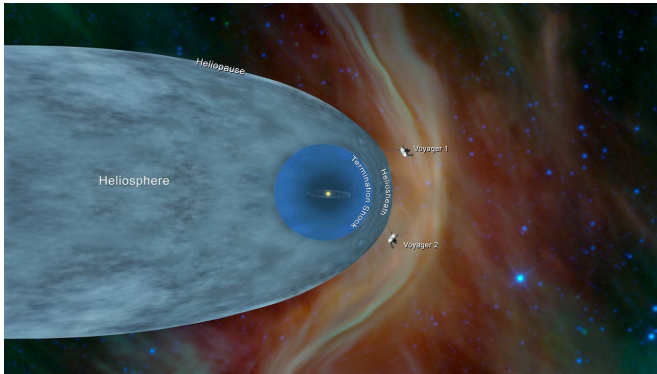


# NASA's Voyager 2 probe enters interstellar space

10 December 2018, by Dwayne Brown / Karen Fox



This illustration shows the position of NASA's Voyager 1 and Voyager 2 probes, outside of the heliosphere, a protective bubble created by the Sun that extends well past the orbit of Pluto. Credit: NASA/JPL-Caltech

For the second time in history, a human-made object has reached the space between the stars. NASA's Voyager 2 probe now has exited the heliosphere – the protective bubble of particles and magnetic fields created by the Sun.

Members of NASA's Voyager team will discuss the findings at a news conference at 11 a.m. EST (8 a.m. PST) today at the meeting of the American Geophysical Union (AGU) in Washington. The news conference will stream live on the agency's [website](#).

Comparing data from different instruments aboard the trailblazing spacecraft, mission scientists determined the probe crossed the outer edge of the heliosphere on Nov. 5. This boundary, called the heliopause, is where the tenuous, hot [solar wind](#) meets the cold, dense interstellar medium. Its twin, Voyager 1, crossed this boundary in 2012, but Voyager 2 carries a working instrument that will provide first-of-its-kind observations of the nature of this gateway into [interstellar space](#).

Voyager 2 now is slightly more than 11 billion miles (18 billion kilometers) from Earth. Mission operators still can communicate with Voyager 2 as it enters this new phase of its journey, but information – moving at the speed of light – takes about 16.5 hours to travel from the spacecraft to Earth. By comparison, light traveling from the Sun takes about eight minutes to reach Earth.

The most compelling evidence of Voyager 2's exit from the heliosphere came from its onboard Plasma Science Experiment (PLS), an instrument that stopped working on Voyager 1 in 1980, long before that probe crossed the heliopause. Until recently, the space surrounding Voyager 2 was filled predominantly with plasma flowing out from our Sun. This outflow, called the solar wind, creates a bubble – the heliosphere – that envelopes the planets in our solar system. The PLS uses the electrical current of the plasma to detect the speed, density, temperature, pressure and flux of the solar wind. The PLS aboard Voyager 2 observed a steep decline in the speed of the solar wind particles on Nov. 5. Since that date, the plasma instrument has observed no solar wind flow in the environment around Voyager 2, which makes mission scientists confident the probe has left the heliosphere.

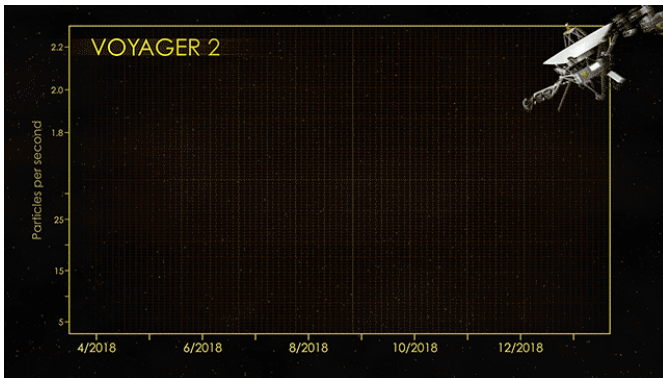
In addition to the plasma data, Voyager's science team members have seen evidence from three other onboard instruments – the cosmic ray subsystem, the low energy charged particle instrument and the magnetometer – that is consistent with the conclusion that Voyager 2 has crossed the heliopause. Voyager's team members are eager to continue to study the data from these other onboard instruments to get a clearer picture of the environment through which Voyager 2 is traveling.

"There is still a lot to learn about the region of interstellar space immediately beyond the heliopause," said Ed Stone, Voyager project scientist based at Caltech in Pasadena, California.

Together, the two Voyagers provide a detailed glimpse of how our heliosphere interacts with the constant interstellar wind flowing from beyond. Their observations complement data from NASA's Interstellar Boundary Explorer (IBEX), a mission that is remotely sensing that boundary. NASA also is preparing an additional mission – the upcoming Interstellar Mapping and Acceleration Probe (IMAP), due to launch in 2024 – to capitalize on the Voyagers' observations.

to fly beyond it.

The Voyager probes are powered using heat from the decay of radioactive material, contained in a device called a radioisotope thermal generator (RTG). The power output of the RTGs diminishes by about four watts per year, which means that various parts of the Voyagers, including the cameras on both spacecraft, have been turned off over time to manage power.

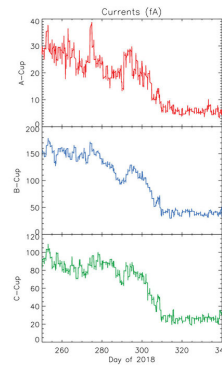


Credit: NASA's Goddard Space Flight Center

"Voyager has a very special place for us in our heliophysics fleet," said Nicola Fox, director of the Heliophysics Division at NASA Headquarters. "Our studies start at the Sun and extend out to everything the solar wind touches. To have the Voyagers sending back information about the edge of the Sun's influence gives us an unprecedented glimpse of truly uncharted territory."

While the probes have left the heliosphere, Voyager 1 and Voyager 2 have not yet left the solar system, and won't be leaving anytime soon. The boundary of the solar system is considered to be beyond the outer edge of the Oort Cloud, a collection of small objects that are still under the influence of the Sun's gravity. The width of the Oort Cloud is not known precisely, but it is estimated to begin at about 1,000 astronomical units (AU) from the Sun and to extend to about 100,000 AU. One AU is the distance from the Sun to Earth. It will take about 300 years for Voyager 2 to reach the inner edge of the Oort Cloud and possibly 30,000 years

"I think we're all happy and relieved that the Voyager probes have both operated long enough to make it past this milestone," said Suzanne Dodd, Voyager project manager at NASA's Jet Propulsion Laboratory (JPL) in Pasadena, California. "This is what we've all been waiting for. Now we're looking forward to what we'll be able to learn from having both probes outside the heliopause."



The set of graphs on the left illustrates the drop in electrical current detected in three directions by Voyager 2's plasma science experiment (PLS) to background levels. They are among the key pieces of data that show that Voyager 2 entered interstellar space in November 2018. Credit: NASA/JPL-Caltech/MIT

Voyager 2 launched in 1977, 16 days before Voyager 1, and both have traveled well beyond their original destinations. The spacecraft were built to last five years and conduct close-up studies of Jupiter and Saturn. However, as the mission continued, additional flybys of the two outermost giant planets, Uranus and Neptune, proved possible. As the spacecraft flew across the solar

system, remote-control reprogramming was used to endow the Voyagers with greater capabilities than they possessed when they left Earth. Their two-planet mission became a four-planet mission. Their five-year lifespans have stretched to 41 years, making Voyager 2 NASA's longest running mission.

The Voyager story has impacted not only generations of current and future scientists and engineers, but also Earth's culture, including film, art and music. Each spacecraft carries a Golden Record of Earth sounds, pictures and messages. Since the spacecraft could last billions of years, these circular time capsules could one day be the only traces of human civilization.

Voyager's mission controllers communicate with the probes using NASA's Deep Space Network (DSN), a global system for communicating with interplanetary spacecraft. The DSN consists of three clusters of antennas in Goldstone, California; Madrid, Spain; and Canberra, Australia.

Provided by NASA's Goddard Space Flight Center

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