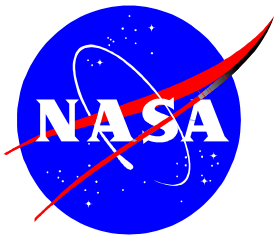
National Aeronautics and Space Administration

Media Kit



Cosmic Hot Interstellar Plasma Spectrometer Satellite (CHIPS) Mission

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CHIPS Ready to Operate on the Bubble

NASA's Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) satellite scheduled for launch on Jan. 11 will study the gas and dust in space, which are believed to be the basic building blocks of stars and planets.

CHIPS will launch aboard a Boeing Delta II rocket at approximately 7:45 p.m. EST from the Vandenberg Air Force Base, Calif. and fly as a secondary payload to NASA's Ice, Cloud and Land Elevation Satellite (ICESat).

The material between the stars is known as the Interstellar Medium (ISM) and contains important clues about the formation and evolution of galaxies. The ISM literally contains the seeds of future stars.

When the gas in the ISM cools and collapses, the gas forms clumps that can evolve into stars and planets. One of the biggest puzzles in astrophysics is the process that turns this very diffuse, hot and cold gas and dust into stars.

Our solar system is located in a region of space called the Local Bubble, which is about 300 light years in diameter and is filled with extremely low-density gas that is much less dense than the average interstellar medium surrounding it. This gas also is extremely hot - about one million Kelvin (1.8 million degrees Fahrenheit), or about 180 times as hot as the surface of our sun. It is this extremely diffuse gas, inside the Local Bubble, that the CHIPS mission is studying.

"CHIPS will give us invaluable information into the origin, physical processes and properties of the hot gas in the nearby interstellar medium," said Dr. Mark Hurwitz, CHIPS principal investigator from the University of California, Berkeley.

The CHIPS satellite, the first NASA University-Class Explorer (UNEX) mission, weighs 131 pounds (60 kilograms) and is the size of a large suitcase. It will orbit above the Earth at about 350 miles (590 kilometers) altitude and is expected to operate for one year.

"As a UNEX mission, CHIPS was developed primarily as a training device, but which can obtain actual and valuable science data," said Dave Pierce, NASA CHIPS mission manager from the Goddard Space Flight Center's Wallops Flight Facility, Wallops Island, Va. "The primary objective of the UNEX Program is to provide the opportunity for training of young scientists and engineers on a real flight mission. In this regard CHIPS has been very successful helping to train about 15 young engineers."

The CHIPS mission cost about $18 million, which includes flight hardware, integration and launch vehicle, data analysis, and mission operations.

It is sponsored by the Office of Space Science, NASA Headquarters, Washington, D.C. The project is managed at the Wallops Flight Facility and the Goddard Space Flight Center, Greenbelt, Md., through the NASA Explorers Program. The CHIPS instrument was built at the Space Science Laboratory of the University of California, Berkeley, and the spacecraft bus was built by SpaceDev, Inc. of Poway, Calif.

For detailed information about CHIPS and its mission, go to:

http://chips.ssl.berkeley.edu

http://www.gsfc.nasa.gov/topstory/2002/1217chips.html

http://icesat.gsfc.nasa.gov/intro.html

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CHIPS Mission Overview

The CHIPS mission is studying the very hot, very low-density gas in the vast spaces between the stars in our local astronomical neighborhood. The majority of the power radiated by this hot gas occurs in the short-wavelength, extreme ultraviolet region of the electromagnetic spectrum, centered around 170 Angstroms (Å). This is a relatively unsurveyed band and the emissions at this wavelength may contain important clues about the process of cooling that takes place in the Local Bubble of the Interstellar Medium.

In our galaxy alone, there are several hundred billion stars. Nearby stars are easy to see, although most of the stars in the Milky Way are so distant that their combined light appears as a fuzzy band stretching across the sky on a clear night. Equally easy to see is the space between the stars - but how often do you wonder about this space? Most of us have an idea that these vast spaces are empty, a perfect vacuum. The material between the stars is known as the Interstellar Medium (ISM) and contains important clues about the formation and evolution of galaxies.

The ISM literally contains the seeds of future stars, and all the stars we see were once formed out of the same kind of diffuse gas and dust. When the gas in the ISM cools and collapses, the gas forms clumps that can evolve into stars and planets. Stars, in turn, expel enriched material back into the ISM as they age. One of the biggest puzzles in astrophysics is understanding this cyclical process.

Processes that heat the ISM are fairly well understood. Stellar winds blow through galaxies, transferring huge amounts of energy. Massive stars explode as supernovae shortly after their formation, stirring and heating the gas out of which they formed. These injections of energy from supernovae and stellar winds profoundly affect the ISM and determine the rate at which new stars form.

The Interstellar Medium—What is it?

About 99% of the ISM is gas (hydrogen and helium); the remaining one percent consists of heavier elements and dust. The gas is extremely dilute, with an average density of about 1 atom per cubic centimeter. The air we breathe is approximately 30 quintillion (30,000,000,000,000,000,000) times more dense than the ISM. Picture this: an "empty" coffee mug in the ISM would contain about 500 hydrogen molecules. The same "empty" coffee mug sitting on your desk contains about 1500 quintillion gas molecules - mostly nitrogen, hydrogen and oxygen.

The dust in the ISM is made of tiny, irregularly shaped particles of silicates, carbon, ice and iron. In areas where the dust is thick, the light from nearby stars can be completely blocked - similar to the way dark clouds block light from the Sun.

Thinner clouds of interstellar dust may dim the light passing through, without completely blocking it. This is known as extinction. The interstellar dust scatters blue light more effectively than red light - which means that most of the light that reaches us through the interstellar dust is reddish. This is known as interstellar reddening. A similar process happens on Earth at sunset - which is why sunsets often appear red. Light from nearby stars also can be reflected from the interstellar dust, similar to the way light from a car's headlights can reflect off fog.

Unlike the dust in the interstellar medium, which can only reflect or block light, the gas in the interstellar medium glows in visible and many other wavelengths. In the region of hot, newly formed stars, clouds of hydrogen gas are ionized by the ultraviolet radiation emitted from the stars. When free electrons recombine with the ionized hydrogen, visible red light is emitted from the hydrogen gas. This accounts for the red colors in photographs of emission nebulae, such as the Trifid and Orion Nebulae.

In the hottest regions of the interstellar medium, hydrogen and helium are fully ionized, or stripped of their electrons. Spectral features in the light emitted by this gas, therefore, originate from heavier elements. At one million degrees Kelvin, the brightest spectral features are predicted to arise from partially ionized iron atoms in the interstellar medium. CHIPS will be the first mission to search for these spectral emission features with sufficient sensitivity to detect them and sufficient resolution to distinguish them from one another.

The Local Bubble: our astronomical neighborhood

Our solar system is located in an unusual region of space called the Local Bubble. The Local Bubble is about 300 light years in diameter and is filled with extremely low-density gas (about 0.001 gas molecules per cubic centimeter) - this is much less dense than the average ISM surrounding it. The coffee mug that would contain about 500 hydrogen molecules in the ISM would only contain 1 hydrogen molecule (or maybe none at all!), if it were in the Local Bubble. This gas also is extremely hot - about one million Kelvin, or almost 200 times as hot as the surface of the sun! Astronomers believe that a supernova explosion may have created this bubble - that is, the explosion "blew" most of the gas and dust from the interstellar medium outward. It is this extremely diffuse gas, inside the Local Bubble, that the CHIPS mission is studying.

Within the Local Bubble are smaller, denser clouds of interstellar gas. Our sun and solar system, along with some other nearby stars, are within but near the edge of one such cloud that is roughly 20 light-years in diameter.

CHIPS Science Objectives

The key questions about the Interstellar Medium that the CHIPS mission will seek to answer:

- At what wavelengths does the majority of the power radiated by local hot gas emerge?
- What are the physical processes by which the hot interstellar gas of the Local Bubble cools?
- What is the thermal pressure of hot gas in the Local Bubble?
- What is the structure and distribution of hot interstellar gas within 300 light years of the Sun (the “Local Bubble”)?
- What is the history and evolution of the Local Bubble?
- How can this knowledge be applied to other diffuse hot plasmas in the Universe?

Program/Project Management

NASA Management:

Office of Space Science

Associate Administrator for Space Science	Dr. Edward Weiler
Director for Astronomy and Physics	Dr. Anne Kinney
CHIPS Program Scientist	Dr. Philippe Crane
CHIPS Program Executive	Steven L. Horowitz

Goddard Space Flight Center

Explorers Program Manager	Anthony Comberiate
CHIPS Mission Manager	David Pierce
CHIPS Project Scientist	Dr. Randy Kimble

University of California, Berkeley, Project Management:

CHIPS Principal Investigator	Dr. Mark Hurwitz, Space Sciences Laboratory
CHIPS Project Manager	Dr. Mike Sholl, Space Sciences Laboratory

SpaceDev Project Management:

CHIPS Spacecraft Manager	Jeff Janicik

CHIPS Quick Facts

CHIPS Mission

The Cosmic Hot Interstellar Plasma Spectrometer (CHIPS) satellite examines the interstellar medium, the gas and dust that fill the space between the stars. Just as raindrops split sunlight into the colors of the rainbow, the CHIPS instrument will collect and separate the diffuse extreme ultraviolet glow from the interstellar medium. By measuring the distribution and intensity of the glow, scientists will be able to test several competing theories about the formation of the clouds of hot interstellar gas that surround our solar system.

Spacecraft Information

CHIPS measures 3 feet (1 meter) by 3 feet (1 meter) by 18 inches (.5 meters)
Spacecraft mass - 131 pounds (60 kilograms)
Orbit - 350 miles (590-kilometer) circular, 94-degree inclination
Total Power - 42 watts
Mission Duration - 1 year
Onboard Memory – 160 megabytes
Spacecraft Telemetry – Up to 16 megabytes/day

Launch Vehicle - Boeing Delta II 7320-10C. Additional information about the launch vehicle can be obtained at:
http://www.boeing.com/defense-space/space/delta/delta2/delta2.htm

Launch Site - Vandenberg Air Force Base, Calif.

CHIPS Deployment – The CHIPS spacecraft will be deployed from the Delta II about 83 minutes after launch.

First Signal Acquisition – Acquisition will occur no earlier than about 100 minutes after launch. NASA will issue the initial post-launch status to media at this time.

Mission Costs – Total mission costs are $18 million for the flight hardware, integration and launch vehicle, data analysis, and mission operations.

Mission Oversight – CHIPS is the first NASA University-Class Explorer mission. It is sponsored by the Office of Space Science, NASA Headquarters, Washington, D.C. The project is managed at the NASA Goddard Space Flight Center, Greenbelt, Md., and the Wallops Flight Facility, Wallops Island, Va., through the NASA Explorers Program.

Spacecraft and Instrument Development - The CHIPS instrument was built at the Space Science Laboratory of the University of California, Berkeley, and SpaceDev, Inc. of Poway, Calif, built the spacecraft bus.

Launch Operations – NASA Kennedy Space Center is responsible for launch operations.

Spacecraft and Science Operations Centers- Mission operations will be conducted from the SpaceDev Poway facility. Instrument commanding and science operations will be conducted at Berkeley with flow through the SpaceDev site. CHIPS is the first mission ever to use end-to-end satellite operations via the Internet.

Ground Stations – The primary ground station is located at Berkeley with secondary ground stations at the NASA Wallops Flight Facility, Wallops Island, Va., and the University of South Australia, Adelaide.

Media Services Information

NASA Launch Coverage and Commentary

NASA TV will provide live coverage and commentary of the CHIPS/ICESat launch on January 11 beginning at about 6 p.m. EST. The Boeing Delta II is scheduled to lift off at about 7:45 p.m. EST from Vandenberg Air Force Base, Calif.

For a live web cast of the launch, go to: http://www.ksc.nasa.gov

Pre-Launch Press Briefing

A pre-launch press conference will be held at Vandenberg on January 10 (L-1) at 2 p.m. EST to discuss details of the launch vehicle, the two spacecraft, and weather forecast for launch day. The briefing will be carried live on NASA TV.

News Center/Status Reports

NASA Public Affairs will staff the News Center at Vandenberg beginning on L-2 and continuing through launch and receipt of the initial signal from the spacecraft. Recorded status reports will available beginning on L-2 by dialing 805-734-2693, 301-286-NEWS, or 757-824-2050.

Media Credentials

Media seeking launch accreditation should fax requests by the close of business January 8 to:

George Diller, KSC/PAO
NASA Kennedy Space Center
Kennedy Space Center, FL
FAX: 805-605-3380

*****Requests must be submitted on the letterhead of the news organization and specify the editor making the assignment to cover the launch. Include the full name, birth date and Social Security Number of the media representative(s).*****

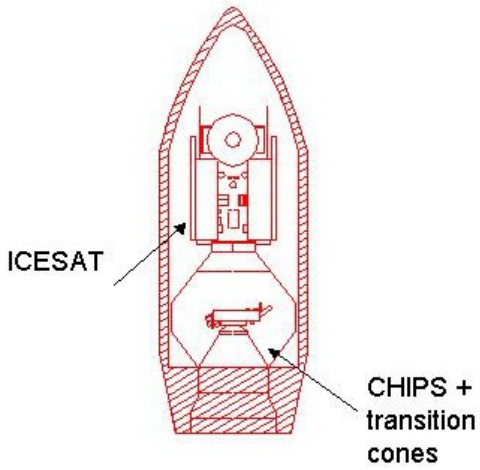
Photo/Video Information

Animations, photographs and video segments are available on the web at:

http://www.gsfc.nasa.gov/topstory/2002/1217chips.html

For a CHIPS mission video file that includes spacecraft animation, interviews with the principal investigator, and spacecraft testing call Deanna Kekesi at (301) 286-0041.

CHIPS' six apertures for observing the Interstellar Medium are located just below the small disk in the center of the forward end. The black rectangles are solar cells. (Photo UCB)



Location of the CHIPS spacecraft in the DELTA II fairing.