


SUPPORT FUNDING FOR SOLAR AND SPACE PHYSICS



The National Academy of Sciences decadal surveys are recognized as the voice of the community. The surveys identify the most compelling science goals and present an ambitious program of activities for future investment. They are foundational to the leadership of the nation in science, technology, and workforce development.

The Next Decade of Discovery in Solar and Space Physics: Exploring and Safeguarding Humanity's Home in Space 2024 - 2033 decadal survey identifies key scientific priorities for **solar and space physics** in the next decade.

Space is not empty, but filled with a diffuse sea of charged particles and electromagnetic fields that flow between and interact with the Sun and the planets and their atmospheres. Understanding these plasmas and how they originate, evolve, and interact is relevant to all aspects of space science as well as laboratory plasma physics on Earth.

Heliophysics is a fundamental science discipline that studies the very nature of plasmas throughout space, originating with our own Sun and solar wind and extending to planetary atmospheres and magnetospheres, stellar atmospheres and astrospheres, and interstellar space.

ENABLING HUMAN EXPLORATION

As humanity seeks to explore beyond Earth, both robotically and in-person, it is critical that we understand the space environment into which we venture. Learning more about the Sun, interplanetary and interstellar space, and the near-space

environments around the planets before we venture there is the same as early explorers understanding weather before setting sail on the open seas.

SPACE WEATHER

Heliophysics is also unique in that it has practical relevance for humanity. Solar activity and resulting geospace responses can have extreme effects on our technological systems — satellites (e.g., GPS), the power grid, aviation, communications — with potentially significant societal, economic, and national security ramifications.

RESEARCHING FOR TOMORROW, TODAY

- Investment in FY27 is required to enable the community to address the highest priority open science questions and implement the bold, new missions required to answer them.
- Strong funding levels are necessary to launch an unprecedented fleet of new Heliophysics missions currently in development including the next round of Medium-size Explorers: HelioSwarm and MUSE.
- Investment is needed to develop enabling technology for high-priority decadal missions, as well as to formulate concepts for new dedicated heliophysics and space weather missions and instruments that will advance our national security and technological competitiveness.
- A robust program of supporting research and mission guest investigator programs is necessary to realize the full scientific potential of these missions, and to educate and train the next generation of heliophysicists.

Support a balanced portfolio to ensure a steady cadence of discoveries and provide a wide range of opportunities for future STEM professionals.



Parker Solar Probe: NASA's most recent major Heliophysics mission has smashed records as the closest human-made object to the Sun and has already revealed answers to major outstanding questions about the solar wind.
(Operating since 2018)

MUSE: This mission will better understand the Sun's million-degree atmosphere or corona, including its eruptions and explosions and obtain the highest resolution images ever captured of Sun's hot atmosphere.
(In development, launch expected in 2027)

HERMES: An instrument package funded for the Lunar Gateway platform as part of the Heliophysics Living With a Star (LWS) Program to help better understand the lunar radiation environment before astronauts land.
(In development, launch expected in 2027)

TRACERS & PUNCH: These two upcoming Small Explorer missions will respectively investigate the dynamics of magnetic reconnection and how the upper atmosphere of the Sun converts into the solar wind.
(Both operational since 2025)

IMAP: NASA's next Solar Terrestrial Probes (STP) Program mission will investigate particle acceleration in the solar wind while also mapping the boundary where the solar wind meets the local interstellar medium.
(In development, launch expected in 2025)

HelioSwarm: A constellation of nine spacecraft, that will capture the first in-space measurements of fluctuations in the magnetic field and motions of the solar wind.
(In development, launch expected in 2029)

Cover image: Artist illustration of events on the sun changing the conditions in Near-Earth space. Credit: NASA Goddard Space Flight Center.