



Voyager 2 Enters Interstellar Space

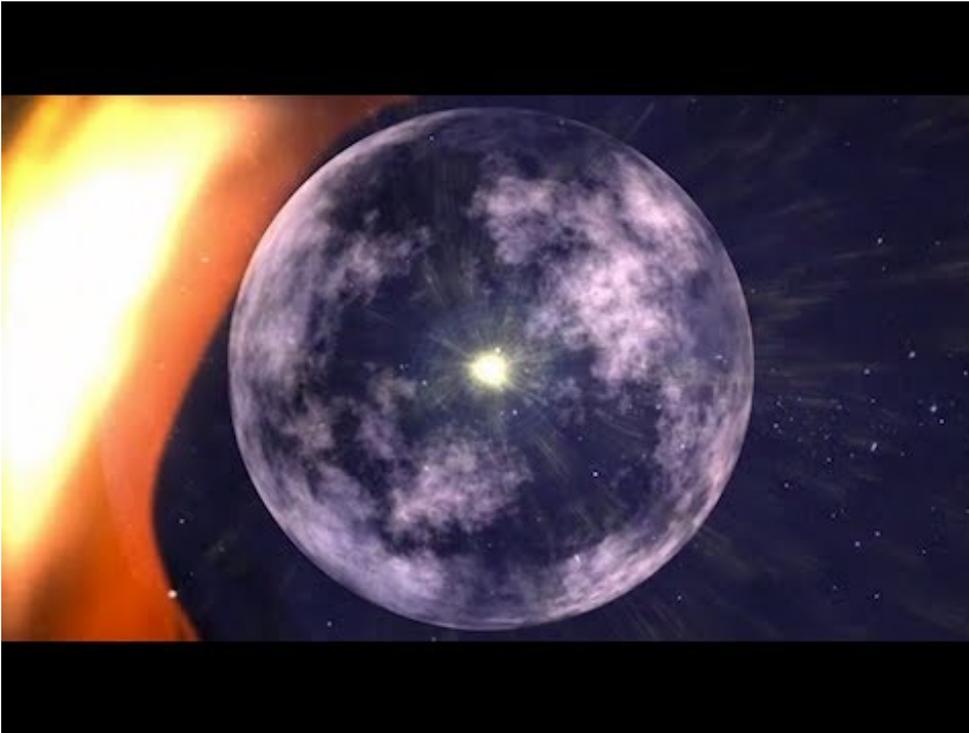
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NASA's Voyager 2 has become the second human-made object in history to exit the Heliosphere (bubble created by solar winds).

- Spacecraft Voyager 1, crossed this boundary in 2012.
- The Voyager spacecraft are the third and fourth spacecraft to fly beyond all the planets in our solar system. Pioneers 10 and 11 preceded Voyager in going beyond the planets in the solar system.
- Voyager 2 is the only spacecraft to have visited all four gas giant planets — Jupiter, Saturn, Uranus, and Neptune.
- The two probes, Voyager 1 and Voyager 2 have left the heliosphere, but have not yet left the solar system as they are not out of the sun's gravitational field yet.

Significance and Challenges

- Together, the two Voyagers provide a detailed information on how heliosphere interacts with the constant interstellar wind flowing from outer space. Their observations will be used to complement data from NASA's Interstellar Boundary Explorer (IBEX), a mission that is remotely sensing the solar system's boundary.
- The challenge for the spacecraft operations is to deal with the gradual loss of heat and power. Voyager 2 is currently operating in temperatures of just about 38.5 degrees Fahrenheit (3.6 degrees Celsius), and for each year that passes the spacecraft's power production drops 4 watts.



[Watch Video At:](#)

<https://youtu.be/MGPM58S5Njg>

About the Mission

- **Launch:** Voyager 2 was launched on August 20, 1977, and Voyager 1 was launched on September 5, 1977.
- The spacecraft were built to last five years and conduct close-up studies of Jupiter and Saturn.
- Voyager 2 is NASA's longest-running mission.

Terminologies

- **Termination Shock**

Blowing outward billions of kilometers from the Sun is the solar wind, a thin stream of electrically charged gas. This wind travels at an average speed ranging from 300 to 700 kilometers per second (700,000 - 1,500,000 miles per hour) until it reaches the termination shock. At this point, the speed of the solar wind drops abruptly as it comes in contact with the interstellar wind.

- **Heliosphere**

The solar wind, emanating from the Sun, creates a bubble that extends far past the orbits of the planets. This bubble is the heliosphere, shaped like a long windsock as it moves with the Sun through interstellar space.

- **Heliosheath**

The heliosheath is the outer region of the heliosphere, just beyond the termination shock, the point where the solar wind slows abruptly, becoming denser and hotter. The solar wind piles up as it presses outward against the approaching wind in interstellar space.

- **Heliopause**

The boundary between solar wind and the interstellar wind is the heliopause, where the pressure of the two winds are in balance. This balance in pressure causes the solar wind to turn back and flow down the tail of the heliosphere.

- **Bow shock**

As the heliosphere plows through interstellar space, a bow shock forms, similar to what forms as a ship plowing through the ocean.

- **Oort Cloud**

- It is a collection of small objects that are still under the influence of the sun's gravity.
- The boundary of the solar system is considered to be beyond the outer edge of the Oort Cloud.
- 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 (1 AU is the distance from the sun to Earth).

- **The Golden Record**

The Golden Record is the 12-inch gold-plated copper disk, phonograph record onboard Voyager 1 and 2. It carries data containing sounds and images selected to portray the diversity of life and culture on Earth.

- **Deep Space Network**

- The Deep Space Network (DSN) supports NASA and non-NASA missions that explore the furthest points of our solar system. The DSN has three ground stations located approximately 120 degrees apart on Earth ($120 + 120 + 120 = 360$). This is to ensure that any satellite in deep space is able to communicate with at least one station at all times.
- **Location of DSN:**
 - Canberra, Australia
 - Madrid, Spain
 - Goldstone, California, US

- **Interstellar Mapping and Acceleration Probe**

It is NASA's additional mission due to launch in 2024 to follow on the Voyagers' observations.

- **Interstellar Boundary Explorer (IBEX)**

- NASA's Interstellar Boundary Explorer (IBEX) mission objective is to discover the nature of the interactions between the solar wind and the interstellar medium at the edge of our solar system.
- It was launched on Oct. 19, 2008.