MIT instrument studies edge of sun's bubble

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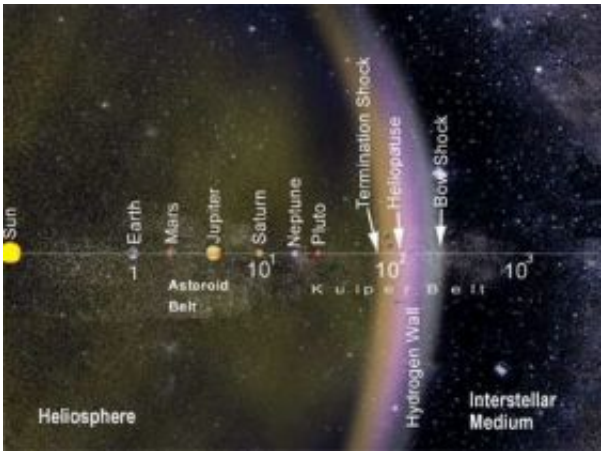

The scale of the heliosphere and nearby galactic neighborhood. The solar system and its nearby galactic neighborhood are illustrated here on a logarithmic scale extending (from

The Voyager 1 and 2 spacecraft have traveled beyond the edges of the bubble in space where the sun's constant outward wind of particles and radiation slams into the interstellar medium that pervades our galaxy. The first scientific reports on what the Voyagers found there appears this week in the journal *Nature.*

The deep-space probes, which were designed mainly to study the outer planets Jupiter, Saturn, Uranus and Neptune, have now traveled more than 8 billion miles away from the Earth.

Voyager 1 is now more than 94 Astronomical Units away (one AU is the average distance from the Earth to the sun, or 93 million miles), and Voyager 2 is more than 84 AU. Because they are leaving the solar system on paths that are about 45 degrees apart, the data reveals details about the shape of the bubble created by the solar wind. The fact that they crossed the edge of the solar outflow--a region

called the boundary shock--at different distances out from the sun proved that this bubble is squashed rather than being a symmetrical sphere.

Some of the data that revealed this boundary region comes from a set of magnetic field sensors developed and built at MIT back in the 1970s, based on an earlier MIT instrument sent on Explorer 1 in 1961. John Richardson, Principal Research Scientist at MIT's Kavli Institute for Astrophysics and Space Science, is a co-author of the two Nature papers, and John Belcher, professor of physics at MIT and former principal investigator for the Voyager Plasma Science instrument, is a co-author of one of them.

"We have never made direct measurements in the interstellar medium, the material between the stars," Belcher says, "because the sun's supersonically expanding atmosphere blows a bubble in the local interstellar medium whose radius is 100 times the distance from the sun to the Earth."

"It's starting to feel the interstellar wind," Richardson says of the fast-receding spacecraft, which is already more than three times as far from the sun as the solar system's outermost planets. "The interstellar wind is coming at us at 26 km per second," he says.

Sometime about a decade from now, Belcher says, Voyager 2 "will be through the shocked solar wind and into the interstellar medium proper. This is the material out of which the sun condensed, which has never been explored before."

Nobody knows much about that interstellar medium, such as what the density of hydrogen atoms is in that incredibly tenuous vacuum. "We will be able to deduce that better" once Voyager reaches it, Richardson says. "We'll also get a first look at cosmic rays that haven't been influenced by the sun's magnetic field, once we get outside," and thus learn more about the origins of these extremely fast-moving particles, he says. "That's one of our major scientific goals."

On a personal note, Belcher said that the creators of the MIT plasma instrument all wrote their names inside it before it was sent to be attached to the spacecraft. "My father had a 7th grade education, my generation was the first in the family to go to college," he says, "and my name is on a spaceship that will eventually reach the stars and probably last longer than the Earth itself!"

An earlier report on what Voyager 2 found was presented at a scientific meeting last December.

Source: MIT