10-15-2009

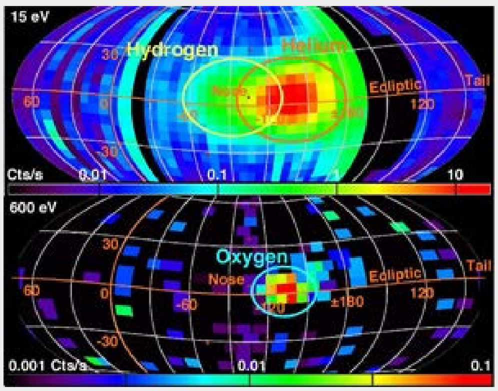
UNH Space Scientists Help Catch The Interstellar Wind

David Sims
UNH Institute for the Study of Earth, Oceans and Space

UNH Space Scientists Help Catch The Interstellar Wind

Media Contact: David Sims
603-862-5369
Science Writer
Institute for the Study of Earth, Oceans, and Space

Oct. 15, 2009



Arrival of interstellar hydrogen, helium, and oxygen atoms as seen in the IBEX-Lo sky maps. The Sun's gravitation deflects the interstellar wind away from its original arrival direction, i.e. coming from the nose of the heliosphere. (Image by the University of New Hampshire and Boston University)

DURHAM, N.H. –On Thursday, Oct, 15, 2009, scientists and engineers from the University of New Hampshire's Space Science Center will celebrate the announcement of the first major results from the National Aeronautics and Space Administration's Interstellar Boundary Explorer (IBEX) mission, which will be published online Thursday in the journal Science in conjunction with a 2 p.m. press conference held at NASA headquarters in Washington, D.C.

The mission launched October 19, 2008 and carries two ultra-high sensitivity cameras containing important components designed and built at UNH. From a highly elliptical Earth orbit the IBEX satellite is exploring the outer solar system using unique energetic neutral atom imaging (instead of photons of light) to create maps of the boundary between our solar system and the rest of our galaxy.

The mission's first global high- and low-energy maps show the interactions between the million-mile-per-hour solar wind and the low-density material between the stars, known as the interstellar medium, which blows through the solar system as a gentler 60,000-mile-per-hour interstellar wind due to the Sun's motion through our galactic neighborhood.

The maps provide a "big-picture" view of the region in space where the solar wind collides with interstellar gas to form the termination shock – the boundary of the huge, magnetic bubble that surrounds the Sun known as the heliosphere. The heliosphere is the Earth's first layer of protection from high-energy cosmic rays. The high-energy maps, which contain a bright "ribbon" snaking across the sky that nobody had expected, provide modelers with new real-world constraints needed to better understand how magnetic fields in the surrounding interstellar medium shape our heliosphere.

According to mission co-investigator Eberhard Möbius of the UNH Institute for the Study of Earth, Oceans, and Space and department of physics, the capability to use neutral atoms to create an image has also allowed scientists to "catch and analyze the interstellar wind at Earth's doorstep."

Says Möbius, "What we have managed to do for the first time is catch the interstellar wind for three species of energetic neutral atoms – helium, hydrogen, and oxygen." This image shows up as the brightest feature in the low-energy maps.

Like water flowing around a rock in a river, the electrically charged “plasma” component of the interstellar medium is forced around the heliosphere due to electrical and magnetic forces (a fraction of all interstellar atoms have lost electrons; the resulting mix of positive ions and negative electrons forms a plasma). While passing through this region, neutral hydrogen and oxygen atoms are partially dragged along by the plasma whereas neutral helium passes straight through. By comparing the arrival directions of these three different species at the IBEX spacecraft, scientists extract the subtle deflection at the boundary of the heliosphere and, thus, learn about the forces that shape it.

“We’re just now getting a handle on the interaction of the surrounding interstellar medium with the heliosphere and that’s providing us with the big picture,” Möbius says. More broadly, the IBEX data will help scientists understand the underlying physics operating in this same boundary region – the astrosphere – of other stars.

“The new and unexpected findings by IBEX will revolutionize our understanding of the heliosphere”, says IBEX principal investigator Dave McComas, of the Southwest Research Institute.

Scientists and engineers at the UNH Space Science Center designed and built a major portion of IBEX’s sensor payload – the “time-of-flight” mass spectrometer that can identify specific species of energetic neutral atoms, the iris or “collimator” of the specialized cameras, and the star sensor that tells with very high accuracy from which direction the interstellar gas is coming. Two undergraduate students, Morgan O’Neill and George Clark, conducted independent research calibrating the star sensor over their four years at UNH – work that helped launch them both into Ph.D. programs upon graduation.

IBEX is the latest in NASA’s series of low-cost, rapidly developed Small Explorers space missions. Southwest Research Institute (SwRI) in San Antonio, Texas, leads and developed the mission with a team of national and international partners. NASA’s Goddard Space Flight Center in Greenbelt, Md., manages the Explorers Program for NASA’s Science Mission Directorate in Washington.

Funding for UNH’s role in the IBEX mission was received from NASA under a subcontract with SwRI.

The University of New Hampshire, founded in 1866, is a world-class public research university with the feel of a New England liberal arts college. A land, sea, and space-grant university, UNH is the state's flagship public institution, enrolling 12,200 undergraduate and 2,200 graduate students.

-30-

Image available to download: http://www.eos.unh.edu/newsimage/ibex_sci_lg.jpg.

Photo caption: Arrival of interstellar hydrogen, helium, and oxygen atoms as seen in the IBEX-Lo sky maps. The Sun’s gravitation deflects the interstellar wind away from its original arrival direction, i.e. coming from the nose of the heliosphere. (Image by the University of New Hampshire and Boston University)