National Aeronautics and Space Administration

Status Update from NASA HQ on Heliophysics Big Year & Science

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Boulder, CO

Heliophysics Missions

Heliophysics Mission Fleet

Heliophysics missions are strategically placed throughout our solar system, working together to provide a holistic view of our Sun and space weather, along with their impacts on Earth, the other planets, and space in general. NASA's heliophysics mission fleet includes 19 operating missions using 26 spacecraft, 13 missions in development, 1 mission under study, a robust sounding rocket program and a variety of CubeSat missions.

- ESA = European Space Agency
- JAXA = Japan Aerospace Exploration Agency

*Numbers in parentheses indicate how many spacecraft each mission includes.

*Objects Not to Scale

UNDER DEVELOPMENT

- AWE (ISS)
- Carruthers Geocorona Observatory
- ESCAPADE (2)
- EUVST (JAXA)
- EZIE (3)
- GDC (6)
- HelioSwarm (9)
- HERMES (Gateway)
- IMAP
- MUSE
- PUNCH (4)
- SunRISE (6)
- TRACERS (2)

PRIMARY OPERATION

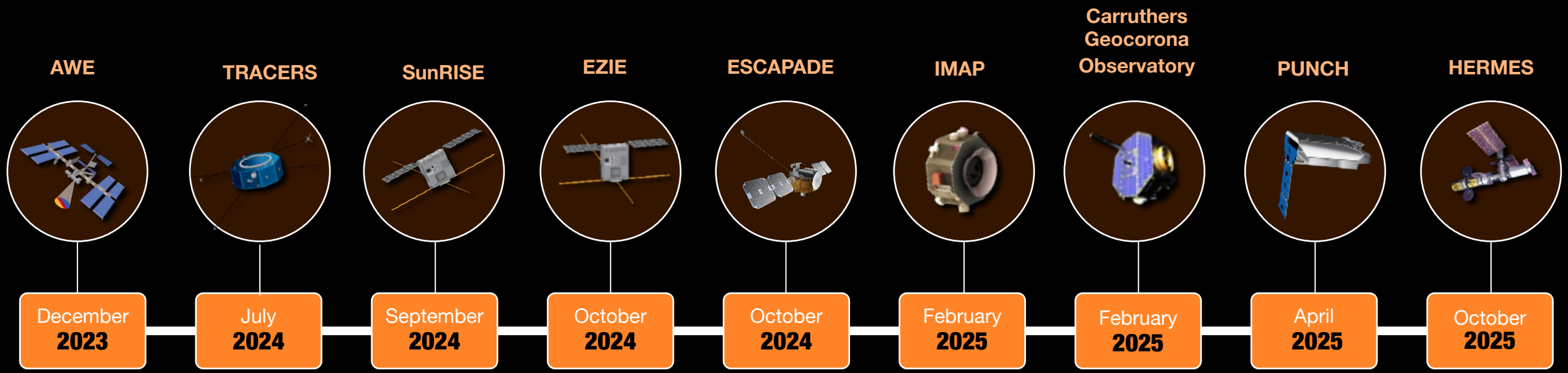
- Parker Solar Probe
- Solar Orbiter (ESA)

EXTENDED OPERATION

- ACE
- AIM
- GOLD (SES-14)
- Hinode (JAXA)
- IBEX
- ICON
- IRIS
- MMS (4)
- RAD (Curiosity)
- SDO
- SOHO (ESA)
- STEREO
- THEMIS-ARTEMIS (2)
- THEMIS (3)
- TIMED
- Wind
- Voyager (2)

HELIOPHYSICS
BIG YEAR

HELIO MISSION FLEET TIMELINE



2023 Research and Analysis Program Elements

- HSR: Supporting Research (Dual Anonymous Format)
- HGIO: Guest Investigator (Dual Anonymous Format)
- Living With a Star (LWS) Science
- Space Weather R2O2R (+Transition)
- HTIDS: Technology and Instrument Development for Science
- HLCAS: Low Cost Access to Space
- HFOS: Flight Opportunity Studies
- HFORT: Flight Opportunities for Research and Technology
- HITS: Heliophysics Innovation in Technology and Science
- H-ARD: Heliophysics AI/ML-Ready Data
- H-TM: Heliophysics Tools and Methods
- H-CSI: Heliophysics Citizen Science
- SOGI: Solar Orbiter Guest Investigator
- Multi-Disciplinary:
  - Habitable Worlds
  - FINESST
  - MDRAIT: Multidomain Reusable Artificial Intelligence Tools
  - XRP: Exoplanets
- In-Development: Two new Space Weather Offerings!

https://science.nasa.gov/researchers/solicitations/roses-2023/research-opportunities-space-and-earth-science-roses-2023-released

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.

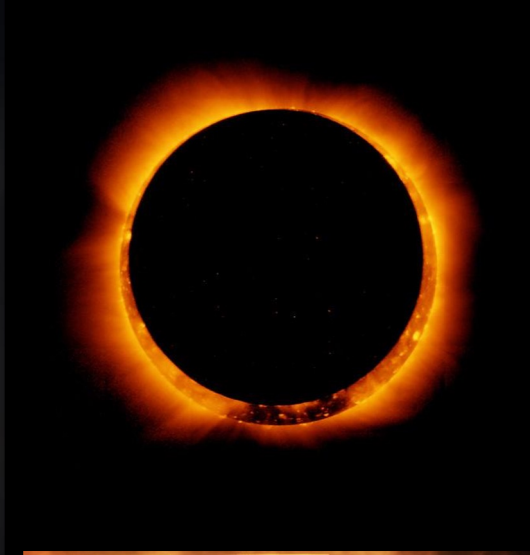
NASA is designating 2023 as the Year of Open Science, a global community initiative to spark change and inspire open science engagement through events and activities that will shift the current paradigm.

- 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

WHY IS 2023-2024 A BIG YEAR FOR HELIOPHYSICS

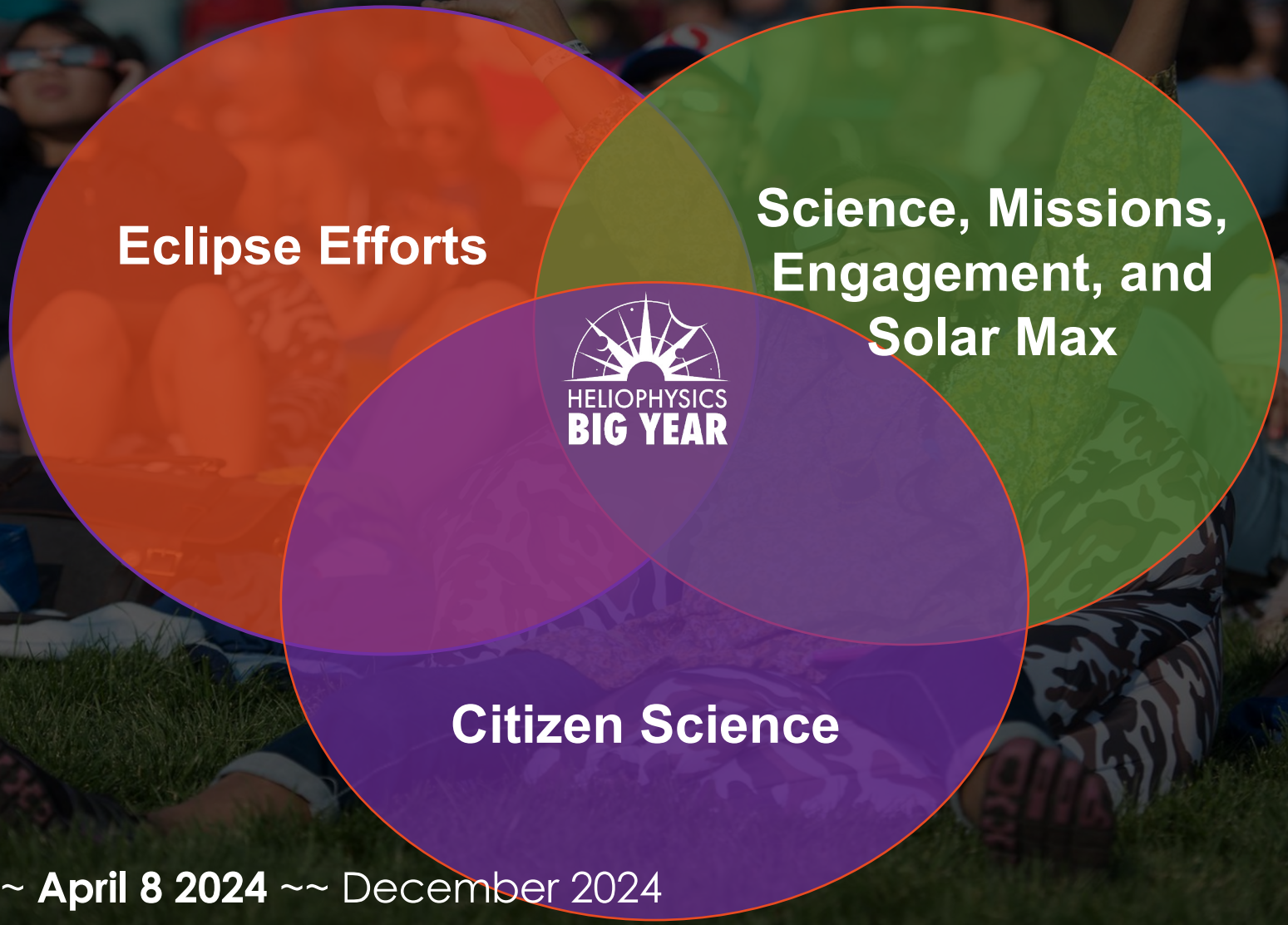
- Two solar eclipses across North America: Annular on **Oct 14, 2023**, and total on **April 8, 2024**
- Parker Solar Probe: Parker will make its closest approach to the Sun in Dec. 2024
- Solar Cycle 25: Solar maximum




eclipse
THROUGH THE EYES OF NASA
NASA
The 2023 & 2024
Solar Eclipses
through the eyes of NASA
Lunar topography data from NASA's Lunar Reconnaissance Orbiter and the Japan Aerospace Exploration Agency's SELENE lunar orbiter were used to precisely calculate the location of the Moon's shadow for the 2023 and 2024 solar eclipses. The planetary positions are from NASA's Jet Propulsion Laboratory Development Ephemeris 421. Earth imagery from NASA's Blue Marble: Next Generation series were used to create the terrain and Earth at night imagery from NASA's Black Marble were used under the eclipse paths.
2023 Annular Solar Eclipse
Saturday October 14, 2023
2024 Total Solar Eclipse
Monday April 8, 2024
Credit: Michala Garrison and the Scientific Visualization Studio (SVS), in collaboration with the NASA Heliophysics Activation Team (NASA HEAT), part of NASA's Science Activation portfolio
Eclipse calculations by Ernie Wright, NASA Goddard Space Flight Center
2023 Annular Solar Eclipse
2024 Total Solar Eclipse
9:15 AM PDT
9:20 PDT
9:25 PDT
10:30 MDT
10:35 MDT
10:40 MDT
11:45 CDT
11:50 CDT
12:00 CDT
12:05 PM CDT
2:20 PM CST
2:25 CST
2:30 CST
1:30 CDT
1:35 CDT
1:40 CDT
1:45 CDT
1:50 CDT
1:55 CDT
2:00 CDT
2:05 CDT
3:05 EDT
3:10 EDT
3:15 EDT
3:20 EDT
3:25 EDT
3:30 EDT
4:35 PM ADT
2023 Path of Annularity Sat. October 14, 2023
Along a path about 125 miles wide, the Sun will appear as a "ring of fire" in the sky. Annularity lasts up to 5 minutes depending on the viewer's location within this path.
2024 Path of Totality Mon. April 8, 2024
Along a path about 115 miles wide, the Moon will completely block the Sun in the sky. Totality lasts up to about 4 minutes and 28 seconds depending on the viewer's location within this path.
Outside of these paths, viewers within the 48 contiguous U.S. states and many other areas will see a partial solar eclipse (in the shaded areas below).
Find More: http://solarsystem.nasa.gov/eclipses
NP-2022-11-909-GSFC
2023 Maximum Partial Obscuration (%)
2024 Maximum Partial Obscuration (%)
Pacific Ocean
Atlantic Ocean
Gulf of Mexico
CANADA
UNITED STATES
MEXICO

THE HELIOPHYSICS BIG YEAR

A HUMAN-CENTERED, CROSS-COUPLED SYSTEM



October 14 2023 ~~ **April 8 2024** ~~ December 2024

HELIOPHYSICS BIG YEAR

HELIOPHYSICS
BIG YEAR

GET INVOLVED!

SEAL PROJECT

LIBRARIES

- FREE eclipse viewing glasses
- Activities & Training
- bit.ly/eclipseseal

RADIO JOVE

CITIZEN SCIENTISTS

- Best in radio quiet areas
- Learn to operate a radio telescope
- Equipment free to university groups
- radiojove.gsfc.nasa.gov

ECLIPSE SOUNDSCAPES & HARP

AUDIOPHILES

- Measure sounds during eclipses
- eclipsesoundscapes.org
- Listen to plasma turned into sound
- bit.ly/harpcitsci

HAMSCI

HAM RADIO OPERATORS

- Use your radio for science
- Eclipse QSO contests
- hamsci.org

ECLIPSE AMBASSADORS

UNDERGRADS & AMATEUR ASTRONOMERS

- Team up for outreach **off** eclipse paths **before** the eclipse
- Honorarium for undergrads
- bit.ly/eclipseambassadors

SCOPE

SUBJECT MATTER EXPERTS

- Be paired with a SciAct project
- Seeking early career scientists who represent underrepresented groups
- Honorarium
- scope.asu.edu

Get Involved and Stay Informed!

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

Sign up for the NASA Eclipse Newsletter to receive updates on eclipse activities!

- https://tinyurl.com/ym9epkjy

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

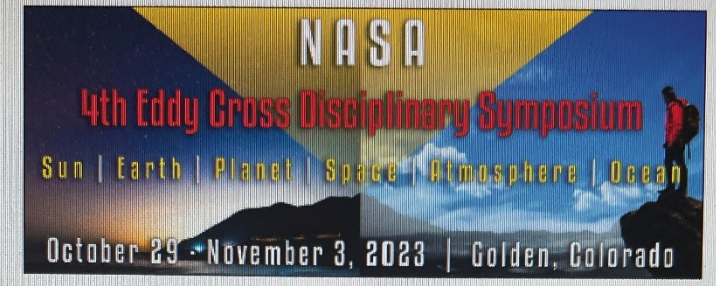
Learn more about the next solar eclipse:

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

Join us for our next Community Town Hall:

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

NASA.gov/sunearth **blogs.nasa.gov/sunspot** **@NASASun** **facebook.com/NASASunScience**



SAVE the DATE

for the **4th Annual NASA Eddy Symposium 2023**

Inspired by the life of Dr. Jack Eddy, and three previous symposia, we will convene the next event from October 29 - November 3, 2023. Our intent is to continue the legacy of the frontier-thinking, cross-disciplinary gathering that the Symposium has come to define.

The overarching theme of the 4th Eddy Symposium is "Why Grand Challenges in Solar Terrestrial Physics Require Open Science and how to achieve it?"

The NASA Jack Eddy Symposia create an atmosphere of inclusivity, generativity, and intellectual friendship. Join us in an uncommon event for cross-disciplinary and frontier scientific discussions.

Substantiating the theme of open science, we will practice its application through four focused areas, building on discussions and development from the 3rd Eddy Symposium:

- Open Science Methods: Emerging Open Science Methodologies
- The Interconnection of Sun, Climate, and Society
- Risk and Resiliency to Space Weather Disruption
- (Exo)Planetary Atmosphere: the Impact of Stars and Solar Physics on Habitability & Life

Save the Date: Evening Reception, Sunday, October 29th - Friday, November 3rd, 2023

Being held in person: Golden, Colorado - registration and hotel information to follow shortly

We look forward to seeing you there!

4th Eddy Cross-Disciplinary Steering Committee

Dan Marsh (co-chair), Ryan McGranaghan (co-chair), Erika Palmerio, King-Fai Li, Logan Wiedenhoffer, Ankush Bhaskar, Meng Jin, Jim Colliander, Rajesh Gupta, and Lika Guhathakurta