NASA selects proposals for new space environment missions

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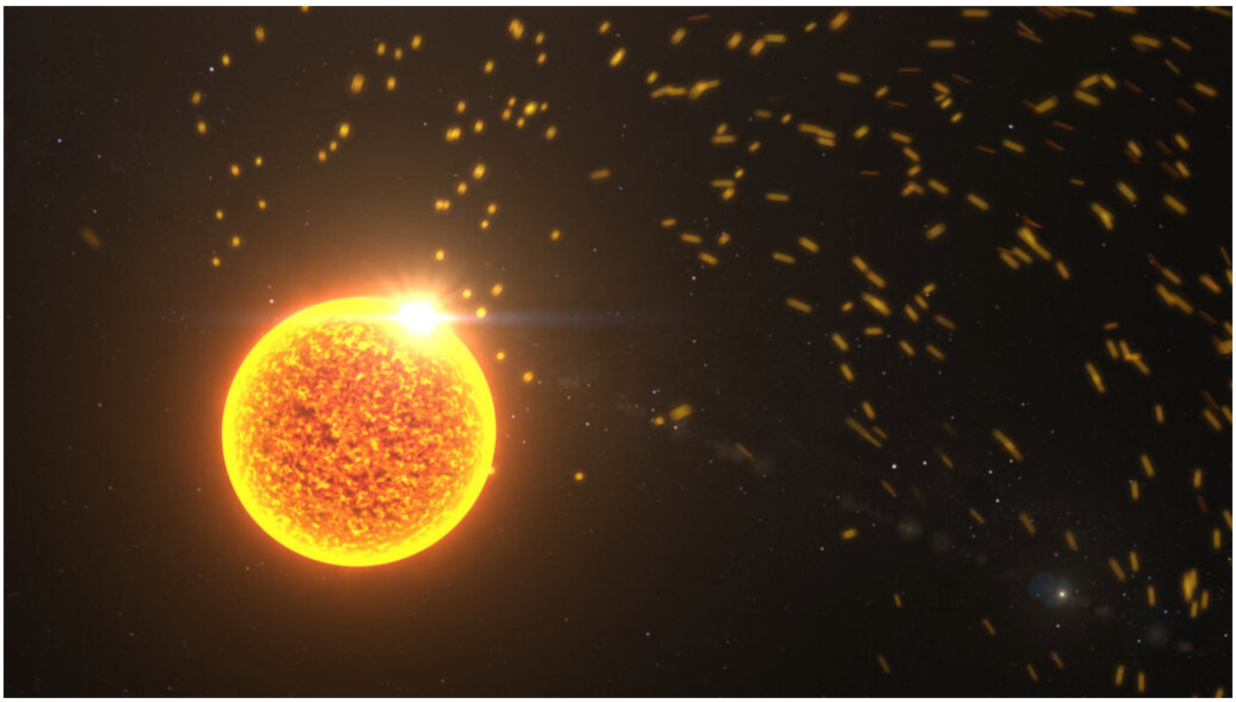

The sun sends out a constant stream of particles and energy, which drives a complex space weather system near Earth and can affect spacecraft and astronauts. NASA has chosen five new mission concept studies for further development to study various aspects of this dynamic system. Credit: NASA

NASA has selected five proposals for concept studies of missions to help improve understanding of the dynamics of the sun and the constantly changing space environment with which it interacts around Earth. The information will improve understanding about the universe as well as offer key information to help protect astronauts, satellites, and communications signals—such as GPS—in space.

Each of these Medium-Class Explorer proposals will receive $1.25 million to conduct a nine-month mission concept study. Following the study period, NASA will choose up to two proposals to go forward to launch. Each potential mission has a separate launch opportunity and timeframe.

"We constantly seek missions that use cutting edge technology and novel approaches to push the boundaries of science," said Thomas Zurbuchen, associate administrator for NASA's Science Mission Directorate in Washington. "Each one of these proposals offers the chance to observe something we have never before seen or to provide unprecedented insights into key areas of research, all to further the exploration of the universe we live in."

NASA's heliophysics program explores the giant, interconnected system of energy, particles, and magnetic fields that fills interplanetary space, a system that constantly changes based on outflow from the sun and its interaction with the space and atmosphere around Earth.

"Whether it's looking at the physics of our star, studying aurora, or observing how magnetic fields move through space, the heliophysics community seeks to explore the space system around us from a variety of vantage points," said Nicky Fox, director of the Heliophysics Division in NASA's Science Mission Directorate. "We carefully pick missions to provide perfectly placed sensors throughout the solar system, each offering a key perspective to understand the space that human technology and humans increasingly travel through."

Each of these new proposals seeks to add a new puzzle piece to understanding that larger system, some by looking at the sun, some by making observations closer to home.

The proposals were selected based on potential science value and feasibility of development plans. The cost for the investigation ultimately chosen for flight will be capped at $250 million and is funded by NASA's Heliophysics Explorers' program.

The proposals selected for concept studies are:

Solar-Terrestrial Observer for the Response of the Magnetosphere (STORM)

STORM would provide the first-ever global view of our vast space weather system in which the constant flow of particles from the sun—known as the solar wind—interacts with Earth's magnetic field system, called the magnetosphere. Using a combination of observation tools that allow both remote viewing of Earth's magnetic fields and in situ monitoring of the solar wind and interplanetary magnetic field, STORM would track the way energy flows into and throughout near-Earth space. Tackling some of the most pressing questions in magnetospheric science, this comprehensive data set would provide a systemwide view of events in the magnetosphere to observe how one region affects another, helping to untangle how space weather phenomena circulate around our planet. STORM is led by David Sibeck at NASA's Goddard Space Flight Center in Greenbelt, Maryland.

HelioSwarm: The Nature of Turbulence in Space Plasmas

HelioSwarm would observe the solar wind over a wide range of scales in order to determine the fundamental space physics processes that lead energy from large-scale motion to cascade down to finer scales of particle movement within the plasma that fills space, a process that leads to the heating of such plasma. Using a swarm of nine SmallSat spacecraft, HelioSwarm would gather multi-point measurements and be able to reveal the three-dimensional mechanisms that control the physical processes crucial to understanding our neighborhood in space. HelioSwarm is led by Harlan Spence at the University of New Hampshire in Durham.

Multi-slit Solar Explorer (MUSE)

MUSE would provide high-cadence observations of the mechanisms driving an array of processes and events in the sun's atmosphere—the corona—including what drives solar eruptions such as solar flares, as well as what heats the corona to temperatures far above that of the solar surface. MUSE would use breakthrough imaging spectroscopy techniques to observe radial motion and heating at ten times the current resolution—and 100 times faster—a key capability when trying to study the phenomena driving heating and eruption processes, which occur on time scales shorter than previous spectrographs could observe. Such data would enable advanced numerical solar modeling and help unpack long-standing questions about coronal heating and the foundation of space weather events that can send giant bursts of solar particles and energy toward Earth. MUSE is led by Bart De Pontieu at Lockheed Martin in Palo Alto, California.

Auroral Reconstruction CubeSwarm (ARCS)

ARCS would explore the processes that contribute to aurora at size scales that have been rarely studied: at the intermediate scale between the smaller, local phenomena leading directly to the visible aurora and the larger, global dynamics of the space weather system coursing through the ionosphere and thermosphere. Adding crucial information to understanding the physics at the border between our atmosphere and space, these observations would provide insight into the entire magnetospheric system surrounding Earth. The mission would use an innovative, distributed set of sensors by deploying 32 CubeSats and 32 ground-based observatories. The combination of instruments and spatial distribution would provide a comprehensive picture of the drivers and response of the auroral system to and from the magnetosphere. ARCS is led by Kristina Lynch at Dartmouth University in Hanover, New Hampshire.

Solaris: Revealing the Mysteries of the sun's Poles

Solaris would address fundamental questions of solar and stellar physics that can only be answered with a view of the sun's poles. Solaris would observe three solar rotations over each solar pole to obtain observations of light, magnetic fields, and movement in the sun's surface, the photosphere. Space researchers have never collected imagery of the sun's poles, though the ESA/NASA Solar Orbiter will provide oblique angle views for the first time in 2025. Better knowledge of the physical processes visible from the pole is necessary to understand the global dynamics of the entire sun, including how magnetic fields evolve and move throughout the star, leading to periods of great solar activity and eruptions approximately every 11 years. Solaris is led by Donald Hassler at the Southwest Research Institute in Boulder, Colorado.

Provided by NASA

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