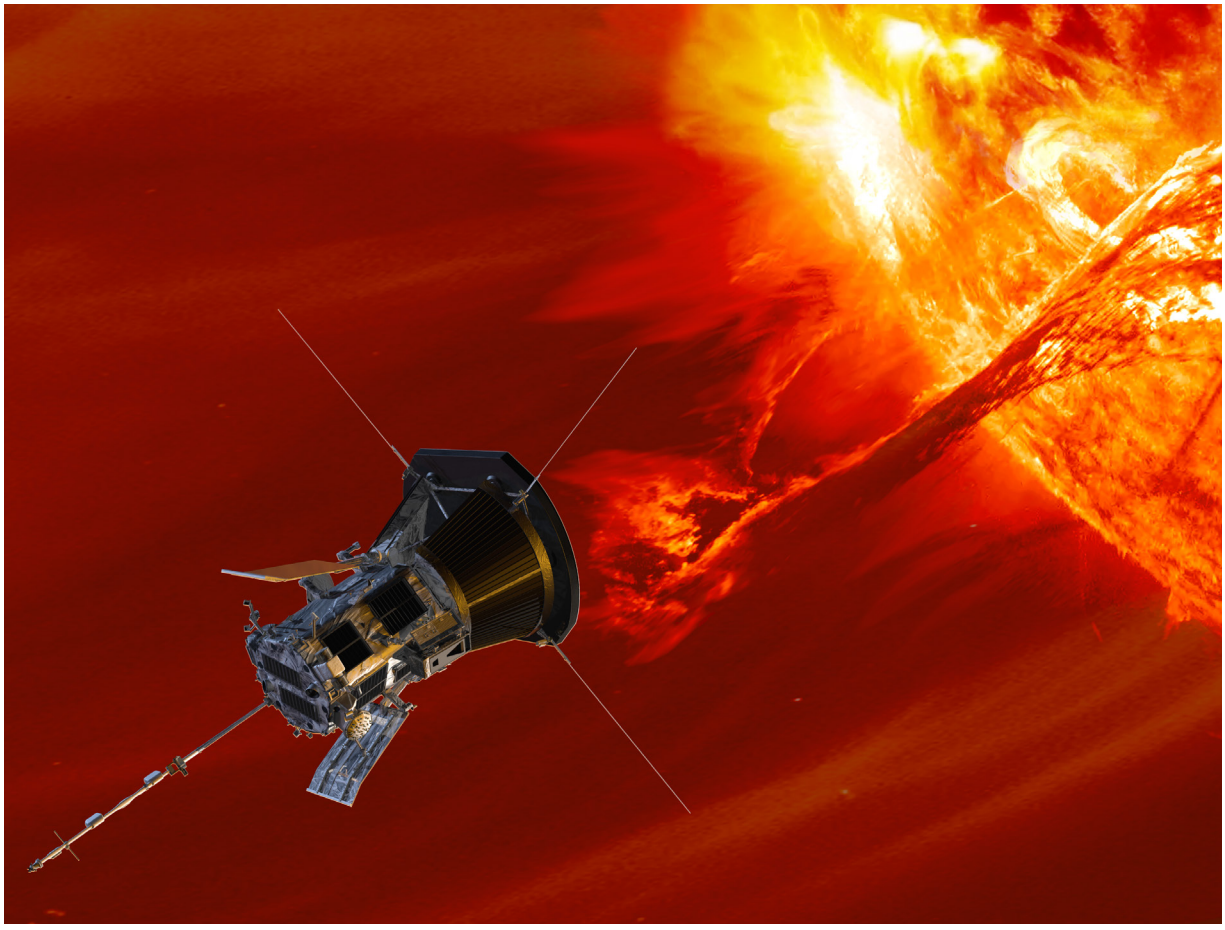
National Aeronautics and Space Administration

Parker Solar Probe

A Mission to Touch the Sun

NASAfacts



Humanity's First Visit to a Star

NASA's Parker Solar Probe mission is revolutionizing our understanding of the Sun. The mission is named for Dr. Eugene N. Parker, whose profound contributions pioneered our modern understanding of our star. Parker Solar Probe is plunging through the Sun's atmosphere, facing brutal heat and radiation—and providing humanity with the first-ever samplings of a star's atmosphere.

Journey to the Sun

Launched on Aug. 12, 2018, Parker Solar Probe is using Venus flybys—called gravity assists—to gradually reduce its orbit around the Sun. The spacecraft will come close to 4% of the distance from the Sun to the Earth, well within the orbit of Mercury—and closer to the Sun's surface than any other spacecraft.

The Science of the Sun

Making the first flights ever into the part of the Sun's atmosphere known as the corona, Parker Solar Probe is discovering much about this mysterious region. The spacecraft employs four instrument suites designed to study electric and magnetic fields, plasma, and energetic particles, as well as image the solar wind. The mission is tracing how energy moves through the solar corona and exploring what accelerates the solar wind and solar energetic particles, enabling critical contributions to our ability to forecast changes in Earth's space environment that impact our lives and technology. This ambitious journey is providing answers to long-standing questions that have puzzled scientists since the dawn of the Space Age: Why is the corona much hotter than the solar surface? How is the solar wind accelerated? What are the sources of the high-energy solar particles? These questions can be answered only by sending a probe right through the tenuous, multimillion-degree temperature coronal plasma.

Extreme Exploration

Parker Solar Probe is performing its scientific investigations in a hazardous region of intense heat and solar radiation. The spacecraft is flying close enough to the Sun to enter the highly magnetized corona, crossing the regions where the solar wind and energetic particles are accelerated. Such a spacecraft is finally possible today through cutting-edge thermal engineering advances that can protect the probe on its dangerous journey. Parker Solar Probe and its instruments are protected from the Sun's heat by a 4.5-inch-thick (11.43-centimeter-thick) carbon-composite shield, which needs to withstand radiation equivalent to about 500 times the Sun's radiation here on Earth. This shield is so effective that the instruments that lie in the umbra (shadow) operate at a comfortable 85 degrees Fahrenheit (29 degrees Celsius). Only the electric field antennas and a small plasma detector brave direct illumination from the Sun.

Teaming for Success

Parker Solar Probe was developed as part of NASA's Living With a Star program to explore aspects of the Sun–Earth system that directly affect life and society. The Living With a Star program is managed by the agency's Goddard Space Flight Center in Greenbelt, Maryland, for NASA's Science Mission Directorate in Washington, D.C. The Johns Hopkins Applied Physics Laboratory designed, built, and operates the spacecraft and manages the mission for NASA. Teams led by the Naval Research Laboratory, Princeton University, the University of California, Berkeley, and the University of Michigan provided the science instrumentation.

Dazzling Discoveries

In December 2021, NASA announced that Parker Solar Probe had achieved its cornerstone objective: making the first measurements from within the atmosphere of a star. This allowed mission scientists to add to their list of major discoveries, which includes:

- Evidence that small-scale jetting in the Sun's corona, driven by a process called magnetic reconnection, is responsible for heating the corona and driving the solar wind.
- Observations that dust—scattered throughout our solar system—begins to thin out close to the Sun, evidence of a long-theorized dust-free zone near our star.
- Insights into the structure of the solar wind, tracing the origin of switchbacks—magnetic zigzag structures in the solar wind—back to the solar surface.

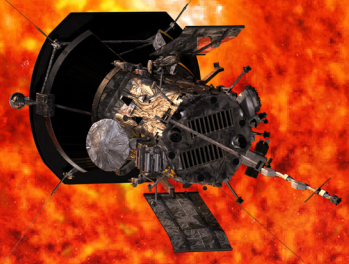
Parker Solar Probe has also studied comets, detected radio emissions from Venus' atmosphere, and even captured the first-ever images of Venus' surface in visible wavelengths. And with its closest pass of the Sun still ahead in December 2024, only time will tell what other discoveries await.

Faster, Hotter, Closer

At closest approach, Parker Solar Probe will zoom around the Sun at approximately 430,000 miles per hour (700,000 kilometers per hour). That's fast enough to get from New York to Tokyo in less than a minute.

Parker Solar Probe will be immersed in the coronal plasma (an ionized gas of electrons, protons and heavier ions), where temperatures can reach more than a million degrees Fahrenheit. However, the coronal plasma has such a low density that the heat transferred to the probe's shield is primarily from sunlight, which will heat it to approximately 2,500 degrees Fahrenheit (about 1,370 degrees Celsius).

On the final three orbits, Parker Solar Probe will fly to within 3.9 million miles (6.2 million kilometers) of the Sun's surface—more than seven times closer than the previous record holder for a close solar pass, the Helios 2 spacecraft, which came within 27 million miles (43 million kilometers) in 1976.



For more information about Parker Solar Probe, visit:

nasa.gov/parkersolarprobe
parkersolarprobe.jhuapl.edu