Diffuse X-ray Spectrometer.

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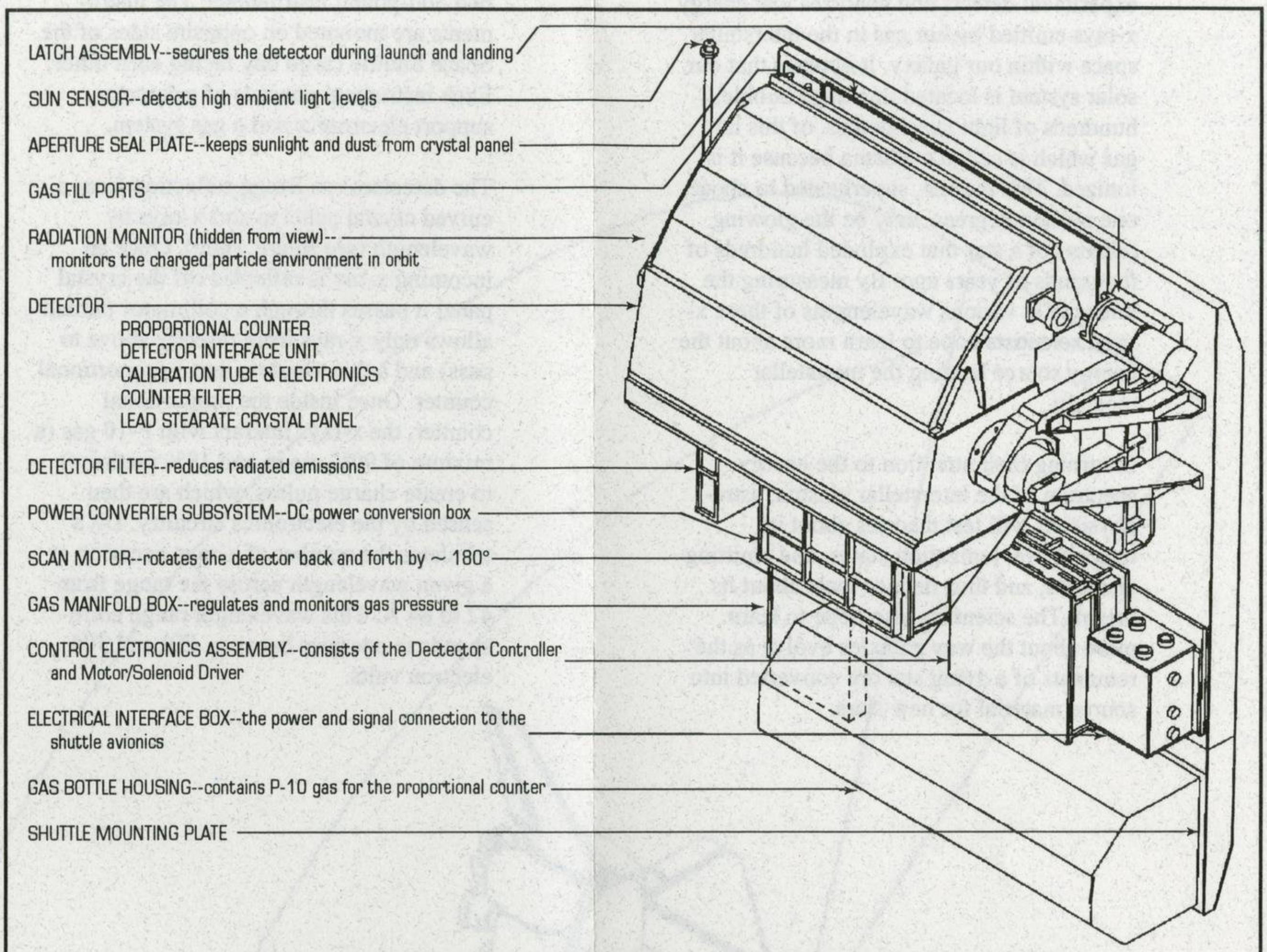
University of Wisconsin-Madison



Diffuse X-ray Spectrometer

THE SCIENCE

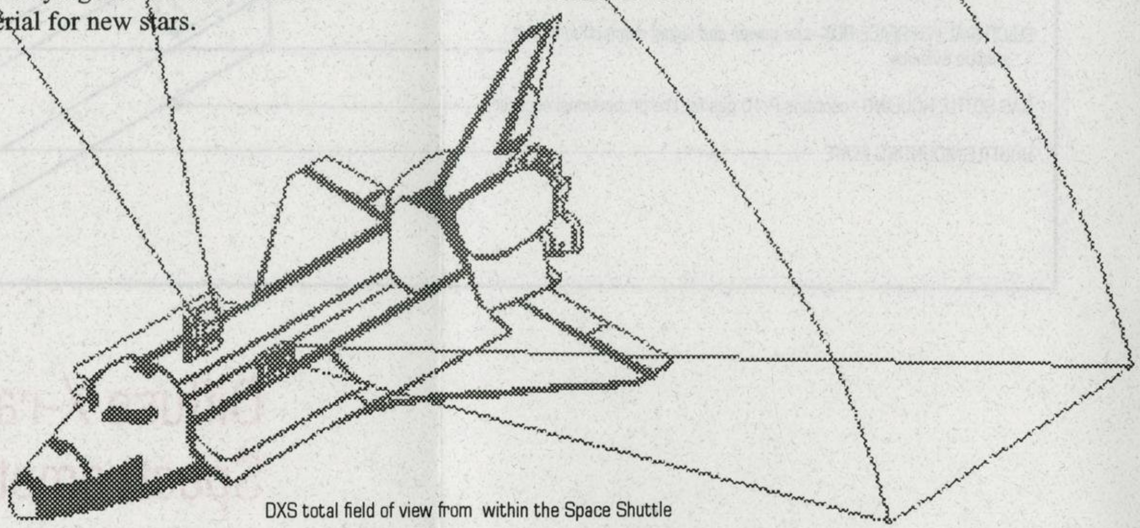
The Diffuse X-ray Spectrometer (DXS) experiment detects and analyzes low energy x-rays emitted by hot gas in the interstellar space within our galaxy. It appears that our solar system is located in a huge bubble, hundreds of light years across, of this hot gas which is called a plasma because it is ionized. This plasma, superheated to about one million degrees, may be the glowing remains of a star that exploded hundreds of thousands of years ago. By measuring the intensity at various wavelengths of these x-rays, scientists hope to learn more about the energy source heating the interstellar medium.

In turning their attention to the energy spectrum of the interstellar plasma, astrophysicists will test theories about its temperature, ionization states, and emitting elements, and thus deduce facts about its origin. The scientists also hope to learn more about the way galaxies evolve as the remnants of a dying star are converted into source material for new stars.

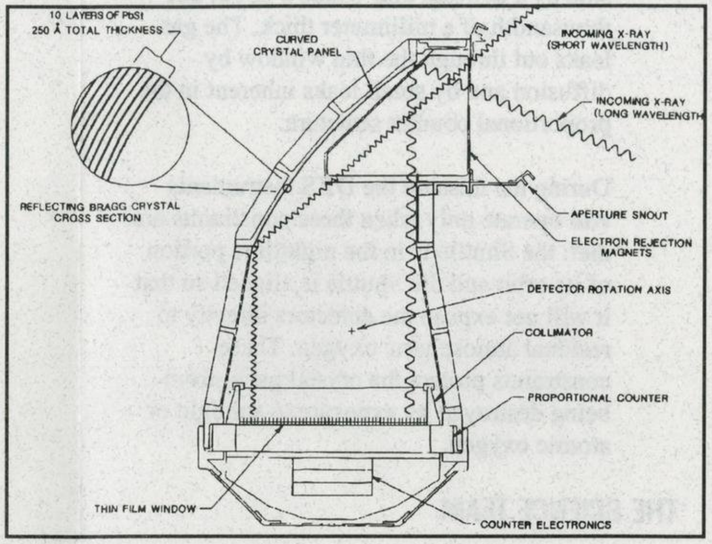
THE EXPERIMENT

The DXS experiment consists of a set of two 500-pound instruments. The instruments are mounted on opposite sides of the Space Shuttle cargo bay facing each other. Each instrument consists of a detector, support electronics and a gas system.

The detectors use Bragg reflection from a curved crystal panel to sort x-rays by wavelength (see figure, right). Once an incoming x-ray is reflected off the crystal panel it passes through a collimator (which allows only x-rays from directly above to pass) and a thin window into a proportional counter. Once inside the proportional counter, the x-rays interact with P-10 gas (a mixture of 90% argon and 10% methane) to create charge pulses, which are then sensed by the electronics circuitry. DXS tabulates the number of x-rays occuring at a given wavelength across the range from 42 to 84 Å. This wavelength range corresponds to energies between 150 and 300 electron volts.



DXS total field of view from within the Space Shuttle



As x-rays enter the DXS detector, they strike the curved Bragg surface, made up of approximately 200 layers of lead stearate. These alternating thin and thick layers serve as a grating that reflects the x-rays at the angle of incidence into the counter. Because they are only reflected at small angles, short wavelength x-rays always enter the counter at the back and from above. Conversely, long wavelengths enter the counter at the opposite end from above.

The DXS detectors view an area of the sky approximately 150º long and 15º wide, rather than a single point source like a star. To obtain data from an area of the sky, the detectors are rotated through an angle of about 150º.

Support electronics for each instrument provide power to the detector and allow the experiment to be controlled and its status to be monitored from the ground during the mission. Experiment telemetry will be monitored and commands sent from a control center at NASA's Goddard Space Flight Center near Washington, D.C.

Each DXS instrument has a gas system on board supplying a constant gas pressure to the proportional counter, which is covered on one side by a delicate thin window about one-thousandth of a millimeter thick. The gas leaks out through the thin window by diffusion and by small leaks inherent in the proportional counter structure.

During the mission the DXS instruments will operate only when these constraints are met: the Shuttle is in the nighttime portion of its orbit and the Shuttle is aligned so that it will not expose the detectors directly to residual atmospheric oxygen. These constraints protect the crystal panel from being destroyed by exposure to sunlight or atomic oxygen.

THE SCIENCE TEAM

The experiment has been under development by the University of Wisconsin-Madison's Space Physics group since the mid-1970s. The Space Science and Engineering Center completed the design and built the instruments. The Diffuse X-ray Spectrometer experiment's first flight is slated for an early 1993 launch aboard the Space Shuttle Endeavour.

Principal investigator—Wilton Sanders, Space Physics & SSEC
Program manager—Robert Paulos, SSEC
Project scientist—Richard Edgar, Space Physics & SSEC
DXS originator--William Kraushaar, Space Physics & SSEC
Contracting agency—NASA/ Goddard Space Flight Center

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THE DIFFUSE X-RAY SPECTROMETER

FACT SHEET -- March 3, 1992

The Diffuse X-ray Spectrometer, DXS for short, is a set of two X-ray detectors scheduled to fly aboard the Space Shuttle Endeavour in December 1992. This experiment will chart the wavelength distribution (measure the energy spectrum) of low-energy X-rays believed to come from pockets of very hot interstellar gas, including a huge bubble in which our solar system is located. Theory holds that this bubble is all that remains of a nearby star that exploded about a million years ago. This hot gas, or plasma, eventually cools and forms clouds which are the spawning grounds for new stars. Scientists wish to discover more about the origins of this hot gas and DXS will clarify their theory.

The experiment has been under development by UW-Madison's Space Physics group since the mid-1970s. The UW-Madison Space Science and Engineering Center completed the design and built the instruments. Astrophysicist Wilton Sanders is DXS principal investigator and an academic staff scientist working with both groups. NASA's Goddard Space Flight Center funded the experiment at a cost of about $9 million.

DXS consists of twin detectors weighing 500 pounds each which will be mounted on opposite sides of the shuttle's cargo bay. At the heart of each detector are sensitive lead stearate crystals which can sort out the diffuse X-rays that UW-Madison scientists are studying. Diffuse means that those X-rays are spread over large areas of the sky, rather than coming from a single point source such as a star.

By measuring the intensity and wavelengths of the diffuse X-rays, scientists will be able to obtain a better understanding of the interstellar plasma. Wavelength is an important diagnostic tool that can provide clues to the chemical composition and temperature of the plasma which, in turn, will tell scientists something about its origin.

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For more information contact:
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--Robert Paulos, program manager, (608) 263-6729
--Terri Gregory, SSEC public information, (608) 263-3373
--Terry Devitt, University News and Information Service, (608) 262-8282

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The Diffuse X-ray Spectrometer

The Diffuse X-ray Spectrometer, DXS for short, is a set of two X-ray detectors scheduled to fly aboard the Space Shuttle Endeavour in January 1993. This experiment will chart the wavelength distribution (measure the energy spectrum) of low-energy X-rays believed to come from pockets of very hot interstellar gas, including a huge bubble in which our solar system is located. Theory has it that this bubble of hot gas is all that remains of a nearby star that exploded a million or so years ago. This hot gas, or plasma, eventually cools and forms clouds which are the spawning grounds for new stars. Scientists wish to discover more about the origins of this hot gas and DXS will clarify their theory.

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Space Science and Engineering Center

The Space Science and Engineering Center (SSEC) is a multidisciplinary research and development center in the University of Wisconsin-Madison's Graduate School.

It was founded in 1966 and specializes in the atmospheric and space sciences. The Center's mission includes the fostering of atmospheric studies of the Earth and the other planets; spaceflight hardware development and fabrication; and interactive computing, data access and image processing.

Work at the Center has included the invention of the spin-scan camera, the geosynchronous satellite-borne camera that since 1966 has provided the world with pictures of the weather from space. Other Space Science and Engineering Center accomplishments include the development of McIDAS, an interactive computer system used for weather forecasting and meteorological research that allows users to view the world's weather in "real time."

The Center has also developed many unique instruments that have been deployed aboard weather satellites and planetary probes.

The Hubble Space Telescope's High Speed Photometer, the only Space Telescope instrument designed and constructed by an academic institution, was built at the Center. SSEC also developed and fabricated the Diffuse X-ray Spectrometer, twin space shuttle-borne detectors designed to measure X-rays from invisible ionized gas in interstellar space.

The Center is funded primarily by federal contracts and grants from the National Aeronautics and Space Administration, the National Science Foundation and the Department of Commerce, as well as other agencies. SSEC has an annual operating budget of $12 million and employs about 150 people.

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University News and Information Service

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Space Physics Group

An arm of the University of Wisconsin-Madison's Department of Physics, the Space Physics Group is active in the areas of observational X-ray astronomy, studies of the interstellar and interplanetary medium, and theoretical work on these and other areas of astrophysics.

With an annual research budget of nearly $2.2 million, the Space Physics Group cooperates closely with the UW-Madison Space Science and Engineering Center and the Department of Astronomy. Nearly 30 UW-Madison students — both graduate and undergraduate — are actively engaged in various aspects of the research programs of the Space Physics Group.

Begun in 1965, the UW-Madison Space Physics Group today is composed of four faculty members and five academic staff scientists. Since its inception, the Space Physics Group has conducted numerous studies of planetary, magnetospheric and interplanetary physics, and in the physics of the interstellar medium. These studies have been carried out through an active sounding rocket program and at various ground-based observatories including Kitt Peak National Observatory in Arizona, Haleakela Observatory in Hawaii, and at an observing facility at UW-Madison's Pine Bluff Observatory.

The Diffuse X-ray Spectrometer (DXS), the twin shuttle-borne X-ray detectors to fly on STS 54, was conceived by scientists in the Space Physics Group and was tested in a series of rocket experiments beginning in 1979. Data collected by DXS will help scientists obtain a better understanding of the nature, chemistry and physics of invisible pockets of ionized interstellar gas that are believed to be the remnants of stars that exploded long ago.

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NEWS

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UW SHUTTLE EXPERIMENT TO PROBE ANCIENT SUPERNOVA REMNANTS

MADISON — The ghostly remains of stars that exploded millions of years ago may begin to yield some of their closely held secrets this month as the Space Shuttle Endeavour sweeps into orbit carrying a unique University of Wisconsin-Madison X-ray telescope.

If NASA keeps to its planned Jan. 13 launch, the Diffuse X-ray Spectrometer, or DXS for short, will take the first detailed look at the vaporized remains of stars that ended their lives eons ago in cataclysmic explosions called supernovae.

For decades, astrophysicists have puzzled over the low-energy X-rays that emanate from pockets of seemingly empty space, including a huge pocket that envelopes our solar system.

"These pockets are believed to be huge bubbles of invisible ionized gas that are so hot they glow in X-rays, and with them we hope to do some interstellar paleontology," said Wilton T. Sanders, a UW-Madison astrophysicist who heads the DXS project. "These are our fossils."

The flight of DXS, which will operate as an attached payload from Endeavour's cargo bay, will mark a new phase of nearly 20 years of experimental and theoretical work aimed at understanding the X-ray background.

With the advent of X-ray astronomy in the early 1960s, scientists discovered that some stars and galaxies emit X-rays. But they also discovered the X-ray background —

-more-

X-rays that seemed to come from everywhere in the sky and that did not come from a particular point source such as a star.

At first, these enigmatic X-rays were thought to have originated far beyond our galaxy, said Sanders, perhaps as a cosmological signal dating back to the beginning of the universe. But subsequent experiments indicated that some of these diffuse X-rays originated within our own galaxy.

"From the beginning of X-ray astronomy, one of the fundamental questions was, 'What is this X-ray background?' " Sanders said. "As late as the early 1970s, we didn't know what was producing these X-rays. But when it was discovered that some of these X-rays were from our own galaxy, it took on a whole new reality."

The question then, said Sanders, was: What are the processes that produce these X-rays?

"We speculate that what we are seeing is a very hot gas with a temperature of about a million degrees," said William Kraushaar, a UW-Madison emeritus professor of physics and one of the pioneers of experimental X-ray astronomy. The idea that the gas might be the remains of stars that exploded long ago was first formulated in 1974 by Kraushaar and Donald P. Cox, a UW-Madison professor of physics.

"This is still a theory," said Kraushaar. "We still haven't proven it's hot gas. That's what we want to do with DXS."

Astronomers and astrophysicists are interested in the gas between stars because it is also the material that spawns new stars. Over tens of millions of years, the gas cools off and, along with dust grains and other interstellar matter, condenses to become the stuff of which new stars are made.

During the course of Endeavour's planned six-day mission, DXS will scan the skies looking for the low-energy X-rays that will shore up scientists' ideas of the X-ray background and provide insight into the nature of the X-ray-emitting phenomena.

Simply detecting X-rays at certain wavelengths will essentially prove the existence of the giant hot gas bubbles, Sanders said. In addition, the spectra can reveal such things as the temperature and whether or not the bubble is heating or cooling, and the chemical makeup of the hypothesized hot gas bubbles.

"Radiation comes out in spectral lines, which are characteristic of the materials doing the emitting," Kraushaar said. "Those spectra can tell us a lot about the gas. You can, for example, determine the elemental composition that's in the gas."

"The main thing we're going to be looking for is simply the existence of the emission lines," Sanders said. "That will be pretty clear evidence that it is a hot gas that's responsible."

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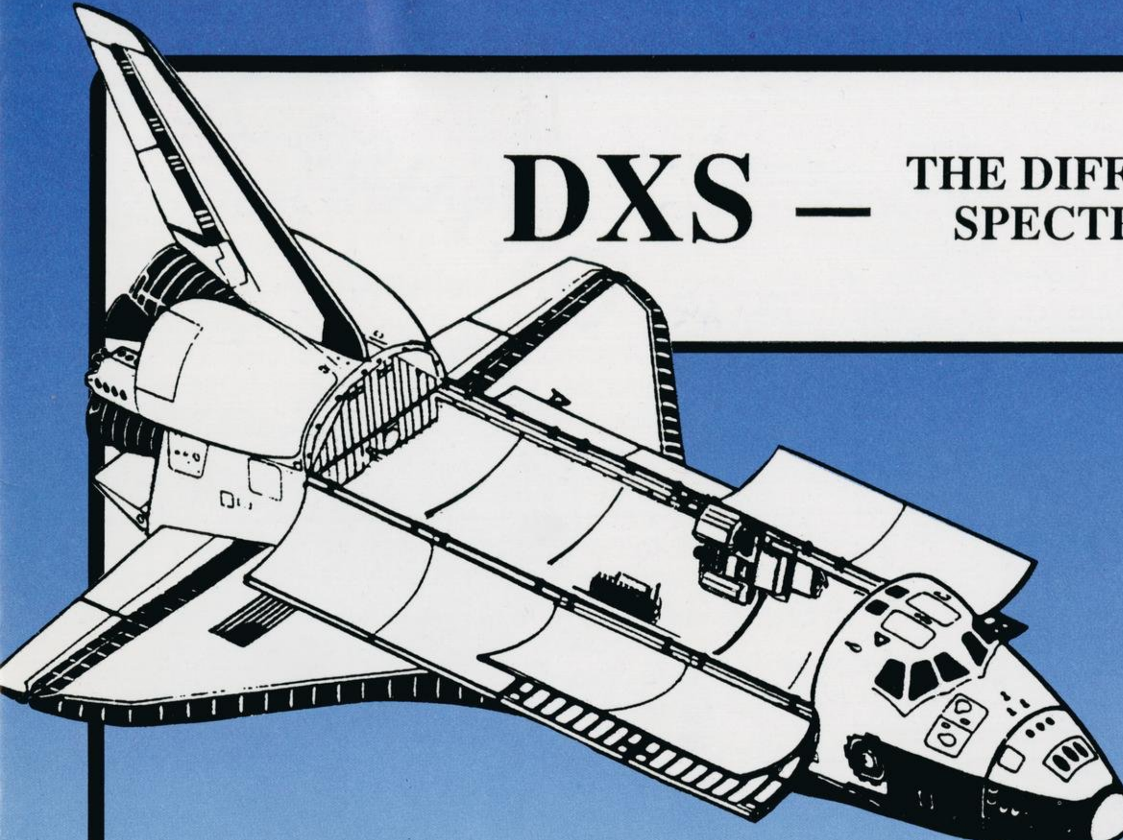
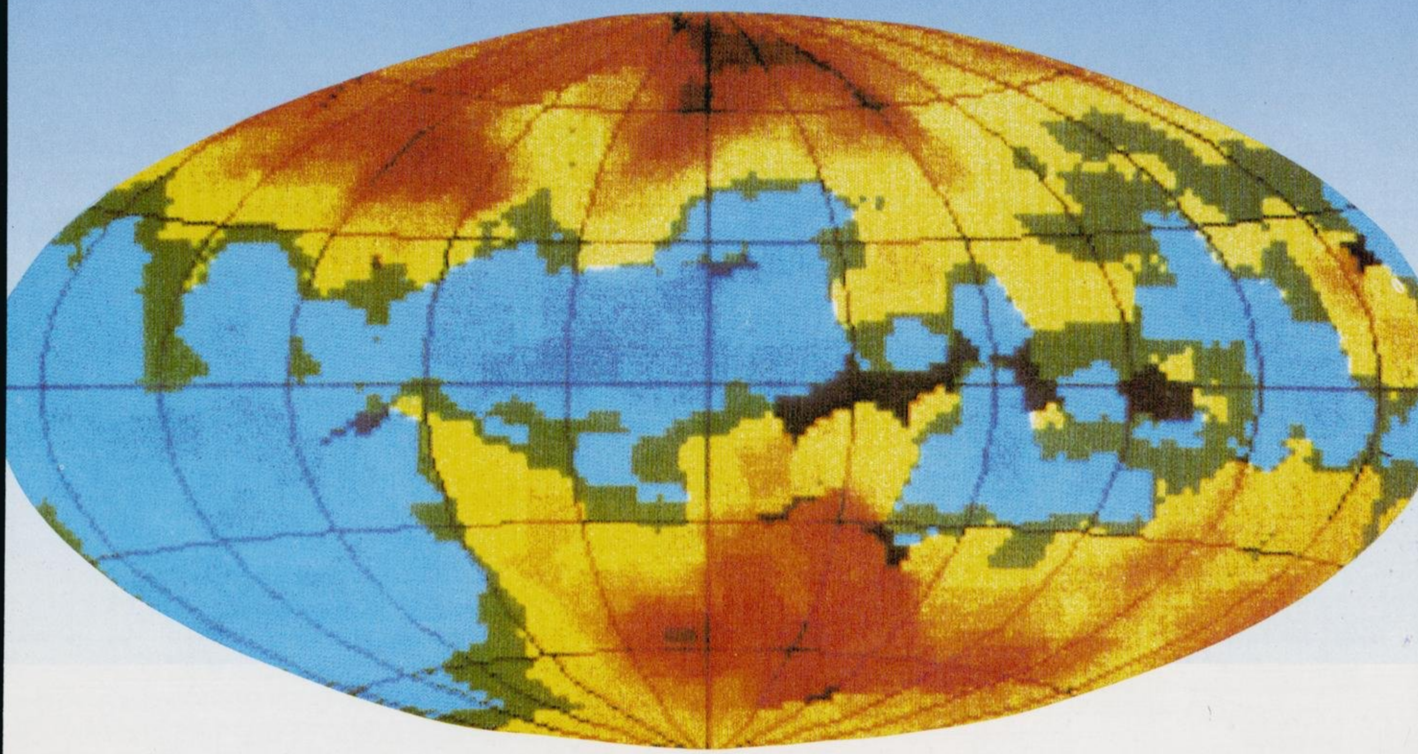
— Terry Devitt, (608) 262-8282

DXS — THE DIFFUSE X-RAY SPECTROMETER





NASA
National Aeronautics and
Space Administration

University of
Wisconsin-Madison

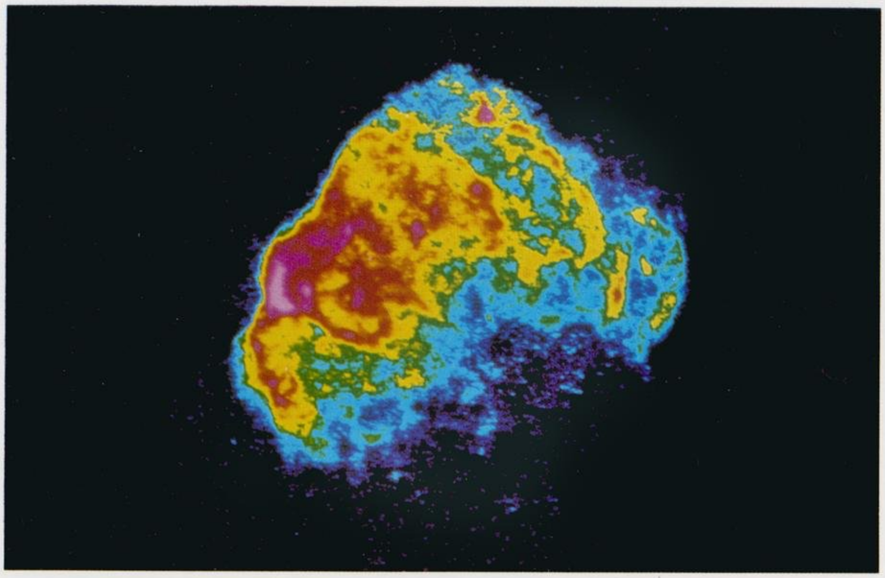
NASA will soon launch an experiment aimed at addressing a fundamental question of present-day astrophysics: the origin and nature of matter which fills the space between the stars -- the interstellar medium. Following in the footsteps of earlier exploratory observations that revealed the existence of an extremely hot (>1 million degrees) component of the interstellar medium, the Diffuse X-ray Spectrometer (DXS) investigation will study the x-ray emission characteristics of this hot gas. By measuring the gas temperature and composition, the DXS will provide important clues to the origin, evolution, and physical state of this gas in our Milky Way Galaxy and, by inference, in other galaxies.

Science Background

Between the individual stars that populate the night sky lies the mysterious interstellar medium. Although largely invisible to the naked eye, it contains magnetic fields, cosmic rays, x-rays, ultraviolet and infrared light, and radio waves. The terrain ranges from dense clouds where new stars are being born to the extremely hot and tenuous gas that constitutes most of the interstellar medium. Scientists are using sophisticated new instruments to explore these dynamic regions of our galaxy. As part of this effort, DXS will study the hottest parts of the interstellar medium by detecting the x-rays that are produced there.

The Galactic Life Cycle

Scientists think that spiral galaxies, like the one in which our solar system resides, are evolving systems whose components participate in an ongoing cycle of stellar birth and death. Stars are born in the gravitational collapse of cool matter present in clouds of gas and dust concentrated in the disk of the galaxy. Fueled by nuclear reactions at their core, typical stars burn for several billion years, radiating energy predominantly in the form of visible light. Some stars end their lives exploding as supernovae, which spew extremely hot, fast-moving plasma (ionized gas) into the interstellar medium. Initially billions of degrees in temperature, calculations show that this plasma rapidly cools in less than 100,000 years to temperatures near a million degrees. Although invisible to the naked eye, this matter is predicted to emit low energy x-rays. After millions of years, the hot plasma cools to a point where it can form new gas clouds, from which another generation of stars is born, thus renewing the galactic life cycle.

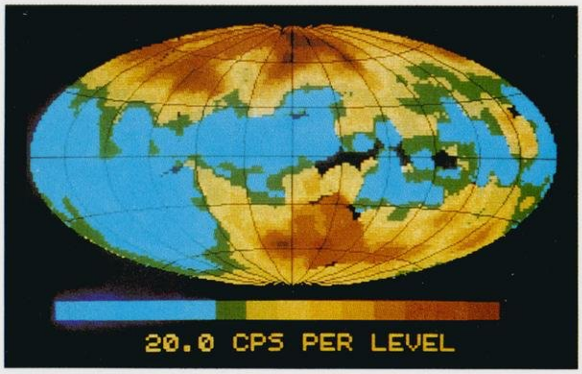


Using data from the Einstein satellite, this computer-generated x-ray image was created of the Puppis A supernova remnant--a star believed to have exploded 5,000 years ago. The invisible hot gas bubble surrounding our solar system is thought to be a remnant of a supernova which occurred over 100,000 years ago. (Photo courtesy of Harvard/Smithsonian Center for Astrophysics.)

Diffuse X-rays from the Local Interstellar Medium

For decades, astrophysicists have used suborbital rocket and satellite observations to study x-rays from celestial objects. Most of the sources of these x-rays have turned out to be well-known objects such as stars, galaxies or supernova remnants. However, a large percentage of low energy x-rays do not originate from these objects, but from some source that appears to be distributed over the entire sky. These x-rays comprise the diffuse low energy, or "soft" x-ray background.

KEY:
Brown = Regions of highest intensity (300 count per second)
Blue = Regions of lowest intensity (20 counts per second)
Black = Regions of no data coverage or where bright sources have been removed.

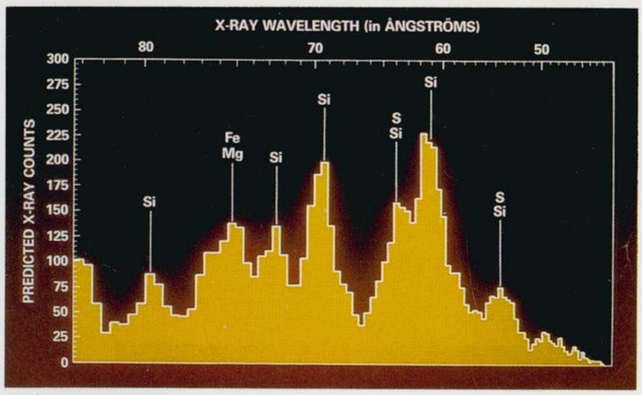


This computer-generated image of low energy x-ray emissions from the sky as seen from the earth was generated in 1983 by the University of Wisconsin Space Physics Group using sounding rocket data. The x-ray energies used to make this image were in the range 0.16 to 0.28 thousand electron volts (keV). The galactic coordinate system used is one in which the plane of our Milky Way Galaxy runs from left to right across the middle of the map.

Since low energy x-rays cannot travel more than a few hundred light years in interstellar space before they are absorbed, most of the diffuse soft x-ray background that we observe must have originated in our galaxy from the vicinity of our solar system. After eliminating other possible sources for these x-rays, scientists believe that they are most likely produced by an interstellar plasma - an invisible, ionized gas at a temperature of approximately one million degrees. It is thought that our solar system is embedded in an enormous bubble of this very tenuous plasma that extends for hundreds of light years in every direction.

DXS Science Objective: The Spectrum of the Diffuse Soft X-ray Background

If the diffuse soft x-ray background is produced by a hot plasma, its spectrum should show the characteristic features described below. The objective of the DXS experiment is to determine the spectrum of this emission from a number of different regions of the sky. If DXS observations confirm that the diffuse soft x-ray background x-rays are indeed coming from invisible ionized plasma, it would provide support to the idea that one or more nearby supernovae produced the hot plasma of the local interstellar medium. This will further our understanding of the later stages of supernova remnant evolution and their role in the galactic life cycle. Also, it will answer the important question of whether our solar system is located in a relatively special region of the Milky Way.



This histogram represents one possible x-ray spectrum that could be detected by the DXS along a wavelength band between 42Å and 84Å.

Previous experiments were not capable of measuring the spectrum of the diffuse soft x-ray background. With its spectral determination capability, the DXS will make this type of measurement possible for the first time. DXS is expected to find emission enhancements at various wavelengths along the spectrum. These preferred wavelengths are known as spectral lines (from early optical studies in which they appeared as lines on photographic plates), which correspond to specific ionized atoms of the emitting plasma.

The DXS measures the arrival direction and wavelength of incident low energy x-rays in the wavelength range 42 - 84 Ångströms (1 Å = 10^{-8} cm) corresponding to x-ray energies in the range 0.16 - 0.28 keV. From this information, the DXS scientists will be able to determine the spectrum (brightness at each wavelength) of the diffuse soft x-ray background from each of several regions of the sky.

Since each element of the atomic table has its own set of characteristic emission wavelengths, the DXS can identify the elements that emit these x-rays. If the diffuse x-ray background originates in a hot plasma, DXS observations will produce a spectrum with peaks and valleys like that shown in the adjacent figure. By analyzing these spectral features, scientists can identify the temperature, the ionization state, and the elements which constitute this plasma.

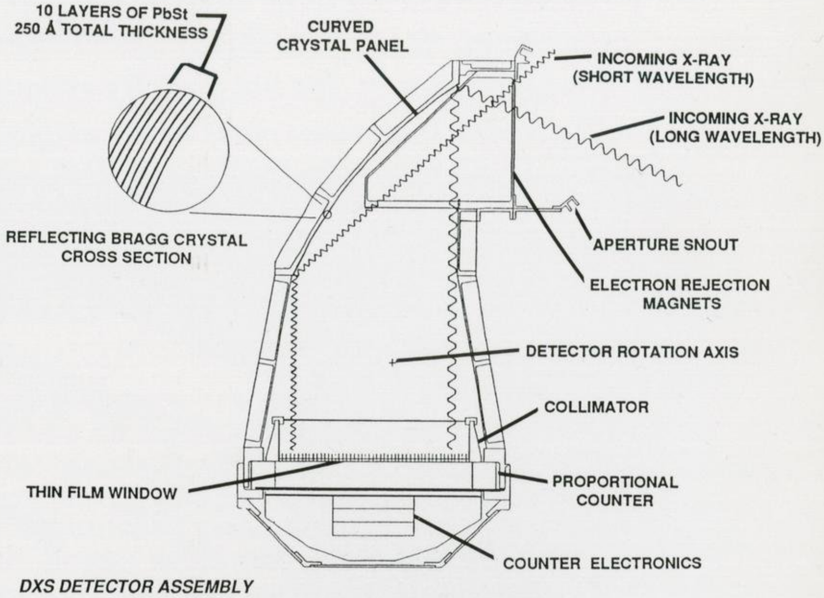
DXS DESCRIPTION

DXS Detector Operation

The DXS instrument is comprised of two identical detector modules. Each detector consists of two key elements: a curved panel of thin reflecting crystals that selectively reflect x-rays of specific wavelengths dependent upon the angle at which they strike the panel, and an x-ray proportional counter which can both record the reflected x-rays and determine the position along the counter at which they are absorbed. X-rays enter the detector aperture and are reflected via a process known as Bragg reflection through a collimator which allows only x-rays reflected from directly above to enter the proportional counter below. This counter is filled with P-10 gas (a mixture of 90% argon and 10% methane). Interaction of x-rays with the P-10 gas allows the detector to count incoming x-rays.

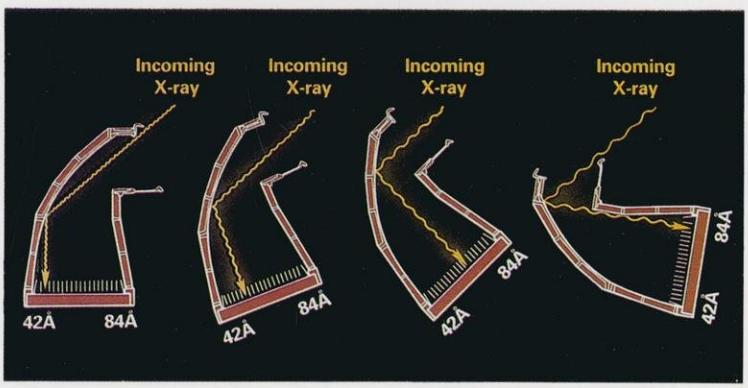
The angle of the reflected x-rays equals the angle of the incoming x-rays (relative to the crystal panel). However, interference from the different layers of lead causes only short wavelength x-rays to be reflected at small angles and only longer wavelength x-rays to be reflected at larger angles. Shorter wavelength x-rays (e.g., 42 Å) enter the proportional counter at the back side of the detector since they are reflected only at smaller angles of incidence. Longer wavelength x-rays (e.g., 84 Å) enter the counter toward the front because they are reflected at larger angles of incidence.

Knowledge of the spatial orientation of the crystal panel as a function of time and the position in the counter of each recorded x-ray allows the wavelength of each event and its direction on the sky to be determined. At any given orientation of the detector, an element on the curved crystal panel reflects only one x-ray wavelength from a given direction on the sky. Thus, by rotating the detector assembly, wavelengths being measured (from 42 to 84Å) may be accumulated over a 15° x 150° strip of the sky. This may be further subdivided into ten independent regions to allow a search for spatial variations of the x-ray spectrum.

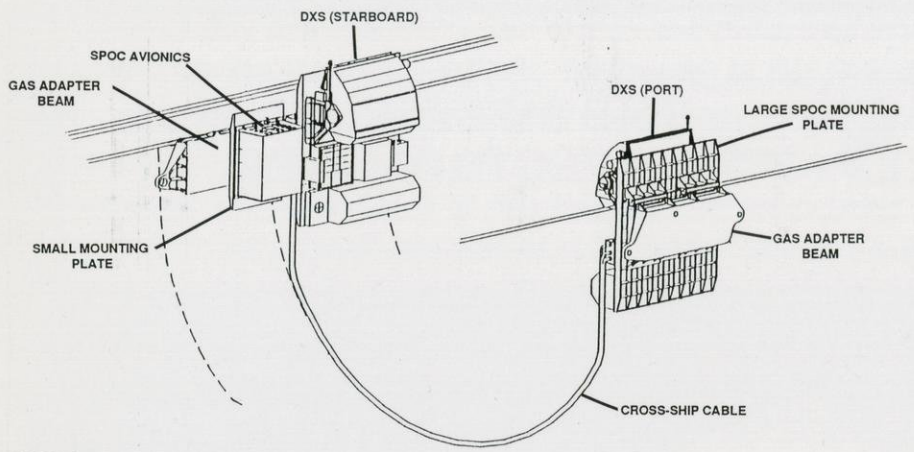


DXS DETECTOR ASSEMBLY

As x-rays enter the opening of the DXS detector, they strike the curved Bragg surface which is made up of approximately 200 alternating layers of lead and stearate. These alternating thin and thick layers serve as a grating that reflects the x-rays at the angle of incidence into the counter. Since they are only reflected at small angles, short wavelength x-rays always enter the counter at the back side from above. Conversely, long wavelengths enter the counter at the opposite end from above.

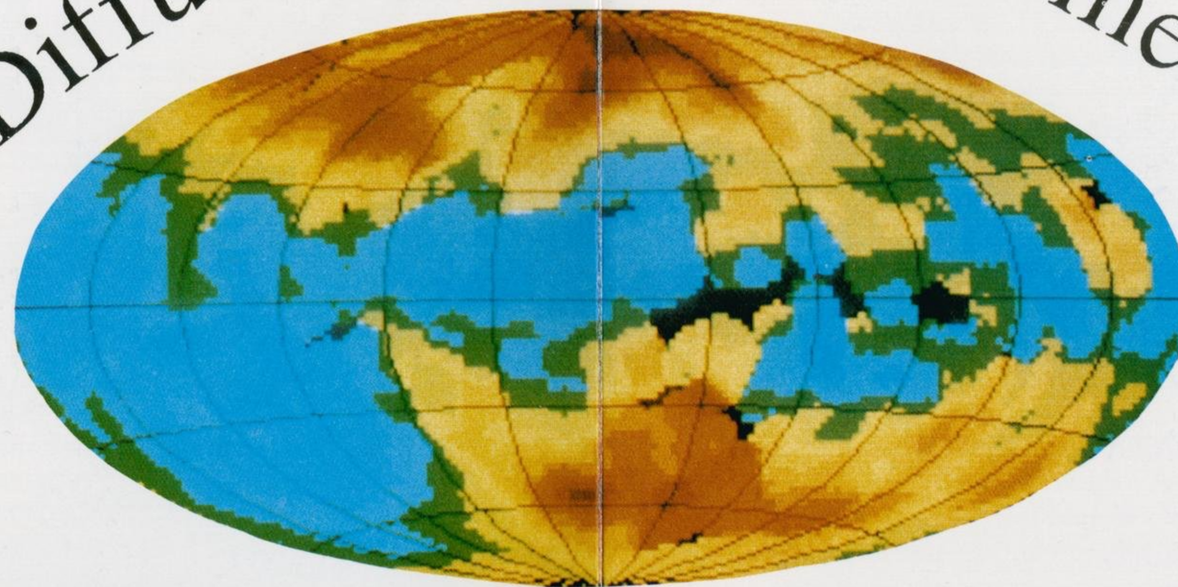


The rotation of the spectrometer allows the detection of x-ray wavelengths along the entire spectrum from 42 Å to 84 Å from any one given direction of the sky being observed.



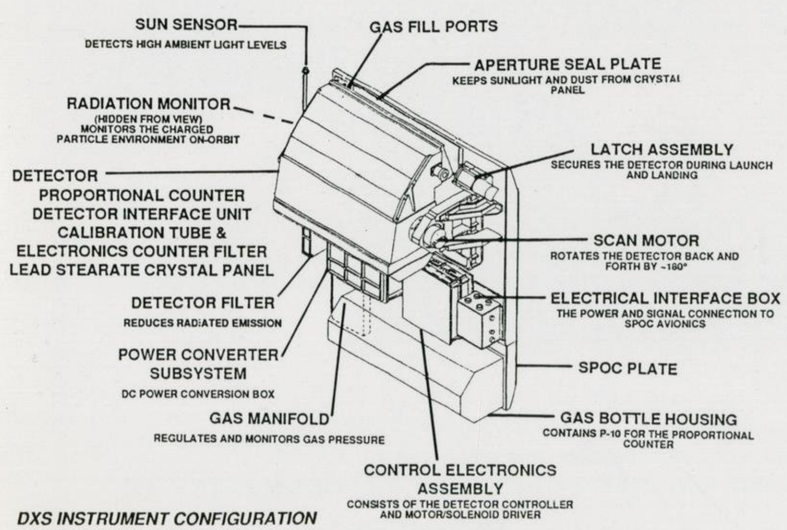
DXS ON-ORBIT FLIGHT CONFIGURATION

Diffuse X-Ray Spectrometer



DXS Instrument Description

The Diffuse X-ray Spectrometer experiment, developed by the University of Wisconsin in Madison consists of two identical instruments, one mounted to each side of the Shuttle cargo bay. A DXS instrument consists of a detector, its associated gas supply, and electronics. Each instrument is mounted to a 200 pound, 50" x 60" plate, which is attached to the Shuttle side wall. These plates are part of the Goddard Space Flight Center's Shuttle Payload of Opportunity Carrier (SPOC) standard hardware, designed for use on multiple missions. Both instruments are electrically connected to a SPOC avionics system. The avionics allows ground controllers to send commands to the DXS instruments and relays science and engineering data during the mission. Both DXS instruments combined with the SPOC plates and avionics comprise the DXS Payload.



DXS INSTRUMENT CONFIGURATION

INTEGRATION AND TEST PROGRAM

Instrument Tests

The two DXS instruments successfully completed environmental testing at the Goddard Space Flight Center (GSFC) in Greenbelt, Maryland. Testing included vibration, electromagnetic compatibility (EMC), and thermal vacuum/thermal balance. The test program objectives were to ensure that the instrument design meets Shuttle requirements and to verify the instrument performance.

Payload Tests and Integration

After completion of the instrument test program the instruments are electrically connected to the SPOC avionics and a payload integration test performed. This test verifies all electrical interfaces between the DXS instruments and the SPOC avionics. Following the integration test, a payload EMC test is performed in the GSFC EMC facility to ensure that the payload meets Shuttle requirements.

Several months prior to launch the DXS payload is transported from GSFC to the Kennedy Space Center (KSC) in Florida. Final preparations and functional testing are performed followed by an orbiter interface test in the Operations and Checkout building at KSC. The payload is then installed in the Shuttle and an interface verification test is performed prior to moving the Shuttle to the Vertical Assembly Building and finally to the launch pad.

MISSION OPERATIONS

Launch and Landing

The DXS experiment is carried into orbit by the Space Shuttle launched from the Kennedy Space Center. Landing is planned 5 to 7 days later at Edwards Air Force Base in California or the Kennedy Space Center in Florida. After landing, the DXS instruments are removed and then transported to the University of Wisconsin for post-flight testing and calibration.

A Payload Officer at Johnson Space Center's Mission Control Center serves as the point-of-contact between Mission Control and the GSFC Payload Operations Control Center during DXS operations.

On-Orbit Operations

Once the Shuttle is on orbit and the payload bay doors are open, a crew member activates the experiment. The DXS Payload Operations Control Center (POCC), located at GSFC in Greenbelt, Maryland, executes instrument commands. University of Wisconsin (UW) personnel in the GSFC POCC control and monitor the DXS experiment. Commands are sent by the UW personnel to perform the scientific data-taking operations, and telemetry data are received to monitor the progress. The GSFC personnel monitor and control the operations of the experiment support hardware.

After an initial checkout, the DXS instrument is commanded into operation when the Shuttle is pointed to the DXS target. Once the exact launch date and time are known, the specific Shuttle attitude is chosen to maximize the scientific return for the mission. The DXS scientists have requested a total of at least 50,000 seconds (about 14 hours) of good observing time. Observations can occur only when all of the following constraints are met:

A. DXS is in orbit night:
Ultraviolet sunlight destroys the lead stearate crystal. Therefore, DXS observations occur only during orbit night.

B. DXS is shielded from oxygen atoms:
Oxygen atoms at the Shuttle orbital altitudes damage the DXS lead stearate crystal panel. To protect against this, the Shuttle is oriented to shield the DXS experiment in the payload bay from oxygen atoms.

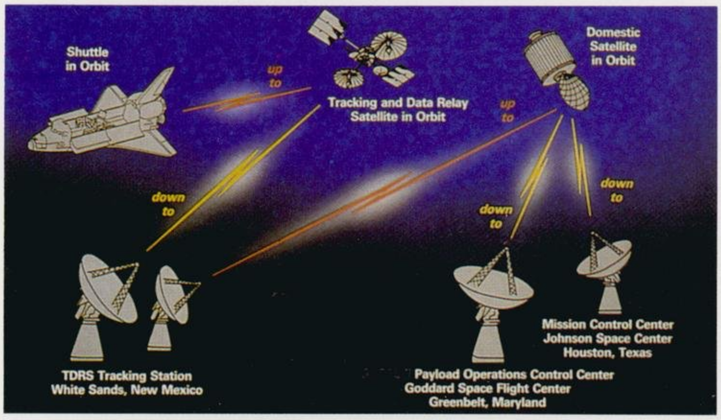
C. DXS is outside the Electron Contamination Region (ECR):
The ECR is a region above the surface of the earth where large numbers of high energy electrons are found. The DXS data quality is degraded and the detectors may be damaged if the proportional counters are operated when large numbers of these electrons are present.

To assist in planning the observational sequences, the GSFC Flight Dynamics Facility (FDF) determines optimum observation start and stop times. During flight operations the FDF also monitors Shuttle attitude via data downlinked to GSFC.

Prior to payload bay door closing the UW personnel command the DXS experiment off and a crew member deactivates the experiment.

Data Flow

During flight, data from the Shuttle is transmitted through a Tracking and Data Relay Satellite and the Domestic Satellite system to the Johnson Space Center and to GSFC. Low-rate scientific and housekeeping data is transmitted through JSC's Mission Control Center to the GSFC POCC. The GSFC Shuttle/POCC Interface Facility serves as the operations interface between the GSFC POCC and the JSC Mission Control Center. Medium-rate scientific data is transmitted directly to the POCC at GSFC. (Refer to figure below)



DXS MANAGEMENT SUPPORT

Three NASA Centers, NASA Headquarters, and one university comprise the team supporting the development, integration, and execution of the DXS mission.

Goddard Space Flight Center [GSFC]

GSFC, through its Explorer and Attached Payload Project and Shuttle Small Payloads Project, is responsible for management of the development and integration of the DXS into its supporting hardware. Additionally, as the Mission Management Center, the GSFC ensures space transportation system compatibility, and plans and executes the mission science timeline and science operations at the GSFC POCC.

Johnson Space Center [JSC]

JSC is responsible for the analytical integration of the DXS instrument and other payloads into the Shuttle and integration of the science timeline into the overall Shuttle mission timeline. Additionally, JSC is responsible for safety of the Space Shuttle and its crew.

Kennedy Space Center [KSC]

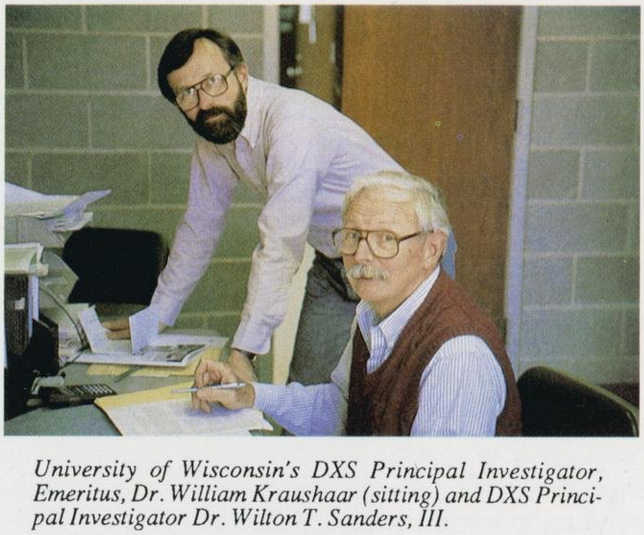
KSC is responsible for the physical integration of the DXS into the Shuttle and for its supporting functional and integration testing. KSC also provides launch support services.

NASA Headquarters

NASA Headquarters provides overall programmatic and science direction to the program in support of the Associate Administrator for the Office of Space Science and Applications (OSSA).

University of Wisconsin, Madison

The University of Wisconsin, Madison is responsible for the entire DXS engineering effort which entails instrument design, construction, testing and verification. The Principal Investigator, Dr. Wilton T. Sanders, III, is responsible for the performance of the DXS, acquisition of science data during flight, and post-flight data analysis.



University of Wisconsin's DXS Principal Investigator, Emeritus, Dr. William Kraushaar (sitting) and DXS Principal Investigator Dr. Wilton T. Sanders, III.

DXS CHARACTERISTICS

CAPABILITY

Measures and records the spectrum of observed diffuse x-rays

WAVELENGTH RANGE

42 to 84 Ångströms (Å)

FIELD OF VIEW

15°x15° per resolution element; 10 resolution elements along one arc of the sky

CONFIGURATION

Two DXS instruments, each mounted on a SPOC plate, facing each other from opposite sides of the Shuttle payload bay

DETECTOR DESCRIPTION

A curved panel of lead stearate crystals Bragg reflects low energy x-rays into a position-sensitive proportional counter

WEIGHT AND SIZE

Each DXS instrument weighs 500 pounds and is mounted on a 200-pound SPOC plate measuring 50" x 60"

ORBITAL AVERAGE POWER CONSUMPTION

400 Watts at 28 Volts (DC)

DATA RATE

200 kilobits per second (medium rate); 12 kilobits per second (low rate)

MISSION OPERATIONS

Orbit night only; ~ 64 passes averaging 13 minutes per pass

OBSERVATIONAL TIME REQUIREMENT

A total of 50,000 seconds (about 14 hours) of good observing time

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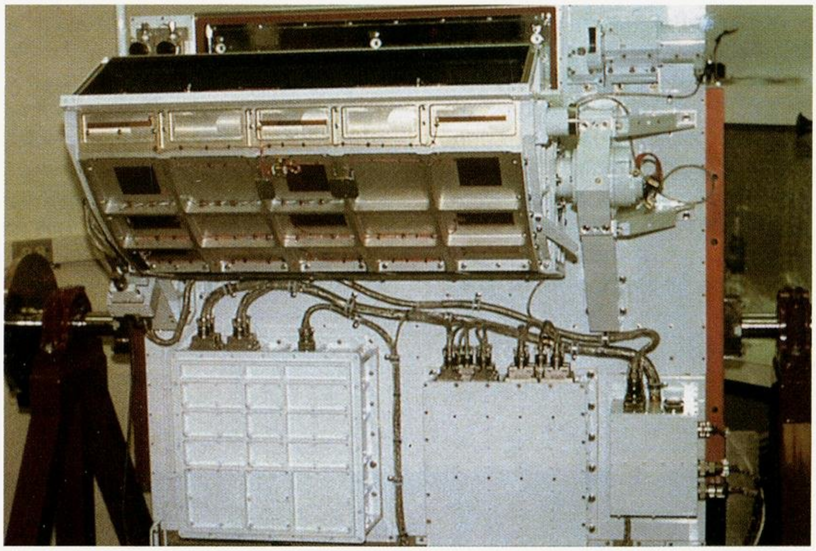

Rotated 90° from the stowed position, the DXS detector can observe x-ray emission coming from above the payload bay