

Heliophysics Division Community Town Hall

Submit your questions throughout the Town Hall



National Aeronautics and
Space Administration



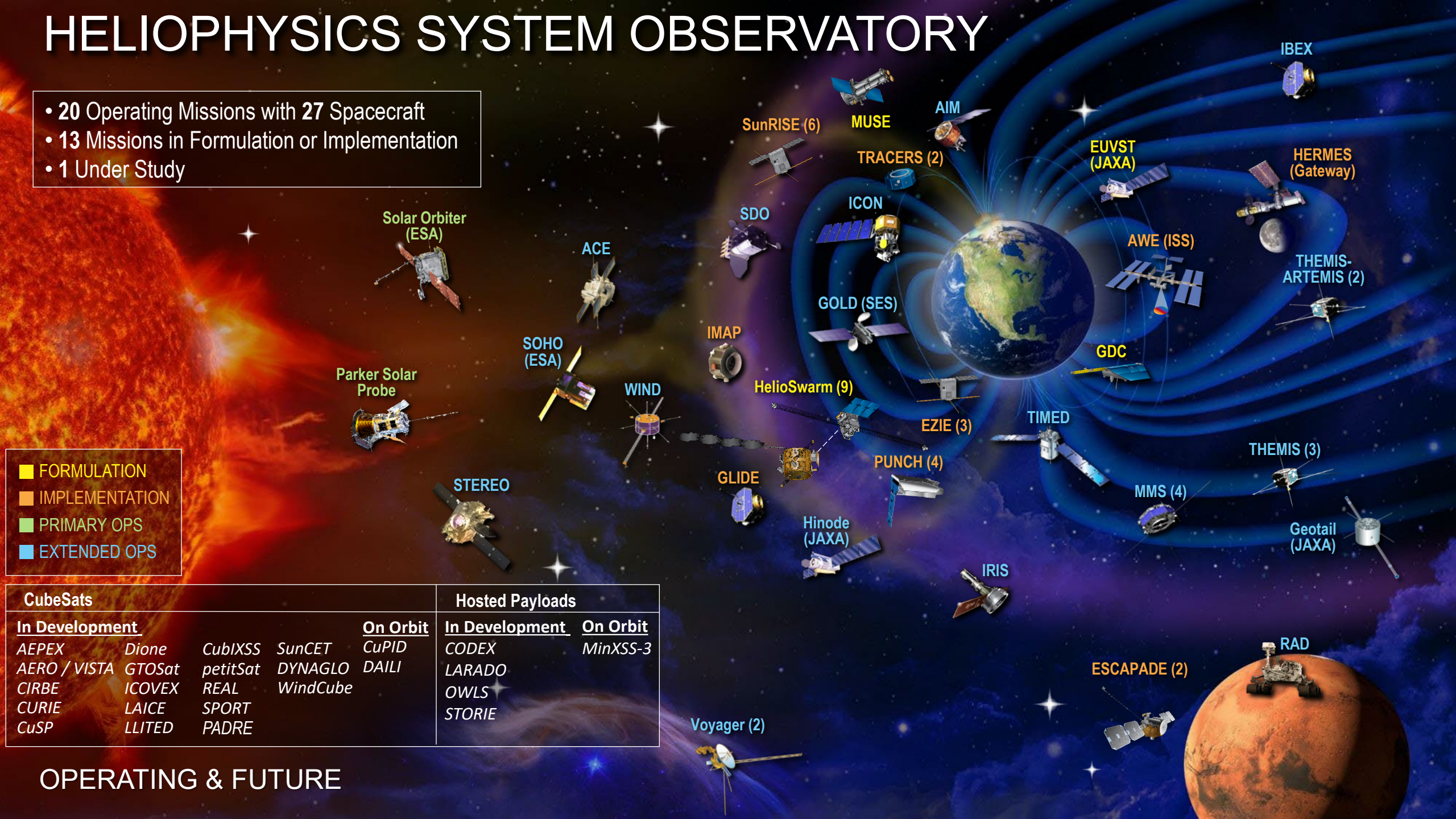
Heliophysics Division

Heliophysics Virtual Community Town Hall

Dr. Nicky Fox
Heliophysics Division Director
October 2022

HELIOPHYSICS SYSTEM OBSERVATORY

- 20 Operating Missions with 27 Spacecraft
- 13 Missions in Formulation or Implementation
- 1 Under Study



- FORMULATION
- IMPLEMENTATION
- PRIMARY OPS
- EXTENDED OPS

CubeSats				Hosted Payloads		
<u>In Development</u>				<u>On Orbit</u>	<u>In Development</u>	<u>On Orbit</u>
AEPEX	Dione	CubIXSS	SunCET	CuPID	CODEX	MinXSS-3
AERO / VISTA	GTOSat	petitSat	DYNAGLO	DAILI	LARADO	
CIRBE	ICOVEX	REAL	WindCube	OWLS	STORIE	
CURIE	LAICE	SPORT				
CuSP	LLITED	PADRE				

OPERATING & FUTURE

Voyager, NASA's longest-lived mission, turns 45

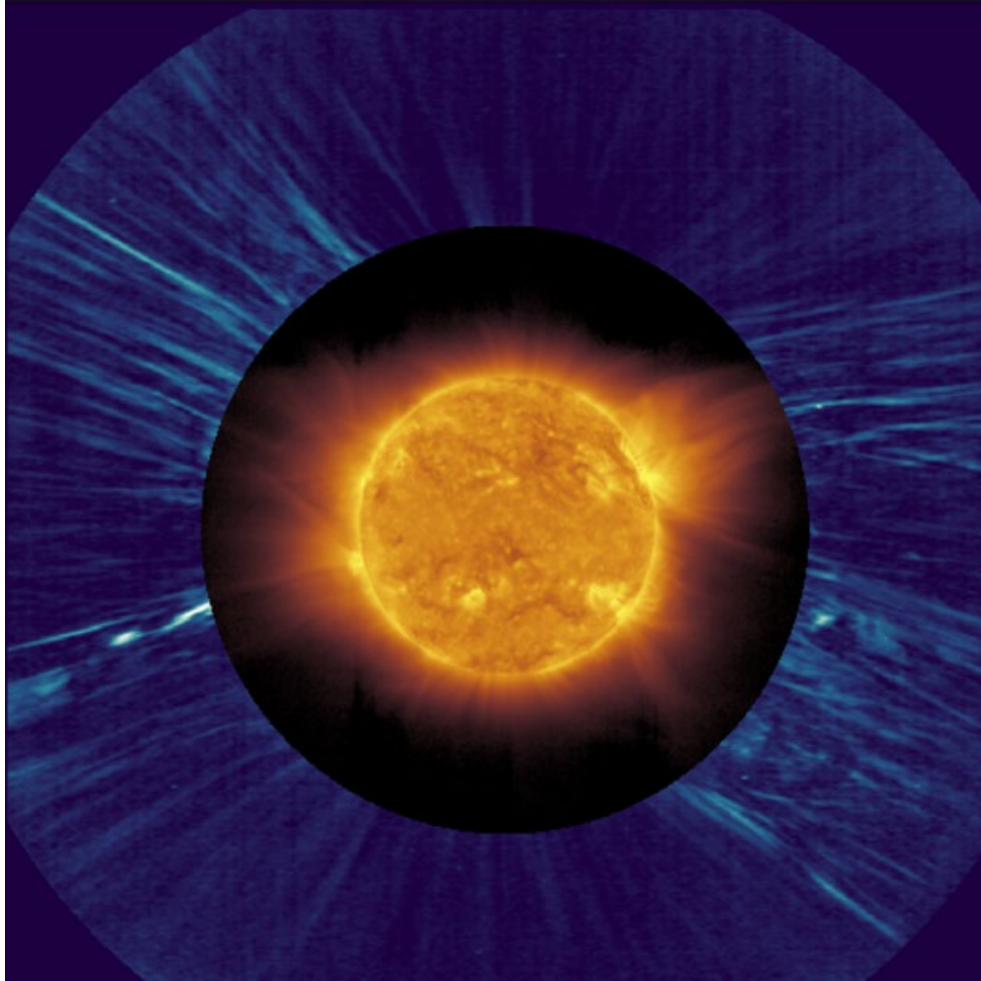


This archival image taken at NASA's Jet Propulsion Laboratory on March 23, 1977, shows engineers preparing the Voyager 2 spacecraft ahead of its launch later that year. *Credits: NASA/JPL-Caltech*



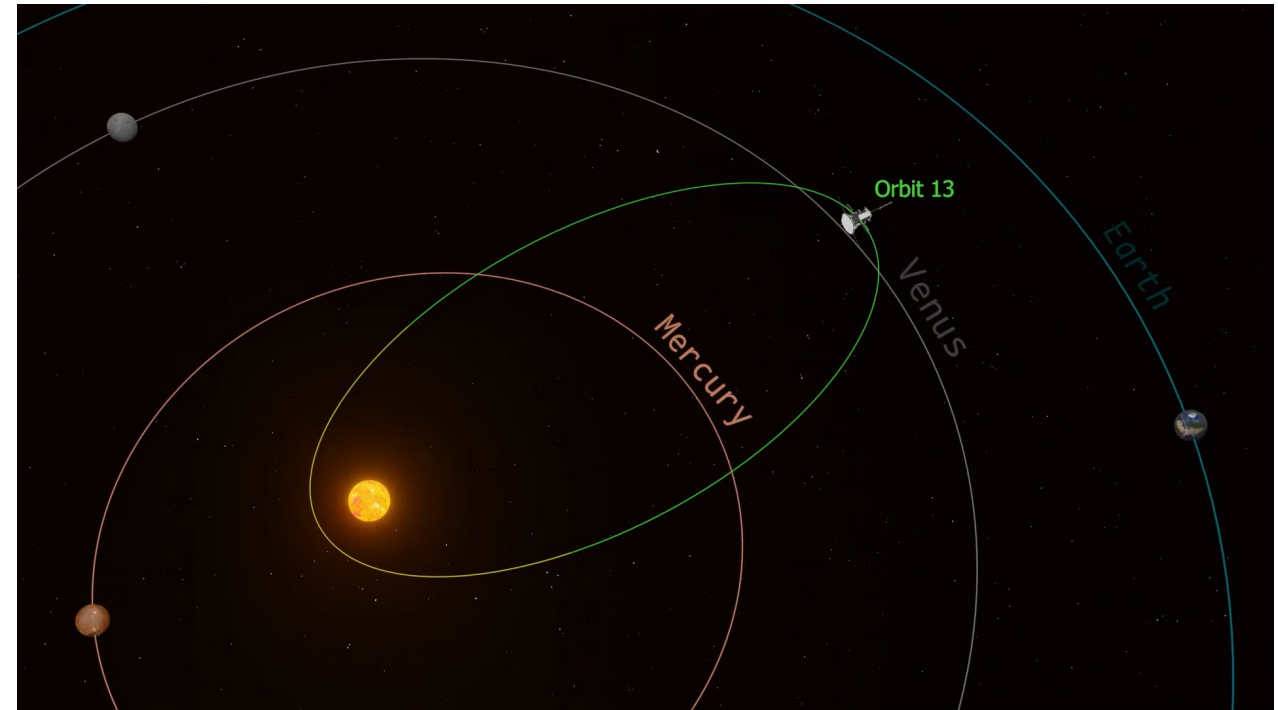
July 2022 Cover of Scientific American

Solar Orbiter observes magnetic switchback



First ever remote sensing observation of an S-shaped 'switchback' magnetic feature in the solar wind by combining data from the EUI Telescope

Parker Solar Probe Encounter #13



On Sept 6, Parker Solar Probe reached perihelion #13

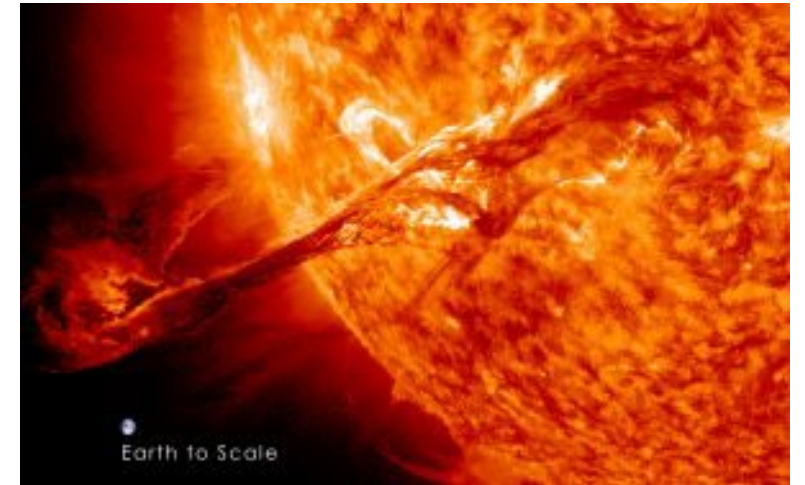
PUNCH Announces Rideshare with SPHEREx

New Rideshare and Launch Date

- NASA's Polarimeter to Unify the Corona and Heliosphere (PUNCH) mission will share a ride to space with NASA's Jet Propulsion Laboratory's Spectro-Photometer for the History of the Universe, Epoch of Re-ionization, and Ices Explorer (SPHEREx) mission.
- The missions will launch no earlier than April 2025 on a SpaceX Falcon 9. The contract with SpaceX was updated to include PUNCH and was awarded July 14, 2022.

PUNCH Overview

- PUNCH, which consists of four suitcase-sized satellites, will focus on the Sun's outer atmosphere (the corona) and how it generates the solar wind. The spacecraft also will track coronal mass ejections – large eruptions of solar material that can drive large space weather events near Earth – to better understand their evolution and develop new techniques for predicting such eruptions.
- The four satellites will spread out around Earth along the day-night line, which enables it to create a continuous, complete, view of the corona and inner solar system.



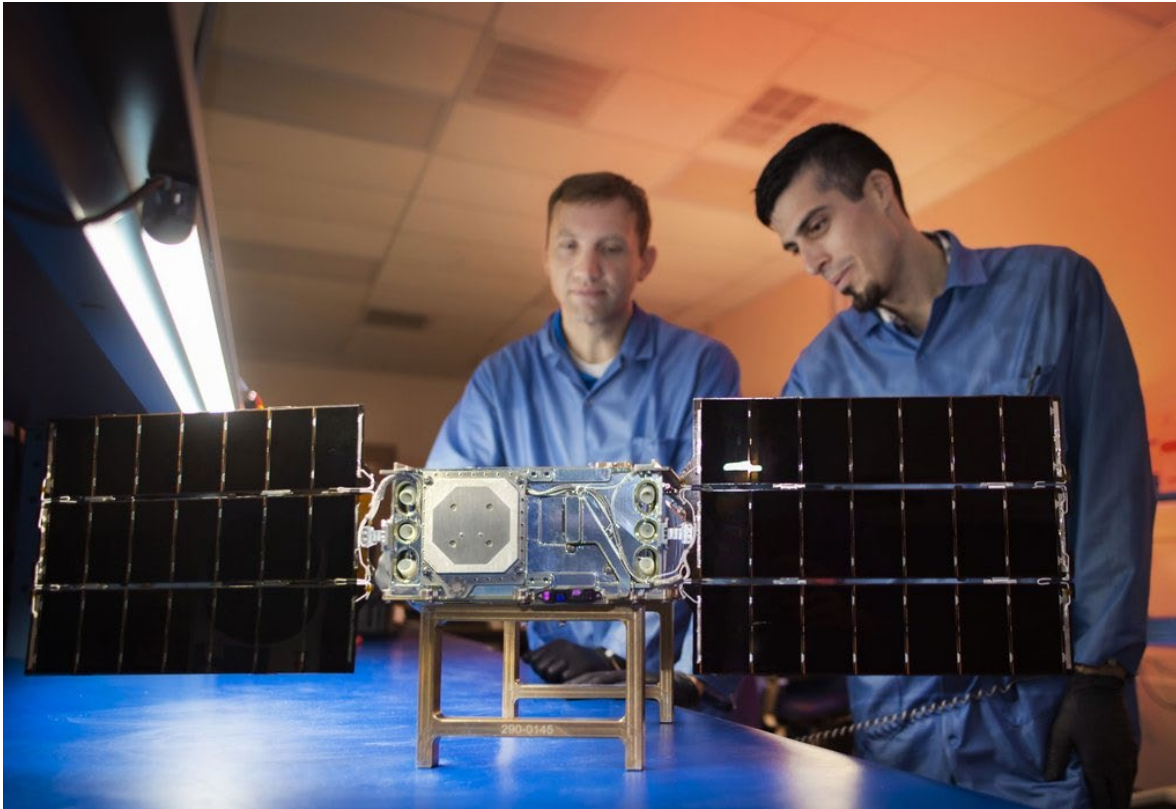
In this image, Earth is shown to scale with a coronal mass ejection that occurred on August 31, 2012. While Earth's size is shown to scale, its distance is not (Earth is much farther from the Sun than shown here). **Credits: NASA/Goddard Space Flight Center**



Credits: Southwest Research Institute

First of SunRISE SmallSats Rolls Off Production Line

Six small satellites work together, creating the largest radio telescope ever launched. SunRISE will detect and track hazardous explosive space weather events.



The first of six SunRISE SmallSats is shown here at a Utah State University Space Dynamics Laboratory clean room being worked on by engineers. Pointed toward the camera is the SmallSat's Sun-facing side, including its fully deployed solar arrays. **Credits: SDL/Allison Bills**



Two 2022 Explorers Announcements of Opportunity Released

The Heliophysics Explorers Program conducts Principal Investigator (PI)-led space science investigations relevant to SMD's Heliophysics programs and manages both solicitations.

Heliophysics Explorers investigations must address NASA's strategic heliophysics science goals:

- Explore the physical processes in the space environment from the Sun to the Earth and throughout the solar system;
- Advance our understanding of the connections that link the Sun, the Earth, planetary space environments, and the outer reaches of our solar system; and
- Develop the knowledge and capability to detect and predict extreme conditions in space to protect life and society and to safeguard human and robotic explorers beyond Earth.

Timeline and Due Dates

- ~~AOs Release Date: September 7, 2022~~
- ~~Pre-proposal Conference Date: September 30, 2022~~
- Required Notice(s) of Intent Due: October 24, 2022
- Proposal(s) Due: December 8, 2022

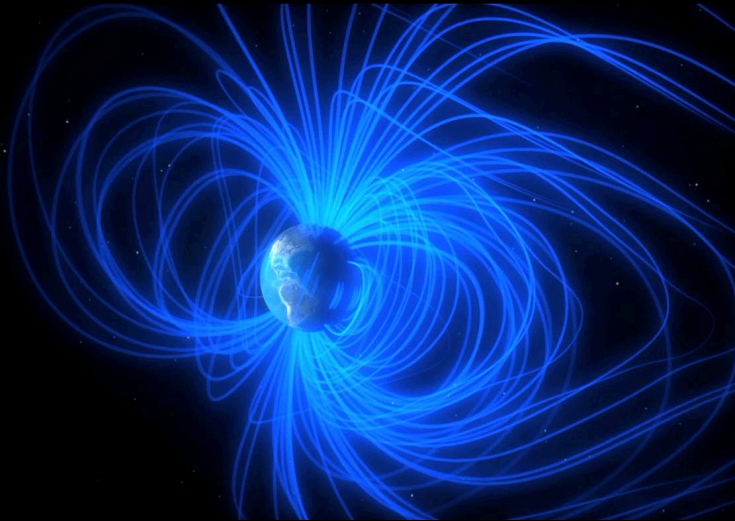
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Geospace Dynamics Constellation (GDC)

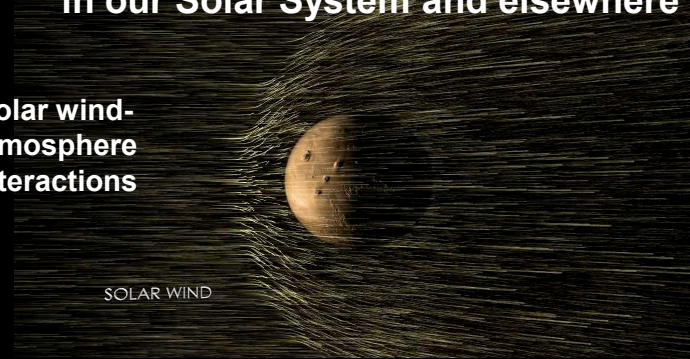
1 HELIOPHYSICS SCIENCE

To understand the fundamental nature of our home planet and connections to Geospace

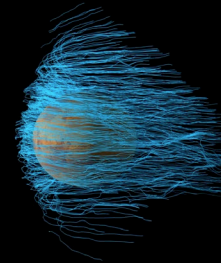


2 COMPARATIVE PLANETOLOGY: To better understand other planets in our Solar System and elsewhere

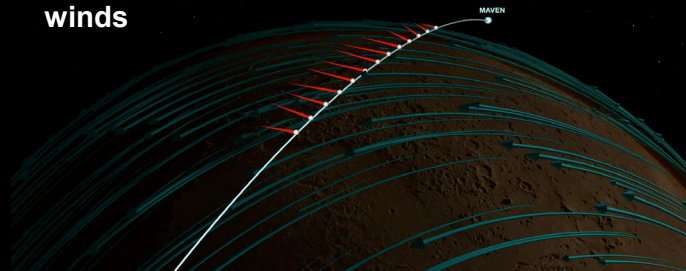
Solar wind-atmosphere interactions



Electric currents

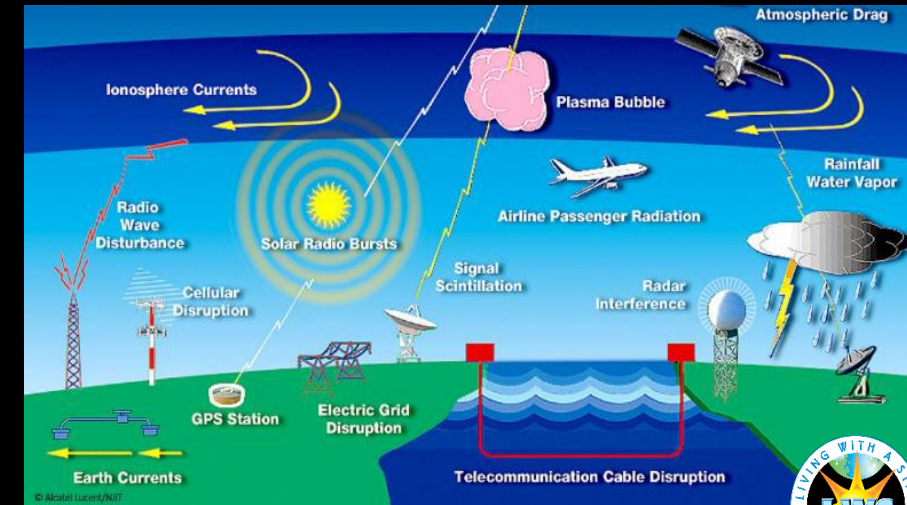


Neutral winds



3 SPACE WEATHER

To better understanding of space weather impacts on society and technology



Geospace Dynamics Constellation (GDC) Selections

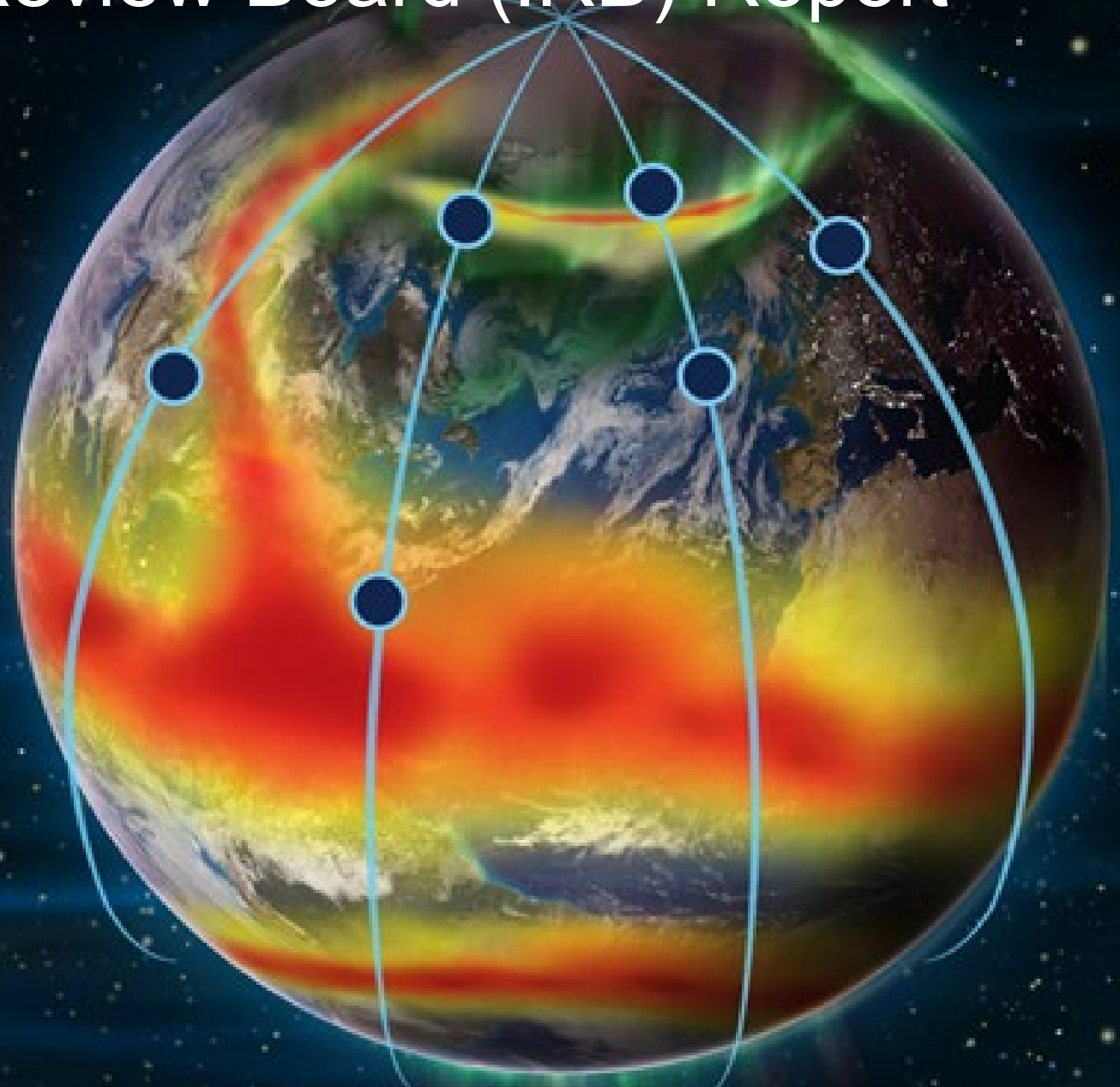
- NASA is thrilled to announce the start of the GDC mission science team!
 - Interdisciplinary Scientists—selected Nov 2021 (top row from left to right)
 - Dr. Rebecca Bishop (The Aerospace Corp.)
 - Prof. Yue Deng (Univ. Texas, Arlington)
 - Prof. Jeffrey Thayer (CU Boulder)
 - Investigations, delivering science instruments—selected Apr 2022 (second row from left to right)
 - *MoSAIC*: Dr. Mehdi Benna (UMBC)
 - *CAPE*: Dr. Daniel Gershman (GSFC)
 - *AETHER*: Dr. Laila Andersson (CU Boulder)
- NASA has selected a competitive Phase A—down select circa Nov/Dec 2022 (third and fourth rows from left to right)
 - *MAG*: Dr. Guan Le (GSFC)
 - *NEMISIS*: Prof. Mark Moldwin (Univ. Mich)
 - *MAG*: Prof. David Miles (Univ. Iowa)
 - *TPS*: Prof. Phil Anderson (Univ. Texas, Dallas)
 - *3DI*: Dr. Keiichi Ogasawara (SwRI)
- Spacecraft procurement via GSFC-managed RFP
 - Details, POCs:
<https://sam.gov/opp/1c5f84b59c304571bfaea969af8203ed/view>



GDC Independent Review Board (IRB) Report



<https://www.nasa.gov/news/reports/>



GDC Community Town Hall at Fall AGU Meeting

Join us for a one-hour town hall discussion, followed by a 30-minute panel (focused on Q&A for early career and student participants).

GDC Town Hall and Panel Logistics

- **Date and Time**
 - Thursday, December 15
 - 6:30 pm-8:00 pm CDT.
- **In-person attendance**
 - To be determined
- **Virtual attendance**
 - Connection info forthcoming via community newsletters

Topics

- Recent events, updates
- GDC competitions, selections
- GDC Independent Review Board (IRB) report

[**GDC Slack Channel**](#)

GDC Mission Updates



<https://blogs.nasa.gov/gdc>

Dynamical Neutral Atmosphere-Ionosphere Coupling (DYNAMIC)

- DYNAMIC is a Solar Terrestrial Probes mission to resolve key science objectives about how lower atmosphere variability affects geospace, including:
 - Day-to-day and longer-term variations of lower atmosphere forcing
 - Multi-scale upper atmosphere responses to energy inputs from below
 - Preconditioning the upper atmosphere to magnetospheric drivers
- DYNAMIC requires multi-point measurements across a range of latitudes
 - Disentangle and characterize the different atmospheric waves
 - Analyze a large range of temporal and spatial scales
 - Quantify the redistribution of energy and momentum of upward-propagating waves
- DYNAMIC has strong synergy with GDC, both scientifically and in terms of implementation details
 - Altitude profiles of the thermosphere and ionosphere (below 300 km altitude)
 - Provided by DYNAMIC
 - In situ measurements of thermosphere and ionosphere (above 300 km altitude)
 - Provided by GDC

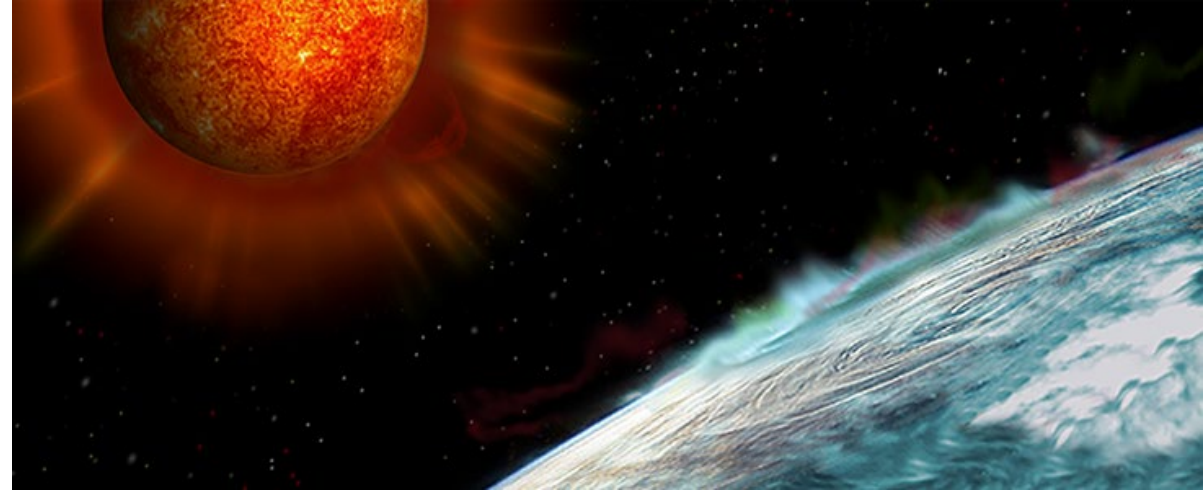
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throughout the Town Hall



Flying DYNAMIC and GDC together achieves high-priority science in a cost-effective manner.

Dynamical Neutral Atmosphere-Ionosphere Coupling (DYNAMIC)

- DYNAMIC was recommended by the 2013 Decadal Survey as the second STP project
 - Decadal Survey Mid-term Assessment affirmed continuing priority
- NASA has released plans for a DYNAMIC formulation
 - Community Announcement (Oct 2021) providing planning information
 - NASA input to 2024 Decadal Survey listed DYNAMIC in the Program of Record
 - **DYNAMIC AO has been delayed, not cancelled**



Tentative timeline

- Nov 2022 Community Announcement, updated planning information
- Feb 2023 AO release, draft
- Apr 2023 AO release, final

For additional information see: <https://soma.larc.nasa.gov/STP/DYNAMIC/>

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2024 Decadal Survey is Underway

*Importance of the Decadal Survey cannot be overstated. This is **the** opportunity to set a vision for the next decade and beyond!*

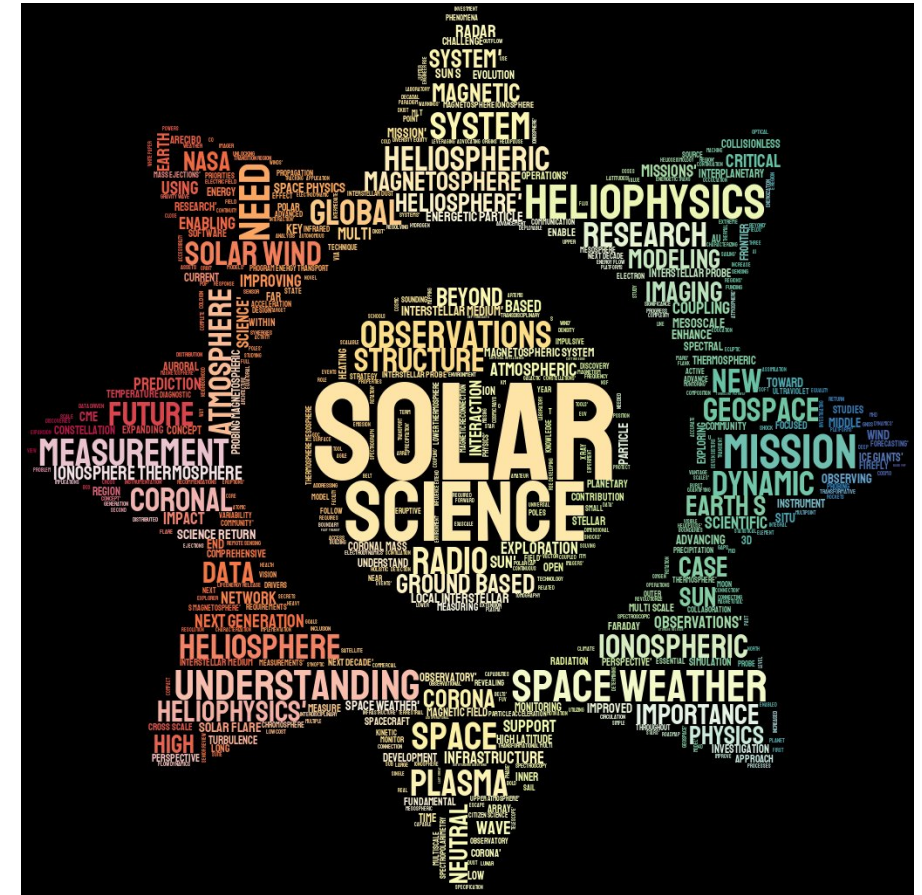
Decadal Survey is charged to “generate consensus recommendations to **advance and expand the frontiers of solar and space physics** in the current decade and **lay the groundwork for continued advances in future decades.**” [Decadal Survey, Statement of Task]

- Statement of Task and Study Approach (linked below the SoT) define scope and identify agency-specific guidance
 - <https://nas.edu/ssphdecadal>



2024 Decadal Survey is Underway

- Steering Committee has been announced
 - Dr. Stephen Fuselier and Dr. Robyn M. Millan will serve as co-chairs
- White Papers
 - Due date was Sept 7 – **492 white papers submitted** which is a huge increase compared to previous decadal surveys
- NASA asking for ambitious but realistic science strategy
- Incorporates NASA programs as part of the strategy
 - https://science.nasa.gov/heliophysics/2024_decadal_survey/heliophysics-strategic-mission-programs
- To learn more about NASA's preparations go to <http://go.nasa.gov/HelioDecadal>



Word cloud of the Heliophysics Decadal White Paper titles, Credit: James Paul Mason

Recent Community Activities & Accomplishments

Observations of Extreme ICME Ram Pressure Compressing Mercury's Dayside Magnetosphere to the Surface

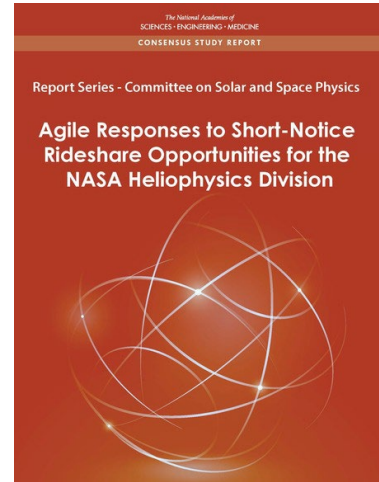


Jul 31, 2017

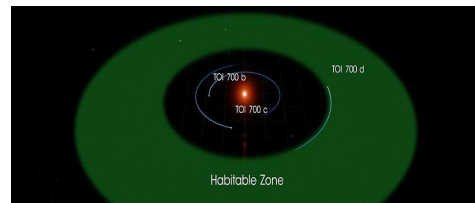
An Earth-like Atmosphere May Not Survive Proxima b's Orbit



LWS Strategic Science Areas [2019]
 SSA-IX: Solar Impacts on Climate
 SSA-X: Stellar Impacts on Planetary Habitability



The Space Environment and Atmospheric Joule Heating of the Habitable Zone Exoplanet TOI 700 d



New Evidence Our Neighborhood in Space Is Stuffed With Hydrogen

Oct 30, 2020

Mars Mission Sheds Light on Habitability of Distant Planets

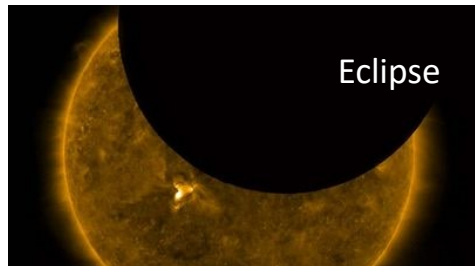
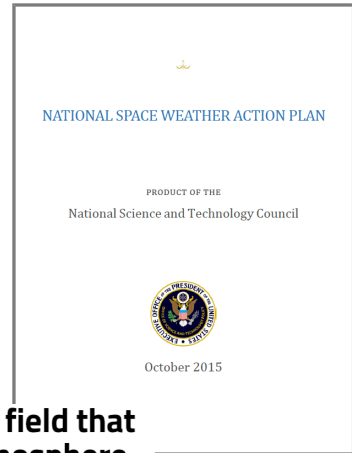
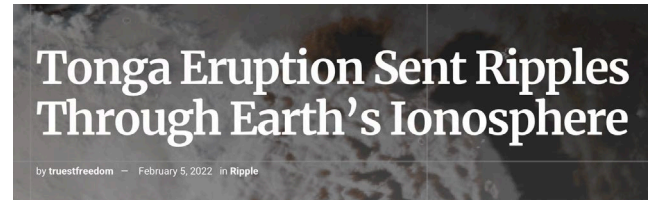
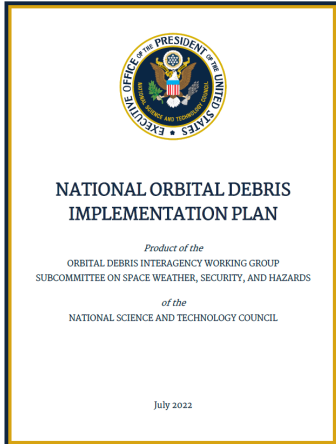
Dec 13, 2017

Oct 8, 2020

A New Look at Sunspots is Helping NASA Scientists Understand Major Flares and Life Around Other Stars

Nov 30, 2018

Charting a Course for Astronaut Safety as NASA Launches to the Moon and to Mars



The moon had a magnetic field that helped protect Earth's atmosphere

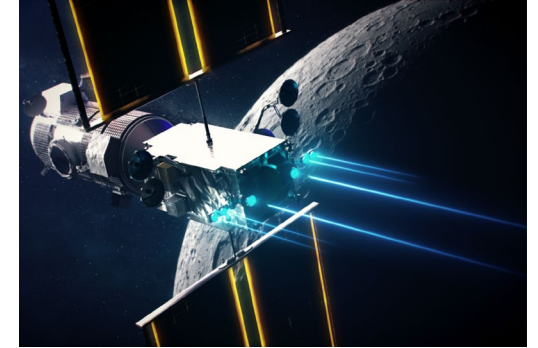
SPACE 14 October 2020

What will we have accomplished by 2033? What will we be prepared to accomplish by 2050?

NASA Space Weather Program (NSWx)

Recent Accomplishments

- Space Weather Council; meetings held March and August 2022
- HERMES passed KDP C in early 2022 and interdisciplinary scientists selected
- Developed a NOAA and DoD Framework to transition NASA research, techniques, and technology relevant to space weather operations
- Supported the Research to Operations to Research (R2O2R) grant solicitation via Transition-Step for efforts that show promise to use in an operational space weather environment at NOAA or DoD
 - ROSES-22 focused topics:
 - High-Latitude Radiation Exposure
 - Downstream Updating of Solar Wind & CME Forecasts
 - Space Weather Centers of Excellence solicitation (ROSES-22)
- Four Space Weather CubeSats selected: CubIXXS/SwRI; DYNAGLO/UCBoulder; WindCube/UCAR; SunCET/APL



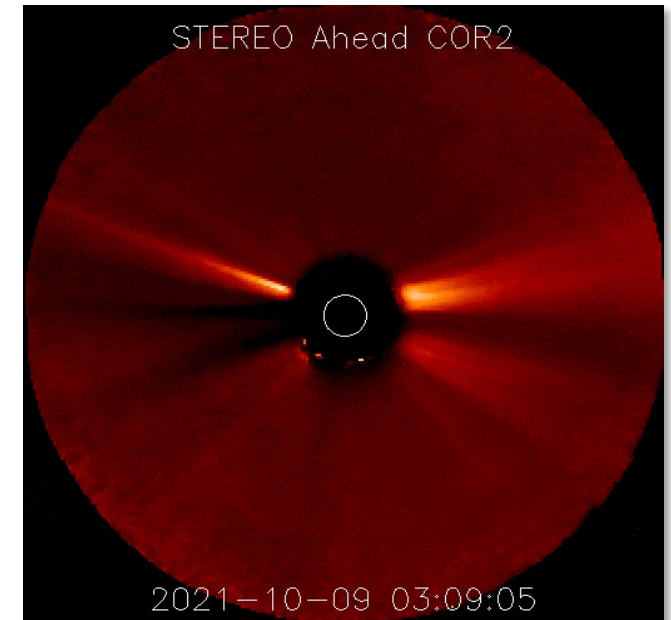
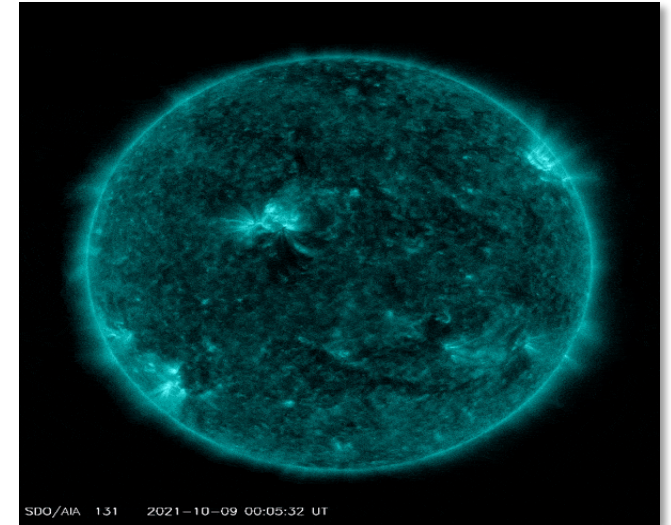
Looking Ahead

- PROSWIFT: continue with actions already underway to support interagency efforts, space weather observations, research, modeling, operational forecasting, and applications (SOHO, SWFO-L1, R2O2R)
- Preparing RFI for commercial platforms to host space weather instruments/sensors.
- Developing space weather instrument pipeline solicitation for ROSES 2023
- Engage international partners on future collaborations: Vigil, ENLoTIS (ESA), AOM (CSA), SNIPE (KASI)

Space Weather Inputs to the Decadal

Decadal Kickoff Presentation

- In early August, the Heliophysics Division presented to the decadal committee on the vital role NASA Space Weather Program serves in space weather research, providing unique, significant, and exploratory observations and data streams for theory, modeling, and data analysis research, and for operations.
- NASA's Heliophysics Division is uniquely poised to support needs of the National and International space weather enterprise and the Agency's Artemis program.
- NASA research fundamentally informs and underpins the science behind space weather operations, the applied expression of solar and space physics.
 - The NASA Space Weather Program has access to the entire breadth of the HPD's science research portfolio, driving space weather research that is both informed by basic solar research as well as operational space weather needs



Orbital Debris – Space Situational Awareness (OD-SSA)

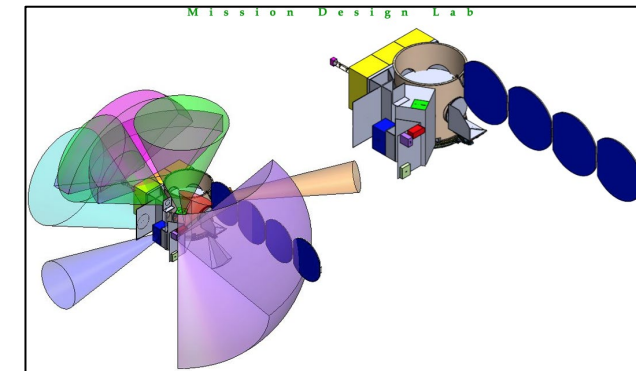
Heliophysics is extending the definition of the “Space Working Environment” – to include all space objects from small debris to microscopic dust and the signatures they cause in the natural plasma environment.

NASA Heliophysics OD-SSA Activity

NASA Heliophysics has stood up an Orbital Debris – Space Situational Awareness (OD-SSA) activity that specifically targets the small <3cm debris that cannot be tracked from the ground. These “lethal non-trackable” objects are considered a NASA Agency risk and have an increasing impact constellation-type activities in LEO (e.g., STARLINK).

Activities:

- Directed and competed programs for OD instrument maturation
- Support for a flight demonstration mission for a laser-based OD concept on the upcoming STP-Sat 7 mission
- Mission concept studies and mission architecture trade studies for a potential HPD led mission to investigate the full space working environment and the related space weather effects



Heliophysics Competed Research (2022)

R&A

Heliophysics Supporting Research

Theory, Modeling, and Simulation

Low-Cost Access to Space

Flight Opportunities for Research & Technology

Data Environment Enhancements

U.S. Participating Investigators

Early Career Investigators Program

Innovation in Technology and Science

Eclipse 2024

Citizen Science Medium

Heliophysics Tools and Methods

Living With a Star

Living With a Star Science (Focus Topics)

Tools and Methods

Strategic Capabilities

Infrastructure (Jack Eddy Fellows)

Space Weather

Science Applications Research-to-Operations-to-Research

Space Weather Centers of Excellence

Guest Investigator

Guest Investigators Open

Targeted Guest Investigators
(e.g. ROSES-2021 GOLD-ICON, ROSES-2021 Parker Solar Probe)

Technology

Technology and Instrument Development for Science

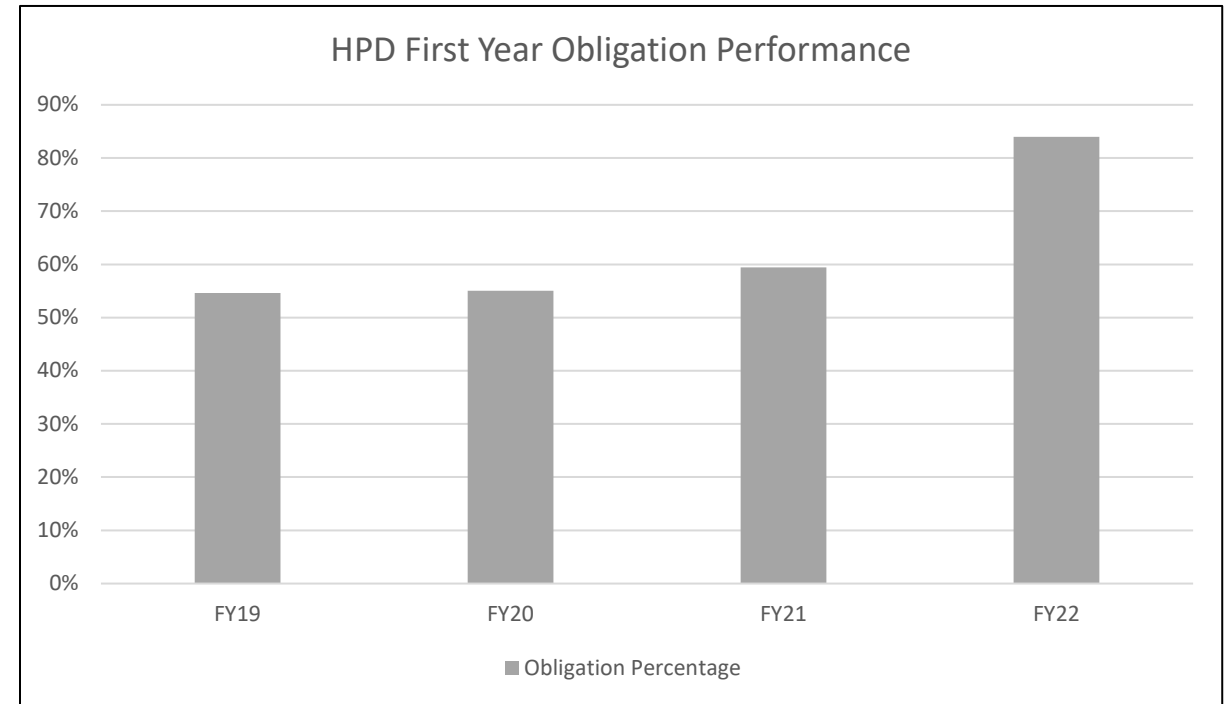
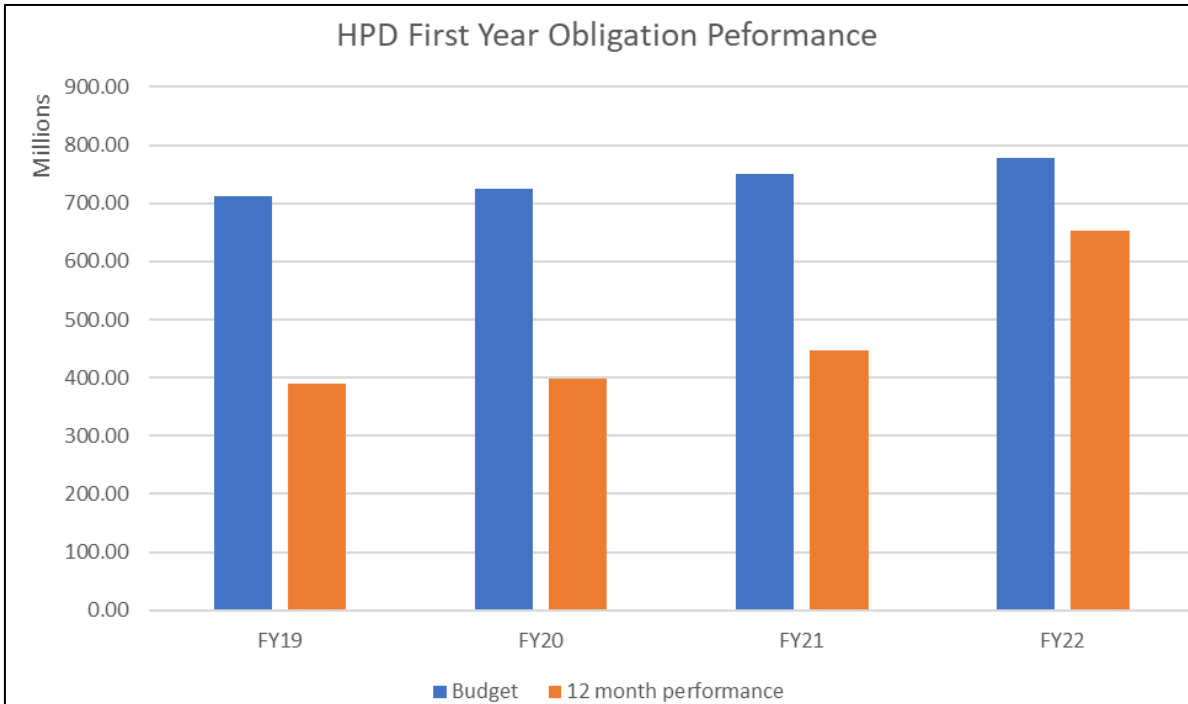
Flight Opportunities Studies

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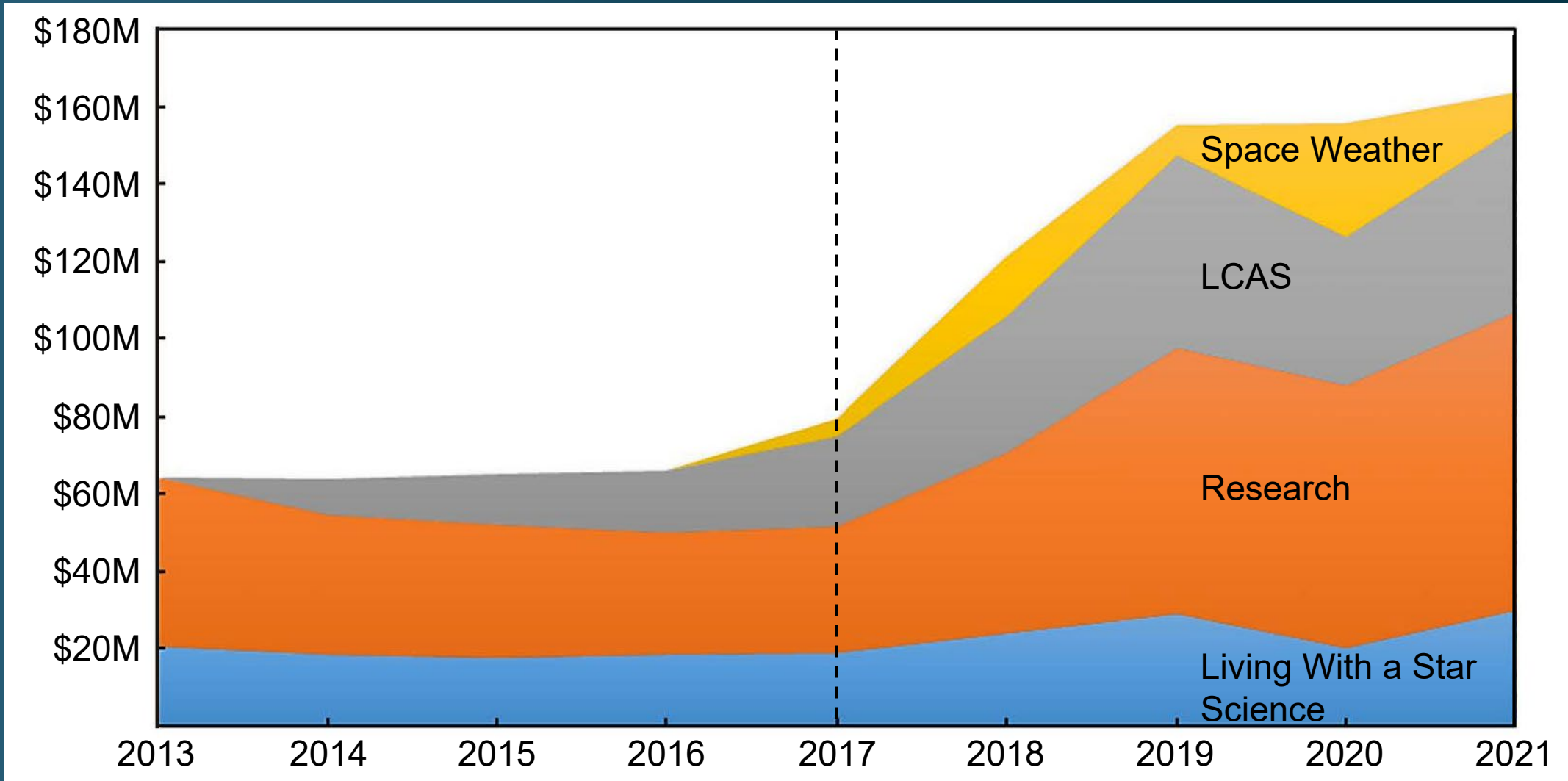


HPD Successfully Met FY22 Obligation Goals

NASA Heliophysics has made significant progress in lowering the amount of carryover funding. We expect to carry-over less than \$124.6M (16%) from FY22 to FY23 and that amount will be further reduced the year after to within the normal range.



R&A Funding: Impact of the Decadal Survey



Inclusion, Diversity, Equity, and Accessibility (IDEA) in Heliophysics

IDEA initiatives in Heliophysics are a long-term and far-reaching effort, but immediate and mid-term action and problem solving will advance initiatives in parallel with systemic, enduring activity.



SMD: Transform to Open Science (TOPS)

From 2022 to 2027, TOPS will accelerate the engagement of the scientific community in open science practices through events and activities aimed at:

- Lowering barriers to entry for historically excluded communities
- Better understanding how people use NASA data and code to take advantage of our big data collections
- Increasing opportunities for collaboration while promoting scientific innovation, transparency, and reproducibility.

NASA is designating 2023 as the Year of Open Science, a global community initiative to spark change and inspire open science engagement through events and activities that will shift the current paradigm.

- TOPS has three overarching goals:
 - Increase understanding and adoption of open science principles and techniques in our Mission and Research Communities
 - Accelerate major scientific discoveries through supporting the adoption of open science
 - Broaden participation by historically excluded communities

Join the TOPS email list: <https://science.nasa.gov/open-science/transform-to-open-science>



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Two solar eclipses

Annular on Oct. 14, 2023,
and total on April 8, 2024,
across North America



HELIOPHYSICS BIG YEAR

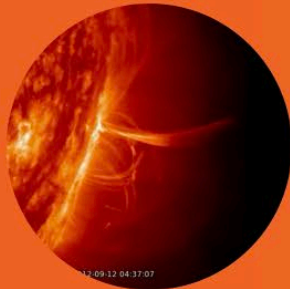
Parker Solar Probe

Parker will make its
closest approach to the
Sun in Dec. 2024

Solar Cycle 25

Solar maximum will present more opportunities to experience space weather

HELIOPHYSICS
BIG YEAR



The Sun will have a very Big Year from **Oct 2023 – Dec 2024!** And we want you to **bring your joy and curiosity to this opportunity of a lifetime** to participate with NASA Heliophysics!

go.nasa.gov/HelioBigYear

Follow us on Twitter **@NASASun** & Facebook **@NASASunScience** as we journey closer to our star



Join us for solar eclipses in **October 2023 and April 2024**



Take part in **@doNASAScience** with NASA citizen science as we rise to **solar maximum**



Find out how you can participate with event planning activities, outreach, and funding around citizen science projects, contests, and more.

Email

hq-heliobigyear@mail.nasa.gov

**Inspired by the birding concept to view as many species of birds in one geography in one year!*

Contact: Ha-Hoa Hamano,
Presidential Innovation Fellow
@ NASA



““ The Sun touches everything ””

The Heliophysics Big Year will usher in a new era of excitement, inspiration and innovation within the heliophysics community. The opportunities to explore and push boundaries are endless.

Research & Analysis

Continue to support a robust R&A program that advances our understanding of the connections that link the sun, the Earth, planetary space environments, and the outer reaches of our solar system

- Close out ROSES-22 and release ROSES-23
- Support three selected DRIVE Science Centers
- Engage the public through “Heliophysics Big Year”

Operating and PI-led Missions

Continue to support missions through key milestones and operations to bolster the current and future Heliophysics System Observatory

- Provide support for 20 operating science missions
- Continue 2023 Senior Review of operating missions
- Advance towards KDP C: EUVST, MUSE and HelioSwarm
- Continued support for recently confirmed missions towards launch: AWE, IMAP, PUNCH, SunRISE, ESCAPADE, EZIE, GLIDE, HERMES, TRACERS/MAGIC

“ The Sun touches everything ”

Space Weather

NASA research fundamentally informs and underpins the science behind space weather operations, the applied expression of solar and space physics.

- Release AO for US participation in ESA Vigil mission
- Select 1-2 Space Weather Centers of Excellence
- Support NASA-NOAA-NSF Research to Operations Framework
- Support OSTP initiatives in SSA/OD and continue instrument technology maturation and demonstration

Technology

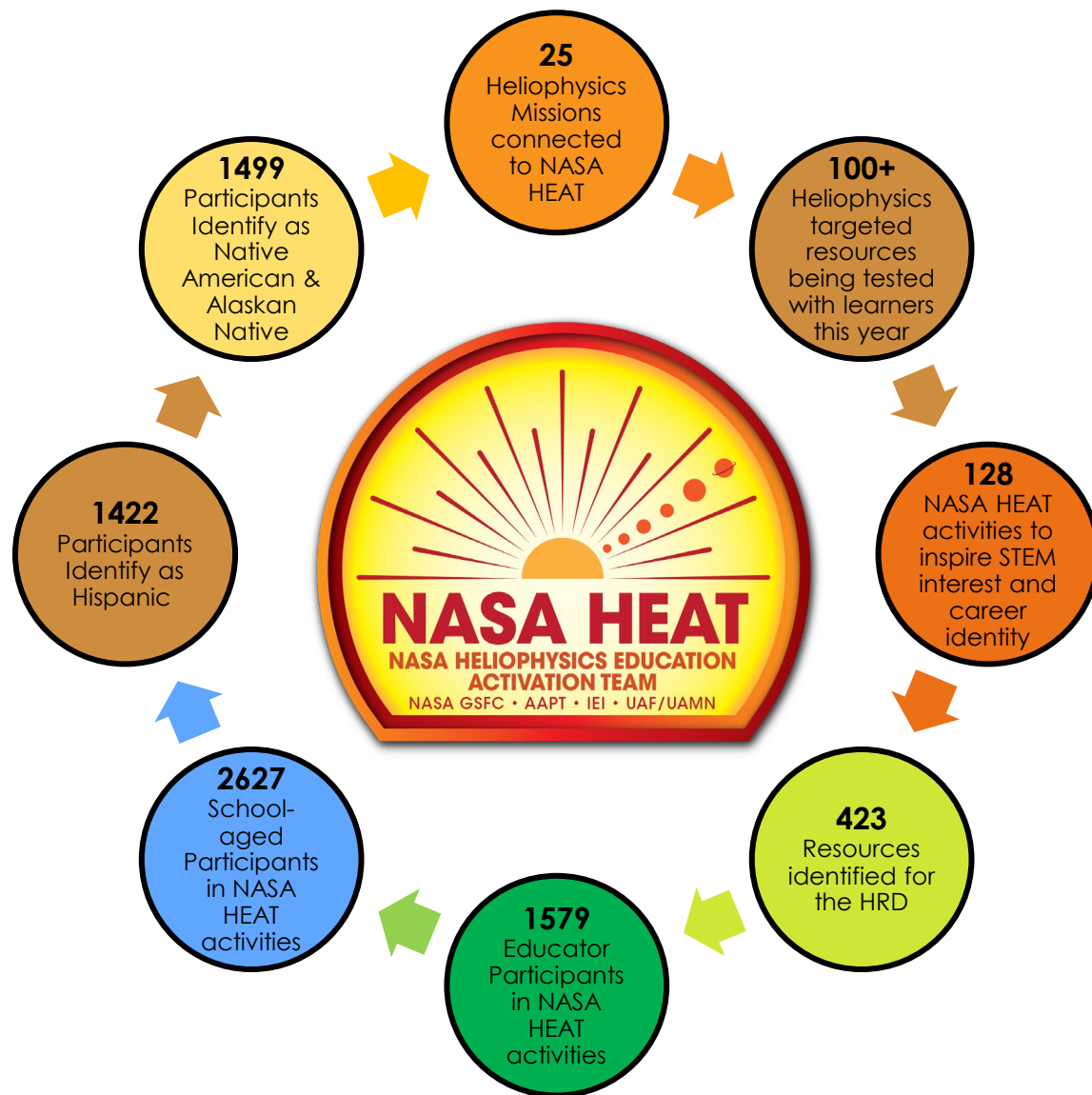
- Invest in modernization of data facilities and archives
- Technology Gap & Trend Analyses led by Heliophysics Science and Technology Office (HESTO)

Other

- Implement IDEA actions and support Heliophysics IDEA Working Group
- Continue support of 2024 Decadal Survey with NASEM

It's a great time to be a heliophysicist!

NASA HEAT



NASA Heliophysics Education Activation Team (NASA HEAT)

provides educational guidance and resources for educators, communicators, and learners of all ages to deepen their understanding of our Sun, its effects on Earth and the Solar System.

NASA HEAT is collecting legacy resources, connecting them to classroom concepts and current NASA missions, and deploying them in a dynamic searchable Heliophysics Resource Database (HRD).

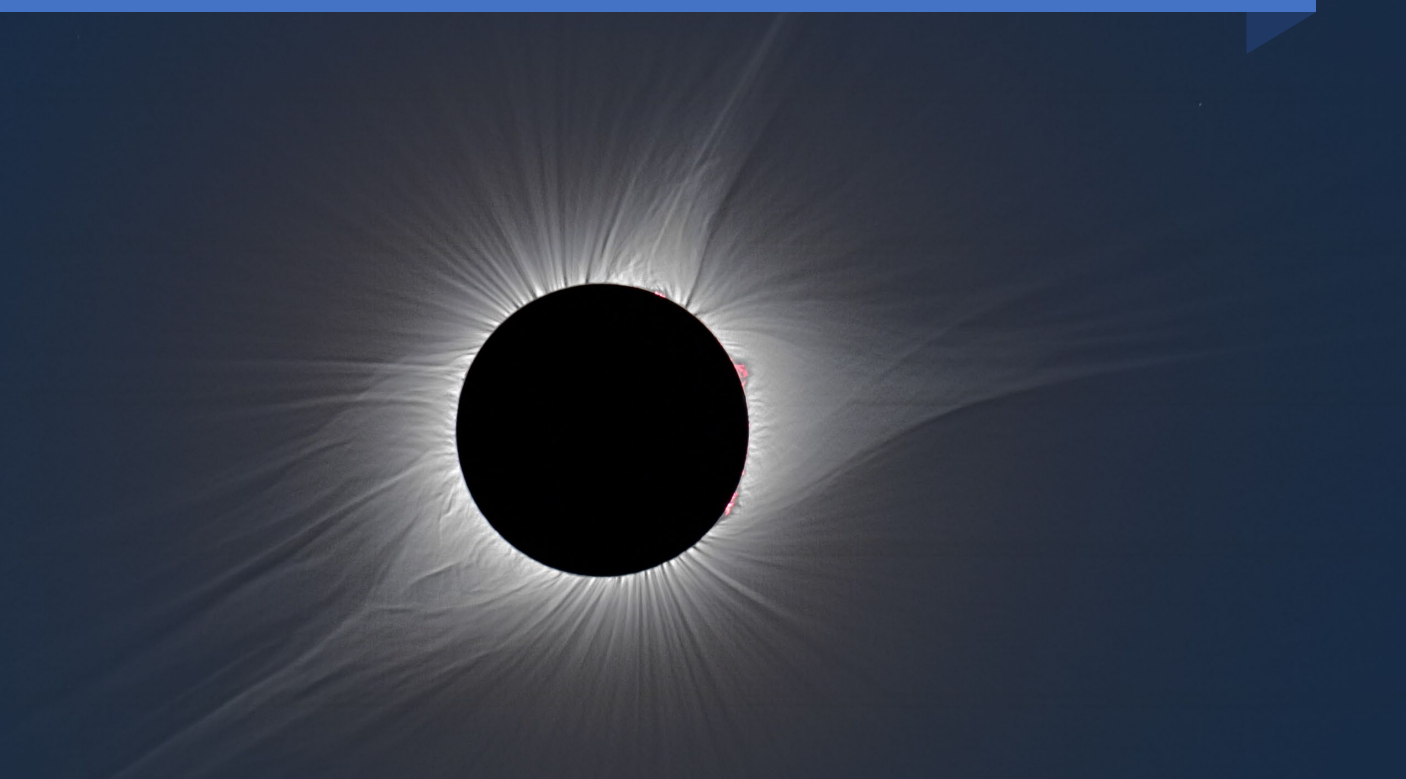
NASA HEAT is advancing NASA's role in the 2023 and 2024 solar eclipses to make heliophysics recognizable across the nation.

Mark Your Calendar for the Triennial Earth-Sun Summit (TESS)

Dallas, Texas, 7-12 April 2024



- TESS 2024 is the perfect opportunity to unite the entire Heliophysics community:
 - 2024 Total Solar Eclipse; 3 min 52 seconds totality in Dallas
 - Heliophysics Big Year
 - Decadal recommendations expected
- TESS is a joint meeting of the Space Physics and Aeronomy Section of the AGU and the Solar Physics Division of the AAS
- TESS encourages sessions covering everything from mission-specific to cross-system studies and universal physical processes



The total phase of the August 21, 2017, solar eclipse as seen from Madras, Oregon. This is a composite of short, medium, and long exposures, as no single exposure can capture the huge range of brightness exhibited by the solar corona. The star to the left (east) of the eclipsed Sun is Regulus, the brightest star in the constellation Leo. Much fainter Nu (ν) Leonis is visible at upper right. Additional processing by Sean Walker of *Sky & Telescope* to enhance the visibility of fine details in the corona. Credit: Rick Fienberg / TravelQuest International / Sean Walker / *Sky & Telescope*

Get Involved and Stay Informed!

Stay in touch and help us find new ways to highlight your work and keep you in the loop!

Stay up to date with what's happening at Headquarters:

- <https://science.nasa.gov/researchers/virtual-townhall>

Let us know what you've been working on:

- <https://bit.ly/SubmitHelioScience>

Learn more about the next solar eclipse:

- <https://solarsystem.nasa.gov/eclipses/home/>

Volunteer for a panel:

- <https://science.nasa.gov/researchers/volunteer-review-panels>

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throughout the Town Hall



NASA.gov/sunearth



blogs.nasa.gov/sunspot



[@NASASun](https://twitter.com/NASASun)



facebook.com/NASASunScience



Heliophysics Division Community Town Hall

Submit your questions throughout the Town Hall



The background of the slide is a composite of two cosmic images. The top half features a dark blue and black space filled with numerous small, bright stars and a prominent, glowing blue nebula on the right side. The bottom half shows a similar starry field but with a warm, orange-to-yellow glow on the left side, transitioning into a greenish-blue glow on the right, with a bright green nebula-like structure in the center-right.

#HelioRocks!

Division Response to the 2013 Decadal Survey

DRIVE



- DRIVE augmentation to R&A
 - DRIVE Science Centers
- HSO, extended mission augmentation
- Support of CubeSats, suborbital projects

- Increase of Explorers cadence
- Combination of MIDEX, SMEX, MOs



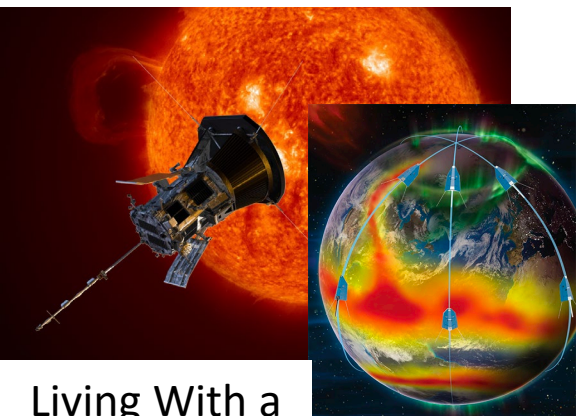
Explorers

- Parker Solar Probe (mission success criteria met, 2021)
- GDC formulation (investigations selected, 2022)



Solar Terrestrial Probes

- IMAP solicitation (confirmed, 2021)
- DYNAMIC pre-formulation announced



Living With a Star

Expanding the Field, Persistent Vision

...the cross-fertilization between solar physics and astrophysics is bidirectional.

KSG 4 (2013): Discover and characterize fundamental processes that occur both within the heliosphere and throughout the universe.

...cross-divisional opportunities for exoplanetary-planetary, astrospheric-heliospheric, solar-stellar, and atmosphere-Earth science research and development of a prioritized strategy for implementing such cross-disciplinary research

Crossdivisional collaborations [...] between Earth science, astronomy, heliophysics, and planetary science have begun the task of breaking down disciplinary entrenchments and are helping the astrobiology and exoplanet communities reach their full potential.

...investigate the effects of space weather throughout the solar system, especially at Venus, Earth, and Mars

...investigate the effects of stellar variability on astrospheres and the exoplanets within them

...studies of sun-planet and star-exoplanet connections can improve predictive capabilities

Progress will require [...] collaboration between [...] stellar astrophysicists, heliophysics, and statisticians.

The identification of life on an exoplanet will [...] only when researchers bring together the combined insights of astrophysicists, planetary scientists, Earth scientists, and heliophysics...

