a few minutes before the blast. Unfortunately, departmental quarters and several research projects, including a just-completed Ph.D. thesis, were damaged extensively. Nearly half of the floor space had to be evacuated during the year of reconstruction.

And so we recognize a century of contributions to astronomy by Washburn Observatory. Older traditions of research, such as the properties of the interstellar medium and the development of innovative astronomical instrumentation, are still being pursued along with more recent activities such as space astronomy. New directions are being established. We have every hope that Washburn Observatory's second century will be as exciting and productive as the first.

R. C. Bless, May 1978

*Partly to make the best use of the small telescopes and limited observing times available in Wisconsin.

2000-7M8A141-78

Obser.

Washburn Observatory

1876-77 Wisconsin State Legislature provided funds for maintenance of an observatory on the condition that funds for construction were donated or privately raised

1877- Gov. Cadwallader C. Washburn donated the necessary funds for construction of the observatory

1878 Washburn Observatory constructed
David R. Jones- architect
(Jones had an architectural office in Madison from c. 1872 to 1885)

Observatory was equipped with a 15 1/2 inch telescope, the third largest telescope in the U.S. at that time

Telescope was produced by Clark Brothers of Cambridge, Mass. Measured 15 1/2 inches in diameter and 20 feet in length

Observatory was also equipped with standard and sidereal time clocks, an astronomy library (donated by Cyrus Woodman) and provided office space for the director

First director of the observatory was James C. Watson, formerly the professor of astronomy at the University of Michigan
Watson was internationally famous for his research on asteroids- he had discovered 22 asteroids
Watson arrived in Madison in 1878 in order to supervise the construction of the observatory

1879- Watson had a Student's Observatory and a Solar Observatory (also called the Magnetic Observatory) constructed at his own expense
The Solar Observatory was located in the side of the hill south of Washburn Observatory

1880 Death of James C. Watson

1881-85 Edward S. Holden served as director

1887-1935 George Comstock-director

Observatory Hill Office Building

Date of construction unknown
Originally the house was the residence of U.W. professor of mental philosophy, Daniel Read; Read occupied the house from 1864 to 1866
1866 the house and property (including the site of Washburn Observatory) were purchased by the university for use and development as an experimental farm
1867-78 house was used as the official residence for presidents of the university (Presidents Chadbourne, Twombly and Bascom)
1878-1959- served as the residence and later the office for the director of the observatory
1959-72-departmental offices for the School of Social Work
1972-date -Graduate departments of Health Services Administration and Health Systems Engineering

Washburn Observatory-occupation by departments

		Research contributions
1878-1959	Astronomy	Joel Stebbins-developed astronomical photometry using photo-cells as detectors, and adapted the selenium cell and the photoelectric cell to a high accuracy system for measuring starlight (1922)
		A. Whitford- developed the first electronic amplifier for use in astronomical photometry
		Astronomy Department relocated in Sterling Hall
1959-date	Institution for Research in the Humanities	

References:

"When It's Dark On Observatory Hill- The 100th Anniversary of Washburn Observatory", Charles M. Huffer

Curti,Merle and Carstensen, Vernon, The University of Wisconsin: The History 1848-1925, published in 1948.

WASHBURN OBSERVATORY, 1878-1978

I

It is not clear what prompted former Wisconsin Governor C. C. Washburn's interest in astronomy; perhaps it was comments by the University Regents in 1869 that no institution of higher learning could aspire to the status of a university without an observatory; or perhaps it had to do with the establishment in 1876 of a magnetic observatory at the University, the only one of its kind in the country at that time. In any case, ~~it was at Washburn's instigation that included~~ in "An Act to permanently provide for deficiencies in the University fund income" (passed by the legislature on March 6, 1876), Washburn instigated a provision ~~was a provision~~ which specified that "the sum of $3000 annually shall be set apart for astronomical work and for instruction in Astronomy . . . so soon as a complete and well-equipped observatory shall be given to the University in its own grounds without cost to the State, provided that such an observatory shall be completed within three years from the passage of this act." Along with the stipulation that state residents should not be required to pay tuition, this was the only condition placed on the use of the money, which was raised by a property tax.*

On Sept. 18, 1877, UW President John Bascom announced that Governor Washburn intended to meet the provisions of the act and provide a fully equipped observatory, including a telescope, which was specified to be larger than the 15-inch Harvard refractor. Washburn, a six-term member of Congress, Civil War Major-General, and Wisconsin governor in 1871-73,

*In 1876 $3000 represented one-seventh of the University's state-provided budget!

had been defeated in his try for re-election and so was devoting all of his attention to his business affairs. On the day before he was formally to select the site for the new observatory, his flour mill in Minneapolis exploded, killing several workers. Nonetheless he kept his appointment with the Regents before setting off for Minneapolis, perhaps thinking that it would be wiser to present a confident appearance to the business world in the face of this disaster than to delay the donation of the observatory.* The observatory site was lovely -- 100 feet above Lake Mendota to the north, isolated from Madison to the east by the University campus, and surrounded by orchards and a vineyard.

Construction of the observatory began in May, 1878; the Clarks of Massachusetts were asked to build the telescope. With an aperture of 15.6 inches, it was then the third largest refractor in the U.S., after the 26-inch and 18-inch instruments at the Naval Observatory and Dearborn Observatory, respectively. (Including the European refractors ~~in the list~~ dropped the Wisconsin instrument only ~~to fourth place~~ ~~one notch~~ one place, though there were many more larger reflectors at the time.)

President Bascom wanted an active and prominent astronomer to become the Observatory's first director. ~~and found him in~~ James C. Watson of the University of Michigan (then probably the country's most prominent school for astronomy) ~~was such a person~~ was such a person.† Watson had an international reputation for his discovery of 22 minor planets and for his book Theoretical Astronomy, the standard work in English for many years. He had become controversial with his claims for the discovery of the intra-Mercurial planet, Vulcan, first

---

*This confidence was well-founded; when he died in 1881 his estate was valued at more than three million dollars.

†Bascom commented, "...it is the intention of the Legislature and of the Regents of the University...that the Observatory shall not be merely a monumental appendage to instruction, but shall be vigorously used in the general interests of science."

predicted by Leverrier 20 years earlier to account for the then unknown relativistic perturbation of Mercury's orbit. To judge by contemporary newspaper accounts, Watson was wooed by Wisconsin and Michigan with an ardor nowadays reserved for football coaches. However, Wisconsin, with its newer and larger telescope, won the day and in October, 1878, Watson occupied the Director's residence next to the Observatory, which had just been vacated by President Bascom.

With characteristic energy, Watson supervised the completion of the original structure, started work on the east wing (which included the Director's office), and with his own money began construction of the Students' Observatory, a short distance to the northeast of the main building, and of the Solar Observatory on the side of a steep hill south of the building. The former contained a small transit instrument and a 6-inch Clark refractor belonging to S. W. Burnham, then a court reporter in Chicago who came to Madison on weekends to search for double stars. This instrument was also to be used for instruction, enabling the 15-inch to be used for research. The Solar Observatory was intended for observations of the putative intra-Mercurial planets (Watson interpreting his 1878 eclipse observations as indicating two such objects). A 12-inch diameter underground tube led to a siderostat and long focus objective by which the sky near the sun could be examined visually. (The notion that such a device can enhance visibility of objects near the sun dies hard and is still periodically revived.) Unfortunately, Watson did not live to complete these projects since he died suddenly in November, 1880, when he was only 42. This was a great loss to the University. In less than two years at Madison he had become known not only as a distinguished astronomer, but had established a reputation as an excellent teacher, which was recognized in the local press: "His lectures are instructive, and that too, which few college professors' lectures are, intensely interesting."

Watson's successor was Edward S. Holden who came to Wisconsin from the U. S. Naval Observatory in 1881. Although Watson had not had the opportunity to make any observations himself, the 15-inch was ready for ~~research~~ use by the Spring of 1881* and when Holden finished the first volume of the Washburn Observatory Publications (Sept. 30, 1881), a considerable amount of visual work was underway. The observers were Burnham (who, with his 6-inch telescope had recently returned from a visit to Mount Hamilton where he observed many double stars as a test of that site for the planned Lick Observatory), G. C. Comstock (later Holden's successor as Director), and Holden himself. These observations were primarily micrometer measurements of double stars, but also included catalogs of nebulae and of red stars, and observations and drawings of the comet of 1881.

By 1884, the Observatory was equipped and set on a course of research it was to follow for the next 40 years. In addition to the 15- and 6-inch Clark telescopes (the latter purchased from Burnham), the observatory had

---

*This was the occasion of a newspaper notice on April 9, 1881 in which Holden emphasized the astronomers' need for uninterrupted nights when working, and that in return for the public's consideration in this matter, the telescope would be available on the first and third Wednesdays of each month to anyone interested in viewing celestial objects. This practice has been maintained to this day.

acquired an excellent 5-inch meridian circle constructed by the Repsolds of Hamburg, which was mounted in the west wing of the main building. All told, Washburn had given more than $65,000 to the Observatory, a very substantial sum in those days. In addition, Cyrus Woodman, like Washburn a New England expatriate, had long wished to associate his name with that of his friend and one-time law partner.* After Washburn's death, Woodman found his opportunity by endowing the Observatory with $5000 to support an astronomical library, an endowment still in existence today. By 1884 the Woodman library was a substantial one counting 1000 volumes and 600 pamphlets in its collection.

Three accurate pendulum clocks were also maintained, one for sidereal time, the other two for standard time. The Observatory set local time in Madison by controlling various clocks in the city, including one at the state Supreme Court, the Western Union office, the Park Hotel, and the Wisconsin State Journal,+ as well as a clock in the University President's office where it ~~rang~~ controlled bells signalling the beginning and end of class periods (then as now 50 minutes long). In addition the Observatory earned several hundred dollars a year by selling the time to Wisconsin railroads.

expressed in relation to the heavens above

---

*Woodman had once suggested that he and Washburn donate money to establish a School of Agriculture at the University, an idea which did not appeal to Washburn.

+A Milwaukee newspaper, apparently skeptical of the value of astronomy, commented in 1882 on the time-keeping service of the Observatory: "It is hoped that in this way that the Washburn Observatory may be of ... practical value to the community, and that the wise liberality of its founder ... may be vindicated."

In 1880, the president of the Lick trustees had tried to interest Watson in becoming the director of the new California Observatory, but Watson died only a few months later before reaching any decision. Holden, the scientific advisor to the Lick trust, left Wisconsin to become the President of the University of California in 1885. He became the Director of Lick Observatory when the 36-inch refractor was completed three years later. For a little more than a year after Holden's departure, John E. Davis, the professor of physics whose enthusiastic research in electromagnetism had led to the establishment of the magnetic observatory at Madison, took charge of the Observatory. A permanent director was not appointed immediately after Holden's departure because President Bascom's essentially forced resignation was soon to take effect and a new president had yet to be found. In the summer of 1887, the geologist T. C. Chamberlin* became president of the University and in August of that year, G. C. Comstock, then at Ohio State, returned to Madison as Associate Director of Washburn Observatory, with Asaph Hall of the Naval Observatory as non-resident Director. This awkward arrangement, perhaps occasioned by Comstock's relative youth (he was 32 on his return to Wisconsin) or by his lack of a Ph.D. degree, ended a few years later and Comstock became the third Director of the Observatory, an office he held for years longer than anyone else. Comstock had been trained at Michigan by Watson, the latter bringing him to Wisconsin as an assistant astronomer in 1879. Except for two years as professor of mathematics at Ohio State, Comstock's career was

*Chamberlin later became well-known to astronomers for his work with Moulton on the planetesimal theory of the origin of the solar system.

1922
1887
35

spent at Wisconsin. His astronomical work was that of precise, visual positional observations, a tradition begun by Holden. His first research, an accurate determination of the constant of aberration, along with an associated investigation of atmospheric refraction, quickly brought him to the attention of his peers. Throughout his long career he also measured visual binary stars, not only as objects of intrinsic interest, but also as part of an investigation of the proper motion of faint stars. This work indicated that some stars were intrinsically faint (and not just far away) and was an early hint of the concept of giant and dwarf stars. An important colleague of Comstock's for nearly 30 years was Albert S. Flint, an expert in visual positional astronomy with the meridian circle. Flint died in 1923 with the reduction of the last ten years of his observational work unfinished; this work was held in such high regard that the Department of Meridianal Astronomy of the Carnegie Institution undertook to complete it, finally doing so in 1938.

Comstock was prominent in the professional activities of his day; he was involved in the founding of the American Astronomical Society in 1897 and served the Society for ten years as its first secretary, and as its President in 1925; he was the chairman of the AAS committee formed to coordinate the observations of Halley's comet in 1910. In 1899 Comstock became the first Wisconsin faculty member to be elected to the National Academy of Sciences and five years later was appointed the first Dean of Wisconsin's Graduate School, a position he held for 16 years.

II

Since the founding of the Observatory, Washburn astronomers had relied entirely on visual techniques for their research, paying little attention to the rapidly expanding uses of photography in astronomy. This situation changed abruptly in 1922 when Professor Joel Stebbins left the University of Illinois to become the fourth Director of Washburn Observatory. For several years Stebbins had been trying to develop electrical means of detecting starlight, first with selenium cells and then beginning in 1913 with the more sensitive photocells. Dr. Jacob Kunz, a colleague of Stebbins's at Illinois, made these detectors in his laboratory while Stebbins tested them at the telescope. As these photocells were finally developed, they generally consisted of a quartz tube, the inside of which was coated with potassium hydride. Electrons emitted by this coating when it was exposed to light were collected at a ring anode kept at about +250 volts with respect to the coating, and the resulting current was detected by an electrometer. Two people were required -- one at the telescope to set and guide on the stars and the other to measure the rate at which the string electrometer received an electrical charge from the photocell. Thus when Stebbins came to Wisconsin with his photocells the Observatory passed immediately from the 300-year old era of visual astronomy to that of the new-fangled techniques of photoelectric astronomy, with not even a passing glance at photographic astronomy.

The Kunz tubes were very sensitive--more so than many modern photocathodes--but their use at the telescope with the delicate electrometers as detectors was difficult and required considerable experimental skill.

The Lindemann electrometer, first used by Stebbins in 1927, improved this situation considerably since it could operate in any position, an obvious advantage at the telescope. However, the greatest improvement came in 1932 when A. E. Whitford at Washburn succeeded in constructing the first workable D.C. amplifier suitable for astronomical use. Although several people had attempted to use a new type of vacuum tube to amplify the feeble photoelectric currents, these attempts had not been successful because of fairly large random fluctuations in the amplified signal. Whitford solved this problem by enclosing the photocell and certain of the electronics in an airtight container which was then evacuated. This decreased the troublesome fluctuations to less than a tenth of their previous value and resulted in a four-fold increase in the sensitivity of the amplifier photometer compared to the older electrometer photometer. In addition, the two million-fold current amplification meant that the output signal could be measured by a galvanometer, a more rugged type of instrument than the electrometer; this simplified work at the telescope, and made it possible to attack an extremely wide range of problems. Stebbins first exploited one of the chief virtues of the photocell, i.e. its ability to detect small variations in the intensity of light, variations too small to be detected by eye or photographically. In particular, Stebbins and Huffer (who was awarded the first Wisconsin Ph.D. in astronomy and remained as a faculty member) found several spectroscopic binaries also to be eclipsing systems which enabled them to derive fundamental data concerning the sizes, brightnesses, and masses of these stars. They also determined accurate light curves of Cepheid variables and showed that essentially all very high luminosity red stars were intrinsically variable. Huffer continued to specialize in photoelectric photometry of variable stars until his retirement from the University in 1961.*

Immediately following Trumpler's demonstration in 1930 of the existence of dust between the stars, Stebbins, Huffer, and Whitford investigated the distribution of the clouds of obscuring matter in our Galaxy by measuring the colors of more than 700 luminous, blue stars, another application to which the photocell was well suited. The observations were made at the 15-inch telescope using the photocell electrometer combination. Given the stringent demands photoelectric astronomy places on the quality of the sky and the relative scarcity of such skies in Madison, this program was a particularly impressive achievement. After 1933 the electrometer was replaced by Whitford's amplifier and the Washburn astronomers observed 600 more such stars with the large reflectors at Mt. Wilson. Thus began a program of research on interstellar matter which 45 years later is still flourishing at Washburn. One of the highlights of this effort was Stebbins's determination in 1932 of the currently accepted size of our galaxy by his measurement of the effect of interstellar dust on the brightness of the distance indicators Shapley had used in his work on this problem. Stebbins's result, that the sun is about 30,000 light years from the center of the Milky Way galaxy, the outer edge of which is about 50,000 light years from the center, has scarcely been improved upon since. This demonstration that our galaxy was about half the size previously thought, combined with the somewhat later Wisconsin photo-

---

*He also served as secretary of the American Astronomical Society from 1946 to 1955.

electric work which showed that our neighboring spiral galaxy in Andromeda was about twice as large as had been previously believed, removed the large and somewhat disturbing difference in size between these two spiral galaxies. A by-product of the early work on the colors of stars was the important result that the intrinsic brightness of the hot, luminous stars (useful as distance indicators) was two to three times greater than previously realized.

Another notable achievement of Washburn astronomers came in the 1940's when they showed that interstellar dust in various directions in space dimmed light of different wavelengths in a way which departed systematically from earlier results. In 1958, Whitford extended these investigations to the near infrared and published an extinction curve for interstellar matter which remains the standard against which other such determinations are measured. In this work the Wisconsin astronomers used the so-called six color photometry system, i.e. they measured the brightness of objects in six wavelength bands spaced from the violet to the near infrared. They devised this system for use on galaxies, in particular, as a means of determining the velocity of recession (the red-shift) of distant galaxies by measuring their colors over a wide spectral region. Using this system Stebbins and his colleagues not only determined accurate colors and magnitudes of galaxies, but also of globular star clusters, and of a wide variety of stars; from the latter they derived the color temperatures of stars which were the standard values for many years. This color system was the forerunner of modern photometric systems.

In the mid-thirties another important advance in the techniques of photoelectric astronomy occurred when Washburn astronomers began experimenting with the new photomultiplier detectors being developed by V. K. Zworykin at RCA. In this type of tube, electrons released from the light sensitive surface are not immediately collected as in a Kunz tube, but are first directed to a series of dynodes each of which releases 3 or 4 electrons for each electron incident upon it. In this way the initially weak photocurrent is increased by about one million times within the tube before it is sent to the amplifier. The first astronomical use of this detector was made in 1937 by Whitford and Kron in their automatic telescope guider. The Second World War interrupted this work, but by the late 1940's the RCA photomultiplier was in regular use at Washburn Observatory, along with pen chart recorders for the output signal. With these developments, astronomical photoelectric photometry had in essence achieved its modern form. .

In 1948 Stebbins retired as Director of Washburn Observatory. More than any other astronomer he was associated with the development of photoelectric astronomy, beginning with instruments able to detect only the moon and ending with photoelectric measurements of faint galaxies. The achievements of his long and remarkably fruitful career were recognized by his colleagues by his election to the National Academy of Sciences in 1920, by his election as President of the American Astronomical Society in 1940, and in 1941 when he was the recipient of the Bruce medal of the Astronomical Society of the Pacific.

A. E. Whitford succeeded Stebbins as Director of Washburn. In the following decade research at Washburn continued along the directions set during the Stebbins era. (Perhaps the only departure was the Observatory's first venture into photographic astronomy which took place in 1956 when Code and Houck took photographs of the Milky Way in both the northern and southern hemispheres with a wide angle camera developed at Yerkes Observatory during the war.) Other aspects did change, however. For the first 70 years of its existence Washburn had remained a separate entity within the University. In 1948, however, it became part of the College of Letters and Science and by 1958 offered greatly expanded opportunities for advanced study in astronomy. Some astronomy has been taught at Wisconsin since the University was founded in 1849. In fact, J. W. Sterling, the University's first faculty member, was described as a professor of mathematics, natural philosophy, and astronomy. Throughout the University's early years, most juniors or seniors took nearly a year of astronomy. By the turn of the century several courses were given--general astronomy, celestial mechanics, practical astronomy, and astrophysics, and on an individual basis, graduate instruction. The total enrollment in these courses then was about 35. By the mid-thirties astronomy enrollments had increased to about 100, and by 1942 to more than 200, partially as a result of the war-inspired interest in navigation, which ~~alone had~~ produced an enrollment of 80 students in the navigation course. ~~an enrollment of about 80 students~~. In 1950 the first graduate courses in astronomy were listed in the UW catalog, and by the mid-fifties several advanced undergraduate courses as well as four graduate courses were offered.

Until this period only three astronomy Ph.D.'s had been awarded by the University (to C.M. Huffer, O.J. Eggen, and T.E. Houck), a graduate program being restricted by the limited course offerings and by an increasingly obsolescent telescope. In 1933 the 15-inch had been thoroughly refurbished, everything being replaced except the lens, tube, and declination axis. However, both Madison and the University were growing, producing more lights, smoke, and dust thus making astronomical research on Observatory Hill more and more difficult.† In a 1942 report to UW President Dykstra, Stebbins pointed out the need for a larger, modern telescope at a nearby, but better location. Whitford undertook the tasks of obtaining both a new country observatory and adequate space for offices, shops, library and instruction for the Department, which had outgrown its facilities in the original building. The former was realized in the mid-fifties, when the Wisconsin Alumni Research Foundation agreed to provide $200,000 for the construction of a new observatory at a dark sky site near the village of Pine Bluff, about 15 miles west of Madison. The 36-inch mirror was ground and polished at the Yerkes Observatory optical shop, and Boller and Chivens constructed the telescope.* A few years later they also provided a 16-inch reflector which replaced a 12-inch telescope in the smaller dome at Pine Bluff. The new observatory was dedicated on June 30, 1958 (at the 100th meeting of the American Astronomical Society); Joel Stebbins was the principal

---

*This instrument (along with an identical telescope now at McDonald Observatory) was the first to be built by this firm.

†A song by Irving Berlin, "When It's Dark on Observatory Hill" indicated its use for other purposes.

speaker. Suitable quarters for the Department were obtained in the new wing of Sterling Hall (the physics building), which was occupied by the astronomers in 1959. (A) Thus when Whitford went to California in 1958 to become the Director of Lick Observatory, he left behind an observatory well provided in its research equipment, its physical quarters, and in its academic course offerings for advanced training in astronomy.*

Insert at (A): Finally, through Whitford's representation, Wisconsin was one of the original founding members of AURA which established and operates the Kitt Peak National Observatory.

~~*A list of all astronomy Ph.D's so far awarded by the University is given in the Appendix.~~

III

A. D. Code, Whitford's successor as Director, was no stranger to Wisconsin, having served on the Washburn staff in 1951-53. On his return to Madison from California, Code was accompanied by a Caltech colleague, D. E. Osterbrock. Code and Osterbrock established what became the two primary strands of research at Washburn over the next twenty years--ultraviolet astronomy from space vehicles and the study of the properties of interstellar matter. (substances spread & among the stars.)

Osterbrock and his colleagues carried out extensive observations and theoretical calculations which helped to clarify the physical conditions--the temperatures, densities, chemical abundances, and dynamics--in diffuse nebulae, plantetary nebulae, novae and supernovae remnants. The work of this group also showed that the emission line spectra of unusual systems like quasi-stellar objects and the centers of active galaxies could be understood by the same techniques used in the analysis of gaseous nebulae. Another significant result of this work, largely due to Mathis, was that the ratio of the abundances of hydrogen to helium in gaseous nebulae is constant not only in our galaxy, but also among nebulae in nearby galaxies as well. The large numbers of graduate students and of post-doctoral fellows who were associated with Osterbrock during this period comprise a significant fraction of the current researchers in this field.

immense bodies in interstellar dust or gases

rare star which may shine 100 million times as brightly as the sun

a star that suddenly >'s its light output tremendously & then fades to its former obscurity in a few weeks or months or years.

9-9130

In recent years observational studies of interstellar matter at Wisconsin have expanded into the ultraviolet spectral region (through the OAO-2, ANS, Copernicus, and IUE satellite) into the x-ray region (through work carried out by the Space Physics group at the University) and most recently into the radio region of the spectrum with the research carried on by Washburn's newest staff member.

Early in 1958, while he was considering a return to Wisconsin, Code was among scientists asked to comment on the possible astronomical uses of small satellites. Code responded with a suggested program of photometry in the ultraviolet (a region of the spectrum absorbed by the earth's atmosphere and, therefore, unobservable from the ground), which was a natural extension of both his own research and the traditions of Washburn Observatory. Late in that year Congress established the National Aeronautics and Space Administration, which quickly moved to begin the satellite program that evolved ultimately into the Orbiting Astronomical Observatory project. In 1959, Code, with the late T. E. Houck, formed the Space Astronony Laboratory, this consisting of a small group of astronomers, technicians, and students within Washburn, who began to study in detail the possibilities and problems of UV astronomy.

Several smaller projects were undertaken, beginning with the flight of a sky brightness photometer carried aloft by a weather balloon. Though certainly not a 'space' instrument, this provided useful experience in building a light weight, self-contained photometer and telemetry system.* Subsequent programs involved NASA's X-15 experimental rocket plane (which seemed to combine the capability of near-rocket altitudes with that of accurate pointing, not then available on conventional research rockets), and Aerobee sounding rockets. Results from these early SAL programs in UV filter photometry showed that earlier reports, that hot stars radiated much less energy in the UV than was expected, were incorrect and that the predictions of theory were approximately right.

Most of the effort at SAL, however, was directed towards the construction of Wisconsin's half of the astronomical payload for the OAO. The other half would be provided by the Smithsonian Astrophysical Observatory, and the 3400 lb spacecraft by the Goddard Space Flight Center. The 500 lb Wisconsin payload contained seven reflecting ultraviolet-sensitive telescopes--four 8-inch and one 16-inch filter photometers, and two scanning spectrometers, along with their associated electronics. After the failure of the first OAO because of difficulties in the spacecraft power and guidance systems, two and a half years passed before OAO-2 was successfully launched on Dec. 7, 1968.

---

*It also afforded Observatory staff and friends considerable excitement one soft summer evening as the 'launch' and flight proceeded from Second Point overlooking Lake Mendota.

The observatory could be pointed by ground command to any point in the sky to within one minute of arc and made to carry out any sequence of observations desired. It was the first true space observatory, and was in operation for 50 months. With OAO-2 Washburn astronomers observed about 1000 objects including planets, comets, a great variety of stars, star clusters, and galaxies. The enormous amount of new data obtained continues to yield useful results up to the present time. Among OAO results are the discovery that comets are surrounded by huge hydrogen halos; evidence that at least some novae increase their UV brightness at the same time that their visible light is fading rapidly; and that galaxies are systematically brighter in the UV than expected from the visual colors of stars which ~~make~~ compose them ~~up.~~ OAO data have been used to investigate the physical properties of interstellar dust and to map the distribution of hydrogen near the sun; OAO data combined with measurements of the angular diameters of stars have enabled the first empirical determinations of the temperatures of the hotter stars.

Though UV astronomy and studies of the interstellar medium have become major activities of the Observatory, Washburn astronomers have pursued a wide variety of other astrophysical interests including observational studies of comets, planets, and the zodiacal light, and photometric measurements of the continua and spectral lines of stars of almost every type.

Theoretical work here has addressed problems in a broad range of fields including stellar interiors, the transfer of radiation in gaseous nebulae and in stars, stellar winds, the shapes of spectral lines in a variety of situations, and studies of large telescope systems.

Beginning with the Stebbins era, Washburn astronomers have devoted considerable effort to the design and construction of new instrumentation.* In addition to instruments already mentioned, there have been developed a variety of photoelectric spectrum scanning devices and also an echelle spectrograph, which makes it possible to carry out detailed studies of spectral lines without the use of Coudé optical systems. Development of the echelle here began a revival of interest in this type of instrument for use in stellar astronomy. The first automatic, computer-operated ground-based telescope was designed and constructed by the late J. F. McNall (of the Space Astronomy Laboratory) who was also a co-designer, with members of Lick Observatory, of the image intensifier-image dissector detector now used at several observatories. Recently the 36-inch telescope at Pine Bluff has been refurbished and instrument hardware and software made so that Washburn instruments can be easily used at the Kitt Peak National Observatory.

As the number of staff and graduate students increased in

---

*Partly to make the best use of the small telescopes and limited observing times available in Wisconsin.

the 1960's and new activities developed, the administrative demands on the director became increasingly time-consuming. Consequently, it was decided that upon Code's resignation as Director in 1969, this position would henceforth be rotated among the staff. Osterbrock served in this capacity from 1969-1972, Bless from 1972-1976, and Mathis currently holds this position. In 1973 Osterbrock left Wisconsin to become the Director of Lick Observatory, the third from Washburn to do so.

The Department did not escape the turbulence of the Vietnam war years; early on the morning of August 24, 1970, Sterling Hall was badly damaged by a bomb which killed one physicist and injured other occupants. By a stroke of good fortune, the last atronomer had left the building a few minutes before the blast. Unfortunately, departmental quarters and several research projects, including a just-completed Ph.D. thesis, were damaged extensively. Nearly half of the floor space had to be evacuated during the year of reconstruction.

And so we recognize a century of contributions to astronomy by Washburn Observatory. As older traditions of research, such as the properties of the interstellar medium, and the development of innovative astronomical instrumentation, are developed further along with more recent activities such as space astronomy, new directions are being established. We have every hope that Washburn Observatory's second century will be as exciting and productive as the first.

R. C. Bless

May 1978

PUBLICATIONS

OF THE

WASHBURN OBSERVATORY

OF THE

UNIVERSITY OF WISCONSIN

VOLUME XV, PART 5

SPACE REDDENING IN THE GALAXY FROM THE COLORS OF 733 B-STARS

By JOEL STEBBINS and C. M. HUFFER

Madison, Wisconsin
1934

PUBLICATIONS

OF THE

WASHBURN OBSERVATORY

OF THE

UNIVERSITY OF WISCONSIN

VOLUME XV, PART 5

SPACE REDDENING IN THE GALAXY FROM THE COLORS OF 733 B-STARS

By JOEL STEBBINS and C. M. HUFFER

MADISON, WISCONSIN
1934

XXI

SPACE REDDENING IN THE GALAXY FROM THE COLORS OF 733 B-STARS

By Joel Stebbins and C. M. Huffer

1. Introduction. The photo-electric cell furnishes an excellent means for the determination of the colors of the brighter stars. As has often been proposed, two cells with metals of widely different color-sensitivities may be used, but because of the practical difficulties with a multiple installation we have found it advantageous to use a single cell with suitable filters. The method has been used on an extensive scale by Guthnick[1] and later by Bottlinger[2], at Berlin-Babelsberg. When the photo-electric photometer was installed on the 40-inch refractor at the Yerkes Observatory by Mr. Stebbins in 1929, one of the first applications of the instrument by Mr. Elvey was the determination of color-indices of stars already on the spectrographic program at Yerkes[3]. A year later Mr. Stebbins took a photometer to Mount Wilson where it was possible with the large reflectors to measure the light and colors of some of the clusters and brighter nebulae.

The present investigation of B-stars, undertaken at Madison, grew out of a conversation with Dr. Robert Trumpler during a visit at the Lick Observatory in the autumn of 1930. In his study of the open clusters, Trumpler[4] had become convinced of a considerable absorption of light in the spaces of our galaxy, as revealed by the reddening of faint stars in the Milky Way. The B-stars, because of their great intrinsic luminosities, are among the most distant stars for a given apparent magnitude, and hence would be good objects to observe for the space reddening. As the problem appealed to us it would be promising to measure the colors of stars of similar spectra inside and outside of apparently obscured regions. As Trumpler had already devoted some attention to the problem, which was new to us at the time, he kindly agreed to furnish a list of several scores of B-stars which because of their relation to the star clouds and dark regions of the Milky Way would furnish the tests desired.

We had not gone far with the observations before it became obvious that a more elaborate program would have to be undertaken. The list which Trumpler had drawn up included naked-eye O- and B-stars mostly in low galactic latitudes, with similar stars in higher latitudes for comparison. We soon realized it was not feasible to compare the color of only one star in a dark region with another star out in the clear, and thus detect a reddening effect caused by the apparent obscuring material near the first star. The differences in color between such stars were not as marked as had been hoped, and because of the dispersion in the colors of stars of the same spectra

[1] *Astronomische Nachrichten*, **210**, 345, 1920.
[2] *Veröffentlichungen Berlin-Babelsberg*, **3**, *Heft* 4, 1923.
[3] *Astrophysical Journal*, **74**, 298, 1931.
[4] *Lick Observatory Bulletin*, **14**, 145, 1930.

it was better to compare them in groups of dozens rather than by twos or threes. Moreover, we were soon aware that the reddest B-stars were within a few degrees of the galactic equator, and that the strongest reddening was among the faintest stars. It would be well then to measure B-stars as faint as could be reached with the equipment available.

2. Observing List. The observing list finally grew to include all stars north of declination—15°, brighter than visual magnitude 7.5, and of classes B0 to B5 in the Draper Catalogue. When a revised classification for many of the stars by Plaskett and Pearce[5] and others became available, it was found that a considerable number of O-stars as well as some of spectra as late as B8 or B9 had been included. Additional B8- and B9-stars, taken for calibration, were afterward transferred to the main list. Also at the start a few other O-stars and some stars fainter than magnitude 7.5 with the rough classification B were measured. The total numbers available for the present study are 733 stars from O to B9, and 110 comparison stars from A to M. The B-stars are distributed as in Table I.

TABLE I

Class	No. Stars	Class	No. Stars
O	43	B6	9
B0	50	B7	24
B1	25	B8	38
B2	99	B9	13
B3	243	B	8
B4	6	Composite	3
B5	172		
		Total	733

3. Cell and Filters. The color-sensitivity of the cell, and the transmission curves of the two filters used throughout the work, were determined in the laboratory of physics at Madison through the kindness of Professor Mendenhall. Mr. Charles F. De Voe placed a working installation at our disposal and assisted in some of the measures. By means of a quartz monochromator and compensated vacuum thermopile, the sensitivity of the cell and the transmission of the filters were determined for equal energy at different wave-lengths; the results are in Table II. It would be a matter of some difficulty to measure accurately the characteristics of the 15-inch objective, and we have assumed a transmission resulting from a thickness of 20 mm each of ordinary crown and flint glass. As the measures for the cell and filters are considerably more accurate than this guess for the objective, there is no need of discussing the data in Table II in greater detail.

The amount of light lost through the filters is rather strikingly exhibited in Figure 1, also the difference between the spectral regions used. The loss of about one stellar magnitude in a filter is not particularly serious; that much and more can sometimes be made up elsewhere in the installation. The best photo-electric cell may be several

[5]*Publications Dominion Astrophysical Observatory,* **5**, No. 2, 1931; No. 3, 1933.

TABLE II

Color-Sensitivities of Cell with Filters

Wave-Length	Cell QK302	Transmission			On Telescope		
		Objective	68a	GG5a	Clear	68a	GG5a
3300	12	.00	.66	......	....	....	......
3400	15	.00	.78	......	0.0	0.0	......
3500	18	.12	.84	......	2.2	1.8	......
3600	22	.37	.87	......	8.1	7.0	0.0
3700	28	.50	.875	.025	14.0	12.2	0.4
3800	36	.62	.865	.036	22.3	19.3	0.8
3900	50	.76	.835	.048	38.0	31.7	1.8
4000	71	.85	.795	.058	60.4	48.0	3.5
4100	112	.84	.725	.072	94.1	68.2	6.8
4200	168	.85	.62	.086	143	88.7	12.3
4300	222	.87	.50	.104	193	96.5	20.1
4400	277	.89	.38	.126	247	93.9	31.1
4500	298	.92	.28	.190	274	76.7	52.1
4600	238	.95	.185	.360	226	41.8	81.4
4700	160	.97	.10	.670	155	15.5	104
4800	105	.98	.045	.840	103	4.6	86.5
4900	70	.98	.01	.890	68.6	0.7	61.1
5000	51	.98	.00	.910	50.0	0.0	45.5
5100	35	.98	....	.915	34.3	....	31.4
5200	25	.98	....	.92	24.5	....	22.5
5300	18	.98	....	.92	17.6	....	16.2
5400	14	.98	....	.92	13.7	....	12.6
5500	11	.98	....	.92	10.8	....	9.9
5600	7	.98	....	.92	6.9	....	6.3
5700	4	.98	....	.92	3.9	....	3.6
5800	2	.98	....	.92	2.0	....	1.8
5900	0	.98	....	.92	0.0	....	0.0
		Effective Wave-length			4500	4260	4770

times as sensitive as the next one available, and the difference between good and poor insulation may mean another factor of two or more. Also it will be shown in the sequel that color-indices determined from the two rather near regions covered by the filters compare favorably with the usual photographic and visual results. What the cell loses in leverage by having the spectral regions close together it gains in the greater precision of the measures, unless the stars are too faint.

4. Atmospheric Extinction. Considerable care was spent on the determination of the atmospheric extinction, but for stars not far apart in the sky the effect of the atmosphere is largely eliminated. In accordance with our regular practice the quality of the sky was estimated on each night according to the observer's judgment; also a few standard stars were measured at low altitudes from time to time to determine the factor for the night. The adopted differential extinction is given by the formula,

$$\text{Reduction to no atmosphere} = 0^{\mathrm{M}}.05\ f \sec z,$$

where the factor f ranges from about 1.5 to 2.5, depending upon the night. Our tables for Madison, giving the quantity 0.20 sec z, with arguments declination and hour angle, are convenient for deriving the differential extinction. We are well aware of the summary nature of this procedure for correcting for the extinction, but it seems to be good enough for the purpose. As far as possible it is best to determine the extinction from the program stars themselves, by a comparison of measures on the same groups on different nights. Sometimes after a good series of measures the sky may cloud over before standard stars can be taken; while if the standard stars are observed first the sky may change or cloud over, leaving us with only a well-determined extinction factor for our pains.

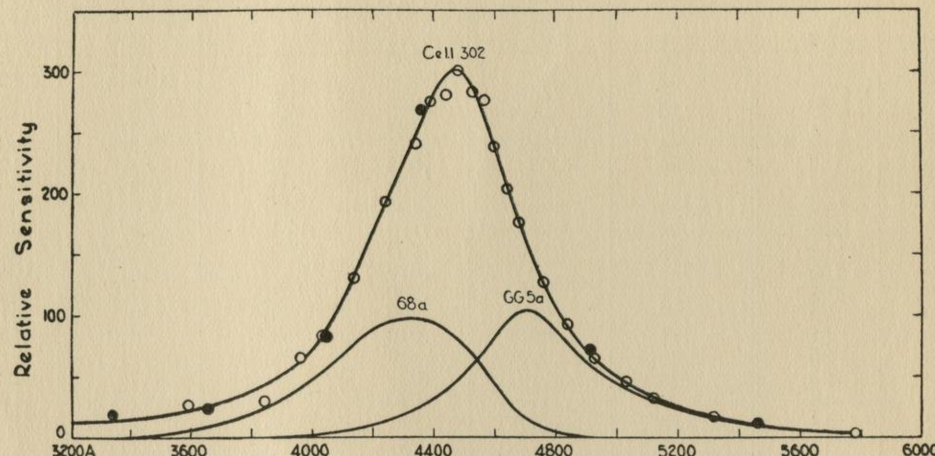


FIGURE 1 — Color-Curves of Cell and Filters

5. Normal Colors. The normal colors of B-stars were taken from the means for stars brighter than visual magnitude 6.0 and more than 15° from the galactic equator, as in Table III. The mean value B0.6 in the table was derived from seven B0- and four B1-stars, three stars being rejected as possibly reddened. Classes B7, B8, and B9 were also bunched together as B8.

TABLE III

Spectrum	Color-Index	No. Stars
O8	$-0^{\mathrm{M}}.23$	1
O9	$-$ .24	1
B0.6	$-$ .211	11
B2	$-$ .210	13
B3	$-$ .183	37
B5	$-$ .160	23
B8	$-$ .145	26

Because of their known concentration in low latitude and hence the lack of comparison stars of the same class, we did not intend to study the O-stars at all; but those that were observed seemed to fit in with the results for the B-stars. Only four O-stars were measured with latitude greater than 15°, and two of these, θ^1 and θ^2 Orionis are in the Orion nebula. We are then left with the two stars to be called of normal color, H.D. 37043, ι Orionis, spectrum O8; and H.D. 214680, 10 Lacertae, spectrum O9.

The summary value $-0\overset{M}{.}23$ was adopted for O-stars, and the resulting color-excesses give conservative measures for space reddening.

There were also measured 110 comparison stars of Classes A to M, from the Mount Wilson Classification[6], all giants, and with galactic latitudes greater than 10°. The adopted mean values for the B-stars and the comparison stars are in Table IV, and are shown graphically in Figure 2.

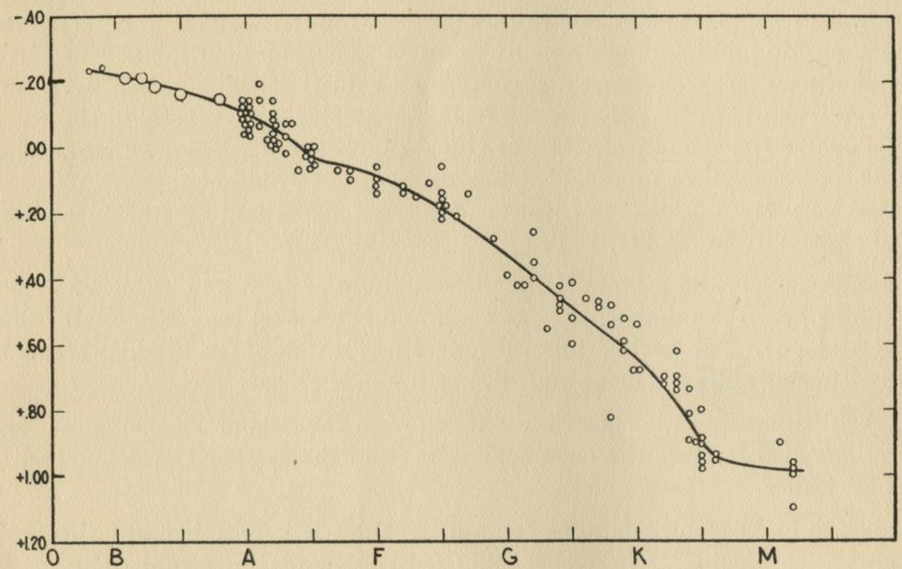


FIGURE 2 — Normal Colors

TABLE IV

B-Stars		Comparison Stars	
Class	Color-Index	Class	Color-Index
O	$-0\overset{M}{.}23$	A0	$-0\overset{M}{.}10$
B0	− .22	A5	+ .03
B1	− .21	F0	+ .09
B2	− .20	F5	+ .18
B3	− .19	G0	+ .33
B4	− .18	G5	+ .49
B5	− .17	K0	+ .64
B6	− .16	K5	+ .90
B7	− .14		
B8	− .13		
B9	− .12		

[6] *Mount Wilson Contributions*, 9, 444, 1920; 11, 283, 1922.

6. The Observations. The observations were taken on 114 nights, extending from November 12, 1930, to March 26, 1932. About three-fourths of the measures were made by Mr. Huffer, and the remainder by Mr. Stebbins who was absent at Mount Wilson for part of the time. When feasible the stars were observed near the meridian, usually following the order of right ascension unless the differences in declination were too great. The greatest care was taken with the identification of the B-stars, and for stars fainter than magnitude 6.5 the fields were charted from the Durchmusterung. Since these stars are at one end of the spectral sequence, every mis-identification would mean the apparent detection of a star showing space reddening. The danger was constantly in mind and occasionally as much as half an hour might be spent on a single star when there was something confusing about the field. Ordinarily, however, the observations went smoothly enough from star to star, with a total of three or four minutes devoted to each object. It was aimed to measure each star on two nights; in case of discordance one or more additional observations would be taken. We are confident that very few mistakes in identification were made, and no star once observed has been omitted from the list.

The measures of the B-stars in the present study are given in Table V. The first four columns give the number, the position, and the visual magnitude, all from the Draper Catalogue. For double stars the magnitude is that of the brighter component, while for eclipsing stars the magnitude at maximum is given.

In the fifth column the spectrum is taken from the lists of Plaskett and Pearce[7]. For stars not in these lists the classification is from the Draper Catalogue and is indicated by italics.

The sixth and seventh columns contain the galactic longitude and latitude taken from the Vatican Tables, where the pole used is that of Newcomb, right ascension $12^h44^m.4$, declination $+26°.8$ (1900). The necessary correction $+23°.6$ has been added to the tabular longitude to bring the starting point to the intersection of the galactic circle with the equator. The longitude is rounded off to the nearest degree, and the latitude to the same figure except when it is less than 8°, when the tenth is given.

The color-index in the eighth column is the value measured with the filters referred to in Table I, and is already corrected for differential atmospheric extinction.

The average deviation and the number of observations are in the ninth and tenth columns. An observation usually comprised four measures through each filter, taken alternately. All measures of one night were combined into one observation.

The eleventh column gives the color-excess, E, obtained by subtracting the normal color-index in Table IV from the observed color-index in the eighth column. As usual the plus sign indicates that the star is redder than normal. Parentheses indicate that the star was rejected or omitted from the further discussion.

The twelfth column gives the intensity of the interstellar calcium listed by Plaskett and Pearce, and wherever given is always accompanied by the letter *k* in the classification of the spectrum.

[7] *Op. cit.*

The thirteenth column gives the distance r in parsecs, computed by formula (2) in Section 10.

The rejected stars, noted in the remarks at the end of Table V, were first those of rough classification B, assumed to be B5 for obtaining the color-excesses. Though the numerical values are rough, every one of these eight stars is strongly colored. Three stars of composite spectra and two variable stars were rejected, but the eclipsing systems were retained. Finally there are three strongly reddened stars of classification B8s which were omitted as being possibly objects of high luminosity like Rigel, as also were a few double stars where the presence of the second components may change the colors.

The comparison stars in Table VI were measured in the same fashion as the B-stars. The spectra were taken from the Mount Wilson lists[8], except for some of the fainter A-stars, where there is no difference between giants and dwarfs. Our color-scale is based exclusively upon the giants.

[8] *Op. cit.*

TABLE V
Observations of B-Stars

H. D.	R. A.	Decl.	Mag.	Spec.	l	b	Color-Index	A. D.	No.	E	Ca	r
	h m	° ′			°	°	M	M		M		pscs
108	0 0.9	+63 7	7.36	O6fqk	85	+ 0.4	.00	±.03	4	+.23	7.2	1500
593	0 5.3	+59 6	6.70	B2sk	85	− 3.7	−.14	±.00	2	+.06	4.7	580
698	0 6.3	+57 39	7.08	B9sek	85	− 5.1	.00	±.04	2	+.12	5.6	280
829	0 7.6	+37 9	6.57	B3sk	82	−25	−.15	±.00	2	+.04	4.2	420
886	0 8.1	+14 38	2.87	B2ss	77	−48	−.19	±.03	3	+.01	.....	100
1337	0 12.5	+50 53	6.12	O8nk	85	−12	−.20	±.02	2	+.03	9.0	1000
1976	0 18.9	+51 28	5.36	B4n	86	−12	−.15	±.02	2	+.03	.....	170
2083	0 20.0	+71 15	6.94	B0k	88	+ 8	−.12	±.00	2	+.10	6.0	960
2329	0 22.1	+58 0	7.24	B3k	87	− 5.1	−.04	±.04	4	+.15	5.4	440
2654	0 25.1	+61 48	7.31	B3	88	− 1.4	−.08	±.04	4	+.11	.....	480
2729	0 25.7	+65 58	6.14	B7n	88	+ 2.9	−.12	±.02	2	+.02	.....	170
2905	0 27.3	+62 23	4.24	B0k	88	− 0.8	−.08	±.00	2	+.14	5.2	280
3240	0 30.5	+53 38	5.14	B8	88	− 9	−.16	±.00	2	−.03	.....	110
3360	0 31.4	+53 21	3.72	B2sk	88	−10	−.22	±.01	6	−.02	3.3	150
3366	0 31.5	+72 21	7.06	B3sk	89	+ 9	−.08	±.02	2	+.11	3.3	480
3369	0 31.5	+33 10	4.44	B3	87	−30	−.18	±.02	2	+.01	.....	140
3379	0 31.6	+14 41	5.86	B3	85	−48	−.21	±.01	2	−.02	.....	280
3901	0 36.5	+49 58	4.85	B3k	89	−13	−.15	±.00	2	+.04	3.5	170
3940	0 36.9	+63 45	7.40	*B5*	89	+ 0.6	+.23	±.02	3	+.40	.....	290
3950	0 37.0	+51 48	6.93	B0k	89	−11	−.08	±.01	2	+.14	8.2	910
4142	0 38.8	+47 19	5.55	B5n	89	−16	−.19	±.01	3	−.02	.....	170
4180	0 39.2	+47 44	4.70	B5n	89	−15	−.14	±.02	2	+.03	.....	110
4727	0 44.3	+40 32	4.42	B5s	90	−23	−.18	±.01	2	−.01	.....	120
4841	0 45.4	+63 14	7.06	B7s	90	0.0	+.14	±.03	3	+.28	.....	280
5394	0 50.7	+60 11	2.25	B0nne	91	− 3.0	−.11	±.02	2	+.11	.....	100
6084	0 57.0	+51 16	6.81	B5	92	−12	−.10	±.00	2	+.07	.....	300
6118	0 57.3	+31 16	5.46	B9s	93	−32	−.14	±.01	2	−.02	.....	140
6300	0 58.9	+50 29	6.50	B4	92	−13	−.16	±.03	2	+.02	.....	300
6417	1 0.0	+57 14	7.10	B5	92	− 5.9	−.10	±.02	2	+.07	.....	350
7157	1 6.8	+61 10	6.29	B9	93	− 1.9	−.08	±.02	2	+.04	.....	170
7252	1 7.7	+60 21	7.26	B2k	93	− 2.7	−.10	±.02	2	+.10	7.0	600
7636	1 11.2	+57 6	7.6	B2ne	94	− 5.9	−.10	±.02	2	+.10	.....	630
7694	1 11.7	+54 54	7.41	B3	94	− 8	−.18	±.03	2	+.01	.....	550
8209	1 16.4	+43 4	6.62	B5n	96	−20	−.15	±.01	2	+.02	.....	260
8965	1 23.3	+59 44	7.26	B2k	95	− 3.1	−.04	±.00	2	+.16	3.4	550
9105	1 24.6	+62 51	7.46	B6sk	95	0.0	+.16	±.04	3	+.32	5.5	330
9311	1 26.6	+60 10	7.26	B5s	95	− 2.6	+.07	±.03	4	+.24	.....	360
10260	1 35.3	+60 32	6.63	*B8*	96	− 2.1	−.11	±.02	2	+.02	.....	230
10516	1 37.4	+50 11	4.19	B0ne	99	−12	−.12	±.00	2	+.10	.....	260
11241	1 45.4	+54 39	5.49	B3	99	− 7.5	−.20	±.02	2	−.01	.....	230
11415	1 47.2	+63 11	3.44	B5s	97	+ 0.8	−.17	±.02	2	.00	.....	76
11606	1 48.8	+58 47	7.04	B3nek	98	− 3.4	−.10	±.02	2	+.09	3.0	380
12301	1 55.6	+63 54	5.62	B8s	98	+ 1.8	+.05	±.02	4	+.18	.....	140
12882	2 1.1	+64 33	7.54	*B3*	98	+ 2.6	−.01	±.00	2	+.18	.....	500
13267	2 4.6	+57 11	6.36	B8s	101	− 4.3	−.01	±.00	3	+.12	.....	210
13590	2 7.6	+63 34	8.0	*B5p*	99	+ 1.8	+.02	±.02	2	+.19	.....	460
13841	2 9.8	+56 34	7.21	B2sk	102	− 4.7	−.05	±.04	3	+.15	8.7	660
13854	2 9.9	+56 36	6.42	B0sk	102	− 4.7	−.04	±.01	3	+.18	9.8	790
14010	2 11.1	+63 58	7.05	B8s	99	+ 2.4	+.10	±.01	2	+.23	.....	260
14134	2 12.1	+56 40	6.66	B2sk	102	− 4.5	+.05	±.02	4	+.25	10.0	480

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	l	b	Color-Index	A. D.	No.	E	Ca	r
	h m	° ′			°	°	M	M		M		*pscs*
14143	2 12.2	+56 43	6.66	B1sk	102	− 4.5	+.10	±.02	3	+.31	9.7	580
14220	2 12.9	+52 5	7.04	B5sk	104	− 9	−.12	±.02	2	+.05	6.0	400
14372	2 14.2	+46 51	6.08	B7	106	−14	−.14	±.02	2	.00	.....	190
14818	2 18.2	+56 10	6.24	B1sk	103	− 4.7	+.06	±.01	3	+.27	1.5	500
14951	2 19.5	+10 9	5.53	B7n	125	−46	−.18	±.00	2	−.04	.....	130
14956	2 19.6	+57 14	7.32	B1sk	103	− 3.6	+.16	±.00	2	+.37	7.5	760
15497	2 24.6	+57 15	7.20	B7s	103	− 3.3	+.26	±.06	3	+.40	.....	260
15558	2 25.1	+61 1	7.82	*B*	102	+ 0.2	+.12	±.08	3	(+.29)	.....	....
15570	2 25.2	+60 56	8.0	*B*	102	+ 0.1	+.20	±.08	2	(+.37)	.....	....
15571	2 25.2	+56 59	8.0	*B*	103	− 3.5	+.02	±.04	2	(+.19)	.....	....
15690	2 26.3	+57 5	7.7	*B3*	104	− 3.4	+.18	±.02	2	+.37	.....	460
16582	2 34.4	− 0 6	4.04	B2s	139	−52	−.24	±.04	2	−.04	.....	170
16908	2 37.6	+27 17	4.58	B3	119	−29	−.15	±.01	2	+.04	.....	150
16968	2 38.1	+34 42	7.22	*B5*	115	−23	−.10	±.02	2	+.07	.....	360
17036	2 39.0	+14 53	5.80	*B8*	127	−40	−.12	±.02	2	+.01	.....	160
17081	2 39.4	−14 17	4.39	B5	161	−60	−.16	......	1	+.01	.....	100
17088	2 39.5	+57 19	7.54	*B2*	105	− 2.4	+.25	±.05	4	+.45	.....	480
17145	2 40.0	+57 15	8.0	*B*	105	− 2.5	+.28	±.08	2	(+.45)	.....	....
17505	2 43.4	+60 1	7.11	O7k	104	+ 0.2	+.01	±.02	2	+.24	7.5	1300
17543	2 43.7	+17 3	5.30	B8	127	−37	−.16	±.02	2	−.03	.....	130
17769	2 46.0	+14 40	5.46	B6n	129	−39	−.16	±.02	2	.00	.....	140
17857	2 47.0	+63 43	7.78	*Bp*	103	+ 3.7	+.16	±.02	2	(+.33)	.....	....
18326	2 51.6	+60 10	7.91	*B*	105	+ 0.8	+.05	±.01	2	(+.22)	.....	....
18352	2 51.9	+60 53	7.00	B2sk	105	+ 1.5	−.08	±.01	2	+.12	5.0	630
18409	2 52.4	+62 19	8.0	*B*	104	+ 2.8	.00	±.02	2	(+.17)	.....	....
18537	2 53.7	+51 57	5.42	B8n	109	− 6.3	−.10	±.02	2	+.03	.....	110
18604	2 54.4	+ 8 31	4.69	B5	136	−43	−.18	±.02	2	−.01	.....	120
18883	2 57.1	+ 3 58	5.63	*B5*	141	−46	−.12	±.02	2	+.05	.....	180
19243	3 0.7	+62 0	6.54	B2nek	105	+ 2.9	+.06	±.02	2	+.26	5.0	330
19268	3 0.9	+51 50	6.17	B5	110	− 5.9	−.10	±.04	2	+.07	.....	220
19374	3 1.8	+17 30	6.09	B2s	131	−35	−.12	±.01	2	+.08	.....	420
19624	3 4.5	+51 49	6.71	*B5*	111	− 5.6	−.04	±.02	2	+.13	.....	260
19820	3 6.2	+59 11	7.09	O8nk	107	+ 0.8	+.09	±.02	3	+.32	5.7	1200
20134	3 9.1	+59 41	7.51	*B3*	107	+ 1.5	−.07	±.05	3	+.12	.....	520
20295	3 10.8	+59 16	8.5	B8	108	+ 1.2	−.02	......	1	(+.11)	.....	....
20315	3 11.0	+43 39	5.38	B7n	116	−12	−.10	±.00	2	+.04	.....	130
20336	3 11.2	+65 17	4.76	B3ek	105	+ 6.3	−.15	±.03	3	+.04	.....	170
20365	3 11.5	+49 51	5.30	B3	113	− 6.7	−.18	±.00	3	+.01	.....	210
20418	3 12.0	+49 43	5.08	B3	113	− 6.7	−.16	±.02	2	+.03	.....	190
20756	3 15.5	+20 47	5.17	B7s	131	−30	−.14	±.01	2	.00	.....	150
20809	3 16.1	+48 51	5.30	B3	114	− 7.1	−.14	±.02	2	+.05	.....	210
21071	3 18.9	+48 45	5.91	B8	114	− 6.9	−.12	±.02	3	+.01	.....	170
21278	3 20.9	+48 43	4.94	B5	115	− 6.7	−.10	±.02	2	+.07	.....	130
21362	3 21.7	+49 31	5.64	B8nn	114	− 6.0	−.09	±.00	3	+.04	.....	130
21428	3 22.2	+49 10	4.67	B5	115	− 6.3	−.12	±.02	2	+.05	.....	120
21448	3 22.4	+44 42	7.37	B3	117	−10	+.04	±.02	2	(+.23)	.....	....
21455	3 22.5	+46 37	6.20	B6	116	− 8	.00	±.03	3	+.16	.....	190
21483	3 22.7	+30 2	7.06	B3	126	−22	+.11	±.03	3	+.30	.....	360
21650	3 24.6	+41 25	7.15	B5ne	120	−12	−.09	±.00	2	+.08	.....	320
21803	3 25.8	+44 32	6.33	B2s	118	−10	−.08	±.02	2	+.12	.....	460

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	*l*	*b*	Color-Index	A. D.	No.	*E*	Ca	*r*
	h m	° ′			°	°	M	M		M		*pscs*
21856	3 26.3	+35 6	5.80	B3	124	−17	−.13	±.02	2	+.06	.....	250
22192	3 29.4	+47 51	4.26	B0e	116	− 6.7	−.14	±.01	2	+.08	.....	290
22253	3 29.9	+56 23	6.79	B1nk	111	+ 0.2	−.04	±.01	2	+.17	3.9	550
22780	3 34.6	+37 16	5.57	B8nn	124	−14	−.12	±.02	2	+.01	.....	130
22928	3 35.8	+47 28	3.10	B8n	118	− 6.3	−.16	±.01	2	−.03	.....	40
22951	3 36.0	+33 39	5.04	B2	126	−17	−.10	±.04	2	+.10	.....	210
23180	3 38.0	+31 58	3.94	B2k	128	−18	−.08	±.02	2	+.12	2.8	130
23288	3 38.9	+23 59	5.43	B7n	134	−24	−.11	±.01	2	+.03	.....	130
23302	3 39.0	+23 48	3.81	B6ne	134	−24	−.13	±.00	2	+.03	.....	66
23338	3 39.3	+24 10	4.37	B8	134	−24	−.14	±.02	2	−.01	.....	83
23408	3 39.9	+24 4	4.02	B9s	134	−24	−.13	±.01	2	−.01	.....	72
23466	3 40.3	+ 5 44	5.36	B3	149	−37	−.17	±.04	2	+.02	.....	220
23478	3 40.4	+32 0	6.51	B5n	128	−18	−.02	±.03	2	+.15	.....	220
23480	3 40.4	+23 39	4.25	B7n	134	−24	−.12	±.02	2	+.02	.....	72
23625	3 41.5	+33 18	6.36	B3	127	−17	−.02	±.02	2	+.17	.....	290
23630	3 41.5	+23 48	2.96	B5n	134	−24	−.15	±.02	2	+.02	.....	50
23675	3 41.9	+52 21	6.76	B0k	115	− 1.9	+.08	±.02	2	+.30	4.5	760
23793	3 42.8	+10 50	5.03	B3	145	−33	−.18	±.01	2	+.01	.....	180
23800	3 42.9	+52 11	6.87	B2nk	116	− 1.9	+.01	±.04	3	+.21	4.7	400
24131	3 45.5	+34 3	5.73	B2	128	−16	−.08	±.00	2	+.12	.....	290
24190	3 46.0	+33 53	7.49	B5	128	−16	−.06	±.04	2	+.11	.....	400
24398	3 47.8	+31 35	2.91	B1s	130	−17	−.04	±.01	2	+.17	.....	120
24431	3 48.1	+52 21	6.70	O8k	116	— 1.3	.00	±.00	2	+.23	6.0	1100
24432	3 48.1	+48 45	7.02	B5s	118	− 4.0	+.09	±.02	3	+.26	.....	320
24504	3 48.8	+47 35	5.34	B7n	119	− 4.9	−.12	±.00	2	+.02	.....	120
24534	3 49.1	+30 45	var.	B0nne	131	−17	+.04	±.02	2	(+.26)	.....	....
24640	3 50.0	+34 47	5.48	B3	128	−14	−.12	±.00	2	+.07	.....	210
24760	3 51.1	+39 43	2.96	B2	125	−11	−.20	±.02	2	.00	.....	91
24912	3 52.5	+35 30	4.05	O7nk	128	−14	−.14	±.02	2	+.09	5.3	380
25090	3 54.1	+62 9	7.28	B1sk	110	+ 6.6	+.04	±.02	2	+.25	4.5	830
25204	3 55.1	+12 12	3.3	B3	146	−29	−.17	±.01	3	+.02	.....	83
25340	3 56.5	− 1 50	5.25	B7	160	−38	−.16	±.00	2	−.02	.....	130
25443	3 57.4	+61 48	6.75	B0k	111	+ 6.7	+.02	±.00	2	+.24	4.5	790
25539	3 58.3	+32 18	6.70	B3k	131	−15	−.06	±.04	2	+.13	3.4	350
25558	3 58.4	+ 5 9	5.33	B5k	153	−33	−.15	±.01	2	+.02	3.7	160
25638-9	3 59.1	+62 4	7.1	B0nk	111	+ 7.0	+.08	±.01	2	+.30	4.5	830
25787	4 0.2	+51 11	7.49	B3k	118	− 0.9	−.11	±.01	2	+.08	4.2	520
25799	4 0.3	+32 6	6.87	B5n	131	−15	−.08	±.00	2	+.09	.....	280
25833	4 0.6	+33 11	6.61	B3k	131	−14	−.08	±.00	2	+.11	3.0	350
25940	4 1.4	+47 27	4.03	B3e	121	− 3.5	−.14	±.02	2	+.05	.....	110
26356	4 5.0	+83 34	5.39	B5n	95	+23	−.14	±.00	2	+.03	.....	150
26684	4 8.2	+75 52	6.63	B5n	101	+17	−.14	±.00	2	+.03	.....	260
26739	4 8.6	− 1 24	6.34	B5	161	−35	−.12	±.02	2	+.05	.....	250
26912	4 10.1	+ 8 39	4.32	B3	152	−29	−.14	±.00	2	+.05	.....	130
27192	4 12.6	+50 41	5.54	B3n	120	+ 0.1	−.12	±.02	2	+.07	.....	190
27396	4 14.3	+46 16	4.89	B4k	123	− 2.9	−.13	±.00	2	+.05	5.3	140
27795	4 18.2	+45 56	7.16	B3sk	124	− 2.6	+.02	±.05	3	+.21	3.5	460
28114	4 21.0	+ 8 22	5.99	B5n	154	−27	−.10	±.03	4	+.07	.....	180
28149	4 21.3	+22 46	5.41	B7n	142	−18	−.14	±.02	2	.00	.....	130
28446	4 24.1	+53 42	5.86	B2nk	119	+ 3.4	−.08	±.00	2	+.12	5.2	280

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	*l*	*b*	Color-Index	A. D.	No.	*E*	Ca	*r*
	h m	° ′			°	°	M	M		M		*pscs*
28497	4 24.5	−13 17	5.50	B3ne	177	−37	−.15	±.00	2	+.04	.....	200
29248	4 31.3	− 3 33	4.12	B2s	167	−31	−.22	±.02	2	−.02	.....	180
29335	4 32.1	+ 0 48	5.32	B8	163	−29	−.14	±.00	2	−.01	.....	130
29376	4 32.5	+ 7 7	6.89	B5k	157	−25	−.14	±.00	2	+.03	4.2	330
29763	4 36.2	+22 46	4.33	B5n	144	−15	−.16	±.00	2	+.01	.....	91
29866	4 37.3	+40 36	6.10	B5nnek	130	− 3.6	−.08	±.00	2	+.09	3.0	190
30076	4 39.3	− 8 41	5.87	B5ne	173	−32	−.15	±.04	3	+.02	.....	190
30112	4 39.6	+ 0 23	7.28	B3	164	−27	−.15	±.01	2	+.04	.....	520
30211	4 40.5	− 3 26	4.18	B5	168	−29	−.14	±.00	2	+.03	.....	96
30614	4 44.1	+66 10	4.38	O9sek	111	+13	−.14	±.00	2	+.09	10.3	440
30650	4 44.4	+43 24	7.37	B5n	129	− 0.8	−.12	±.02	2	+.05	.....	380
30836	4 45.9	+ 5 26	3.78	B2s	160	−23	−.20	±.02	4	.00	.....	160
30870	4 46.2	+ 9 49	6.08	B5n	157	−21	−.06	±.01	2	+.11	.....	190
31237	4 49.0	+ 2 17	3.87	B2s	164	−24	−.21	±.00	2	−.01	.....	170
31327	4 49.7	+36 1	6.18	B2sk	135	− 4.6	+.08	±.00	2	+.28	5.0	360
31331	4 49.7	+ 0 19	5.86	B6	166	−25	−.11	±.01	2	+.05	.....	190
31617	4 52.2	+43 11	7.34	B2sk	130	+ 0.2	−.10	±.01	2	+.10	6.0	720
31726	4 53.1	−14 24	5.87	*B3*	181	−31	−.20	±.01	2	−.01	.....	280
32069	4 55.5	+40 56	3.94	B1+K4	132	− 0.7	−.18	±.00	2	......	.....	....
32343	4 57.4	+58 50	5.31	B3e	118	+10	−.14	±.01	2	+.05	.....	210
32446	4 58.2	+44 55	7.97	*B3*	129	+ 2.1	−.04	±.03	2	+.15	.....	630
32612	4 59.3	−14 31	6.35	*B3*	182	−30	−.16	±.02	2	+.03	.....	350
32630	4 59.5	+41 6	3.28	B3	133	0.0	−.21	±.00	3	−.02	.....	83
32641	4 59.6	+22 56	6.66	B5n	147	−11	−.06	±.02	2	+.11	.....	240
32656	4 59.7	+26 17	6.56	B5n	145	− 9	−.09	±.01	3	+.08	.....	240
32672	4 59.8	+38 23	7.7	*B3*	135	− 1.6	−.08	±.02	2	+.11	.....	580
32686	4 59.9	− 3 11	5.98	B5	171	−.25	−.16	±.02	2	+.01	.....	220
32990	5 2.0	+24 8	5.50	B3k	147	−10	−.08	±.00	2	+.11	6.2	210
32991	5 2.0	+21 34	5.95	B3nek	149	−11	−.04	±.01	3	+.15	4.5	210
33152	5 3.2	+36 53	7.8	B2e	136	− 2.0	.00	......	1	+.20	.....	690
33203	5 3.5	+37 11	6.17	B2k	136	− 1.7	+.21	±.03	3	(+.41)	.....	....
33328	5 4.4	− 8 53	4.34	B3nk	177	−26	−.16	±.02	2	+.03	.....	110
33604	5 6.3	+40 5	7.32	B3sek	134	+ 0.4	−.12	±.00	2	+.07	5.0	580
33988	5 9.0	+46 19	6.94	B5ne	129	+ 4.5	−.02	±.02	2	+.15	.....	260
34078	5 9.7	+34 12	5.81	O9ssk	139	− 2.5	−.07	±.02	3	+.16	4.7	790
34233	5 10.8	+58 1	6.23	B5	120	+11	−.10	±.00	2	+.07	.....	230
34251	5 10.9	+18 20	7.5	B3n	153	−11	−.04	±.02	2	+.15	.....	440
34333	5 11.6	+36 31	7.56	*B5*	138	− 0.8	−.04	±.02	3	+.13	.....	400
34503	5 12.8	− 6 57	3.68	B8	176	−23	−.16	±.01	2	−.03	.....	60
34576	5 13.4	+36 34	7.38	B5n	138	− 0.5	−.10	±.01	3	+.07	.....	350
34656	5 14.0	+37 20	6.71	O6sfk	137	0.0	−.06	......	1	+.17	5.2	1200
34748	5 14.6	− 1 31	6.42	B3	171	−21	−.16	±.00	2	+.03	.....	350
34759	5 14.7	+41 43	5.12	B7	134	+ 2.7	−.16	±.00	2	−.02	.....	120
34816	5 15.0	−13 17	4.29	B1k	182	−26	−.22	±.00	2	−.01	2.7	230
34863	5 15.4	−12 25	5.29	B8n	182	−25	−.12	±.02	2	+.01	.....	110
34921	5 15.8	+37 35	7.39	B0ne	137	+ 0.5	−.01	±.04	3	+.21	.....	1000
34959	5 16.1	+ 3 54	6.41	B3	166	−18	−.18	±.00	2	+.01	.....	350
34989	5 16.4	+ 8 20	5.71	B2k	162	−15	−.18	±.02	2	+.02	2.8	320
35007	5 16.5	− 0 31	5.65	B3	170	−20	−.18	±.03	3	+.01	.....	240
35039	5 16.7	− 0 29	4.65	B3	170	−20	−.19	±.01	3	.00	.....	150

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	*l*	*b*	Color-Index	A. D.	No.	*E*	Ca	*r*
	h *m*	° ′			°	°	M	M		M		*pscs*
35149	5 17.6	+ 3 27	4.99	B3n	167	−18	−.19	±.01	2	.00	.....	160
35299	5 18.6	− 0 15	5.64	B3s	170	−19	−.22	±.02	2	−.03	.....	280
35337	5 18.9	−14 1	5.17	B3s	184	−25	−.18	±.01	3	+.01	.....	230
35395	5 19.3	+20 30	6.83	B2sk	152	− 8	+.02	±.02	3	+.22	3.0	520
35407	5 19.4	+ 2 15	6.32	B3n	168	−18	−.14	±.01	2	+.05	.....	290
35411	5 19.4	− 2 29	3.44	B0k	172	−20	−.22	±.02	4	.00	2.0	210
35439	5 19.6	+ 1 45	4.73	B3ne	168	−18	−.16	±.01	2	+.03	.....	140
35468	5 19.8	+ 6 16	1.70	B2s	164	−16	−.24	±.00	2	−.04	.....	60
35532	5 20.3	+16 36	6.18	B3nk	155	−10	−.16	±.01	2	+.03	4.5	280
35575	5 20.6	− 1 35	7.3	B3	172	−19	−.17	±.02	2	+.02	.....	520
35588	5 20.7	+ 0 25	6.02	B3n	170	−18	−.20	±.02	3	−.01	.....	250
35653	5 21.2	+33 52	7.50	B1sk	141	− 0.7	−.04	±.03	3	+.17	5.0	1000
35671	5 21.3	+17 53	5.31	B3	154	− 9	−.14	±.02	2	+.05	.....	210
35708	5 21.6	+21 51	4.83	B3sk	151	− 7.2	−.18	±.02	2	+.01	2.8	190
35715	5 21.6	+ 3 0	4.66	B2	168	−17	−.22	±.00	2	−.02	.....	200
35762	5 21.9	+ 3 45	6.61	B3	167	−17	−.16	±.02	2	+.03	.....	380
35777	5 22.0	− 2 27	6.56	B5n	173	−19	−.17	±.02	2	.00	.....	260
35899	5 22.8	− 2 14	7.36	B5	173	−19	−.12	±.02	2	+.05	.....	420
35912	5 22.9	+ 1 13	6.37	B3sk	169	−17	−.18	±.00	2	+.01	3.5	400
35921	5 23.0	+35 18	6.71	O9k	140	+ 0.4	−.02	±.02	3	+.21	5.7	1100
36104	5 24.2	+12 12	7.00	*B8*	160	−12	−.18	......	1	−.05	.....	280
36113	5 24.3	+20 29	6.85	B8	153	− 7.4	−.12	±.01	2	+.01	.....	250
36133	5 24.4	+ 3 3	7.5	B5	168	−16	−.12	±.02	2	+.05	.....	440
36151	5 24.6	− 7 21	6.55	B5	178	−21	−.16	±.00	2	+.01	.....	290
36166	5 24.7	+ 1 42	5.67	B3	169	−17	−.20	±.02	2	−.01	.....	250
36262	5 25.4	+12 1	7.3	B3	160	−12	−.17	±.01	2	+.02	.....	520
36267	5 25.4	+ 5 52	4.32	B4n	166	−15	−.17	±.02	3	+.01	.....	100
36285	5 25.5	− 7 31	6.24	B3	178	−21	−.20	±.03	2	−.01	.....	320
36337	5 25.9	+14 51	6.62	B8s	158	−10	−.12	±.00	2	+.01	.....	260
36351	5 26.0	+ 3 13	5.52	B3	168	−16	−.19	±.01	2	.00	.....	230
36371	5 26.2	+32 7	4.88	B3ss	143	− 0.8	−.01	±.01	3	+.18	.....	170
36374	5 26.2	+26 54	7.11	B5nn	147	− 3.6	−.01	±.00	2	+.16	.....	290
36430	5 26.5	− 6 47	6.03	B3sk	177	−20	−.19	±.04	3	.00	3.7	330
36486	5 26.9	− 0 22	2.48	B0k	171	−17	−.23	±.02	6	−.01	2.5	140
36512	5 27.1	− 7 23	4.64	B2	178	−21	−.18	±.04	2	+.02	.....	190
36576	5 27.6	+18 29	5.50	B3ek	155	− 7.8	−.11	±.01	2	+.08	2.6	210
36591	5 27.7	− 1 40	5.30	B2sk	173	−18	−.20	±.00	2	.00	3.8	320
36646	5 28.1	− 1 48	6.46	B3	173	−18	−.19	±.02	2	.00	.....	360
36653	5 28.2	+14 15	5.58	B3k	158	−10	−.16	±.00	2	+.03	2.5	240
36695	5 28.5	− 1 14	5.37	B2nk	172	−17	−.21	±.01	2	−.01	.....	250
36741	5 28.8	+ 1 20	6.42	B5	170	−16	−.20	±.01	2	−.03	.....	260
36779	5 29.0	− 1 6	6.18	B3k	172	−17	−.18	±.00	2	+.01	2.2	320
36819	5 29.3	+23 58	5.28	B3	150	− 4.6	−.14	±.00	2	+.05	.....	210
36822	5 29.3	+ 9 25	4.53	B0ssk	163	−12	−.18	±.00	2	+.04	3.3	380
36824	5 29.3	+ 5 35	6.71	B5	166	−14	−.14	±.01	2	+.03	.....	300
36861	5 29.6	+ 9 52	3.66	O8sk	162	−12	−.22	±.02	2	+.01	4.7	350
36960	5 30.1	− 6 5	4.67	B1sk	177	−19	−.24	±.00	2	−.03	2.9	320
37016	5 30.4	− 4 29	6.28	B2sk	176	−18	−.14	±.05	3	+.06	3.8	480
37017	5 30.4	− 4 34	6.54	B2	176	−18	−.14	±.02	2	+.06	.....	440
37018	5 30.4	− 4 54	4.65	B2	176	−19	−.19	±.01	2	+.01	.....	190

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	l	b	Color-Index	A. D.	No.	E	Ca	r
	h m	° ′			°	°	M	M		M		pscs
37022	5 30.4	− 5 27	5.36	O7k	176	−19	−.02	±.03	2	+.21	2.2	600
37040	5 30.5	− 4 26	6.29	B3	176	−18	−.14	±.00	2	+.05	.....	330
37041	5 30.5	− 5 29	5.17	O9k	177	−19	−.16	±.02	2	+.07	3.3	630
37043	5 30.5	− 5 59	2.87	O8sk	177	−19	−.23	±.02	2	.00	2.2	240
37055	5 30.6	− 3 19	6.33	B3	174	−18	−.18	±.03	3	+.01	.....	330
37058	5 30.6	− 4 54	7.35	B3sk	176	−19	−.13	±.05	3	+.06	3.4	580
37128	5 31.1	− 1 16	1.75	B0k	173	−17	−.20	±.04	3	+.02	3.1	100
37129	5 31.1	− 4 29	6.98	B3k	176	−18	−.17	±.04	3	+.02	2.7	460
37150	5 31.3	− 5 43	6.45	B3	177	−19	−.18	±.03	2	+.01	.....	350
37202	5 31.7	+21 5	3.00	B3e	153	− 5.6	−.20	±.02	4	−.01	.....	72
37209	5 31.7	− 6 8	5.62	B1s	177	−19	−.25	±.04	2	−.04	.....	480
37232	5 31.9	+ 8 53	6.09	B3k	164	−12	−.19	±.01	2	.00	2.3	300
37303	5 32.5	− 6 0	5.75	B3n	177	−19	−.26	±.04	2	−.07	.....	230
37334	5 32.7	− 5 0	7.30	B3	176	−18	−.20	±.00	2	−.01	.....	520
37356	5 32.9	− 4 52	6.32	B3sk	176	−18	−.18	±.06	3	+.01	4.7	380
37366	5 33.0	+30 50	7.52	*B5*	145	− 0.2	−.10	±.00	2	+.07	.....	420
37367	5 33.0	+29 10	6.00	B3s	146	− 1.1	−.05	±.01	2	+.14	.....	290
37397	5 33.2	− 1 13	6.74	B3n	173	−16	−.17	±.03	3	+.02	.....	350
37438	5 33.5	+25 50	5.00	B3	149	− 2.8	−.20	±.02	2	−.01	.....	180
37468	5 33.7	− 2 39	3.78	B0k	174	−17	−.16	......	1	+.06	4.3	240
37481	5 33.8	− 6 38	5.92	B3	178	−19	−.22	±.01	2	−.03	.....	280
37490	5 33.9	+ 4 4	4.54	B3ek	168	−14	−.19	±.02	2	.00	6.2	140
37635	5 34.8	− 9 46	6.36	B5	181	−20	−.15	±.10	3	+.02	.....	260
37657	5 35.1	+43 0	6.99	B3ne	135	+ 6.5	−.16	±.02	2	+.03	.....	400
37711	5 35.5	+16 29	4.87	B3k	157	− 7.2	−.18	±.04	3	+.01	3.1	170
37742	5 35.7	− 2 0	2.05	B0nk	174	−16	−.22	±.02	3	.00	2.0	100
37744	5 35.7	− 2 53	6.07	B3	175	−17	−.21	±.05	2	−.02	.....	300
37756	5 35.8	− 1 11	5.00	B3	173	−16	−.22	±.02	2	−.03	.....	180
37967	5 37.2	+23 10	6.06	B3ek	152	− 3.4	−.12	±.02	2	+.07	3.1	280
38010	5 37.5	+25 24	6.86	B3nnek	150	− 2.2	−.09	±.00	2	+.10	2.7	350
38622	5 42.0	+13 52	5.20	B3s	160	− 7.2	−.19	±.03	2	.00	.....	230
38672	5 42.4	+12 23	6.57	B8	162	− 7.8	−.10	±.04	2	+.03	.....	230
38771	5 43.0	− 9 42	2.20	B0k	182	−18	−.16	±.00	2	+.06	.....	110
39291	5 46.5	− 7 33	5.32	B3k	180	−16	−.20	±.03	2	−.01	2.8	210
39477	5 47.8	+30 28	7.46	B5n	147	+ 2.3	.00	±.04	4	+.17	.....	330
39698	5 49.1	+19 44	5.89	B3	156	− 2.8	−.18	±.00	2	+.01	.....	280
39777	5 49.6	− 4 5	6.35	B2k	178	−14	−.18	±.00	2	+.02	4.0	440
39970	5 50.9	+24 14	6.02	B9s	153	− 0.2	+.06	±.01	3	+.18	.....	160
40005	5 51.1	+16 21	6.91	B3k	159	− 4.1	−.14	±.02	2	+.05	.....	440
40111	5 51.8	+25 57	4.90	B0	151	+ 0.8	−.16	±.01	3	+.06	.....	400
40160	5 52.1	+46 31	7.24	B5	133	+11	−.17	±.02	2	.00	.....	380
40978	5 57.2	+46 33	6.98	B3e	133	+11	−.14	±.02	2	+.05	.....	460
41117	5 58.0	+20 8	4.71	B2ssk	157	− 0.8	−.02	±.02	4	+.18	6.7	210
41161	5 58.2	+48 15	6.51	O9nk	132	+13	−.16	±.03	2	+.07	3.4	1200
41253	5 58.8	+ 2 52	7.5	B5	172	− 9	−.08	±.05	3	+.09	.....	400
41285	5 59.1	+16 40	7.5	B5n	160	− 2.2	−.15	±.00	2	+.02	.....	400
41335	5 59.4	− 6 42	5.12	B2e	181	−13	−.18	±.02	2	+.02	.....	240
41398	5 59.8	+28 56	7.45	B0k	149	+ 3.8	−.02	±.02	2	+.20	3.5	1100
41541	6 0.7	+42 41	6.88	B5	137	+10	−.10	±.01	2	+.07	.....	300
41692	6 1.6	− 4 11	5.37	B5	179	−11	−.20	±.02	2	−.03	.....	170

TABLE V—*Continued*

H. D.	R. A.		Decl.		Mag.	Spec.	l	b	Color-Index	A. D.	No.	E	Ca	r
	h	m	°	′			°	°	M	M		M		pscs
41753	6	1.9	+14	47	4.40	B3s	162	− 2.5	−.22	±.00	3	−.03	.....	160
41756	6	1.9	− 3	20	6.75	B5	178	−11	−.14	±.02	2	+.03	.....	320
41814	6	2.2	−11	10	6.38	*B5*	185	−14	−.18	±.02	2	−.01	.....	260
41943	6	2.9	+13	59	7.4	B2	163	− 2.7	−.14	±.02	2	+.06	.....	660
42087	6	3.7	+23	8	5.76	B2sk	155	+ 1.8	−.05	±.02	4	+.15	5.4	350
42352	6	5.1	+13	40	6.67	B3	163	− 2.4	−.12	±.05	3	+.07	.....	360
42400	6	5.4	+20	56	6.86	B8s	157	+ 1.1	−.03	±.01	2	+.10	.....	280
42545	6	6.2	+16	9	4.92	B3nk	161	− 0.9	−.20	±.00	2	−.01	2.4	150
42560	6	6.3	+14	14	4.35	B3nn	163	− 1.9	−.20	±.00	2	−.01	.....	120
42597	6	6.5	+ 7	26	6.91	B2	169	− 5.0	−.17	......	1	+.03	.....	550
42655	6	6.8	+10	22	7.43	B5	166	− 3.6	−.14	±.02	2	+.03	.....	420
42690	6	7.0	− 6	31	5.09	B3s	182	−11	−.20	±.01	2	−.01	.....	220
43112	6	9.4	+13	53	5.81	B2sk	164	− 1.4	−.27	±.02	5	−.07	3.3	400
43285	6	10.3	+ 6	6	5.95	B5ne	171	− 4.8	−.18	±.02	2	−.01	.....	200
43286	6	10.3	+ 3	59	7.4	B6	173	− 5.8	−.20	±.02	2	−.04	.....	380
43301	6	10.4	+ 0	51	7.19	B5nn	175	− 7.2	−.16	±.02	2	+.01	.....	350
43317	6	10.5	+ 4	19	6.44	B5	172	− 5.6	−.16	±.02	2	+.01	.....	260
43384	6	10.8	+23	46	6.26	B2s	155	+ 3.6	+.01	±.00	2	+.21	.....	380
43818	6	13.2	+23	30	7.03	B0sk	156	+ 3.9	−.01	±.04	3	+.21	5.3	1000
44112	6	14.9	− 7	47	5.13	B3	184	−10	−.19	±.03	3	.00	.....	190
44172	6	15.3	+14	45	7.29	B5	164	+ 0.3	−.18	±.00	2	−.01	.....	400
44173	6	15.3	+11	47	6.43	B5n	166	− 1.1	−.16	±.00	2	+.01	.....	240
44458	6	16.8	−11	44	5.49	B2ne	188	−11	−.09	±.01	3	+.11	.....	240
44700	6	18.0	+ 3	49	6.25	B3s	174	− 4.2	−.17	±.02	2	+.02	.....	360
44701	6	18.0	− 3	14	6.58	B5n	180	− 7.3	−.16	±.03	2	+.01	.....	260
45314	6	21.6	+14	57	7.09	B2nek	164	+ 1.7	−.06	±.01	3	+.14	3.4	480
45321	6	21.6	− 4	32	6.07	B3	181	− 7.1	−.16	±.01	2	+.03	.....	300
45418	6	22.1	− 4	17	6.88	B5n	181	− 6.9	−.16	±.02	2	+.01	.....	300
45542	6	23.0	+20	17	4.06	B5ne	160	+ 4.5	−.17	±.01	2	.00	.....	83
45546	6	23.0	− 4	42	4.98	B3	182	− 6.9	−.19	±.02	2	.00	.....	180
45677	6	23.7	−13	0	7.46	B2se	189	−10	−.10	±.02	2	+.10	.....	790
45725	6	24.0	− 6	58	4.73	B3ne	184	− 7.7	−.18	±.00	2	+.01	.....	140
45910	6	25.2	+ 5	57	6.70	B3emq	173	− 1.6	.00	±.00	2	+.19	.....	330
45995	6	25.6	+11	19	5.83	B2nek	168	+ 1.0	−.16	±.02	2	+.04	8.0	300
46064	6	26.0	−13	5	6.09	*B3*	190	−10	−.16	±.04	2	+.03	.....	300
46150	6	26.6	+ 5	0	6.80	O6k	174	− 1.7	−.04	±.00	2	+.19	4.4	1200
46185	6	26.8	−12	30	6.76	*B5*	189	−10	−.18	±.03	2	−.01	.....	320
46223	6	27.0	+ 4	53	7.14	O8k	174	− 1.7	−.04	±.03	2	+.19	4.8	1400
46487	6	28.6	− 1	9	5.02	B3n	179	− 4.0	−.19	±.03	2	.00	.....	160
46769	6	30.1	+ 0	58	5.69	B3sk	178	− 2.8	−.12	±.00	2	+.07	.....	280
46966	6	31.1	+ 6	10	7.3	O8k	173	− 0.2	−.16	±.02	2	+.07	6.6	1700
47129	6	32.0	+ 6	13	6.06	O8ek	173	0.0	−.12	±.00	2	+.11	8.7	910
47240	6	32.5	+ 5	3	6.16	B1k	174	− 0.4	−.06	±.03	3	+.15	3.8	480
47395	6	33.3	+28	21	5.84	*B8*	153	+10	−.16	±.02	2	−.03	.....	160
47417	6	33.4	+ 7	0	7.4	B2k	173	+ 0.7	−.10	±.00	2	+.10	4.6	630
47432	6	33.5	+ 1	42	6.13	B0k	177	− 1.6	−.05	±.00	2	+.17	3.0	630
47839	6	35.5	+ 9	59	4.68	O7sk	170	+ 2.5	−.25	±.00	3	−.02	5.0	550
47887	6	35.7	+ 9	34	7.02	B2	171	+ 2.4	−.21	±.05	3	−.01	.....	580
47961	6	36.0	+ 9	57	7.27	B5s	170	+ 2.7	−.15	±.03	3	+.02	.....	460
48038	6	36.3	−12	5	6.78	*B3*	190	− 7.2	−.08	±.00	2	+.11	.....	380

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	l	b	Color-Index	A. D.	No.	E	Ca	r
	h m	° ′			°	°	M	M		M		*pscs*
48099	6 36.6	+ 6 27	6.20	O7k	173	+ 1.2	−.18	±.02	2	+.05	6.6	1100
48215	6 37.2	− 6 1	6.88	B5	185	− 4.3	−.24	±.02	2	−.07	.....	330
48434	6 38.3	+ 4 2	5.78	B0k	176	+ 0.5	−.15	±.01	2	+.07	3.0	580
48879	6 40.5	+67 41	5.04	B3	115	+24	−.18	±.00	2	+.01	.....	180
48914	6 40.7	+ 2 37	7.5	B5	177	+ 0.4	−.16	±.02	2	+.01	.....	440
48977	6 41.1	+ 8 42	5.84	B3	172	+ 3.2	−.20	±.00	2	−.01	.....	260
49340	6 42.9	+69 0	5.13	B7	113	+25	−.16	±.02	2	−.02	.....	120
49567	6 43.9	+ 1 6	6.06	B3	179	+ 0.4	−.19	±.02	2	.00	.....	300
49787	6 45.0	− 5 24	7.30	B3e	185	− 2.3	−.14	±.02	2	+.05	.....	520
49888	6 45.5	−12 29	7.4	*B5*	191	− 5.4	−.22	±.04	3	−.05	.....	420
50083	6 46.5	+ 5 13	6.76	B3e	176	+ 2.8	−.11	±.03	2	+.08	.....	380
50820	6 49.7	− 1 38	6.25	B3+Fn	182	+ 0.4	+.15	±.02	2	(+.34)	.....	....
51354	6 51.9	+18 2	7.13	B2ne	165	+10	−.22	±.01	2	−.02	.....	550
51480	6 52.4	−10 41	6.97	B9q	190	− 3.0	+.02	±.00	2	+.14	.....	210
51560	6 52.7	+37 14	7.30	B9n	146	+17	−.10	±.02	2	+.02	.....	240
52266	6 55.4	− 5 40	6.97	B2nk	186	− 0.1	−.16	±.01	2	+.04	4.5	520
52382	6 55.9	− 9 4	6.36	B2	189	− 1.5	−.05	±.03	2	+.15	.....	380
52559	6 56.6	+ 5 42	6.46	B2s	176	+ 5.2	−.12	±.03	2	+.08	.....	500
52721	6 57.2	−11 9	6.57	*B3*	191	− 2.2	−.06	±.02	2	+.13	.....	330
52918	6 57.9	− 4 6	4.89	B3n	185	+ 1.2	−.20	±.01	4	−.01	.....	150
53367	6 59.7	−10 18	7.01	B1ne	191	− 1.3	+.06	±.02	2	+.27	.....	580
53974	7 2.0	−11 8	5.28	B2n	192	− 1.1	−.12	±.02	2	+.08	.....	220
53975	7 2.0	−12 14	6.40	*B5p*	193	− 1.7	−.19	±.00	2	−.02	.....	260
55135	7 6.6	−10 16	7.16	B5e	192	+ 0.2	−.11	......	1	+.06	.....	350
55879	7 9.7	−10 8	5.99	O9sk	192	+ 1.0	−.23	±.01	2	.00	3.2	1000
57291	7 15.5	+ 3 46	6.84	B5	180	+ 9	−.18	±.04	2	−.01	.....	320
57539	7 16.6	− 5 43	6.59	B8n	189	+ 4.5	−.12	±.02	2	+.01	.....	200
57682	7 17.2	− 8 48	6.17	O9s	191	+ 3.3	−.20	±.00	2	+.03	.....	1100
58050	7 18.8	+15 43	6.37	B3e	170	+15	−.15	±.02	2	+.04	.....	350
59211	7 23.8	− 9 50	6.62	B5	193	+ 4.2	−.16	±.00	2	+.01	.....	290
59543	7 25.3	−13 46	6.94	*B5*	197	+ 2.7	−.09	±.02	2	+.08	.....	320
60325	7 28.8	−14 7	6.24	*B5*	198	+ 3.3	−.14	±.00	2	+.03	.....	240
60855	7 31.4	−14 16	5.57	*B5*	198	+ 3.8	−.16	±.02	2	+.01	.....	180
65041	7 51.7	+43 47	7.04	B3	143	+30	−.21	......	1	−.02	.....	460
65875	7 55.8	− 2 36	6.43	B2e	191	+15	−.20	±.02	4	.00	.....	440
66594	7 59.2	− 4 32	7.38	*B5*	193	+14	−.19	±.04	2	−.02	.....	420
71518	8 22.8	−14 36	6.55	*B5*	205	+14	−.16	±.04	2	+.01	.....	290
74280	8 38.0	+ 3 46	4.32	B5n	190	+27	−.22	±.01	3	−.05	.....	91
77770	8 59.5	+50 1	7.52	*B5*	136	+42	−.24	......	1	−.07	.....	440
80081	9 12.6	+37 14	3.82	B9n	153	+44	−.08	±.00	2	+.04	.....	48
83754	9 35.5	−13 53	4.96	B3	216	+29	−.18	±.02	3	+.01	.....	180
87015	9 57.2	+22 26	5.59	B3	177	+52	−.20	±.02	2	−.01	.....	240
89688	10 15.9	+ 2 47	6.53	B3	208	+47	−.14	±.04	2	.+05	.....	360
90994	10 25.2	− 0 8	4.95	B8	213	+47	−.18	±.01	3	−.05	.....	110
91316	10 27.5	+ 9 49	3.85	B0sk	201	+53	−.21	±.02	3	+.01	3.1	280
93152	10 40.3	+31 13	5.37	B9n	163	+63	−.15	±.02	2	−.03	.....	100
93521	10 42.7	+38 6	6.89	B3nn	148	+62	−.26	±.02	2	−.07	.....	380
97991	11 11.1	− 2 55	7.28	B2	229	+53	−.17	±.04	2	+.03	.....	660
100600	11 29.5	+17 21	6.0	*B3*	205	+70	−.20	±.00	2	−.01	.....	290
109387	12 29.2	+70 20	3.88	B5e	92	+46	−.18	±.00	3	−.01	.....	83

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	l	b	Color-Index	A. D.	No.	E	Ca	r
	h m	° ′			°	°	M	M		M		pscs
113797	13 01.1	+36 20	5.11	B9n	71	+80	−.12	±.00	2	.00	.....	87
116658	13 19.9	−10 38	1.21	B2	284	+52	−.23	±.00	2	−.03	.....	40
120315	13 43.6	+49 49	1.91	B3n	68	+64	−.23	±.02	3	−.04	.....	38
129956	14 40.4	+ 1 9	5.54	B9	322	+52	−.12	±.00	2	.00	.....	120
138764	15 29.0	− 8 51	5.15	B8s	324	+36	−.14	±.00	5	−.01	.....	140
139892	15 35.6	+36 58	5.07	B8n	27	+53	−.18	±.01	2	−.05	.....	100
142983	15 52.6	−13 59	4.68	B3n	324	+29	−.15	±.01	3	+.04	.....	140
144206	15 59.6	+46 19	4.64	B9	40	+47	−.18	±.00	2	−.06	.....	79
147394	16 16.7	+46 33	3.91	B7s	40	+44	−.20	±.01	3	−.06	.....	83
149757	16 31.7	−10 22	2.70	B0nnk	334	+24	−.11	±.01	5	+.11	1.8	130
149881	16 32.4	+14 40	6.59	B2k	359	+36	−.19	±.02	4	+.01	6.6	480
154445	17 0.4	− 0 45	5.62	B3k	347	+23	−.10	±.02	3	+.09	2.9	220
156110	17 10.6	+45 30	7.44	B3	38	+35	−.18	±.02	2	+.01	.....	550
156633	17 13.6	+33 12	4.8	B3	24	+32	−.20	±.00	4	−.01	.....	170
160762	17 36.6	+46 4	3.79	B3s	40	+30	−.20	±.00	4	−.01	.....	120
161056	17 38.3	− 7 2	6.20	B5n	346	+11	+.07	±.02	3	+.24	.....	170
162094	17 44.2	+34 19	6.57	B3	27	+26	−.19	±.01	2	.00	.....	380
163472	17 51.2	+ 0 42	5.73	B2	355	+12	−.08	±.02	4	+.12	.....	290
164284	17 55.3	+ 4 23	4.81	B5n	358	+13	−.14	±.01	3	+.03	.....	110
164353	17 55.6	+ 2 56	3.92	B8s	357	+12	−.13	±.01	5	.00	.....	76
164432	17 56.0	+ 6 16	6.18	B3s	0	+14	−.15	±.02	4	+.04	.....	360
164852	17 58.1	+20 50	5.09	B5	14	+19	−.15	±.00	3	+.02	.....	140
165174	17 59.6	+ 1 55	6.09	B2nk	357	+11	−.12	±.02	2	+.08	8.3	320
166182	18 4.4	+20 48	4.32	B2sk	15	+18	−.20	±.01	7	.00	5.0	200
167971	18 12.5	−12 17	7.34	*B0*	345	+ 1.5	+.22	±.00	2	+.44	.....	870
168199	18 13.5	+13 44	6.18	B5n	9	+13	−.13	±.02	3	+.04	.....	220
168797	18 16.5	+ 5 24	6.04	B5n	2	+ 9	−.13	±.01	5	+.04	.....	200
168957	18 17.3	+25 1	6.86	B3ek	20	+17	−.17	±.02	3	+.02	4.3	440
169033	18 17.6	−12 3	5.73	B8	346	+ 0.5	−.09	±.00	5	+.04	.....	150
169454	18 19.6	−14 2	6.84	*B0*	345	− 0.8	+.30	±.02	2	+.52	.....	630
169753	18 21.1	− 9 15	7.5	*B2*	349	+ 1.0	+.15	......	1	+.35	.....	520
169798	18 21.3	+22 39	6.72	B5s	18	+15	−.19	±.01	2	−.02	.....	350
170028	18 22.3	+26 10	6.83	B3n	22	+16	−.18	±.04	3	+.01	.....	360
170051	18 22.4	+26 23	6.87	B5	22	+16	−.18	±.03	3	−.01	.....	330
170111	18 22.7	+26 23	6.36	B5nk	22	+16	−.17	±.02	3	.00	2.8	240
170580	18 25.1	+ 4 0	6.50	B5	1	+ 6.1	−.07	±.04	3	+.10	.....	250
170650	18 25.5	+23 48	5.72	B5k	20	+14	−.16	±.02	3	+.01	4.6	190
170714	18 25.8	− 5 51	7.31	B5n	353	+ 1.5	+.04	±.02	3	+.21	.....	300
170740	18 25.9	−10 52	5.80	B3k	348	− 0.8	+.04	±.04	9	+.23	3.5	210
171406	18 29.6	+30 49	6.43	B5n	27	+16	−.14	±.01	3	+.03	.....	240
171780	18 31.6	+34 22	5.93	B5n	30	+17	−.18	±.01	3	−.01	.....	190
171871	18 32.0	+51 2	7.39	B2s	47	+22	−.14	±.04	3	+.06	.....	790
173087	18 38.5	+34 38	6.12	B5	31	+16	−.15	±.02	2	+.02	.....	230
173370	18 39.8	+ 1 57	5.04	B9n	1	+ 1.9	−.13	±.01	4	−.01	.....	83
174179	18 44.2	+31 39	5.78	B3sk	29	+14	−.21	±.02	4	−.02	3.4	300
174237	18 44.5	+52 53	5.76	B5n	50	+21	−.18	±.03	3	−.01	.....	180
174261	18 44.6	+21 3	6.93	B5n	19	+ 9	−.14	±.02	2	+.03	.....	300
174298	18 44.8	+23 57	6.51	B2sk	22	+10	−.12	±.02	2	+.08	4.5	520
174391	18 45.2	+15 49	6.54	B3sk	14	+ 6.9	−.17	±.02	2	+.02	4.0	420
174585	18 46.1	+32 42	5.77	B3k	30	+14	−.19	±.02	4	.00	3.5	260

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	l	b	Color-Index	A. D.	No.	E	Ca	r
	h m	° ′			°	°	M	M		M		*pscs*
174638	18 46.4	+33 15	Var.	B8+B2	31	+14	−.13	±.01	3	.....	.....	....
174959	18 48.1	+36 25	6.01	B5s	34	+15	−.16	±.02	2	+.01	.....	250
175081	18 48.6	+37 24	7.08	B5n	35	+15	−.16	±.02	3	+.01	.....	330
175426	18 50.2	+36 51	5.51	B3	34	+15	−.20	±.02	2	−.01	.....	230
175863	18 52.3	+59 53	6.94	B5	57	+22	−.11	±.05	2	+.06	.....	320
176162	18 53.8	−12 58	5.36	B7	349	− 7.8	−.13	±.03	3	+.01	.....	140
176254	18 54.3	+20 29	6.72	B3sk	19	+ 7.0	−.11	±.01	3	+.08	6.8	440
176304	18 54.5	+10 0	6.52	B2sk	10	+ 2.3	−.02	±.02	3	+.18	5.5	480
176502	18 55.5	+40 33	6.12	B5s	38	+15	−.18	±.00	2	−.01	.....	260
176582	18 55.9	+39 5	6.25	B5	37	+14	−.14	±.02	2	+.03	.....	240
176818	18 57.0	+21 22	6.86	B3	20	+ 6.8	−.06	±.02	3	+.13	.....	380
176819	18 57.0	+20 42	6.55	B2	20	+ 6.5	−.06	±.04	3	+.14	.....	420
176871	18 57.2	+26 9	5.50	B3n	25	+ 9	−.14	±.00	3	+.05	.....	200
176914	18 57.4	+28 16	6.78	B5n	27	+10	−.14	±.04	2	+.03	.....	290
177003	18 57.7	+50 24	5.24	B3	48	+18	−.20	±.00	2	−.01	.....	200
177109	18 58.2	+33 29	6.22	B3nk	32	+12	−.14	±.00	2	+.05	2.8	280
177593	19 0.3	+34 0	7.12	B5n	32	+12	−.14	±.01	2	+.03	.....	330
177624	19 0.4	+ 9 29	6.93	B5n	10	+ 0.8	−.01	±.04	3	+.16	.....	260
177648	19 0.5	+23 11	6.94	B3e	23	+ 6.9	−.05	±.03	3	+.14	.....	400
178329	19 3.1	+41 16	6.15	B3sk	39	+14	−.20	±.04	2	−.01	3.9	360
178475	19 3.7	+35 57	5.13	B5n	34	+12	−.17	±.01	3	.00	.....	130
178540	19 3.9	+24 34	6.66	B5	24	+ 6.8	−.14	±.04	2	+.03	.....	300
178591	19 4.1	+40 54	6.94	*B5*	39	+14	−.12	±.02	2	+.05	.....	330
178849	19 5.1	+34 35	6.63	B3s	33	+11	+.34	±.02	2	(+.53)	.....	....
179406	19 7.3	− 8 7	5.37	B3n	355	− 9	−.06	±.02	2	+.13	.....	170
180163	19 10.4	+38 58	4.46	B5s	38	+12	−.20	±.01	5	−.03	.....	130
180554	19 11.9	+21 13	4.60	B5n	22	+ 3.7	−.14	±.00	2	+.03	.....	100
180844	19 13.0	+32 57	7.01	B5	33	+ 9	−.19	±.02	2	−.02	.....	350
180968	19 13.5	+22 51	5.40	B0nn	24	+ 4.1	−.10	±.00	2	+.12	.....	460
181164	19 14.3	+25 53	7.32	B3sk	26	+ 5.2	−.16	±.02	2	+.03	3.5	600
181360	19 15.1	+23 7	7.50	B3	24	+ 3.9	−.08	±.02	2	+.11	.....	520
181409	19 15.3	+33 13	6.32	B3k	33	+ 8	−.22	±.00	2	−.03	2.4	330
181492	19 15.6	+31 47	6.64	B4	32	+ 7.7	−.16	±.02	3	+.02	.....	320
181858	19 17.0	− 8 23	6.49	B5s	356	−11	−.13	±.00	2	+.04	.....	320
181963	19 17.4	+25 25	7.26	B3sk	26	+4.5	−.10	±.00	2	+.09	3.5	550
181987	19 17.5	+25 23	7.3	B3n	26	+ 4.4	−.07	±.01	2	+.12	.....	420
182255	19 18.7	+26 4	4.92	B8s	27	+ 4.5	−.16	±.00	2	−.03	.....	120
182568	19 20.2	+29 26	4.86	B5	30	+ 5.8	−.17	±.01	2	.00	.....	130
183013	19 22.4	+21 27	7.23	B3	23	+ 1.6	−.12	±.00	2	+.07	.....	480
183143	19 23.0	+18 5	6.93	B8s	20	− 0.1	+.38	±.02	3	(+.51)	.....	190
183144	19 23.0	+14 5	6.26	B5n	17	− 2.0	−.17	±.01	2	.00	.....	230
183261	19 23.6	+20 2	7.15	B3n	22	+ 0.7	−.14	±.01	2	+.05	.....	440
183362	19 24.1	+37 44	6.36	B3nek	38	+ 9	−.18	±.04	2	+.01	3.1	300
183537	19 25.0	+20 4	6.39	B5nn	22	+ 0.4	−.16	±.00	2	+.01	.....	240
184171	19 28.1	+34 14	4.85	B5s	35	+ 6.6	−.18	±.01	3	−.01	.....	140
184279	19 28.6	+ 3 34	6.78	B3sk	8	− 8	−.19	±.04	2	.00	3.0	480
184502	19 29.7	+16 3	6.81	B3k	19	− 2.5	−.17	±.02	2	+.02	3.3	420
184915	19 31.5	− 7 15	5.04	B0nk	359	−14	−.14	±.02	2	+.08	4.2	400
184930	19 31.6	− 1 31	4.28	B8n	4	−11	−.17	±.03	3	−.04	.....	69
184942	19 31.7	+25 36	7.46	B3k	28	+ 1.7	−.10	±.03	3	+.09	3.2	520

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	*l*	*b*	Color-Index	A. D.	No.	*E*	Ca	*r*
	h *m*	° ′			°	°	M	M		M		*pscs*
185268	19 33.2	+29 7	6.26	B5n	31	+ 3.2	−.17	±.02	2	.00	.....	230
185418	19 33.9	+17 2	7.42	B3	21	− 2.9	−.10	±.04	3	+.09	.....	500
185507	19 34.3	+ 5 10	5.17	B3	10	− 9	−.10	±.01	3	+.09	.....	180
185780	19 35.7	+40 24	7.47	B2k	41	+ 8	−.17	±.01	3	+.03	4.7	720
185842	19 36.0	− 2 33	7.12	B5s	4	−13	−.14	±.02	2	+.03	.....	420
185859	19 36.1	+20 15	6.44	B0k	24	− 1.8	+.04	±.02	3	+.26	3.3	660
185915	19 36.4	+23 29	6.41	B8	27	− 0.3	−.11	±.01	3	+.02	.....	210
185936	19 36.5	+13 35	5.84	B5	18	− 5.2	−.15	±.01	3	+.02	.....	200
186412	19 39.1	+22 15	6.53	B5	26	− 1.4	−.16	±.01	2	+.01	.....	280
186587	19 40.2	+10 32	7.36	B5	16	− 7.4	−.06	±.02	2	+.11	.....	360
186660	19 40.6	− 3 7	6.50	B3s	4	−14	−.12	±.02	3	+.07	.....	400
186777	19 41.4	+31 10	7.35	B7s	34	+ 2.6	−.14	±.02	2	.00	.....	420
186980	19 42.4	+31 52	7.28	O8k	35	+ 2.8	−.11	±.01	2	+.12	6.3	1600
187459	19 45.0	+33 12	6.35	B0nk	36	+ 3.0	−.06	±.00	2	+.16	8.5	660
187567	19 45.5	+ 7 39	6.39	B3nek	14	−10	−.13	±.01	2	+.06	6.4	290
187811	19 46.8	+22 21	4.91	B5ne	27	− 2.9	−.18	±.02	2	−.01	.....	120
187879	19 47.2	+40 20	5.62	B2k	42	+ 6.1	−.14	±.00	2	+.06	4.3	290
187961	19 47.6	+10 6	6.48	B5n	16	− 9	−.13	±.01	2	+.04	.....	250
188001	19 47.9	+18 25	6.29	O7fk	24	− 5.1	−.10	±.07	2	+.13	9.2	1000
188209	19 49.0	+46 47	5.51	O8sk	48	+ 9	−.17	±.02	4	+.06	4.8	760
188252	19 49.2	+47 41	5.70	B2sk	49	+10	−.18	±.04	2	+.02	5.5	380
188293	19 49.3	− 8 29	5.78	B5n	0	−18	−.16	±.00	2	+.01	.....	180
188439	19 50.1	+47 34	6.15	B2nnk	49	+ 9	−.19	±.02	3	+.01	5.7	360
188461	19 50.2	+41 6	6.82	B3sk	43	+ 6.0	−.18	±.01	2	+.01	4.6	480
188665	19 51.2	+57 16	5.04	B5	58	+14	−.18	±.00	2	−.01	.....	140
188891	19 52.3	+40 8	7.22	B3	43	+ 5.2	−.17	±.01	2	+.02	.....	500
188892	19 52.3	+38 13	4.87	B7s	41	+ 4.2	−.18	±.02	3	−.04	.....	130
189066	19 53.1	+35 59	6.04	B3	39	+ 2.9	−.18	±.02	2	+.01	.....	290
189178	19 53.7	+40 6	5.43	B3n	43	+ 5.0	−.16	±.02	3	+.03	.....	190
189432	19 54.9	+37 50	6.28	B7s	41	+ 3.6	−.14	±.01	2	.00	.....	250
189687	19 56.2	+36 46	5.15	B3	40	+ 2.8	−.16	±.02	2	+.03	.....	200
189775	19 56.6	+51 47	6.02	B8n	53	+11	−.17	±.01	2	−.04	.....	150
189818	19 56.9	+57 32	7.08	B3k	58	+13	−.18	±.00	2	+.01	5.6	480
189921	19 57.4	+10 26	6.80	B7s	18	−11	−.16	±.02	2	−.02	.....	320
190025	19 57.9	+42 46	7.29	B3	46	+ 5.7	−.16	±.06	2	+.03	.....	520
190066	19 58.1	+21 52	6.55	B0sk	28	− 5.4	−.06	±.02	2	+.16	6.3	830
190429	19 59.8	+35 45	7.23	O5nfk	40	+ 1.6	−.02	±.01	2	+.21	7.8	1400
190603	20 0.7	+31 56	5.69	B0ssk	37	− 0.6	+.13	±.02	4	+.35	8.3	480
190918	20 2.2	+35 31	7.01	O9k+Ow5	40	+ 1.1	+.02	±.02	2	+.25	9.7	1300
190919	20 2.2	+35 24	7.30	B1sk	40	+ 1.0	+.08	±.02	3	+.29	5.5	790
190993	20 2.5	+23 19	5.08	B3	30	− 5.5	−.18	±.01	2	+.01	.....	190
191201	20 3.6	+35 26	7.12	B0k	40	+ 0.8	−.03	±.01	3	+.19	6.7	960
191263	20 3.9	+10 26	6.23	B5s	19	−13	−.17	±.01	2	.00	.....	280
191566	20 5.5	+35 11	7.7	B2k	40	+ 0.4	−.05	±.02	3	+.15	5.0	690
191610	20 5.7	+36 33	4.82	B3nne	41	+ 1.1	−.20	±.02	5	−.01	.....	140
191639	20 5.8	− 9 9	6.45	B2	1	−22	−.14	±.01	3	+.06	.....	420
191746	20 6.4	+28 8	6.94	B3	34	− 3.6	−.12	±.00	2	+.07	.....	420
191877	20 7.0	+21 35	6.11	B0k	29	− 7.3	−.12	±.02	2	+.10	6.2	660
192281	20 9.0	+39 58	7.47	O5n	44	+ 2.4	+.07	±.01	2	+.30	.....	1500
192422	20 9.7	+38 28	7.10	B0sk	43	+ 1.5	+.05	±.02	2	+.27	5.3	1000

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	*l*	*b*	Color-Index	A. D.	No.	*E*	Ca	*r*
	h *m*	° ′			°	°	M	M		M		*pscs*
192445	20 9.8	+36 2	7.12	B3nek	41	+ 0.1	−.12	±.02	2	+.07	4.4	400
192517	20 10.2	+29 54	6.94	B3s	36	− 3.3	−.14	±.04	3	+.05	.....	500
192539	20 10.3	+31 41	7.38	B2sk	38	− 2.3	−.04	±.01	2	+.16	4.3	720
192575	20 10.5	+67 58	6.79	B2sk	69	+17	−.06	±.02	2	+.14	4.3	550
192685	20 11.0	+25 17	4.82	B3n	32	− 6.0	−.18	±.01	4	+.01	.....	140
192987	20 12.8	+36 45	6.32	B5n	42	0.0	−.17	±.02	3	.00	.....	230
193009	20 12.9	+32 4	7.02	B0ek	38	− 2.6	−.06	±.00	2	+.16	4.3	960
193183	20 13.8	+37 55	7.12	B2sk	43	+ 0.5	+.08	±.02	3	+.28	5.5	580
193220	20 14.0	+25 20	6.78	B3	33	− 6.6	−.16	±.02	2	+.03	.....	420
193237	20 14.1	+37 43	4.88	B1qk	43	+ 0.4	+.06	±.02	6	(+.27)	.....	....
193322	20 14.6	+40 25	5.82	O8k	45	+ 1.8	−.10	±.02	4	+.13	9.1	830
193514	20 15.5	+38 57	7.29	O8k	44	+ 0.8	+.10	±.04	4	+.33	4.8	1300
193536	20 15.6	+46 0	6.28	B2k	50	+ 4.8	−.17	±.00	2	+.03	4.7	420
193683	20 16.5	+31 42	7.40	B3sk	38	− 3.5	−.19	±.01	2	.00	4.3	630
194279	20 19.7	+40 26	7.05	B0sk	46	+ 1.0	+.33	±.05	3	+.55	4.5	760
194335	20 20.0	+37 10	5.68	B3nek	43	− 0.9	−.17	±.00	2	+.02	3.4	220
194779	20 22.4	+41 1	7.66	*B*	47	+ 1.0	.00	±.08	2	(+.17)	.....	....
194839	20 22.8	+41 3	7.45	B2sk	47	+ 0.9	+.34	±.01	3	+.54	3.7	520
194883	20 23.0	+54 22	7.24	B3e	58	+ 9	−.10	±.02	2	+.09	.....	480
195089	20 24.1	+41 42	7.24	B3k	47	+ 1.1	−.12	±.01	2	+.07	5.5	480
195407	20 26.0	+36 39	7.72	*B5*	44	− 2.2	.00	......	1	+.17	.....	420
195556	20 27.0	+48 37	4.89	B3	53	+ 4.8	−.17	±.02	3	+.02	.....	170
195592	20 27.2	+43 59	7.15	B0sk	50	+ 2.0	+.30	±.01	3	+.52	4.3	790
195810	20 28.4	+10 58	3.98	B7	22	−17	−.16	±.00	2	−.02	.....	72
195965	20 29.3	+47 53	6.82	B2k	53	+ 4.0	−.15	±.01	2	+.05	4.2	520
195985	20 29.4	+44 39	7.50	B5	50	+ 2.1	−.13	±.05	2	+.04	.....	440
195986	20 29.4	+42 51	6.41	B6s	49	+ 1.0	−.16	±.02	2	.00	.....	280
196006	20 29.5	+32 34	7.08	B3s	41	− 5.1	−.18	±.00	2	+.01	.....	550
196025	20 29.6	+ 6 32	6.86	B5	19	−20	−.18	±.00	2	−.01	.....	330
196035	20 29.7	+20 38	6.28	B3s	31	−12	−.17	±.01	2	+.02	.....	380
196243	20 31.0	+29 55	7.41	B5	39	− 6.9	−.14	±.02	2	+.03	.....	420
196740	20 34.2	+23 46	5.04	B7n	34	−11	−.17	±.00	2	−.03	.....	100
196775	20 34.4	+15 29	5.92	B3	27	−16	−.18	±.00	2	+.01	.....	280
197036	20 36.0	+45 19	6.46	B3n	52	+ 1.6	−.14	±.03	2	+.05	.....	320
197419	20 38.5	+35 5	6.50	B3s	44	− 5.1	−.19	±.02	2	.00	.....	420
197511	20 39.1	+49 59	5.41	B3sk	56	+ 4.0	−.14	±.00	2	+.05	3.3	250
197637	20 39.9	+79 4	6.78	B3sk	80	+21	−.14	±.00	2	+.05	2.7	480
197770	20 40.7	+56 46	6.36	B2sk	61	+ 8	+.03	±.00	3	+.23	5.7	420
198183	20 43.5	+36 7	4.47	B6e	45	− 5.3	−.14	±.02	2	+.02	.....	100
198478	20 45.5	+45 45	4.89	B2sk	53	+ 0.6	+.05	±.01	3	+.25	4.3	210
198625	20 46.5	+46 17	6.48	B4n	54	+ 0.7	−.10	±.00	2	+.08	.....	250
198781	20 47.6	+63 40	6.38	B1nk	67	+12	−.07	±.02	3	+.14	10.0	480
198784	20 47.6	+37 36	6.97	B3k	47	− 5.0	−.04	±.03	3	+.15	3.7	400
198820	20 47.9	+32 28	6.35	B5sk	43	− 8	−.15	±.03	4	+.02	5.3	300
198846	20 48.1	+34 17	7.1	O9nnk	44	− 7.1	−.13	±.03	3	+.10	5.2	1500
199081	20 49.7	+44 0	4.68	B3k	52	− 1.2	−.16	±.01	2	+.03	.....	160
199140	20 50.1	+28 8	6.44	B1s	40	−11	−.18	±.01	2	+.03	.....	690
199216	20 50.7	+49 9	7.13	B1sk	56	+ 2.0	+.11	±.05	4	+.32	4.7	720
199356	20 51.6	+39 55	7.02	B3ek	49	− 4.1	−.03	±.03	3	+.16	3.9	400
199579	20 53.1	+44 33	6.01	O6k	53	− 1.3	−.12	±.01	2	+.11	7.8	910

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	*l*	*b*	Color-Index	A. D.	No.	*E*	Ca	*r*
	h *m*	° ′			°	°	M	M		M		*pscs*
199661	20 53.6	+56 29	6.14	B3	62	+ 6.4	−.20	±.02	3	−.01	.....	300
200120	20 56.4	+47 8	4.86	B3nne	55	0.0	−.22	±.01	3	−.03	.....	150
200310	20 57.6	+45 46	5.24	B3nk	54	− 1.0	−.20	±.00	2	−.01	2.0	170
200775	21 0.4	+67 47	7.20	B5se	71	+13	+.07	±.02	3	+.24	.....	350
200857	21 1.0	+54 51	7.16	B2k	61	+ 4.6	+.16	±.04	8	+.36	3.2	440
201254	21 3.2	+14 16	6.86	B5	30	−22	−.15	±.01	2	+.02	.....	330
201666	21 6.0	+45 20	7.52	*B5*	55	− 2.4	−.10	±.02	2	+.07	.....	420
201733	21 6.4	+45 6	6.52	B5ne	55	− 2.7	−.19	±.01	2	−.02	.....	250
201819	21 7.0	+35 53	6.40	B1nk	48	− 9	−.18	±.02	2	+.03	4.0	550
201836	21 7.1	+47 17	6.36	B5	57	− 1.2	−.11	±.00	2	+.06	.....	240
201910	21 7.5	+40 47	7.30	B5n	52	− 5.7	−.16	±.00	2	+.01	.....	360
201912	21 7.5	+29 18	6.77	B6s	43	−14	−.16	±.03	3	.00	.....	330
202214	21 9.3	+59 35	5.65	O9sk	66	+ 7.0	−.08	±.00	2	+.15	6.3	760
202347	21 10.1	+45 12	7.47	B5	55	− 3.1	−.16	±.00	2	+.01	.....	440
202349	21 10.1	+37 21	7.34	*B3*	50	− 8	−.17	±.00	2	+.02	.....	520
202654	21 12.2	+47 33	6.32	B5n	57	− 1.7	−.16	±.01	2	+.01	.....	230
202900	21 13.8	+78 34	6.95	B3	80	+20	−.06	±.02	2	+.13	.....	400
202904	21 13.8	+34 29	4.42	B3nek	48	−11	−.17	±.02	4	+.02	.....	120
203064	21 14.8	+43 31	5.06	O8nnk	55	− 4.8	−.16	±.02	2	+.07	5.8	960
203245	21 16.0	+49 6	5.65	B5	59	− 1.1	−.14	±.00	2	+.03	.....	180
203374	21 16.7	+61 25	6.64	B0nek	68	+ 7.6	+.01	±.00	2	+.23	3.5	720
203467	21 17.3	+64 27	5.18	B3nek	70	+10	−.13	±.01	2	+.06	2.7	170
203699	21 18.8	+13 37	6.71	B5e	32	−26	−.20	±.00	2	−.03	.....	300
203731	21 19.0	+40 16	7.42	B3nek	53	− 7.7	−.07	±.04	3	+.12	4.4	440
203938	21 20.2	+46 44	7.10	*B2*	58	− 3.2	+.13	±.02	3	+.33	.....	440
204172	21 21.7	+36 14	5.84	B0k	51	−11	−.19	±.03	3	+.03	4.0	630
204403	21 23.2	+36 41	5.20	B3	51	−11	−.18	±.01	2	+.01	.....	200
204536	21 24.2	+46 8	6.88	B5	58	− 4.1	−.12	±.03	3	+.05	.....	330
204722	21 25.5	+43 54	7.52	*B2*	56	− 5.8	−.10	±.04	3	+.10	.....	660
204770	21 25.8	+66 22	5.42	B5n	72	+10	−.16	±.00	2	+.01	.....	150
204860	21 26.3	+45 4	6.96	B5nk	57	− 5.1	−.14	±.01	2	+.03	4.2	320
205021	21 27.4	+70 7	3.32	B1	75	+13	−.25	±.00	2	−.04	.....	140
205060	21 27.7	+42 16	7.07	B5e	56	− 7.3	−.11	±.00	2	+.06	.....	350
205139	21 28.3	+60 1	5.52	B1sk	68	+ 5.6	−.08	±.00	2	+.13	5.7	420
205196	21 28.6	+57 4	7.36	B0sk	66	+ 3.4	+.15	±.03	3	+.37	4.8	1000
206165	21 35.2	+61 38	4.87	B2sk	70	+ 6.2	+.02	±.01	3	+.22	5.0	210
206267	21 35.9	+57 2	5.64	O6nk	67	+ 2.7	−.06	±.00	2	+.17	7.2	720
206672	21 38.6	+50 44	4.78	B3	63	− 2.3	−.16	±.00	2	+.03	3.7	170
206773	21 39.3	+57 17	6.98	B0nnek	67	+ 2.6	−.05	±.02	3	+.17	5.8	870
207198	21 42.2	+61 59	5.97	O9sk	70	+ 6.0	+.03	±.02	3	+.26	5.0	760
207329	21 43.1	+51 39	7.45	B2ek	64	− 2.1	+.03	±.01	3	+.23	5.0	580
207330	21 43.1	+48 51	4.26	B3k	62	− 4.2	−.16	±.00	3	+.03	3.7	130
207538	21 44.6	+59 14	7.03	O9ssk	69	+ 3.6	+.03	±.01	3	+.26	3.5	1300
207563	21 44.8	+20 0	6.16	B3k	42	−26	−.16	±.02	2	+.03	4.7	320
207793	21 46.5	+52 14	6.56	B2nk	65	− 1.9	+.06	±.02	3	+.26	4.8	330
208057	21 48.5	+25 27	5.05	B3k	47	−23	−.18	±.00	2	+.01	3.3	180
208095	21 48.8	+55 20	5.54	B8	67	+ 0.3	−.16	±.02	2	−.03	.....	140
208218	21 49.7	+62 13	6.76	B1sk	71	+ 5.6	+.01	±.01	3	+.22	6.3	660
208392	21 50.9	+62 8	7.10	B3nnk	71	+ 5.4	.00	±.02	3	+.19	6.3	350
208501	21 51.5	+56 8	6.01	B8s	68	+ 0.7	+.26	±.03	3	(+.39)	.....	140

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	l	b	Color-Index	A. D.	No.	E	Ca	r
	h m	° ′			°	°	M	M		M		*pscs*
208682	21 52.9	+64 52	5.85	B3nek	73	+ 7.5	−.14	±.00	2	+.05	5.4	230
208905	21 54.3	+60 49	6.90	B2k	71	+ 4.2	−.07	±.00	2	+.13	5.5	480
208947	21 54.7	+65 41	6.28	B3k	74	+ 8	−.12	±.02	2	+.07	5.2	300
209008	21 55.1	+ 6 14	5.99	B5sk	33	−37	−.16	±.02	2	+.01	4.3	250
209339	21 57.6	+62 0	6.48	B0k	72	+ 4.9	−.12	±.00	3	+.10	5.3	790
209409	21 58.1	− 2 38	4.66	B5ne	24	−44	−.14	±.02	2	+.03	.....	110
209419	21 58.2	+52 24	5.66	B5	66	− 2.9	−.16	±.03	3	+.01	.....	190
209481	21 58.7	+57 31	5.50	O9nk	69	+ 1.2	−.12	±.00	2	+.11	8.5	720
209744	22 0.6	+59 19	6.74	B2nk	70	+ 2.5	+.01	±.03	3	+.21	3.8	380
209961	22 2.0	+47 45	6.16	B3k	64	− 7.0	−.16	±.03	3	+.03	7.1	320
209975	22 2.1	+61 48	5.17	O9k	72	+ 4.4	−.12	±.00	2	+.11	9.0	630
210424	22 5.2	−12 4	5.40	B5	14	−50	−.16	±.01	2	+.01	.....	170
210628	22 6.6	+55 36	6.87	B5s	69	− 0.9	−.04	±.02	2	+.13	.....	330
210839	22 8.1	+58 56	5.19	O6nfk	71	+ 1.7	−.04	±.01	2	+.19	8.8	580
211924	22 15.5	+ 5 17	5.35	B7	36	−42	−.04	±.03	3	+.10	.....	130
212044	22 16.4	+51 21	7.08	B2ek	68	− 5.3	−.16	±.01	2	+.04	6.5	600
212076	22 16.6	+11 42	4.93	B3e	42	−37	−.16	±.02	3	+.03	.....	170
212120	22 16.9	+46 2	4.66	B5	65	−10	−.15	±.03	2	+.02	.....	120
212222	22 17.6	+41 36	6.27	B7	63	−14	−.14	±.01	2	.00	.....	210
212571	22 20.2	+ 0 52	4.64	B1nnek	33	−46	−.18	±.06	2	+.03	4.4	240
212883	22 22.4	+36 57	6.39	B2sk	61	−18	−.16	±.02	2	+.04	6.0	520
212978	22 23.1	+39 19	6.07	B3	62	−16	−.18	±.00	2	+.01	.....	300
213087	22 23.9	+64 37	5.66	B1k	76	+ 5.4	.00	±.02	2	+.21	7.0	350
213322	22 25.5	+53 44	6.59	B5	70	− 4.1	−.10	±.03	2	+.07	.....	260
213420	22 26.1	+42 36	4.54	B3k	65	−14	−.14	±.01	3	+.05	5.7	140
213571	22 27.3	+69 40	7.16	B5s	79	+10	−.14	±.02	2	+.03	.....	440
213976	22 30.1	+40 16	7.00	B5	64	−16	−.14	±.02	2	+.03	.....	350
214168	22 31.4	+39 7	5.83	B3nek	64	−17	−.14	±.02	2	+.05	4.3	230
214240	22 31.8	+49 33	6.20	B3k	69	− 8	−.11	±.00	2	+.08	6.3	290
214263	22 31.9	+37 19	6.75	B3k	63	−19	−.20	±.04	2	−.01	5.8	420
214652	22 34.6	+36 51	6.67	B3k	63	−19	−.15	±.02	2	+.04	3.3	400
214680	22 34.8	+38 32	4.91	O9sk	64	−18	−.24	±.00	2	−.01	5.4	600
214923	22 36.5	+10 19	3.61	B8	46	−42	−.14	......	1	−.01	.....	58
214930	22 36.6	+23 19	7.30	B3s	55	−31	−.12	±.02	3	+.07	.....	580
214993	22 37.0	+39 43	5.18	B1sk	65	−17	−.21	±.01	4	.00	5.0	400
215191	22 38.4	+37 17	6.22	B3k	64	−19	−.14	±.02	2	+.05	4.6	320
215371	22 39.6	+64 48	6.76	B3k	77	+ 4.7	−.11	±.04	3	+.08	3.3	380
216014	22 44.2	+64 32	6.83	B0k	78	+ 4.3	+.05	±.01	3	+.27	4.9	790
216200	22 45.8	+41 26	5.84	B3k	67	−16	−.07	±.00	2	+.12	4.0	240
216411	22 47.6	+58 28	7.16	B0sk	75	− 1.3	+.15	±.00	2	+.37	3.3	910
216916	22 51.9	+41 4	5.54	B3sk	68	−17	−.17	±.02	3	+.02	3.8	260
217050	22 52.7	+48 9	5.20	B3nek	71	−11	−.14	±.00	2	+.05	3.7	170
217101	22 53.1	+38 48	6.07	B2k	67	−19	−.17	±.04	2	+.03	3.2	380
217227	22 54.2	+43 18	7.02	B3sk	70	−15	−.16	±.02	2	+.03	4.3	520
217297	22 54.7	+63 10	7.36	B0k	78	+ 2.5	+.01	±.01	2	+.23	3.7	1000
217543	22 56.3	+38 10	6.39	B3ne	68	−20	−.16	±.02	2	+.03	.....	300
217675	22 57.3	+41 47	3.63	B5n	69	−17	−.14	±.00	2	+.03	.....	66
217811	22 58.2	+43 31	6.32	B3s	70	−16	−.12	±.02	2	+.07	.....	360
217817	22 58.3	+59 18	6.87	B3k	77	− 1.1	−.10	±.01	3	+.09	3.6	400
217891	22 58.8	+ 3 17	4.58	B5e	46	−51	−.16	±.02	2	+.01	.....	110

TABLE V—*Continued*

H. D.	R. A.	Decl.	Mag.	Spec.	l	b	Color-Index	A. D.	No.	E	Ca	r
	h m	° ′			°	°	M	M		M		*pscs*
217943	22 59.2	+59 54	6.57	B3k	77	− 0.6	−.10	±.00	2	+.09	3.1	350
218342	23 2.1	+62 41	7.46	B2	79	+ 1.7	+.10	±.04	3	+.30	.....	550
218344	23 2.1	+50 33	7.17	B3	74	− 9	−.18	±.02	2	+.01	.....	500
218376	23 2.4	+58 53	4.93	B1s	77	− 1.7	−.18	±.00	2	+.03	.....	350
218407	23 2.7	+45 33	6.56	B3k	72	−14	−.15	±.02	3	+.04	3.8	380
218440	23 3.0	+59 13	6.28	B3sk	77	− 1.5	−.12	±.02	2	+.07	4.2	350
218537	23 3.7	+63 6	6.19	B3k	79	+ 2.1	−.10	±.02	2	+.09	4.0	290
218674	23 4.8	+49 7	6.53	B3nk	74	−11	−.10	±.02	2	+.09	3.6	300
218723	23 5.2	+64 41	6.62	B3k	80	+ 3.5	−.10	±.05	3	+.09	5.3	350
218915	23 6.7	+52 31	7.06	O9sk	75	− 7.9	−.10	±.00	2	+.13	6.6	1400
219063	23 7.9	+64 11	7.22	B5	80	+ 2.9	−.12	±.02	2	+.05	.....	380
219188	23 8.9	+ 4 27	6.93	B2nk	50	−51	−.14	±.04	3	+.06	2.5	480
219523	23 11.3	+63 44	7.07	B5	80	+ 2.4	−.10	±.02	2	+.07	.....	330
219688	23 12.7	− 9 44	4.56	B5n	34	−62	−.11	±.01	2	+.06	.....	96
220057	23 15.7	+60 36	6.82	B5	79	− 0.8	−.08	±.04	4	+.09	.....	290
220562	23 19.6	+56 59	6.76	B5	79	− 4.3	−.01	±.02	3	+.16	.....	260
220598	23 19.9	+35 49	6.82	B5n	71	−24	−.16	±.05	3	+.01	.....	290
221253	23 25.4	+58 0	4.89	B3k	80	− 3.6	−.17	±.01	2	+.02	.....	170
221711	23 29.4	+54 56	7.41	B3k	79	− 6.6	−.08	±.02	2	+.11	3.5	500
223128	23 41.8	+66 13	5.94	B2sk	84	+ 3.8	−.13	±.01	4	+.07	5.4	400
223152	23 42.0	+50 41	7.47	B5	80	−11	−.12	±.04	3	+.05	.....	440
223229	23 42.6	+46 16	5.84	B3k	79	−16	−.16	±.02	2	+.03	4.1	260
223960	23 48.9	+60 18	6.98	*B0*	83	− 2.2	+.21	±.01	3	+.43	.....	720
224055	23 49.7	+61 17	7.16	B8s	83	− 1.2	+.20	±.02	3	(+.33)	.....	250
224151	23 50.5	+56 53	6.05	B0k	83	− 5.5	−.06	±.01	4	+.16	4.7	600
224544	23 53.7	+31 48	6.36	B5ne	78	−30	−.15	±.01	2	+.02	.....	240
224559	23 53.8	+45 52	6.46	B3nek	81	−16	−.18	±.02	2	+.01	3.4	320
224572	23 53.9	+55 12	4.93	B2n	83	− 7.2	−.16	±.00	2	+.04	.....	200
224868	23 56.3	+60 17	7.36	B5	84	− 2.3	−.06	±.03	2	+.11	.....	360
225094	23 58.3	+63 5	6.26	B2sk	85	+ 0.4	+.04	±.00	2	+.24	5.0	400
225095	23 58.3	+55 0	7.56	*B2p*	83	− 7.5	−.10	±.01	2	+.10	.....	690
225190	23 59.2	+53 43	7.55	*B3*	83	− 9	−.13	±.01	2	+.06	.....	550
225257	23 59.7	+57 58	6.51	B3	84	− 4.6	−.10	±.01	2	+.09	.....	330

Remarks on Table V

15558 Rough classification.
15570 " "
15571 " "
17145 " "
17857 " "
18326 " "
18409 " "
20295 Taken by mistake, faint.
21448 Double.
24534 Variable, X Persei.
32069 Composite, ζ Aurigae.
33203 Double.
50820 Composite.
174638 Composite, β Lyrae.
178849 Double.
183143 B8s.
193237 Variable, P Cygni.
194779 Rough classification.
208501 B8s.
224055 B8s.

TABLE VI

Comparison Stars

H. D.	R. A.		Decl.		Mag.	Spec.	b	Color-Index	A. D.	No.
	h	m	°	′			°	M	M	
358	0	3.2	+28	32	2.15	A1n	−34	−.19	.....	1
2774	0	26.2	+52	17	5.69	K0	−11	+.68	±.01	3
3627	0	34.0	+30	19	3.49	K3	−33	+.70	.....	1
6695	1	2.6	+20	12	5.63	A2	−43	−.03	±.04	3
7034	1	5.6	+30	53	5.04	A5	−32	+.03	±.00	2
7804	1	12.6	+ 3	5	5.28	A1n	−59	−.06	±.02	2
7964	1	14.0	+26	44	4.67	A2	−36	−.10	±.02	2
8723	1	20.9	+18	39	5.32	F0	−44	+.10	±.04	2
8763	1	21.3	+18	44	5.63	G9	−44	+.62	±.04	2
9138	1	24.9	+ 5	38	5.12	K5	−56	+.80	±.02	3
9927	1	31.9	+48	7	3.77	K4	−14	+.74	.....	1
11443	1	57.4	+29	6	3.58	F2	−32	+.14	±.04	2
11636	1	49.1	+20	19	2.72	A3	−40	−.03	±.02	2
11973	1	52.4	+23	7	4.83	A5	−37	+.07	±.02	3
12869	2	1.0	+22	11	5.08	A0	−38	−.04	±.00	2
14191	2	12.6	+19	26	5.69	A0n	−39	−.10	±.00	2
16350	2	32.3	+37	40	6.26	A0	−21	−.07	±.00	2
16811	2	36.7	+19	35	5.72	A0	−36	−.12	±.02	2
17584	2	44.2	+37	55	4.27	A8	−19	+.10	±.00	2
18519,20	2	53.5	+20	56	4.64	A3s	−33	−.07	±.00	2
19476	3	2.7	+44	29	4.00	K0	−12	+.54	±.00	2
20150	3	9.2	+20	40	4.95	A0	−31	−.10	±.00	3
23230	3	38.4	+42	16	3.93	F5	−10	+.14	±.01	2
26161	4	3.3	+31	22	6.94	F5	−15	+.21	±.00	3
31910	4	54.5	+60	18	4.22	F7p	+11	+.14	±.01	2
35317	5	18.8	− 0	57	6.11	F5	−19	+.20	.....	1
37160	5	31.4	+ 9	15	4.39	G7	−12	+.48	±.00	2
37594	5	34.5	− 3	37	5.97	A5	−17	+.04	±.00	2
46251	6	27.2	+33	6	6.38	A0	+11	−.04	±.00	2
47731	6	35.0	+28	18	6.54	G5	+10	+.60	±.02	3
48329	6	37.8	+25	14	3.18	G8	+10	+.82	±.01	3
50522	6	48.6	+58	33	4.54	G4	+23	+.42	±.01	2
53329	6	59.6	+34	38	5.60	G4	+18	+.48	±.02	2
54719	7	4.8	+30	25	4.48	K3	+17	+.72	±.00	2
56986	7	14.2	+22	10	3.51	A7	+16	+.07	±.00	3
57927	7	18.3	+27	50	5.71	F0	+19	+.11	±.02	2
58207	7	19.5	+28	0	3.89	G8	+19	+.54	±.02	2
58728	7	21.8	+21	39	5.27	F3	+18	+.15	±.00	2
59294	7	24.2	+12	13	4.85	K3	+14	+.74	±.00	2
59333	7	24.4	+21	0	7.40	A0	+18	−.06	±.02	2
60178,9	7	28.2	+32	6	1.58	A2s	+23	−.07	±.00	2
60522	7	29.8	+27	7	4.22	K6	+21	+.94	±.00	2
61110	7	32.6	+34	49	4.92	F0	+24	+.14	±.00	2
62345	7	38.4	+24	38	3.68	G7	+22	+.49	.....	1
62509	7	39.2	+28	16	1.21	G9	+24	+.52	±.00	2
66141	7	57.1	+ 2	36	4.52	K2	+17	+.72	±.04	2
66216	7	57.4	+28	4	5.04	K3	+27	+.62	±.00	2
69267	8	11.1	+ 9	30	3.76	K4	+24	+.89	±.00	2
70272	8	16.0	+43	31	4.43	K5	+34	+.94	.....	1
70569	8	17.6	+18	39	5.88	F1	+29	−.02	±.00	2

TABLE VI—*Continued*

H. D.	R. A.		Decl.		Mag.	Spec.	*b*	Color-Index	A. D.	No.
	h	*m*	°	′			°	M	M	
71369	8	22.0	+61	3	3.47	G2	+35	+.40	±.00	3
73017	8	30.9	+53	45	5.74	G4	+37	+.49	±.01	2
73471	8	33.5	+ 3	42	4.54	K2	+26	+.70	±.00	2
74739	8	40.6	+29	8	4.20	G5	+37	+.41	±.02	2
74874	8	41.5	+ 6	47	3.48	F9	+29	+.28	±.01	3
76294	8	50.1	+ 6	20	3.30	G5	+31	+.52	±.02	3
77912	9	0.2	+38	51	4.71	G3	+42	+.55	±.01	5
78715	9	4.6	+22	24	6.09	G8	+40	+.48	±.04	2
79248	9	7.9	+21	42	6.09	A0	+41	−.10	±.00	2
79452	9	9.1	+35	3	6.02	G1	+44	+.42	±.03	2
79469	9	9.2	+ 2	44	3.84	A1n	+33	−.14	.....	1
80024	9	12.3	+35	47	5.76	A2n	+44	.00	±.00	2
80290	9	13.8	+51	42	6.12	F2	+44	+.12	±.01	2
80493	9	15.0	+34	49	3.30	K5	+45	+.96	±.00	2
81937	9	23.7	+63	30	3.75	A4n	+41	+.07	.....	1
82308	9	26.1	+23	25	4.48	K6	+45	+.95	±.00	2
82328	9	26.2	+52	8	3.26	F5	+45	+.16	±.02	2
82395	9	26.6	+11	45	5.12	G9	+41	+.59	±.02	2
82523	9	27.4	+28	49	6.35	A2	+47	−.02	±.00	2
82621	9	28.0	+52	30	4.65	A0	+46	−.08	±.00	2
82635	9	28.1	+36	51	4.62	G4	+48	+.46	±.02	4
83287	9	32.2	+40	42	5.24	A5n	+48	+.05	±.01	2
83808,9	9	35.8	+10	21	3.76	F5p	+43	+.18	±.00	2
84194	9	38.3	+14	29	5.62	M2	+45	+.99	±.01	2
84441	9	40.2	+24	14	3.12	G0	+49	+.39	±.01	2
84561	9	41.0	+12	17	5.87	K5	+45	+.90	±.00	2
84999	9	43.9	+59	31	3.89	A8	+45	+.07	±.00	2
86663	9	54.9	+ 8	31	4.89	M2	+46	+.98	±.00	2
87696	10	1.6	+35	44	4.47	A5	+54	.00	±.00	3
87837	10	2.6	+10	30	4.58	K5	+49	+.89	±.01	2
89025	10	11.1	+23	55	3.65	F0	+55	+.06	±.01	2
89449	10	14.3	+19	59	4.97	F5	+55	+.18	±.00	2
89758	10	16.4	+42	0	3.21	K5	+56	+.97	±.01	2
90537	10	22.1	+37	13	4.41	G6	+58	+.46	.....	1
90882	10	24.4	− 2	14	5.24	A0n	+45	−.14	±.00	2
91232	10	26.9	+14	39	5.74	M2	+56	+1.10	±.04	3
92769	10	37.6	+26	51	5.55	A2	+62	−.01	±.00	2
92941	10	38.8	+20	17	6.10	A3	+61	+.02	±.03	3
93273	10	41.1	+13	16	6.80	A2	+58	−.01	±.02	3
95128	10	53.9	+40	58	5.14	G2	+63	+.26	±.00	2
95212	10	54.5	+46	4	5.67	K5	+61	+.90	±.02	2
95382	10	55.6	+ 6	38	5.08	A2	+57	−.02	±.02	2
96097	10	59.9	+ 7	53	4.66	F5	+59	+.06	±.02	2
97244	11	6.5	+14	56	6.29	A5	+64	+.02	±.02	2
97778	11	9.9	+23	39	4.87	M2	+68	+.97	±.02	2
98262	11	13.1	+33	38	3.71	K4	+69	+.81	±.00	2
98547	11	15.2	+17	52	6.87	A0	+68	−.08	±.05	3
99028	11	18.7	+11	5	4.03	F4	+64	+.11	±.02	2
102212	11	40.7	+ 7	5	4.20	M1	+65	+.90	±.01	2
136849	15	17.8	+33	17	5.36	A0n	+56	−.14	±.00	2

TABLE VI—*Continued*

H. D.	R. A.		Decl.		Mag.	Spec.	b	Color-Index	A. D.	No.
	h	m	°	′			°	M	M	
199253	20	50.9	+13	21	5.39	K0	−21	+.68	±.00	2
204862	21	26.3	+11	43	5.94	A0	−28	−.10	±.02	2
210418	22	5.2	+ 5	42	3.70	A2	−40	−.08	.....	1
214994	22	37.0	+28	48	4.85	A2s	−27	−.14	.....	1
215182	22	38.3	+29	42	3.10	G1	−26	+.42	.....	1
216735	22	50.2	+ 8	17	4.95	A0	−45	−.12	.....	1
218658	23	4.7	+74	51	4.56	G2	+13	+.35	.....	1
220657	23	20.4	+22	51	4.57	F6	−36	+.21	.....	1
220825	23	21.8	+ 0	42	4.94	A3s	−56	−.07	.....	1
222603	23	37.0	+ 1	14	4.61	A5	−58	.00	.....	1

7. Comparison with Other Observers. Of the other series of photo-electric color-indices we have selected that of Bottlinger[9] for the comparison shown in Figure 3. There are 55 stars in common with our list of comparison stars, and to these we have

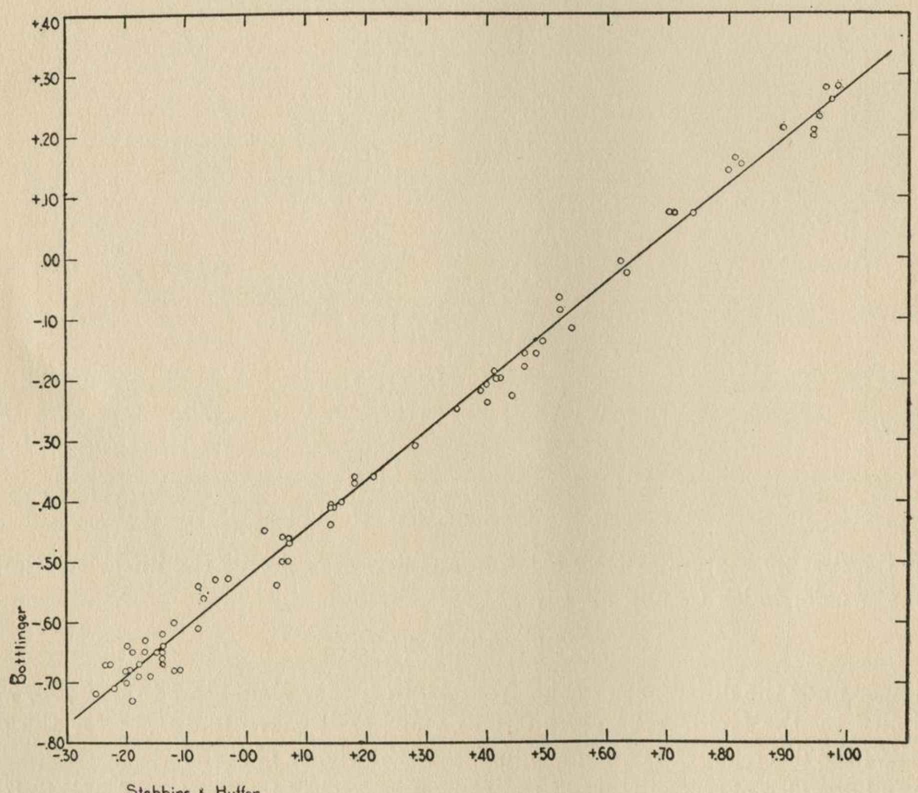


FIGURE 3 — Comparison with Bottlinger

[9]*Op. cit.*

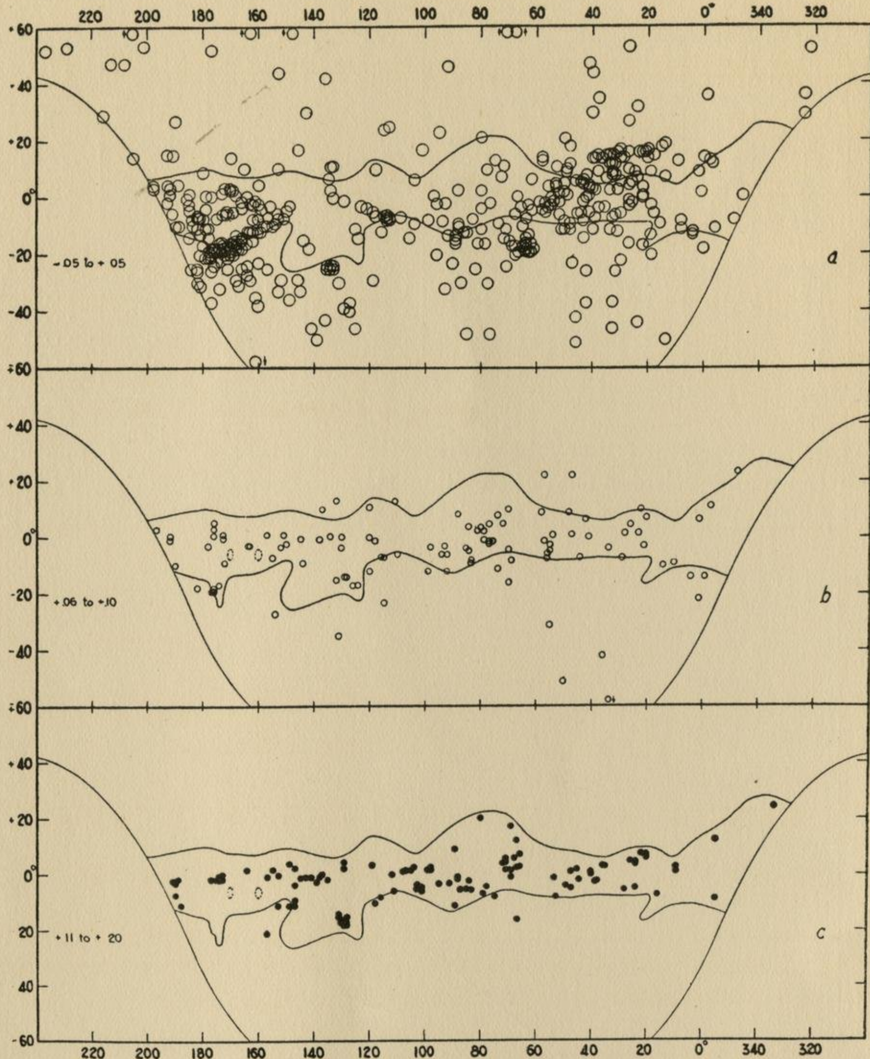


FIGURE 4 — Color-Excesses of B-Stars

added the first 20 B-stars as they came in our list. We derive the linear relation between our color-index $C_{\rm w}$ and his $C_{\rm b}$,

$$C_{\rm w} = +0^{\rm M}.65 + 1.24\ C_{\rm b}.$$

Bottlinger finds the difference of color from A0 to K0 for giant stars to be $0^{\rm M}.53$, which multiplied by the factor 1.24 gives $0^{\rm M}.66$ on our scale. We find $0^{\rm M}.74$ for the same quantity; the discrepancy is due presumably to the choice of stars.

We have also observed most of the B-stars measured by Elvey and Mehlin[17] in a region in Cepheus, and the comparison of the results is shown in Figure 6. From 35

[10]*Astrophysical Journal*, **75**, 354, 1932.

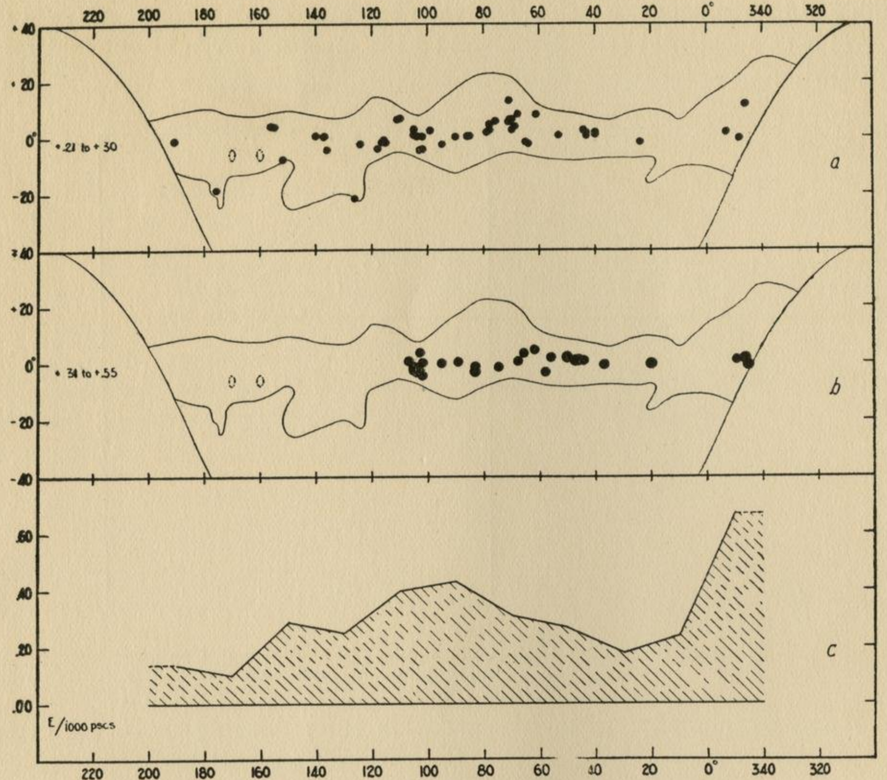


FIGURE 5 — *a*) and *b*) Color-Excesses of B-Stars
c) Space Reddening at Different Longitudes

stars in common we find that the factor 1.20 will change their color-excesses to our scale. The close agreement of the reddening of the stars in the two diagrams shows that both series are reliable indicators of what is in the sky.

8. Probable Errors. The average deviations in Table V show a tendency to be larger for the fainter stars, and the probable errors have been computed for different magnitudes. Taking fifty stars beginning at right ascension 0^h, and fifty at 12^h, we find,

TABLE VII

Limits of magnitude	1.21 – 6.00	6.01 – 7.00	7.01 – 7.50	7.51 – 8.5
Number of stars	100	100	100	22
Probable error of one observation	$\pm 0\overset{M}{.}014$	$\pm 0\overset{M}{.}020$	$\pm 0\overset{M}{.}025$	$\pm 0\overset{M}{.}038$

Since nearly all of the stars were observed at least twice, we may assume that the probable error of an adopted color-index ranges from $\pm 0\overset{M}{.}01$ to $\pm 0\overset{M}{.}02$, depending upon the brightness of the star. Bottlinger gives $\pm 0\overset{M}{.}013$ for the mean error of a color-index of his catalogue, which is equivalent to a probable error of $\pm 0^{M}.011$ on our scale. So far as accidental error is concerned the measures even of our faintest stars are sufficiently precise for our purpose.

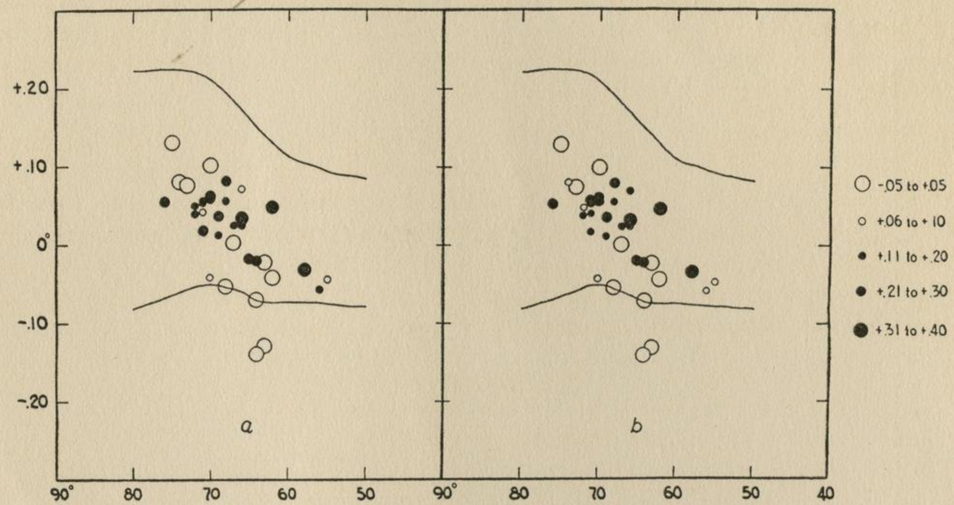


FIGURE 6 — Color-Excesses of B-Stars in a Region in Cepheus
a) Elvey and Mehlin. *b*) Stebbins and Huffer

9. Space Reddening. In the discussion of the reddening shown by B-stars in various regions, we assume that the effect is due simply to Rayleigh scattering by dark particles in space, which are small in relation to the wave-length of light. Whether these are gas molecules or dust particles need not bother us for the moment; the first step is to find out just where and how much the reddening is. Also the relation of the space reddening to the dark obscuring clouds of the Milky Way may be studied without prejudice to the view that there may be absorption without reddening. If some of the dark nebulae are composed wholly of particles which merely scatter the light, then stars which are barely seen through them should be conspicuously red. While some such reddening has been known, there have been no cases established where B-stars are as red as M-stars, as they would be if the absorption of light were all in the nature of selective scattering.

The B-stars are charted in Figures 4 and 5 according to their color-excesses from Table V. We are indebted to Dr. Edwin P. Hubble[11] for giving us in advance of publication the limits of the zone of avoidance of extra-galactic nebulae, based upon his survey at Mount Wilson. The irregular outlines in the figures mark the boundaries of the region near the galactic equator within which no such nebulae are found, presumably because of the obscuring effect of dark material in our own galaxy. The boundaries are somewhat indefinite; there are ordinarily no nebulae in the middle zone, and at any longitude they increase irregularly from the boundaries toward the galactic poles. Within the zone of avoidance there are several small regions where

[11] *Astrophysical Journal*, **79**, 8, 1934.

Hubble finds a few nebulae, and two such holes are marked at latitude $-6°$, longitudes 160° and 170°.

Allowing for observational errors, we call the observed color-excesses normal from $-0^{M}.07$ to $+0^{M}.05$; values of $+0^{M}.06$ to $+0^{M}.10$ are marked as suspicious; and those greater than $+0^{M}.10$ are assumed to show definite reddening. Even among the normal stars there is early evidence of space reddening, indicated by the frequency distribution of color-indices near the zero value.

In Figure 4*a* the stars of normal color are well distributed and extend to higher latitudes while the colored objects, Figures 4*c*, 5*a*, and 5*b*, are practically all within the zone of avoidance of the nebulae, the reddest stars being nearest to the galactic equator. The stars in Figure 4*b* which we have called suspicious are intermediate in distribution, as would be expected. Comparing the different diagrams there are regions which stand out with all of the stars normal, others with all of them colored. The approximate positions of a number of such regions are as follows:

TABLE VIII

Regions with No Reddening

Longitude	Latitude	Constellation
30°	+15°	Cygnus-Lyra
64	−17	Lacerta
134	−23	Pleiades
170	−17	Orion

Regions with Strong Reddening

Longitude	Latitude	Constellation
346°	0°	Aquila
46	+ 2	P Cygni Region
70	+ 5	Cepheus
84	− 3	Cassiopeia
104	− 2	Near Perseus Cluster
129	−17	Perseus-Taurus
140	− 1	Auriga

It is by no means the case that the areas of strong reddening appear dark in the sky. For instance, the region near P Cygni includes a well-known bright cloud of stars, most of which are undoubtedly between us and the colored B-stars. The material causing the reddening may be beyond the star cloud, or, what is more probable, the material is in the spaces between the stars. In general, since the apparent reddening follows closely the line of the Milky Way, it is reasonable to look for the largest effects of coloration not where there are apparently few stars but where there are many. Down to our limit of magnitude 7.5 we have found practically no reddened B-stars in regions of apparently strong obscuration. The natural inference is that if a B-star is far enough in or beyond a dark cloud to show strong reddening, the star will appear fainter than magnitude 7.5.

10. Absolute Magnitudes and Distances. The distance r in Table V is derived from the mean absolute magnitude, with due allowance for probable absorption in space as shown by the color-excess. Since our scale is 0.74 / 1.48, or just one-half the photographic-visual scale of Seares, and the photographic absorption may be assumed to be roughly double the visual absorption, we have the simple relation,

$$m_o = m - 2E, \qquad (1)$$

where m is the apparent visual magnitude, m_o the corrected magnitude, and E the photo-electric color-excess. The distance r in parsecs is then given by

$$5 \log r = m_o - M + 5, \qquad (2)$$

where M is the assumed absolute visual magnitude. It is convenient to use a table giving r with $m_o - M$ as the argument. For the mean absolute magnitude for each spectral class we have taken the simple mean of the values of Adams and Joy[12] and of Edwards[13], as in Table IX.

TABLE IX

Mean Absolute Magnitudes of O- and B-Stars

Class	ss,s	......	n, nn
	M	M	M
O	−4.0	−4.0	−4.0
B0	−3.4	−3.2	−3.1
B1	−2.8	−2.5	−2.3
B2	−2.2	−1.8	−1.6
B3	−1.6	−1.3	−1.0
B4	−1.2	−0.9	−0.7
B5	−1.0	−0.7	−0.5
B6	−0.8	−0.5	−0.3
B7	−0.7	−0.3	−0.1
B8	−0.5	−0.2	+0.1
B9	−0.3	+0.1	+0.4

The use of mean absolute magnitudes involves of course considerable uncertainty, and moreover in many instances there are probably greater differences than shown in the table between sharp (s) and diffuse (n) lines. We use the classification of the spectra given by Plaskett and Pearce, but cases are not lacking where one observer gives the designation (s) to a spectrum noted as (n) by another.

For known groups of B-stars like those of the Pleiades, Orion, and Scorpio, the group parallaxes give much better distances than do the assumed absolute magnitudes for individual stars, but to keep the results homogeneous we have computed all distances from the mean absolute magnitudes. Among other inaccuracies in this procedure it may be noted that in every case where the star is an undetected double, the distance may be wrong by a factor as much as $\sqrt{2}$. The correction $-2E$ to the appar-

[12] *Mount Wilson Contributions*, **12**, 98, 1923.

[13] *Monthly Notices*, **87**, 364, 1927.

ent magnitude obviously involves the assumption that the reddening shown by the color-excess gives a measure of all of the absorption in the space between us and the star, which may be far from the truth. For these different reasons, therefore, the mean absolute magnitudes give only rough distances of individual B-stars, but the mean parallaxes and distances are worth something for statistical purposes.

11. Variation with Longitude. In Figure 5*b* it is seen that there are no stars with color-excesses greater than $+0^{M}.30$ in the whole region from longitude 110° to 200°. As this area includes the anti-center of the galaxy at longitude about 150°, and includes also the "holes" detected by Hubble, it would seem that the B-stars of magnitude extend 7.5 to the outer spaces of the galaxy in that direction, at least so far as scattering material is concerned. This conclusion is strengthened by the colors of a score of B-stars in longitude 115° to 200° averaging about magnitude 8.5, measured with the reflectors at Mount Wilson. Not one of these fainter objects shows a color-excess greater than $0^{M}.30$.

For a further test of the variation of space reddening with the longitude, the stars within 5° of the galactic equator were grouped in sections of 20° of longitude, and on the basis of mean absolute magnitudes the average color-excess per thousand parsecs of distance was determined. Due to the apparently spotted nature of the effect, the results depend largely upon how the averages are taken. As a first trial the computed distances were added and the total length of path was divided into the sum of the color-excesses for the corresponding stars. The space reddening c_1 per thousand parsecs is given simply by the relation,

$$c_1 = \Sigma E / \Sigma r$$

where E is the color-excess for each star at the distance r in kiloparsecs. As no probable error is found in this procedure we have derived alternative values of the coefficient, given by the formula,

$$c_2 = \frac{1}{n} \sum \frac{E}{r}$$

where n is the number of stars in each section of longitude considered. The values of c_1 and c_2 for each 20° of longitude are in Table X. We prefer to adopt c_1 as representing the space reddening in a region, and we assign to the different values of c_1 the corresponding probable errors of c_2. In taking the mean, the values at longitudes 350° and 10°, with the fewer stars, have been given half weight. For the graph in Figure 5*c* the values of c_1 have been used.

While no great weight is given to the numerical quantities, there is a maximum near 90°, with lower values on each side and strong reddening again at 350° as we approach the galactic center. The decrease of the mean color-excess in each direction from longitude 90° looks suspiciously like the possible effect of a systematic error in the original observations, depending upon the declination. The longitude 90° is the point of the galactic circle nearest the pole of rotation, and if there were an over-correction for atmospheric extinction the stars of southern declination, observed at low altitudes, would come out as less red than they really are. We have scrutinized the reductions with this point in mind, taking rough means for the extinction correction at different declinations. It turns out that even if the effect of the atmosphere were neglected altogether, the increased coloring at longitude 90° would remain. Stars which culminate near our zenith, or north of it, were actually redder at the telescope than those south of the equator, observed through more air.

TABLE X

Space Reddening at Different Longitudes

l	c_1	c_2	P. E.	n	$\bar{r}$
					pscs
350°	+0.67	+0.68	±0.07	6	450
10	.24	.21	± .10	5	290
30	.18	.15	± .02	33	570
50	.27	.23	± .03	42	450
70	.31	.35	± .03	36	490
90	.43	.51	± .06	26	390
110	.40	.47	± .04	24	560
130	.25	.24	± .03	19	500
150	.29	.34	± .05	22	390
170	.10	.08	± .02	31	450
190	.14	.16	± .04	18	400
Mean	0.28	0.30			

It may be noted that Zug[14] in his study of open clusters does not find a small space reddening near longitude 30°; in fact, he gets a maximum rather than a minimum effect. Our determination is not strong in the directions of 350° and 10° with only a dozen B-stars brighter than magnitude 7.5, but at 30° the value $c_1 = 0.18 \pm 0.02$ from 33 stars is apparently as well determined as that of any other region in the sky. Zug suggests that the discrepancy results from the difference in the average distances of the objects observed; his clusters being between 1000 and 2000 parsecs and our stars about 500 parsecs from the sun. The matter will no doubt be cleared up when measures of additional objects are available, and we already have an uncompleted series of measures of fainter B-stars observed with the reflectors at Mount Wilson. A preliminary reduction of the measures of these stars near the galactic center indicates that the high value of the coefficient of space reddening, 0.67 mag./kiloparsec on our scale, is probably excessive, but in the general region toward the center are to be found the reddest B-stars thus far observed.

It is not easy to transform our coefficients of space reddening into total photographic absorption because of some uncertainty in the relative scales, and moreover the selective absorption only indicates a lower limit of the total absorption. Our scale of color-indices is just half that of Seares, and if we take the photographic to be twice the visual absorption, it follows for any star that the total photographic absorption is simply four times our color-excess. Hence from Table X we find the photographic coefficient $4c_1$ to range from 0.40 mag./kiloparsec at longitude 170° to 1.72 mag./kiloparsec at 90°. Trumpler derived a mean coefficient of 0.67 all around the

[14] *Lick Observatory Bulletin*, **16**, 141, 1933.

FIGURE 7 — Color-Excesses of B-Stars within 50 Parsecs of the Galactic Plane

a) Omitting $+0\overset{\mathrm{M}}{.}06$ to $+0\overset{\mathrm{M}}{.}10$

b) Omitting $+0\overset{\mathrm{M}}{.}06$ to $+0\overset{\mathrm{M}}{.}30$

galaxy and Joy's[15] independent determination from radial velocities of Cepheid variables is 0.85 mag./kiloparsec, but Schalen[16] has found limited dark clouds giving a photographic absorption of 5 or 6 magnitudes per kiloparsec. The conversion of measured space reddening into the proper values of total absorption is a complicated problem.

12. Space Distribution of B-Stars. Some idea of the distribution of the nearer B-stars, and possibly of the dark material between them, may be had by charting the stars in space as in Figures 7*a* and 7*b*. Stars within ±50 parsecs of the galactic plane are included, the projected distance on the plane being $r \cos b$. In Figure 7*a* the stars of suspicious color are omitted, as they tend to obscure the picture, which is perhaps still better presented by using only the normal and the strongly-colored stars as in Figure 7*b*.

The two certain features of the charts are the longitudes and the colors; the distances are rough and there is the usual lack of stars from the southern hemisphere. Nevertheless there is a hint of a "clear" space among the B-stars, running in the direction from 10° to 190° in longitude, with regions of absorption on either side. Considering the galaxy as a spiral, this lane is inclined about 40° to a radius from the center. Because of the danger of over-interpretation of the data for stars so near the sun, we let the matter go with this suggestion. The rapid thinning out of the stars with increasing distance is due mostly to observational selection. At apparent magnitude 7.5 the limits for stars of normal color are approximately as follows:

O	2000 parsecs
B0	1400
B2	720
B3	580
B5	440

Hence few of the observed B3- and B5-stars are far enough away to be strongly colored, while the faint O- and B0-stars on the program show a large percentage of reddening. The stars of classes B7, B8, and B9 have been omitted from Figures 7*a* and 7*b*.

It may be noted that in this study we have uniformly ignored the distinction between B-stars of the local system and of the general system of the galaxy. We have found no evidence of space reddening associated with the well-known belt of bright B-stars inclined to the galactic equator. The reddening seems to be confined closely to the main galactic plane.

13. Globular Clusters. The galactic center at longitude about 330° is too far south to be reached satisfactorily from Madison, but we may compare the B-stars observed at Madison with the globular clusters measured at Mount Wilson. In Figure 8 the color-excesses of the clusters have been reduced to the scale of the B-stars, and it is seen that the reddened clusters are all in the general region of obscuration outlined by Hubble's limits. The zone 7° wide, where no clusters are found, is indi-

[15] *Annual Report of the Director of the Mount Wilson Observatory*, p. 156, 1933.
[16] *Upsala Meddelanden*, No. 58, p. 28, 1934.

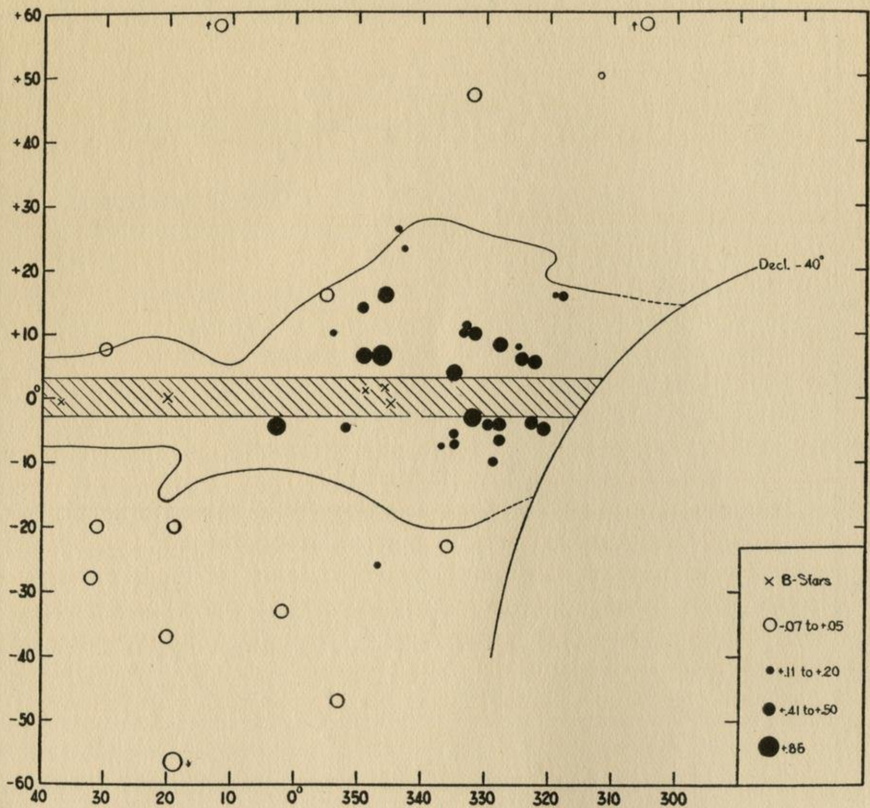


FIGURE 8 — Color-Excesses of Globular Clusters Near the Center of the Galaxy

cated by the shading, and in this narrow strip are the five B-stars which show the greatest reddening in that neighborhood, their color-excesses ranging from $0^{M}.35$ to $0^{M}.52$. There are a dozen or more additional clusters not yet measured, but from the figure as it stands it seems reasonable to infer that Hubble's limits definitely outline the nucleus of the galaxy in longitude not far from 330°, and that the globular clusters concentrated near the nucleus are subject to reddening and absorption which increase toward the galactic plane until finally no clusters are visible. The strongly-reddened B-stars are much nearer than the clusters. Undoubtedly a test of faint B-stars in low latitude near the center will show even greater reddening, and if a few globular clusters can be found in the apparently forbidden region, the maximum of coloration may be anticipated.

In Shapley's general system of globular clusters the positions in space of a number of the members are nearly in line with but far beyond the nucleus of the galaxy. On this view the light of the clusters comes through where the extra-galactic nebulae are blotted out altogether. We think it more probable that the general region near the galactic center is opaque to the light of objects beyond the nucleus, and that the fainter globular clusters in that direction are between us and the center. A further investi-

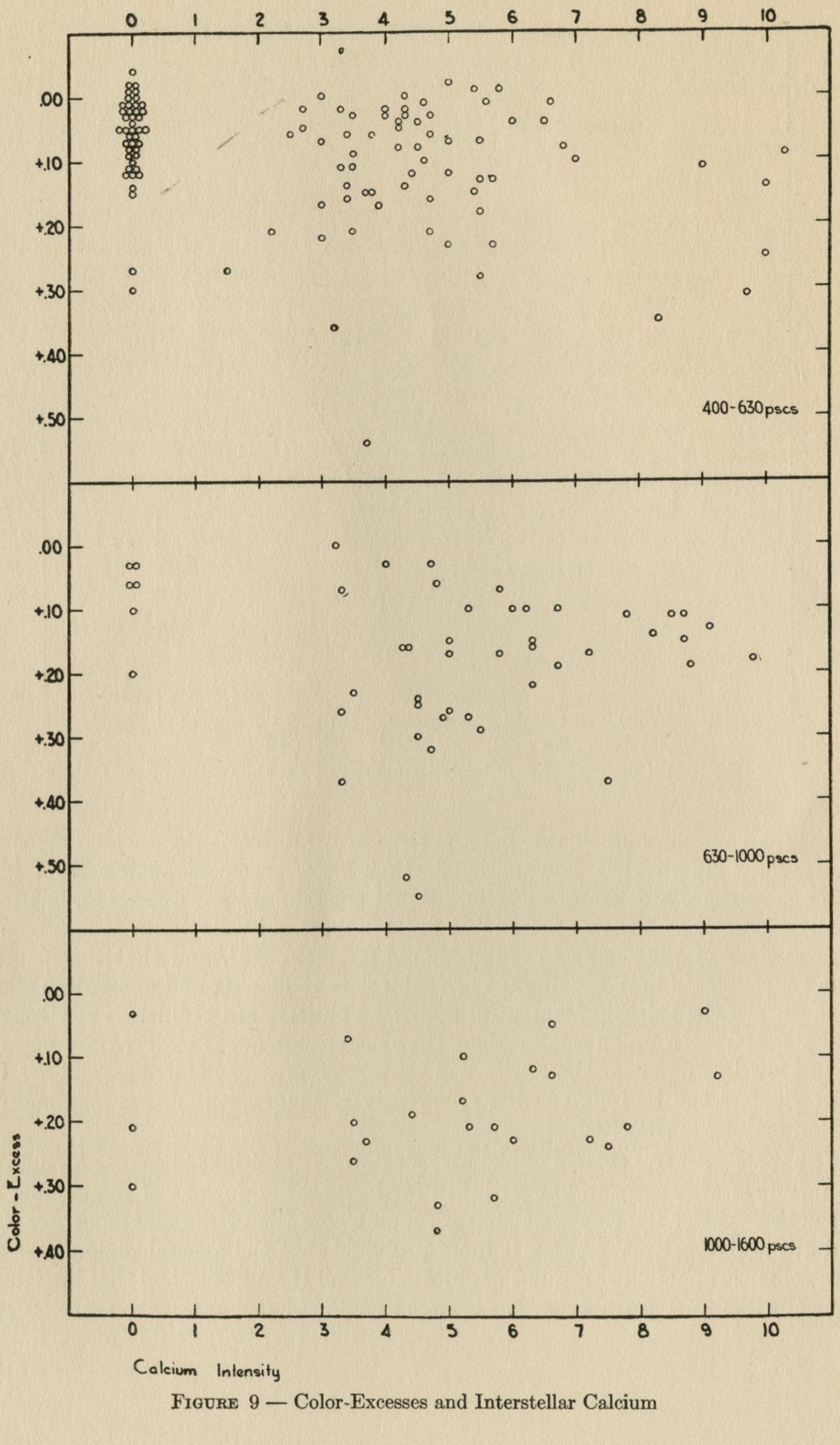


FIGURE 9 — Color-Excesses and Interstellar Calcium

gation of the reddened globular clusters should be made, including a determination of the probable effect of absorption on the apparent diameters. Clusters strongly condensed at their centers appear much larger with increased photographic exposure, and conversely the apparent diameters of such clusters would shrink with space absorption.

14. Interstellar Calcium. It is natural to expect that the material which causes the space-reddening should be more or less co-extensive with the calcium clouds revealed by the interstellar (K) line of early B-stars, and which are shown by Plaskett and Pearce to partake in the rotation of the galaxy. However, Elvey and Mehlin found almost no connection between color-excess and calcium intensity in some fifty stars in the region in Cepheus[17], and others have found at most only a weak correlation between the two kinds of space absorption. As there may be an indirect connection depending upon the distance or apparent magnitude, we have divided our B-stars according to shells concentric with the sun, of radii 400-630, 630-1000, and 1000-1600 parsecs. Nearer than 400 parsecs there is very little space-reddening or calcium absorption, and the few measured stars beyond 1600 parsecs have been included in the third shell. In Figure 9 are plotted our color-excesses against the intensities of interstellar calcium, taken respectively from the eleventh and twelfth columns of Table V. Where no estimate is given by Plaskett and Pearce the calcium intensity is assumed to be zero and is so marked on the diagram.

The only trace of correlation that we can find between color-excess and calcium intensity lies in the fact that the stars with no interstellar calcium average just a trifle bluer than the stars with calcium absorption. As a matter of form, the coefficients of correlation *r* have been computed, first including and then omitting the stars of zero calcium.

TABLE XI

Coefficient of Correlation Between Color-Excess and Interstellar Calcium

Distance	Including Zero's		Omitting Zero's	
	r	P. E.	*r*	P. E.
400- 630 parsecs	+0.28	±0.06	+0.12	±0.08
630-1000 parsecs	+0.12	±0.10	−0.18	±0.10
1000-1600 parsecs	−0.17	±0.13	−0.33	±0.13

The only coefficient in Table XI which looks as though it might mean something is the first one; the others are too small. With some of the correlations coming out negative there is no point in drawing lines of regression in the figures.

Another test of the distribution of the calcium is to chart the stars with different degrees of calcium intensity in the same way as was done for the color-excesses. In Figure 10 the stars with no calcium have been omitted, as their distribution is in all latitudes. The others with increasing intensity of the interstellar (K) line exhibit a narrowing toward the galactic plane, but nothing like the concentration shown by

[17] *Op. cit.*

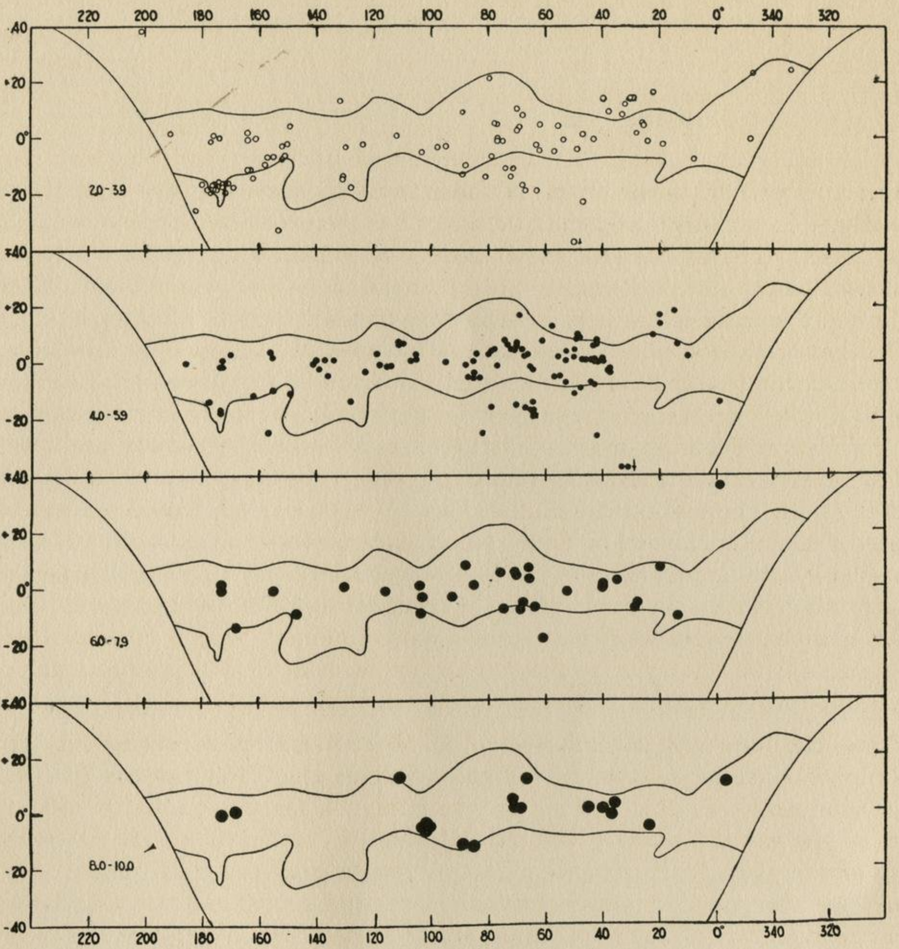


FIGURE 10 — Apparent Distribution of Interstellar Calcium

the reddened B-stars. The stars with strong calcium probably outline the flattened galaxy, but there is no such thin layer of the calcium cloud as there is of the reddening material. No other conclusion seems possible from the colors of the B-stars which we have observed down to magnitude 7.5. Miss Westgate[18] found a weak correlation between calcium intensities, estimated by Struve, and the photo-electric colors of B-stars by Bottlinger and by Elvey and Mehlin, and we have heard of other work, published and unpublished, showing this relation between space reddening and interstellar absorption by calcium or sodium, but there is no such evidence in our data presented here.

15. Dimensions of the Galaxy. It is well recognized that the presence of an absorbing stratum near the galactic plane causes all objects in low latitude to appear

[18]*Astrophysical Journal*, **78**, 65, 1933.

fainter than they really are, and estimates of distance based upon photometric considerations must allow for this absorption. Our B-stars, mostly nearer than 1000 parsecs, and the open clusters studied by Trumpler and by Zug, ranging up to about 5000 parsecs in distance, cannot give as good a measure of the total absorption as do the more distant globular clusters, which presumably are outside of the space where most of the absorption takes place. The irregularities of the space reddening as well as the appearance of the obscuring clouds of the Milky Way show that the dark material is quite spotted in its effect, and that the proper allowance for absorption will be difficult to make. The five largest color-excesses of B-stars range from $0^{\mathrm{M}}.52$ to $0^{\mathrm{M}}.55$, which correspond to a photographic absorption of about two magnitudes. Therefore the inferred distances of these stars should be divided by 2.5. The mean values of the coefficient of absorption depend necessarily upon the selection of the data. One of us[19] found from the globular clusters that the observed space-reddening corresponds to the total photographic absorption, or optical thickness of the layer normal to the plane, equal to $0^{\mathrm{M}}.35$; while van de Kamp[20] from considerations of the probable rotational symmetry of the general system of globular clusters derived an optical thickness of $0^{\mathrm{M}}.8$. On the basis of the cosecant law these two values require division of the distances of globular clusters by about 4 and 30 respectively at latitude 3°, the lowest at which they are found. Neither result can be right in detail, as the variation with longitude was ignored. A more reliable determination of the optical thickness of the dark layer is that by Hubble[21] who from counts of nebulae finds a total photographic absorption of $0^{\mathrm{M}}.50$ from pole to pole. Any one of these determinations means practically complete obscuration of distant objects near the galactic plane.

From Hubble's optical thickness of $0^{\mathrm{M}}.50$ and our mean absorption of 1.12 mag./kiloparsec there follows an effective thickness of 450 parsecs for the dark layer, but most of the absorption probably takes place within 50 or 100 parsecs of the galactic plane. The data at hand are not sufficient to determine the density gradient of the dark material as we recede from the main plane. We shall probably be able to get a satisfactory measure of the extent of the galactic system first in the direction of the anti-center, where there is less absorption. Toward the nucleus we need observations of very faint objects, but the zone of avoidance of the globular clusters indicates that the part of the galaxy which we most want to see will always remain out of our ken.

16. General Remarks. Some comments on the shortcomings or defects of the present work may aid in pointing the way to further progress. First of all, the observations were taken with the combination of cell and Lindemann electrometer which has since been superseded by the amplifier perfected by Whitford[22]. Though the amplifier is more sensitive than the older form of photometer, to the extent of about two magnitudes, the speed of its operation is no greater for moderately bright stars and for the stars on our program the electrometer did well enough.

---

[19]*Proceedings National Academy of Sciences*, **19**, 56, 1933.
[20]*Astronomical Journal*, **42**, 103, 1932.
[21]*Op. cit.*, p. 51.
[22]*Astrophysical Journal*, **76**, 213, 1932.

It would have been better if the color-sensitivity of the cell had been tested in the laboratory from time to time during the observations, instead of after they were completed. This potassium-hydride cell by Kunz, our number QK302, has been a real prize. From 1925 to the present time it has shown no change or deterioration, and with one exception it is the best cell for our purpose that we have ever seen. In our experience the last stellar magnitude of effective sensitivity of a photo-electric cell is a matter of good luck, and it is literally true that this best cell on the 15-inch refractor is equal to a moderately good one on a telescope of double the aperture.

The photo-electric magnitudes of the B-stars might have been determined while they were being measured for color; but there was the difficulty of standards and the allowance for atmospheric extinction. Just a couple of measures of a star with the stop watch, and the brightness referred to the next star is better determined than can possibly be done with the eye. But how bright is the next star? As it would probably have doubled the work to set up a list of standards we kept our efforts to the colors.

The observing procedure of spending a total of three to four minutes on each star did not allow time enough for really precise measures; the increase of the probable errors for the fainter magnitudes indicates this fact. Instead of about four alternate measures each through the two filters we could have made a dozen, but we were more interested in pushing on to avoid or eliminate systematic errors. In stellar photometry there is all the difference in the world between two hundredths and half a hundredth of a magnitude, but in this case the two hundredths is good enough.

Our treatment of the atmospheric extinction may seem rather perfunctory to those who like a satisfactory theoretical treatment of a problem. We have never understood how investigators can go through with an elaborate derivation of formulae for the atmospheric extinction and then coolly call all nights of the same quality. We can say with assurance that at Madison the sky varies in blueness; the sun is not always the same color at sunset; the full moon is sometimes nearly white and at others distinctly yellow at the same altitude. If such conspicuous differences are obvious to the eye, there ought to be some slight variations in the light and color of a star measured with an instrument, even on apparently good nights. Once on a really hazy night when the moon was very yellow we measured a star of spectrum A0 near the zenith and found the color equivalent to K0. Of course photometric measures are not made with such a thick sky, but at Madison we are hampered by variations in transparency. At Mount Wilson it is a different story; the stars stand out night after night. There are variations in the sky, of course, vid. Abbot's long series of observations of the spectral transmission of solar radiation, but for ordinary photometric measures it would be a waste of time trying to detect changes of transparency on different nights. However, in the present investigation of colors the effect of extinction is merely differential between stars in and out of the Milky Way. Every conclusion derived from the B-stars would remain practically the same if we should simply ignore the presence of the atmosphere.

The comparison stars were measured early in the work, and as shown in Table VI they are nearly all in the first twelve hours of right ascension. A further test will be to check the observations of the B-stars for difference between the extremes of galactic longitude. We anticipate no seasonal difference, as the series included two winters with an intervening summer.

The weakest point in the discussion is obviously the assumption of mean absolute magnitudes for determining the individual distances of the B-stars. Without a spectrogram actually before one the listed classification of a star may possibly be misleading. Moreover we have ignored such spectral peculiarities as bright lines, extra strong hydrogen absorption, etc. Nevertheless the galactic distribution of the reddened stars indicates that the minor spectral differences are probably averaged out.

In conformity with the usual experience in astronomical investigations the present work indicates that there is a promising field among still fainter stars, and that the observations should be extended to the southern hemisphere. We already have measures of the colors of about 150 B-stars made with the reflectors at Mount Wilson; the magnitudes range from eight to ten, with a few still fainter. The amplifier on the 100-inch will now reach to the fifteenth magnitude, and new B-stars within that limit can be measured when once they are classified. An amplifier on a 10-inch telescope in the southern hemisphere would suffice for stars say to the ninth magnitude. It should be much more economical to do the work by photography, especially with one of the modern wide-angle lenses. In fact we do not quite understand why the results in the present paper were not all secured by photography long ago; but we have been expecting photography to put us out of business ever since we began using the photoelectric cell.

SUMMARY

1. The colors of 733 B-stars, mostly brighter than visual magnitude 7.5, have been measured with a photo-electric cell with blue and yellow filters, which give effective sensitivities at about 4260A and 4770A, respectively.

2. There were also measured 110 stars of classes A to M in galactic latitudes greater than 10°, which with the brighter B-stars in latitudes above 15° serve as standards of comparison.

3. The precision of the measures is satisfactory, and the colors agree well with those of Bottlinger, and of Elvey and Mehlin. The probable error of an adopted color-index varies from $\pm 0^{M}.01$ to $\pm 0^{M}.02$. The color-equation, or difference between A0 and K0, is $0^{M}.74$.

4. The color-excesses of the B-stars when charted in galactic coordinates confirm the existence of a thin layer of dark scattering material near the median plane of the galaxy. The reddened stars are practically all within Hubble's zone of avoidance of the extra-galactic nebulae.

Sun 6,000

5. The space reddening is quite irregular or spotted in its nature, there being a number of regions where the effect is exceptionally strong. The colored B-stars down to magnitude 7.5 are not in the obscured regions of the Milky Way; they are apparently in the bright clouds, or at most on the edges of dark areas.

20,000-35,000 degrees centigrade

B-blue stars

6. There is a conspicuous variation of the space reddening with the longitude. For stars within 5° of the galactic equator the coefficient of reddening ranges from 0.10 mag./kiloparsec near the anti-center up to a maximum of 0.43 mag/kiloparsec at longitude 90°, with probably still greater reddening toward the galactic center. With a rather doubtful conversion of scale, these values correspond to total photographic absorption of 0.40 to 1.72, with a mean of 1.12 mag./kiloparsec.

7. Considering the galaxy as a spiral nebula, the distribution of the observed B-stars suggests a clear space or lane inclined about 40° to a radius from the center. There is apparently no connection between the dark galactic layer and the local system of B-stars.

8. The colors of the B-stars agree well with the results from globular clusters; the reddest stars are in the zone of avoidance of the clusters, and still greater reddening is anticipated for fainter B-stars near the galactic center. It is probable that many of the globular clusters assumed to be beyond the nucleus are really on this side of the center of the system.

9. There is practically no correlation between the color-excesses of our B-stars and the intensities of interstellar calcium lines in their spectra. The calcium cloud

is not condensed into as thin a layer near the galactic plane as is the material which causes the space reddening.

20 quadrillion

10. The amount of the absorption for B-stars out to a thousand parsecs or more shows that the inferred distances of objects near the galactic plane, especially in the direction of the galactic center, must be greatly reduced. Because of the spotted nature of the space reddening in different longitudes the correction of distances is uncertain. The largest absorption found for B-stars is about two magnitudes, photographic, which means a division of the distances by 2.5.

11. The evidence from B-stars, from open and globular clusters, and from the extra-galactic nebulae all agree in establishing the presence of the thin stratum of absorbing material near the galactic plane. There is every reason to conclude that this absorbing layer is quite similar to the dark lanes that we see in other galaxies that are viewed edge-on. When the absorbing effect of the dark material is properly allowed for it is expected that the hiatus between the dimensions of our galaxy and other such systems will largely disappear.

difference

This publication was made possible by a grant from the Committee on Funds for Publication of Research of the National Academy of Sciences.

3260 light-years

End of Volume XV

3260
186