Next stop: A trip inside the Sun's atmosphere

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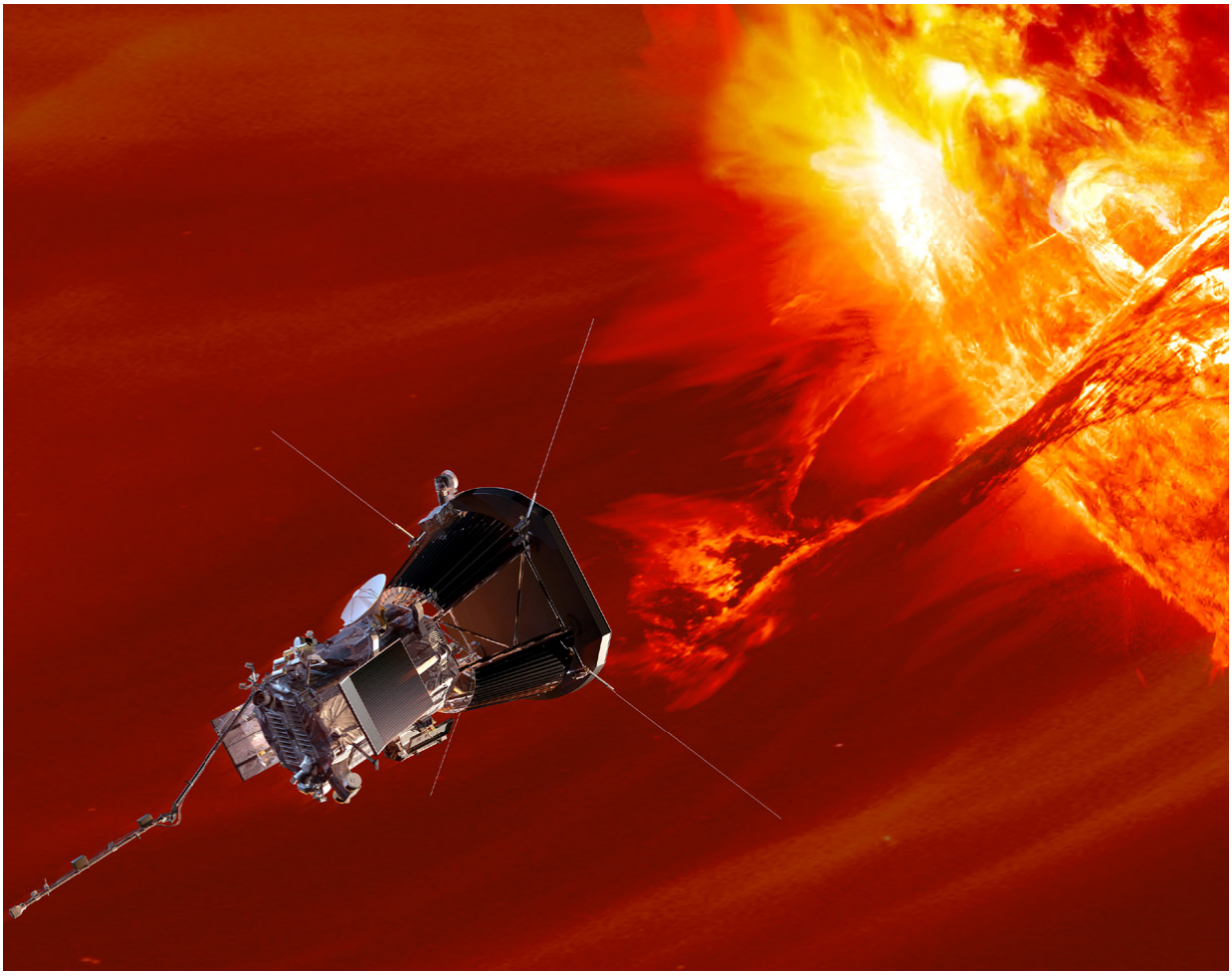

NASA's Solar Probe Plus will enter the sun's corona to understand space weather using a Faraday cup developed by the Smithsonian Astrophysical Observatory and Draper. Credit: NASA/Johns Hopkins University Applied Physics Laboratory

Every so often the sun emits an explosive burst of charged particles that makes its way to Earth and often wreaks havoc on power grids, aircraft and satellite systems. When clouds of high-speed charged particles come racing off the sun, they can bathe spacecraft, astronauts and planetary surfaces in damaging radiation. Understanding why the sun occasionally emits these high-energy particles can help scientists predict space weather. Knowing when solar energetic particles may hit Earth can help people on the planet take precautions.

Now, Draper and the Smithsonian Astrophysical Observatory (SAO) are addressing these challenges, and hoping to untangle these unsolved science mysteries, by developing sophisticated sensors for a new NASA mission. Launching in 2018, NASA's Solar Probe Plus spacecraft, which is being designed and built by the Johns Hopkins University Applied Physics Laboratory in Laurel, Md., will make 24 solar flybys over nearly seven years, setting a new record for the fastest moving man-made object as it zips 37.6 million kilometers closer to the sun than any spacecraft that has ever studied this star, and be exposed to temperatures exceeding 2500 degrees Fahrenheit.

NASA's Solar Probe Plus—the first mission that will fly into the sun's upper atmosphere and "touch" the sun—will collect data on the mechanisms that heat the corona and accelerate the solar wind, a constant flow of charged particles from the sun. These are two processes with fundamental roles in the complex interconnected system linking the sun and near-Earth space—a system that can drive changes in our space weather and impact our satellites.

To capture the velocity and direction of the positively-charged particles, Solar Probe Plus will be equipped with a Faraday cup, built by the Smithsonian Astrophysical Observatory, with technical support from Draper, and operated by SAO and the University of Michigan in Ann Arbor. The Faraday cup, which is capable of measuring the full force of

supersonic solar particles and radiation, is one of only two instruments riding outside the protective sunshield of NASA's Solar Probe Plus. The challenge will be to capture the data while operating at extreme temperatures on the fastest moving manmade spacecraft ever created—it will achieve a velocity of close to 200 km/sec—and do it with accuracy.

For years, astronomers have studied the sun, but never from inside the sun's atmosphere, according to Seamus Tuohy, Director of the Space Systems Program Office at Draper. "Such a mission would require a spacecraft and instrumentation capable of withstanding extremes of radiation, high velocity travel and the harsh solar condition—and that is the kind of program deeply familiar to Draper and the Smithsonian Astrophysical Observatory."

The investigation will specifically track the most abundant particles in the solar atmosphere and wind—electrons, protons and helium ions—"in addition to answering fundamental science questions, the intent is to better understand the risks space weather poses to the modern communication, aviation and energy systems we all rely on," said Justin C. Kasper, principal investigator at the Smithsonian Astrophysical Observatory and University of Michigan Professor in Space Science. "Many of the systems we in the modern world rely on—our telecommunications, GPS, satellites and power grids—could be disrupted for an extended period of time if a large solar storm were to happen today. Solar Probe Plus will help us predict and manage the impact of space weather on society."

Draper

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