
Prelims and Mains focus: about the mission and its significance; about Ulysses and Parker missions; about Heliosphere

News: The Solar Orbiter spacecraft was launched from Cape Canaveral (USA) on a United Launch Alliance Atlas V 411 rocket and is on a 10-year voyage.

Background
This follows the Ulysses spacecraft, another collaboration between ESA and NASA that launched in 1990 and also flew over the sun's poles. Ulysses completed three passes of the sun before its mission ended in 2009, but its view was limited to what it could see from the sun's equator.

About the Space orbiter mission

- The mission, which is a joint collaboration between NASA and the European Space Agency set off on a blazing hot journey to the sun to take the first close-up look at the star's polar regions, a mission expected to yield insight into how solar radiant energy affects Earth

- Solar Orbiter is equipped with ten instruments that can capture observations of the sun's corona (which is its atmosphere), the poles and the solar disk. It can also use its variety of instruments to measure the sun's magnetic fields and solar wind, or the energized stream of particles emitted by the sun that reach across our solar system.

- It will take Solar Orbiter about two years to reach its highly elliptical orbit around the sun. Gravity assists from Earth and Venus will help swing the spacecraft out of the ecliptic plane, or the space that aligns with the sun's equator, so it can study the sun's poles from above and below.
Solar Orbiter also has a seven-year mission and will come within 26 million miles of the sun. It will be able to brave the heat of the sun because it has a custom titanium heat shield coated in calcium phosphate so that it can endure temperatures up to 970 degrees Fahrenheit.

What's so special about the mission?

- This is the first mission that will provide images of the sun's north and south poles using a suite of six instruments on board that will capture the spacecraft's view.

- Up until Solar Orbiter, all solar imaging instruments have been within the ecliptic plane or very close to it. Now, we'll be able to look down on the sun from above.

Significance of the mission

- Understanding the sun's magnetic field and solar wind are key because they contribute to space weather, which impacts Earth by interfering with networked systems like GPS, communications and even astronauts on the International Space Station. The sun's magnetic field is so massive that it stretches beyond Pluto, providing a pathway for solar wind to travel directly across the solar system.

- Observations of the poles could explain why the sun's magnetic field changes, alternating over an 11-year period. When the magnetic field is active, it produces dark sunspots on the sun's surface, and then there are calmer periods with less activity.

- Solar Orbiter's observations of the poles could also lead to better predictions of space weather because it can provide a better view of the magnetic field.

- The poles are particularly important for the scientists to be able to model more accurately. For forecasting space weather events, scientists need a
pretty accurate model of the global magnetic field of the sun.

**Cooperation with Parker Mission**

- The Space Orbiter mission will work in tandem with NASA’s Parker Solar Probe, which is currently orbiting the sun on a seven-year mission and just completed its fourth close approach of the star. It launched in August 2018 and will eventually come within four million miles of the sun -- the closest a spacecraft has ever flown by our star.

- The Parker probe is tracing the flow of energy that heats and accelerates the sun’s corona and solar wind; determining the structure and dynamics of the plasma and magnetic fields at the sources of the solar wind; and exploring mechanisms that accelerate and transport energetic particles.

- Together, the missions can help unlock the mysteries of the sun and provide more data to researchers than either could accomplish on its own. Parker can sample particles coming off the sun up close, while Solar Orbiter will fly farther back to capture more encompassing observations and provide broader context.

- At times, the spacecraft will both align to take measurements of the solar wind or magnetic field.

**About Heliosphere**

- Solar Orbiter Mission addresses a central question of heliophysics: How does the Sun create and control the constantly changing space environment throughout the solar system?

- The Sun creates what’s known as the heliosphere — a giant bubble of charged particles and magnetic fields blown outward by the Sun that stretches more than twice the distance to Pluto at its nearest edge, enveloping every planet in our solar system and shaping the space around us.
To understand it, Solar Orbiter will travel as close as 26 million miles from the Sun, inside the orbit of Mercury. There, it will measure the magnetic fields, waves, energetic particles and plasma escaping the Sun while they are in their pristine state, before being modified and mixed in their long journey from the Sun.