Topic of the week for discussion: 25th to 31st Jan 2018

Topic: SOLAR PARKER PROBE – HUMANITY'S FIRST VISIT TO A STAR

Topic Introduction

Parker Solar Probe (previously **Solar Probe**, **Solar Probe Plus**, or **Solar Probe+**) is a planned NASA robotic spacecraft to probe the outer corona (an aura of plasma that surrounds the Sun and other stars) of the Sun. It will approach to within 8.5 solar radii (5.9 million kilometers or 3.67 million miles) to the 'surface' (photosphere - star's outer shell from which light is radiated) of the Sun.

The project was announced in the fiscal 2009 budget year. Johns Hopkins University Applied Physics Laboratory designed and built the spacecraft, which was originally scheduled to launch in 2015. The launch date has since been rescheduled to the summer of 2018. This was the first time a NASA spacecraft was named after a living person, honoring physicist Eugene Parker.

Parker Solar Probe will swoop to within 4 million miles of the sun's surface, facing heat and radiation like no spacecraft before it. Launching in 2018, Parker Solar Probe will provide new data on solar activity and make critical contributions to our ability to forecast major space-weather events that impact life on Earth.

Parker Solar Probe is an extraordinary and historic mission exploring arguably the last and most important region of the solar system to be visited by a spacecraft to finally answer top-priority science goals for over five decades.

One recent study by the National Academy of Sciences estimated that without advance warning a huge solar event could cause two trillion dollars in damage in the US alone, and the eastern seaboard of the US could be without power for a year. In order to unlock the mysteries of the corona, but also to protect a society that is increasingly dependent on technology from the threats of space weather, we will send Parker Solar Probe to touch the sun.

The sun is a dynamic star. We live in the sun's atmosphere! This mission will provide insight on a critical link in the Sun-Earth connection. Data will be the key for understanding and, perhaps, forecasting space weather.

We need to go so close because:

- The corona is unstable, producing the solar wind, flares and coronal mass ejections – we need to study at the source!
- Millions of tons of highly magnetized material can erupt from the sun at speeds of several million miles an hour – fast enough to get from Washington to LA in seconds!
- Why is the corona hotter than the surface? Why is there a solar wind? We can only answer these questions by getting up close and personal with our star

We live in the atmosphere of the sun. Physics of the corona and inner heliosphere (The bubble-like region of space dominated by the Sun, which extends far beyond the orbit of Pluto) connect the activity of the sun to the environment and technological infrastructure of Earth will:

- drive the fundamental physics of the heliosphere, aurora, and magnetosphere of Earth and other planets
- help us improve satellite communications, power grid issues, pipeline erosion, radiation exposure on airline flights, astronaut safety

Until we can explain what is going on up close to the sun, we will not be able to accurately predict space weather effects that can cause havoc at Earth.

NASA's historic Parker Solar Probe (SPP) mission will revolutionize our understanding of the Sun. SPP will swoop closer to the Sun's surface than any spacecraft before it, facing brutal heat and radiation conditions — and ultimately providing humanity with the closest-ever observations of a star.

To perform these unprecedented investigations, the spacecraft and instruments will be protected from the Sun's heat by a 4.5-inch-thick (11.43 cm) carbon-composite shield, which will need to withstand temperatures outside the spacecraft that reach nearly 2,500 degrees Fahrenheit (1,377 degrees Celsius).

Journey to the Sun

- **Launch Window:** July 31 – Aug. 19, 2018
- **Launch Site:** NASA's Kennedy Space Center, Florida
- **Launch Vehicle:** Delta IV-Heavy with Upper Stage

At closest approach, Parker Solar Probe hurtles around the sun at approximately 430,000 mph (700,000 kph). That's fast enough to get from Philadelphia to Washington, D.C., in one second.

At closest approach to the sun, the front of Parker Solar Probe's solar shield faces temperatures approaching 2,500 F (1,377 C). The spacecraft's payload will be near room temperature.

On the final three orbits, Parker Solar Probe flies to within 3.7 million miles 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 in 1976 and more than 10 times closer than Mercury, which is about 42 million miles from the sun.

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 watch the solar wind speed up from subsonic to supersonic, and it will fly though the birthplace of the highest-energy solar particles.

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. The Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, manages the mission for NASA. APL is designing and building the spacecraft and will also operate it.

We are on this mission of studying Sun as it is the only start we can study up close and through it we will learn about more stars in the universe. The sun is a source of light and heat for life on Earth. The more we know about it, the more we can understand how life on Earth developed. The sun also affects Earth in less familiar ways. It is the source of the solar wind; a flow of ionized gases from the sun that streams past Earth at speeds of more than 500 km per second (a million miles per hour). Space weather can change the orbits of satellites, shorten their lifetimes, or interfere with onboard electronics. The more we learn about what causes space weather – and how to predict it – the more we can protect the satellites we depend on.

Read further:

https://www.washingtonpost.com/news/speaking-of-science/wp/2018/01/22/this-nasa-spacecraft-will-get-closer-to-the-sun-than-anything-ever-before/?utm_term=.a28722fe3ee8

http://www.firstpost.com/tech/news-analysis/nasas-parker-solar-probe-mission-is-set-to-fly-closest-to-the-suns-surface-than-any-other-man-made-object-before-it-4315489.html

https://phys.org/news/2018-01-image-prepping-parker-solar-probe.html