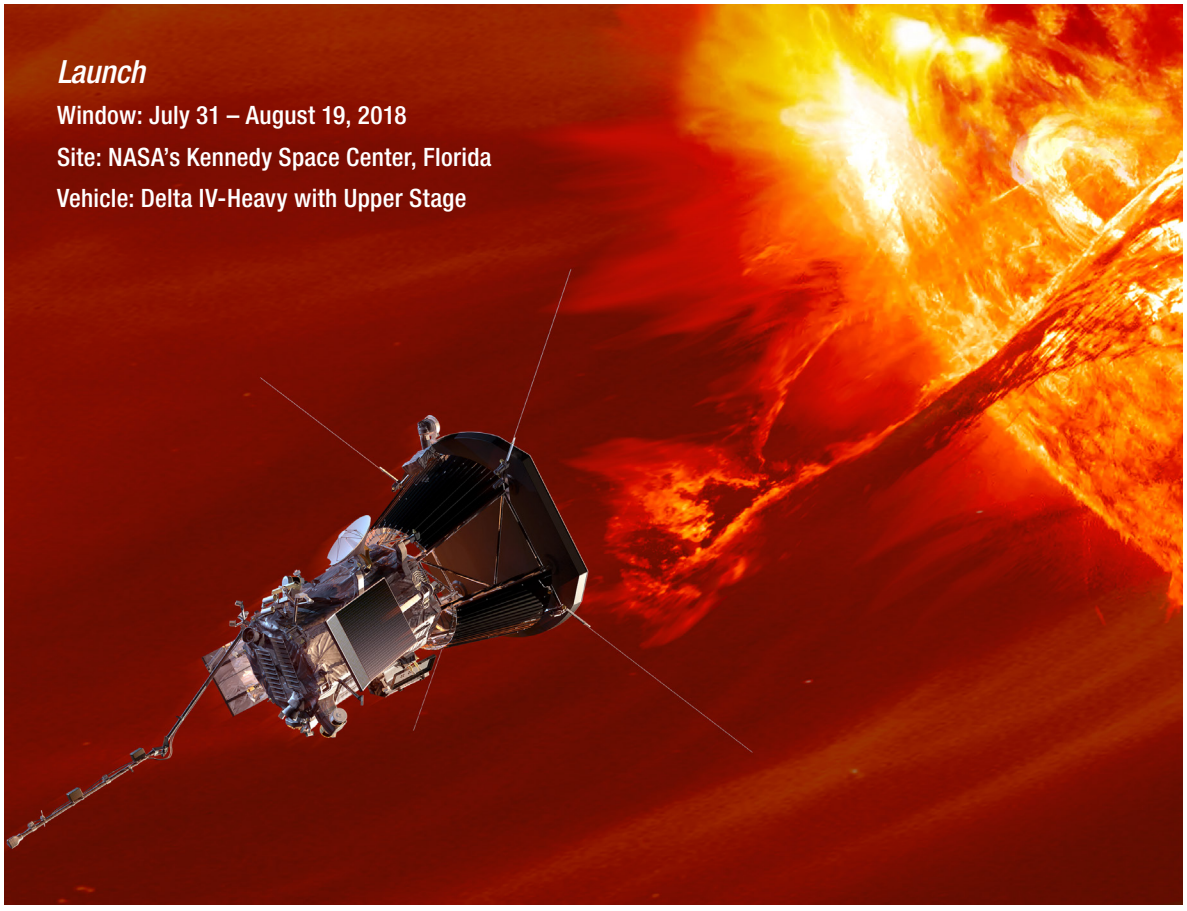
National Aeronautics and Space Administration

Parker Solar Probe

A Mission to Touch the Sun

NASAfacts



Humanity's First Visit to a Star

NASA's historic Parker Solar Probe mission will revolutionize our understanding of our closest star. The mission is named for Dr. Eugene N. Parker, whose other profound contributions have transformed our knowledge of the Sun. Parker Solar Probe will plunge through the Sun's atmosphere, closer to the surface than any spacecraft before it, facing brutal heat and radiation conditions—and ultimately providing humanity with the first-ever close-up view of a star.

Journey to the Sun

To unlock the mysteries of the Sun's atmosphere, Parker Solar Probe will use seven Venus flybys over nearly seven years to gradually reduce its orbit around the Sun. The spacecraft will come as close as ~4% of distance of the Sun to the Earth, well within the orbit of Mercury, and closer to the surface than any spacecraft before it.

The Science of the Sun

Flying into the outermost part of the Sun's atmosphere, known as the corona, for the first time, Parker Solar Probe will revolutionize our understanding of this mysterious region. The spacecraft will employ four instrument suites designed to study electric and magnetic fields, plasma, and energetic particles, as well as image the solar wind. The mission will trace how energy moves through the solar corona and explore 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 life and technology on Earth. During this ambitious journey, the mission will provide answers to long-standing questions that have puzzled scientists for more than 60 years: why is the corona much hotter than the solar surface (i.e., the photosphere)? 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, multi-million-degree temperature coronal plasma.

Extreme Exploration

Parker Solar Probe will perform its scientific investigations in a hazardous region of intense heat and solar radiation. The spacecraft will fly close enough to the Sun to enter the highly magnetized corona, crossing the regions where solar energetic particles are accelerated.

Such a probe is finally possible today through cutting-edge thermal engineering advances that can protect the spacecraft on its dangerous journey. The spacecraft and instruments will be protected from the Sun's heat by a 4.5-inch-thick (11.43-centimeter-thick) carbon-composite shield, which will need to withstand radiation equivalent to ~500 times the Sun's radiation here on Earth. This shield is so effective that the instruments which lie in the umbra (shadow) are able to operate at a comfortable 68 degrees Fahrenheit (20 degrees Celsius). Only the electric field antennas and a small plasma detector will brave direct illumination from the Sun.

Teaming for Success

Parker Solar Probe is 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 flight 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 University Applied Physics Laboratory implements the mission for NASA. Scientific instrumentation is provided by teams led by the Naval Research Laboratory, Princeton University, the University of California, Berkeley, and the University of Michigan.

Eugene Newman Parker

In the mid-1950s, a young physicist named Eugene Parker proposed a number of concepts about how stars—including our Sun—give off energy. He called this cascade of energy the solar wind, and he described an entire complex system of plasmas, magnetic fields, and energetic particles that make up this phenomenon. Professor Parker also theorized an explanation for the superheated solar corona, which is (counterintuitively) hotter than the surface of the Sun itself: nanoflares, which in enough abundance could cause this heating.

More than half a century later, the Parker Solar Probe mission will finally be able to find proof for Parker's groundbreaking theories and ideas, which have informed scientists about solar physics and magnetic fields around stellar bodies. Much of his pioneering work, which has been proven by subsequent spacecraft, defined a great deal of what we know about the how the Sun–Earth system interacts.

Born on June 10, 1927, in Michigan, Parker received a B.S. in physics from Michigan State University and a Ph.D. from Caltech in 1951. He then taught at the University of Utah, and since 1955, Parker has held faculty positions at the University of Chicago and at its Fermi Institute.

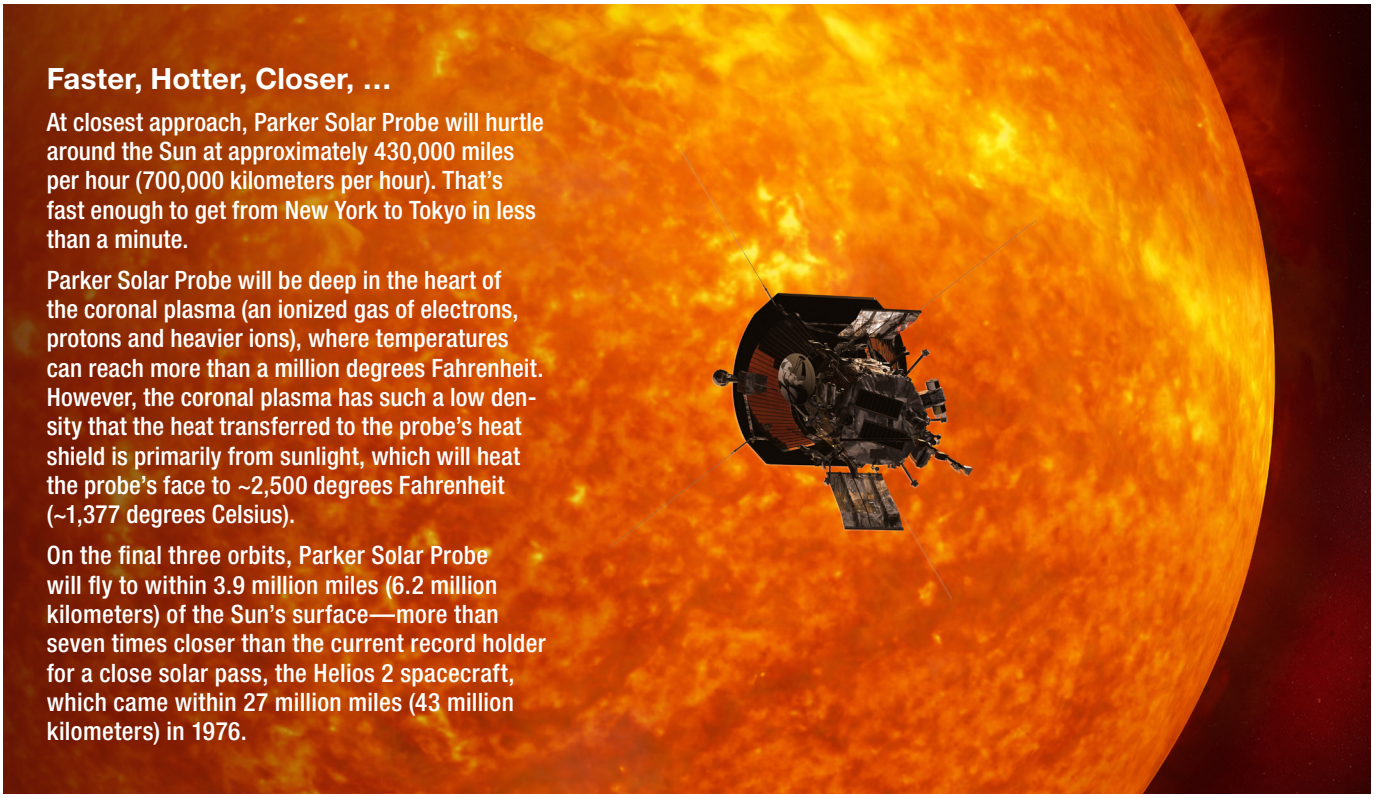
He has received numerous awards for his research, including the National Medal of Science, the NASA Distinguished Public Service Medal, the George Ellery Hale Prize, the Bruce Medal, the Gold Medal of the Royal Astronomical Society, the Kyoto Prize, and the James Clerk Maxwell Prize.

Faster, Hotter, Closer, …

At closest approach, Parker Solar Probe will hurtle 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 deep in the heart of 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 heat shield is primarily from sunlight, which will heat the probe's face to ~2,500 degrees Fahrenheit (~1,377 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 current 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/solarprobe
solarprobe.jhuapl.edu

NASA Facts

JHUAPL_17-01677_08.16.17