National Aeronautics and Space Administration

EXPLORE SCIENCE

NASA Living With a Star Town Hall

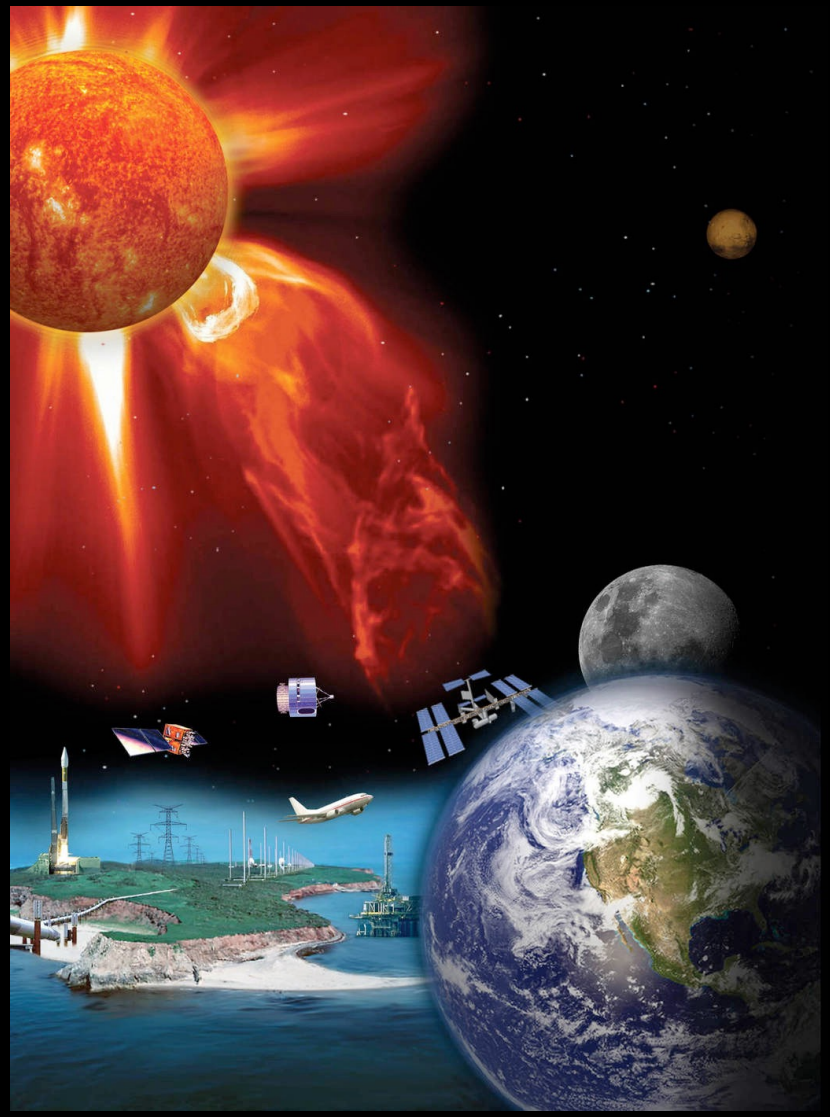
December 14, 2023

Agenda

Item	Time (CST)	Agenda Item	Presenter
1	6:30 PM	Welcome and LWS Program Overview	Simon Plunkett
2	6:40 PM	Mission Updates	Simon Plunkett
3	6:50 PM	LWS Science Update	John McCormack
4	7:05 PM	LWS Infrastructure	Lika Guhathakurta
5	7:20 PM	Wrap Up/Questions	Simon/John
6	7:30 PM	ADJOURN	

LWS Program Overview

Living With a Star (LWS)



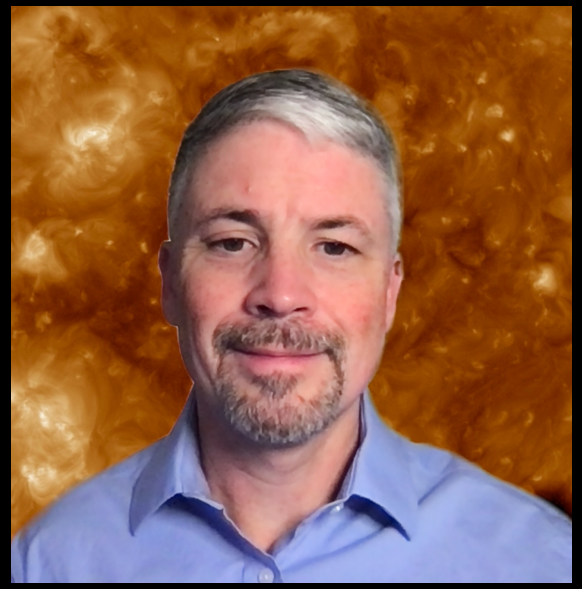
- LWS supports the science needed to understand key aspects of the Sun and the heliosphere, including Earth's space environment, that affect life and society.

- LWS provides a scientific understanding of the system that leads to predictive capability of the space environment conditions at Earth, other planetary systems, and in the interplanetary medium.

- LWS objectives:
  - Understand how the Sun varies and what drives solar variability;
  - Understand how the Earth and planetary systems respond to dynamic external and internal drivers;
  - Understand how and in what ways dynamic space environments affect human and robotic exploration activities.

LWS HQ Management Team

Simon Plunkett
LWS Program Scientist
Strategic Capabilities

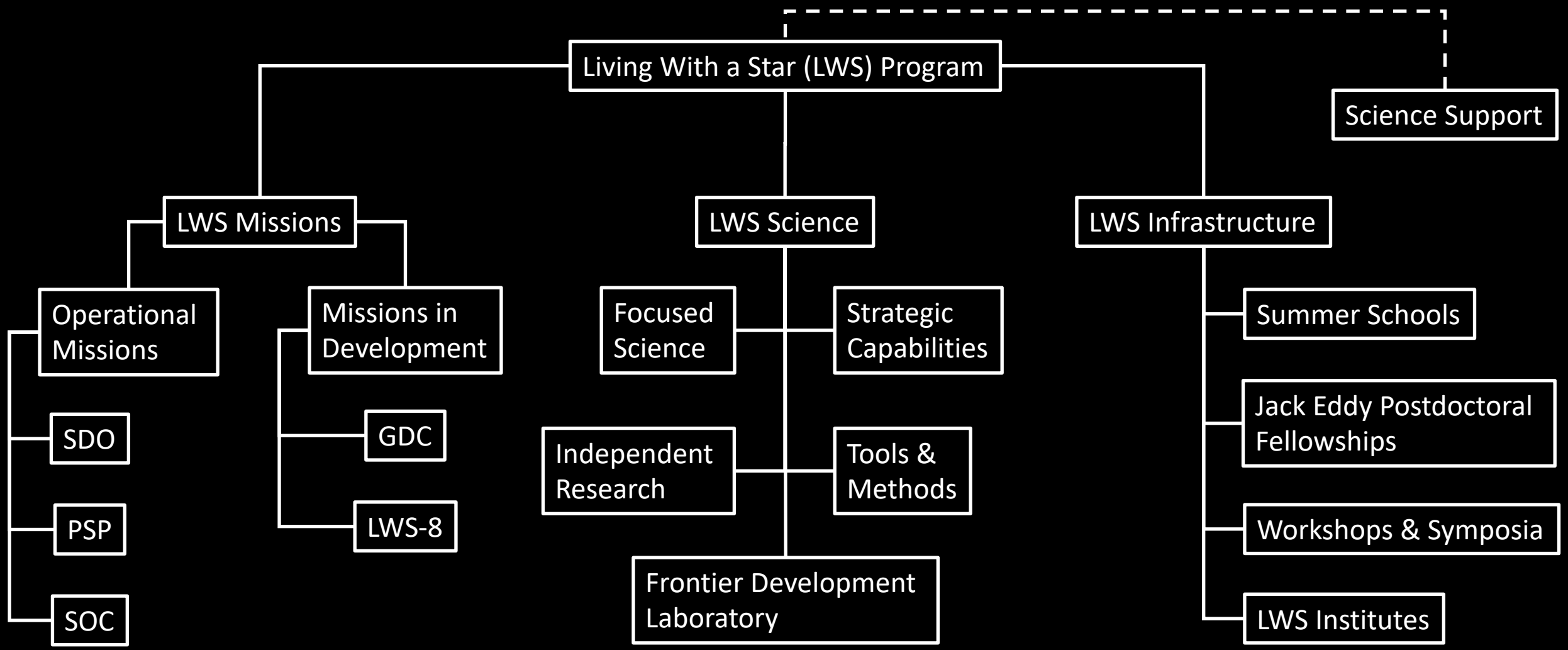


John McCormack
LWS Deputy Program Scientist
LWS Science

Madhulika (Lika) Guhathakurta
LWS Infrastructure
Tools and Methods

Ursula Rick
LWS Program Executive

LWS Program Elements



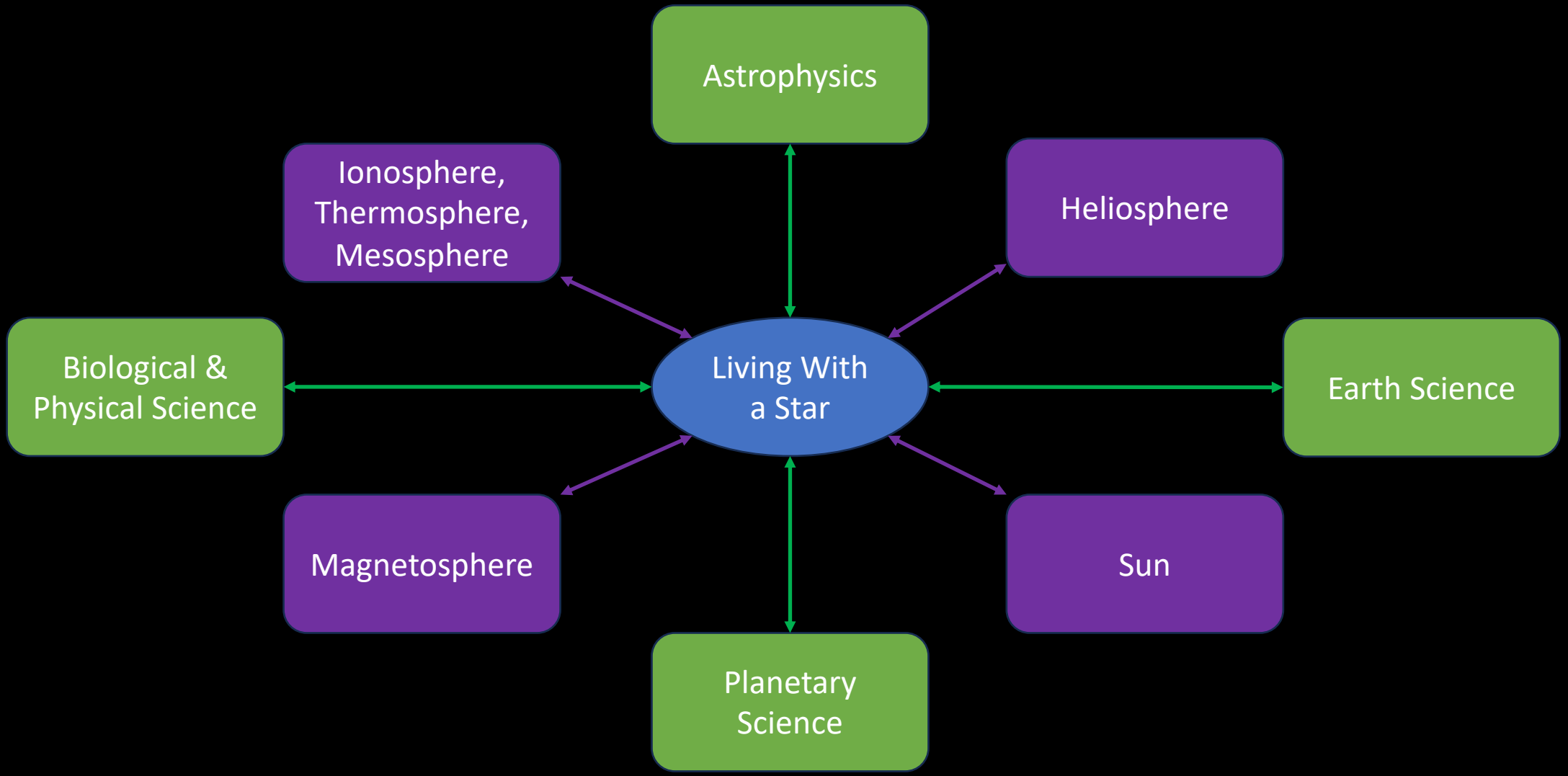
Strategic Science Areas

LWS Missions and Science Programs target these key research areas

- SSA-I: Origins and Variability of Global Solar Processes
- SSA-II: Solar Eruptive and Transient Heliospheric Phenomena
- SSA-III: Acceleration and Transport of Energetic Particles in the Heliosphere
- SSA-IV: Variability of the Geomagnetic Environment
- SSA-V: Dynamics of the Global Ionosphere and Plasmasphere
- SSA-VI: Ionospheric Irregularities
- SSA-VII: Composition and Energetics of the Neutral Upper Atmosphere
- SSA-VIII: Radiation and Particle Environment from Near Earth to Deep Space
- SSA-IX: Solar Impacts on Climate
- SSA-X: Stellar Impacts on Planetary Habitability

For more info on SSAs see
https://lwstrt.gsfc.nasa.gov/

LWS is Interdisciplinary System Science



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)

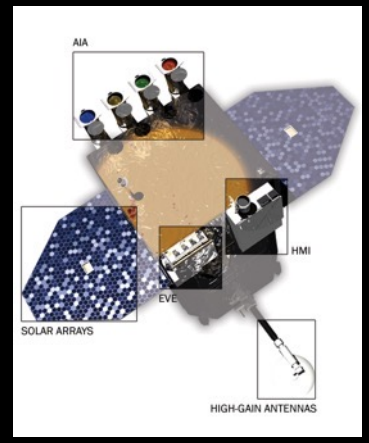
science.nasa.gov/heliophysics

LWS Missions Update

Solar Dynamics Observatory (SDO)

Mission Status

- SDO continues producing high-quality, high-cadence solar data
- SDO participated in the Heliophysics 2023 Senior Review and was selected to continue operating as an Infrastructure Mission
- The team has submitted a report working through the ramifications of this decision



Science Status

- SDO data and personnel continue to support the publication 100's of refereed papers each year
- We continue to sponsor talks on SDO science and encourage people to attend the next one on 17 Jan 2024 when KD Leka will describe research using AIA and HMI data to understand the solar magnetic field.
- We are planning an SDO Science Workshop in late February 2025.

Data Status

- We continue to recover and store 98% of the possible science data. Most of the lost images are are from unavoidable events such as weather and eclipses
- All data products are available as near-realtime with 15 min latency, science data after 4 days
- An SDO dataset was delivered to the HelioCloud project. iPoster IN43B-0635 Music Boxes of the Sun used this dataset for an almost 12-year study of polar faculae

Science Highlight

One paper used a Bayesian formulation to combine HMI, SoHO/MDI, and ground-based GONG Dopplergrams to study the large-scale meridional motions of the Sun.

Changes in the flows over a sunspot cycle improve our predictions of solar activity.

Although the meridional flow varies throughout the solar cycle, the time-varying components have not been identified and isolated.

The data were combined in time using a unique Bayesian statistical model

They propose that the near-surface meridional flow has three components:

- a constant baseline flow profile (derived from quiet-Sun regions) of about 10 m/s,
- variations due to inflows around active regions of about 4 m/s, and
- A solar-cycle-scale variation of about 2 m/s.

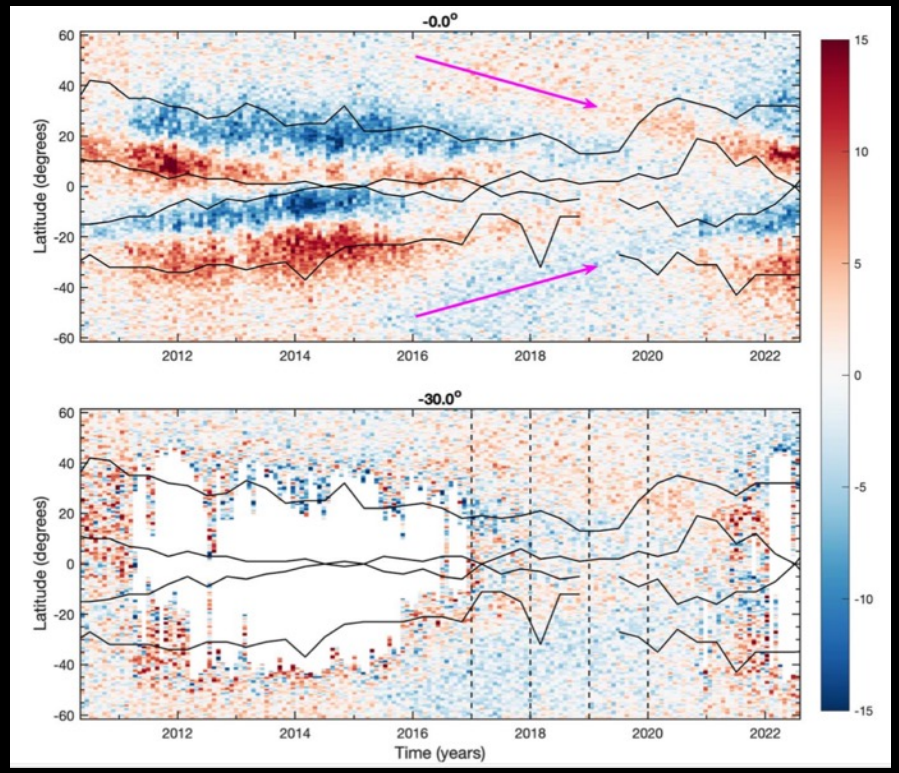
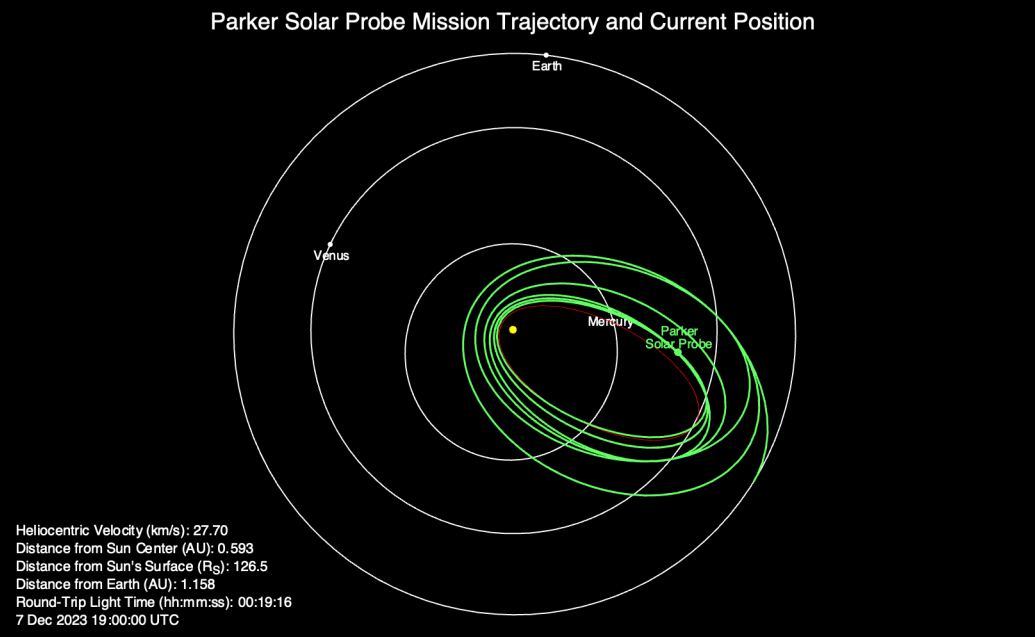


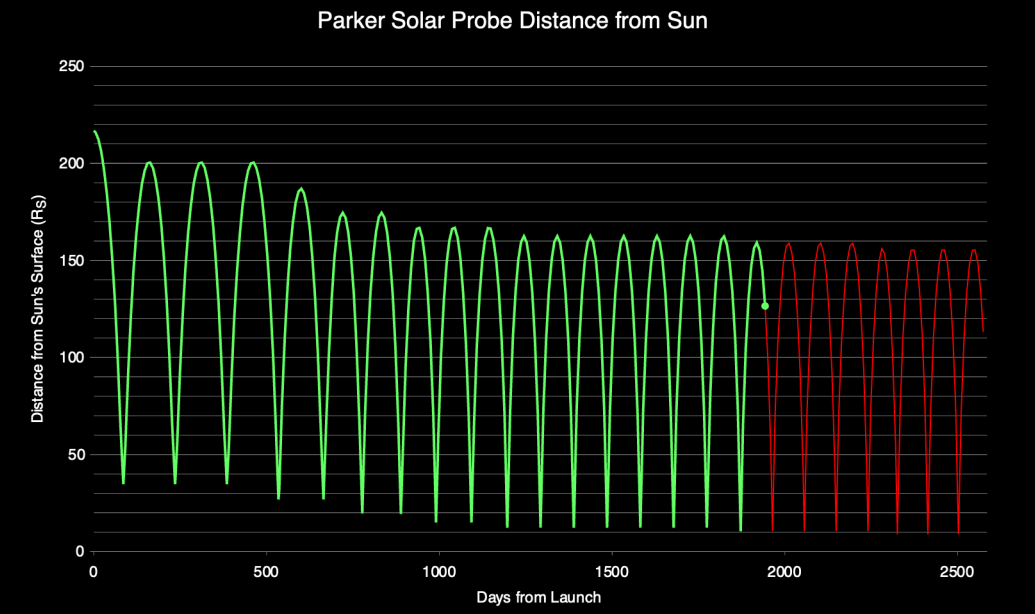
Figure 1. Top: The residual meridional flow (after removing baseline flow) averaged over solar rotations shows strong inflows into activity belts and weak bands of faster meridional flow migrating toward the equator near the end of solar cycle 24 (magenta arrows). Bottom: The residual meridional flow farther than 30° around active regions still shows the weak equatorward migrating bands.

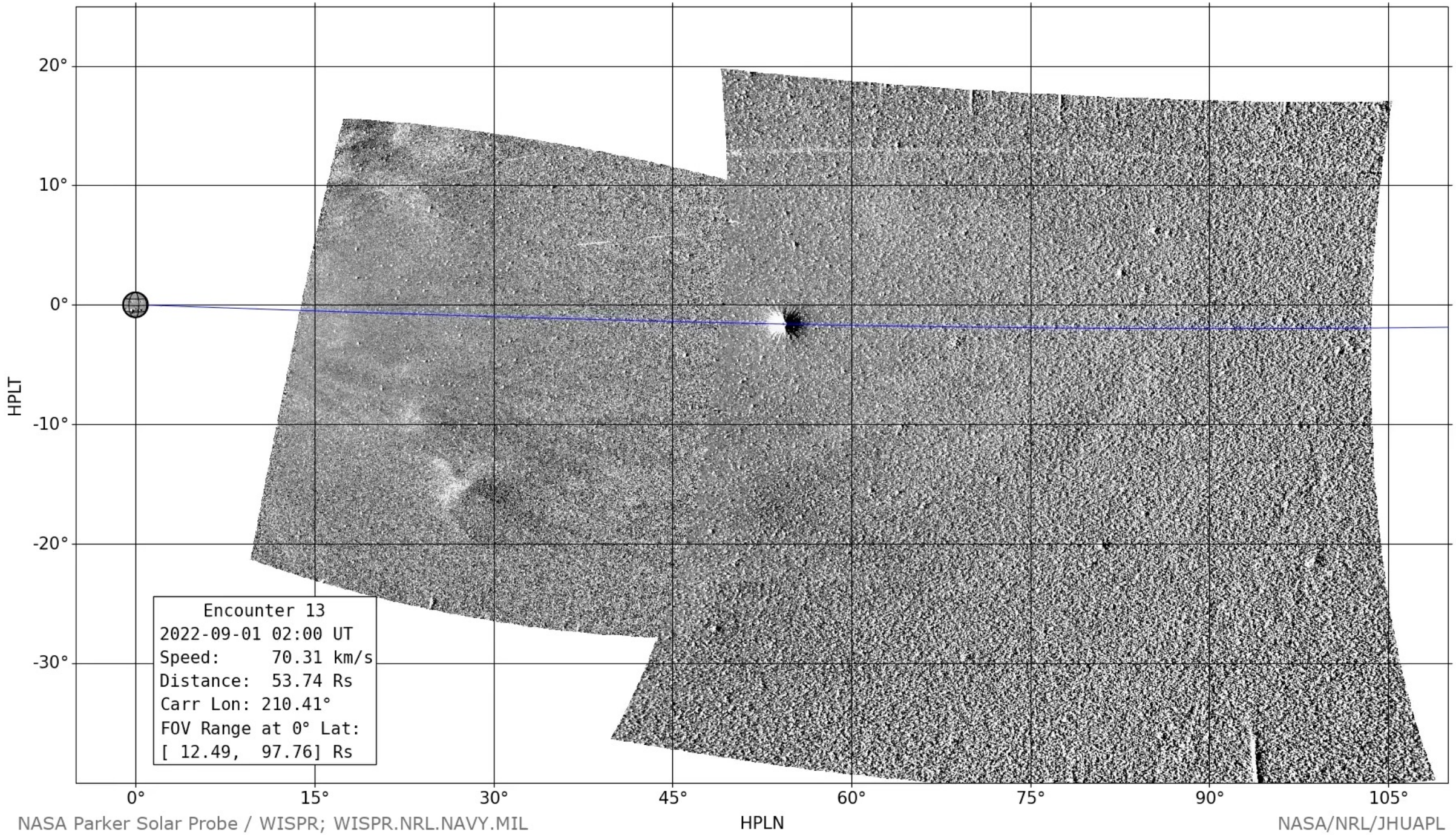
Herczeg, A., and J. Jackiewicz (2023), Ap. J., **954**, 187 (14pp) , https://doi.org/10.3847/1538-4357/acea7b

Parker Solar Probe Mission Status Summary

- Current perihelion: 11.4 solar radii
- Spacecraft is in great shape and is not tracking any life-limiting anomalies
  - System performance is matching models well – thermal, solar array, guidance and control, etc.
  - Trending shows that the system will continue to perform well as perihelion is decreased
  - Tracking low risk of dust impact
- Science Data
  - Data return ~3 times the pre-launch plan
  - Data from Encs. 1-17 and Venus 1-6 successfully downlinked
    - From Spacecraft SSR, additional downlink underway
- Publications
  - ~900 peer-reviewed paper with >15,000 citations
  - ApJ Focus Issue
    - Tens of papers under review
    - 11 papers accepted and available online https://iopscience.iop.org/collections/apj-230531-01






Encounter 13
2022-09-01 02:00 UT
Speed: 70.31 km/s
Distance: 53.74 Rs
Carr Lon: 210.41°
FOV Range at 0° Lat:
[12.49, 97.76] Rs
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60°
75°
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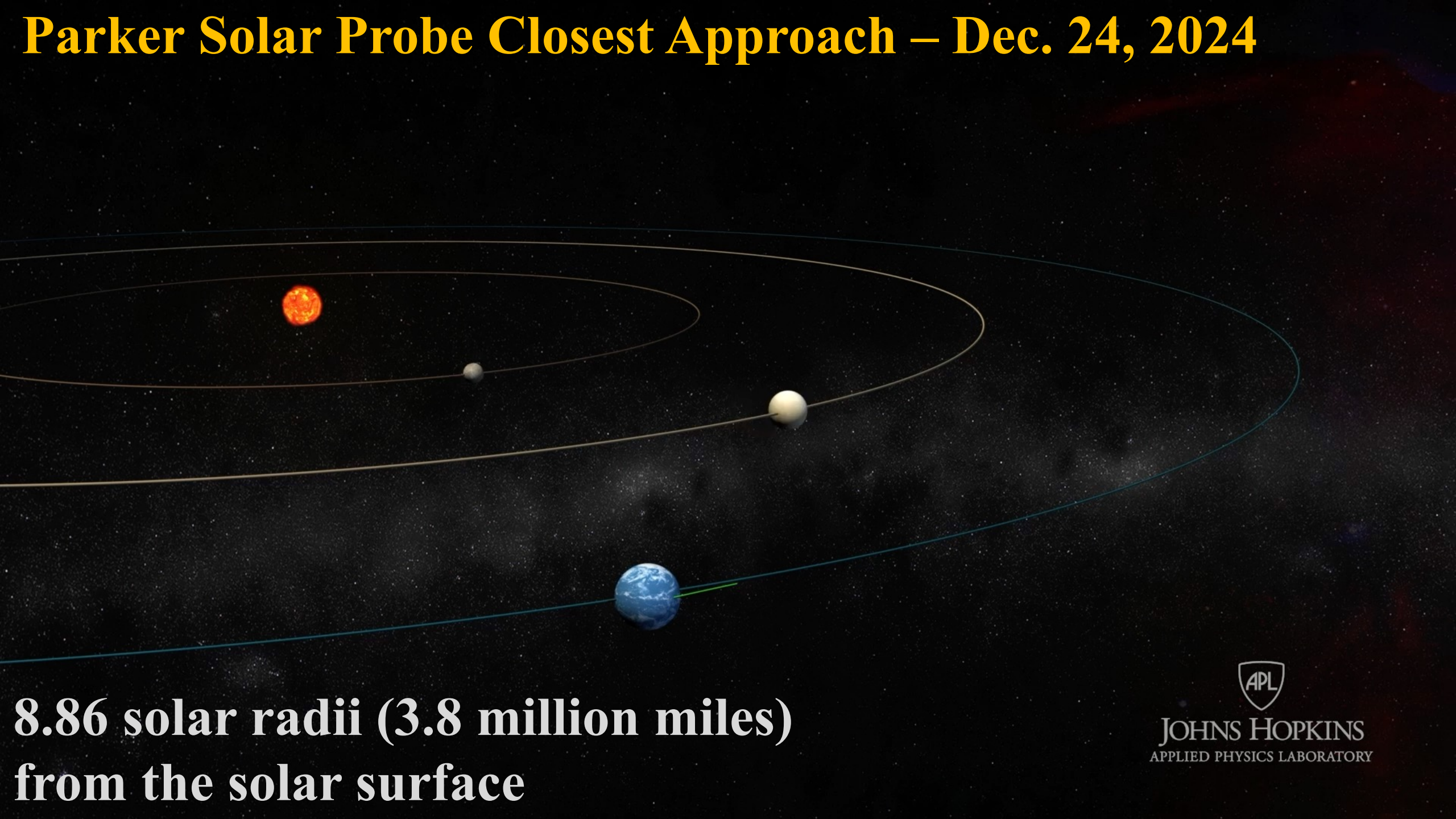
NASA Parker Solar Probe / WISPR; WISPR.NRL.NAVY.MIL
NASA/NRL/JHUAPL

Parker Solar Probe Closest Approach – Dec. 24, 2024



8.86 solar radii (3.8 million miles) from the solar surface

JOHNS HOPKINS
APPLIED PHYSICS LABORATORY

Solar Orbiter Collaboration

Exploring the Sun-Heliosphere Connection

Science Objectives

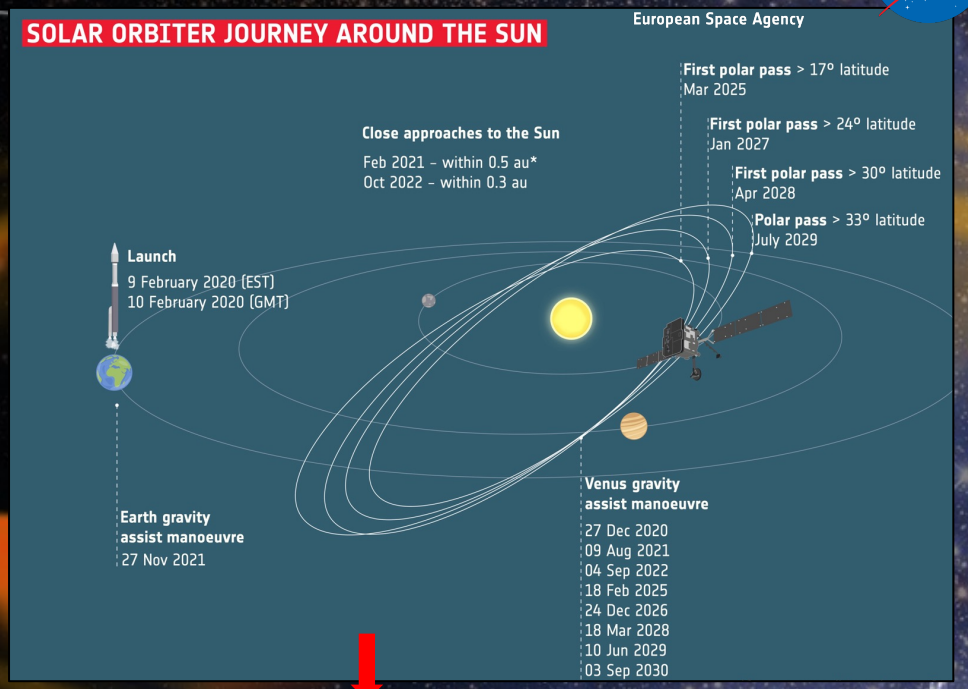
- **#1: How and where do the solar wind plasma and magnetic field originate?**
- **#2: How do solar transients drive heliospheric variability?**
- **#3: How do solar eruptions produce energetic particle radiation that fills the heliosphere?**
- **#4: How does the solar dynamo work and drive connections between the Sun and the heliosphere?**

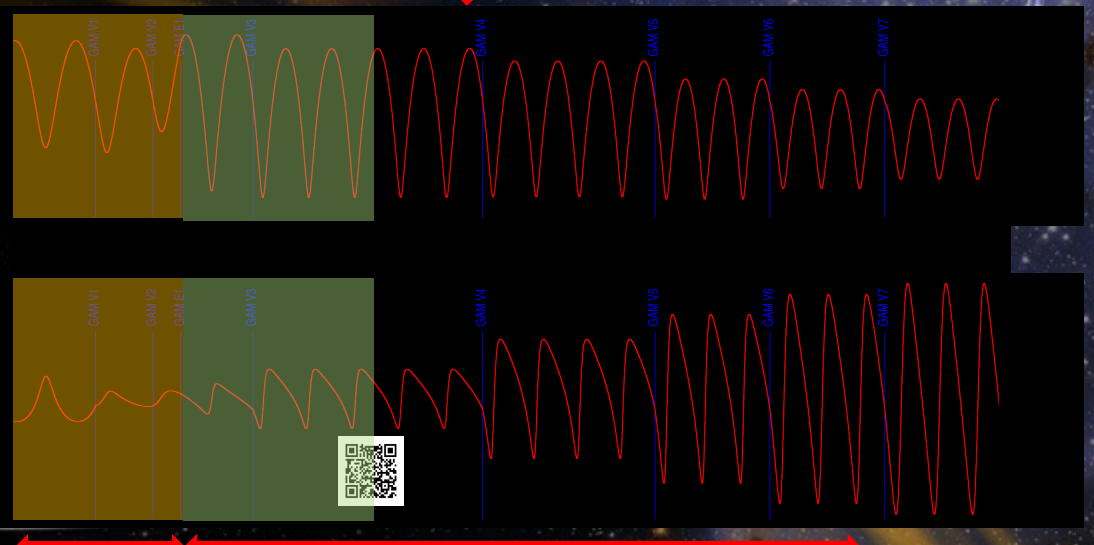
In-situ Instrumentation

- MAG – Magnetometer
- SWA – Solar Wind Analyzer (US Contribution)
- RPW- Radio Plasma Waves
- EPD – Energetic Particle Detector (US Contribution)

Remote-sensing Instrumentation

- EUI -> Extreme Ultraviolet Imager (+occulter)
- PHI -> Polarimetric and Helioseismic Imager
- STIX -> Spectrometer/Telescope for Imaging X-rays
- SPICE –> Spectral Imaging of the Coronal Environment (US Contribution)
- METIS -> Coronagraph
- SOLOHI -> Heliospheric Imager (US instrument)





Cruise Phase

Phase-E (Nominal Phase)

Solar Orbiter: 2023 in Review

Ephemeris

- January 3: Mercury transit
- RSW #7 (22 March - 2 April), RSW #8 (4 - 18 April), RSW #9 (20 - 25 April)
- April 10: Perihelion at 0.29 AU
- RSW #10 (1 - 11 October), RSW #11 (12 - 22 October), RSW #12 (23 October - November 2)
- October 7: Perihelion at 0.29 AU

Science Results

- A&A Special issue ”Solar Orbiter First Results (Nominal Mission Phase)" www.aanda.org/component/toc/?task=topic&id=1717 (70 papers already published)
- Science Nuggets www.cosmos.esa.int/web/solar-orbiter/science-nuggets (contributions are welcome)
- Press releases:

https://www.esa.int/Science_Exploration/Space_Science/Solar_Orbiter

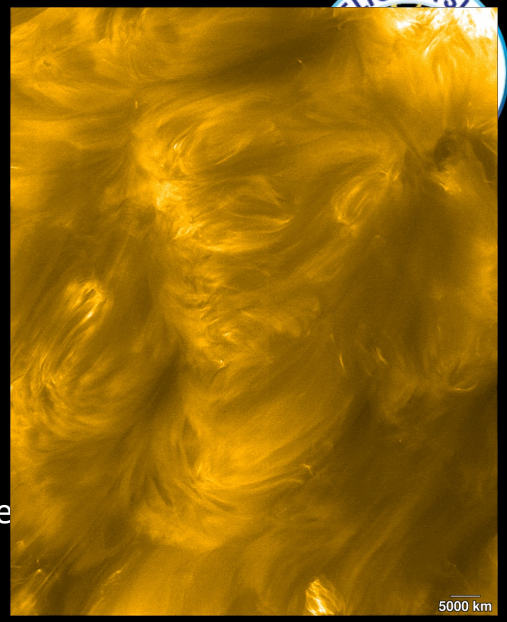
https://science.nasa.gov/mission/solar-orbiter/stories/

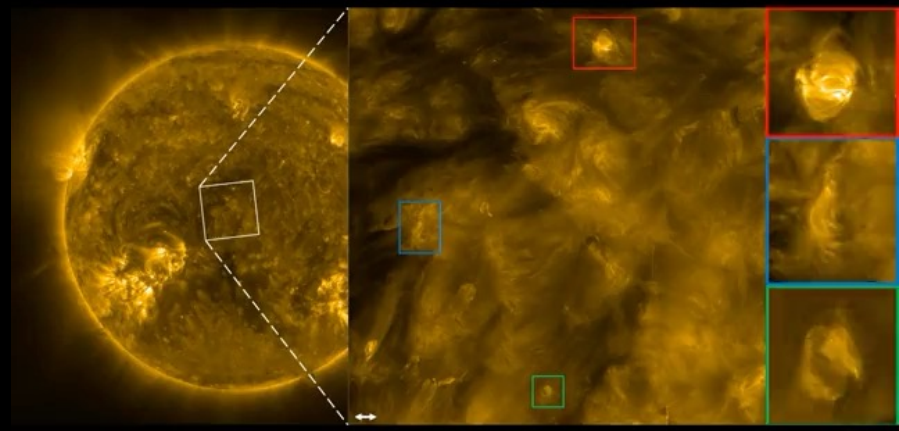
Other Significant Events

- New Solar Orbiters meeting at GSFC (24 - 26 October)
- AGU Session “Solar Orbiter: Sun – Inner Heliosphere connection” (SH13B, SH14B, SH31G)

Chitta et al. (ApJL, 2023)

- EUI-PHI data at perihelion showing close correspondence between small-scale magnetic field concentrations at the base of the EUV coronal loops.





Lim et al. (ApJL, 2023)

- High-frequency transverse oscillations in small-scale loops could contribute to coronal heating

Joint Solar Orbiter, Parker Solar Probe, and DKIST Workshop

EclipseSA

April 8-11, 2024

Joint Solar Orbiter, Parker Solar Probe, and DKIST Meeting

https://eclipse2024sa.com

Themes

1. Origin of the Solar Wind and the Heliospheric Magnetic Field
2. Evolution of plasma and magnetic field in the solar atmosphere and in the heliosphere
3. Solar Dynamo and its role in the connections between the Sun and the Heliosphere
4. Solar Transients and Heliospheric Variability
5. Particle phenomena (including cosmic rays)
6. Dust

Solar Orbiter Guest Investigators

- The Solar Orbiter Guest Investigators (SOGI) program element in ROSES 2023 solicited proposals focused on analysis of data from the Solar Orbiter mission.
- This program is intended to maximize the scientific return from the mission by providing support for research beyond the scope of work of the mission science teams.
- PIs and Co-Is from selected proposals will be named Guest Investigators of Solar Orbiter for the duration of the award and will be invited to attend and present progress at Solar Orbiter team meetings.
- 38 Step-2 proposals received on October 11, 2023.
- Proposals are currently under review, with selections expected in March 2024.

Geospace Dynamics Constellation

SCAN ME!

GDC Website

GDC is a Decadal Survey-recommended strategic mission in the Living With a Star program.

GDC is **a low-Earth orbit (350-400 km, high inclination ~82 deg) constellation of satellites** that will provide the **first global picture of the upper atmosphere and its responses to forcing from the magnetosphere.**

Prime mission: **3 years**. Carries propellant for 2 additional years. Launch expected **early 2030s**.

Provides critically-needed space weather observations of LEO

Looking for partnerships and collaborations, including complementary observations

For more info contact Doug Rowland, Larry Kepko, or Katherine Garcia-Sage

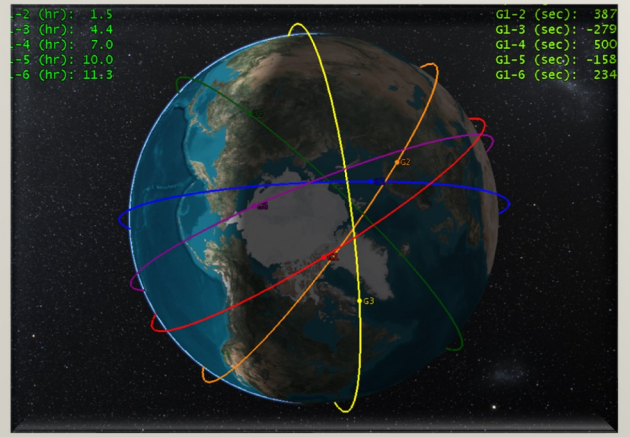
Status

- Science Team: ADAPTIVE (IDS), NEXUS (IDS), SOPHIE (IDS), AETHER, CAPE, MoSAIC, NEMISIS, PROFILE, TPS
- GDC is in Phase A. Near-term plans focus on refining science requirements and on early instrument development.
- Spacecraft procurement process underway

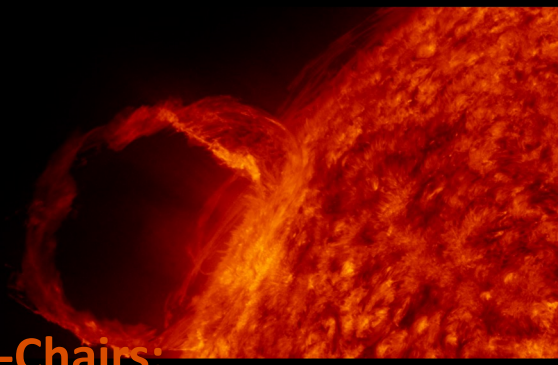
@ AGU: GDC Town Hall (TH53A)

- Friday, December 15. 1-2 PM Pacific.
- Location: 2010 – West (Level 2, West, MC)
- GDC status updates + Q&A + discussion
- Submit Q&A here: https://gsfc.cnf.io/sessions/t492/#!/dashboard

SCAN ME



NASA Living with a Star Program Analysis Group



LPAG Purpose:

The NASA Living with a Star (LWS) Program Analysis Group (LPAG) serves as a community-based interdisciplinary forum for soliciting and coordinating community input for Living with a Star objectives and for examining the implications of these inputs for architecture planning, activity prioritization and future exploration.

LWS Program Ex Officio:

Simon Plunkett, *NASA HQ*
John McCormack, *NASA HQ*
Shing Fung, *NASA GSFC*
Madhulika Guhathakurta, *NASA HQ*

LPAG: https://lwstrt.gsfc.nasa.gov/lpag

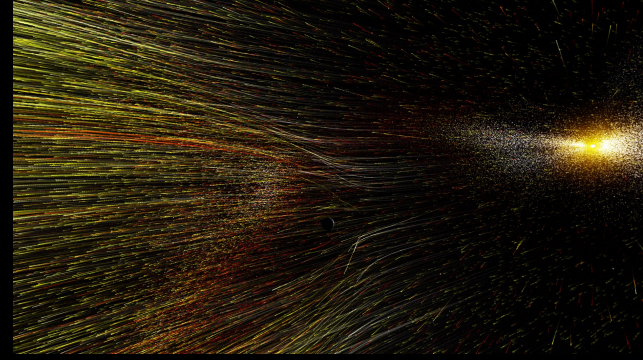
Executive Committee (EC) Co-Chairs:

Sabrina Savage, *NASA MSFC*
Anthea Coster, *MIT Haystack Observatory*

EC Members:

Ian Cohen, *JHU APL*
Robert McCoy, *University of Alaska-Fairbanks*
Olga Verkhoglyadova, *NASA JPL*
Ryan McGranaghan, *NASA JPL*
Fan Guo, *Los Alamos National Laboratory*
Heather Elliott, *Southwest Research Institute*
Alexei Pevtsov, *National Solar Observatory*
Thomas Immel, *Space Sciences Laboratory, UC Berkeley*
Chuanfei Dong, *Boston University*
Angelos Vourlidas, *JHU APL*
Shasha Zou, *University of Michigan*

2023 LPAG Activities



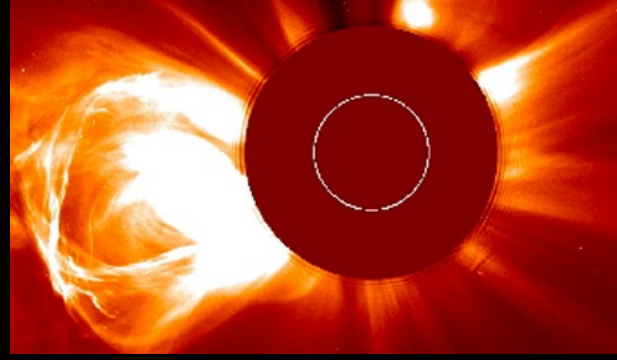
Primary Topic of discussion was generation of new FSTs

1. Meeting May 25 – 26, Washington, DC
2. Call for FST solicitation Draft NOI sent out to community early June (Solar News, CEDAR, GEM, AGU)
3. Virtual Town Hall - July 13
4. August – 13 Roll-over FSTs plus ~18 new FSTs proposed
5. On-line Meetings 10/10, 10/26. ***Decision to update 13 Roll-over FSTs for 2023.***
6. Meeting 12/5 – 12/6 College Park, Maryland. ***12 New FSTs developed.*** Additional FSTs being worked on for 2024.

Other Topics Discussed by LPAG

- How space weather research fits into LWS and relationship to NASA's Space Weather Program
- How best to ensure development of AI/ML and other statistical analysis tools within LWS program

The LPAG EC finalized 12 FSTs based on community input.



1. Connecting Space Weather and Thermospheric Density and Composition
2. Multi-scale High-Latitude Forcing of the Ionosphere-Thermosphere System
3. Solar Eclipses as a Naturally Occurring Ionosphere-Thermosphere Laboratory
4. Ion-Neutral Coupling at Multi-scales in the Ionosphere-Thermosphere System
5. Connecting Auroral Phenomena with Magnetospheric Phenomena
6. Physical Processes Responsible for the Generation and Evolution of the Solar Wind
7. Solar Flare Energetic Particles and Their Effects in Large Solar Energetic Particle Events
8. Understanding the Transport Processes of Solar Energetic Particles from Their Origins to the Entire Inner Heliosphere
9. Extreme Solar Events — Probabilistic Forecasting and Physical Understanding
10. Understanding Energy Partition and Energy Release Processes in Eruptive Events
11. Atmospheric Loss and Habitability in the Presence of a Star
12. Understanding Space Weather Effects for Human Deep Space Flight

New LPAG EC Members Needed!

- At least 4 members of the LPAG EC will complete their terms of service in 2023.
- NASA will circulate an open “Dear Colleague” letter in community newsletters soliciting nominations for new EC members beginning in 2024.
- Nominations will be accepted until January 31, 2024.
- Nominal term of service is 3 years.
- Recommendations for appointment are made by the LPAG EC Co-Chairs, in consultation with LWS Program staff, and are approved by the NASA Heliophysics Division Director.

LWS Science Program Update

LWS Science Selections – ROSES 2022

- **Proposals were solicited for 2 Focused Science Topics (FSTs):**
  - Beyond F10.7: Quantifying Solar EUV Flux and its Impact on the Ionosphere-Thermosphere-Mesosphere System;
  - Coupling of the Solar Wind Plasma and Energy to the Geospace System.
- **39 Step-2 proposals were received on November 23, 2022.**
- **Selections were announced on April 11, 2023.**
  - 14 proposals (36%) were selected for funding and organized into 2 FST teams (see next slide).

New LWS FST Teams – ROSES 2022

FST #1: Quantifying Solar EUV Flux and its Impact on the Ionosphere-Thermosphere-Mesosphere System	FST #2: Coupling of the Solar Wind Plasma and Energy to the Geospace System
Berger (University of Colorado) LEAD	Borovsky (Space Science Inst.) LEAD
Balmaceda (George Mason University) Chamberlin (University of Colorado) Hsu (UCAR) Xu (University of California Berkeley) Yu (New Jersey Inst. of Technology)	Chen (Princeton University) Cucho-Padin (Catholic University) Liu (UCLA) Nykyri (Embry-Riddle Aeronautical University) Sibeck (NASA-GSFC) Vidal-Luengo (CU-LASP) Zou (University of Alabama Huntsville)

LWS FSTs and Dates – ROSES 2023

ROSES 2023 FSTs

- Understanding Ionospheric Conductivity and its Variability
- Synergistic View of the Global Magnetosphere
- Evolution of Coronal Mass Ejections in the Corona and Inner Heliosphere

Important Dates

- ROSES 2023 LWS NRA: initial release February 14, 2023, amended July 21, 2023.
- Step-1 Proposals: August 15, 2023 (68 Step-1 proposals submitted).
- Step-2 Proposals: November 7, 2023 (60 Step-2 proposals submitted).
- **Proposals are currently under review, with selections expected in April 2024.**

Draft FSTs and Dates – ROSES 2024

ROSES 2024 Draft FSTs

NASA anticipates solicitation of ***three FSTs*** for ROSES 2024 on the following topics:

- Auroral & Magnetospheric Phenomena
- Solar Energetic Particle Transport
- Solar/Stellar Variability, Atmospheric Evolution and Habitability

Important Dates (Tentative)

- ROSES 2024 LWS NRA: February 2024.
- Step 1 Proposals: ~ September 2024. Step 2 Proposals: ~ November 2024.

- **NEW FOR 2024: LWS Science review will be Dual Anonymous. Read NRA carefully!**

LWS Science Award Management

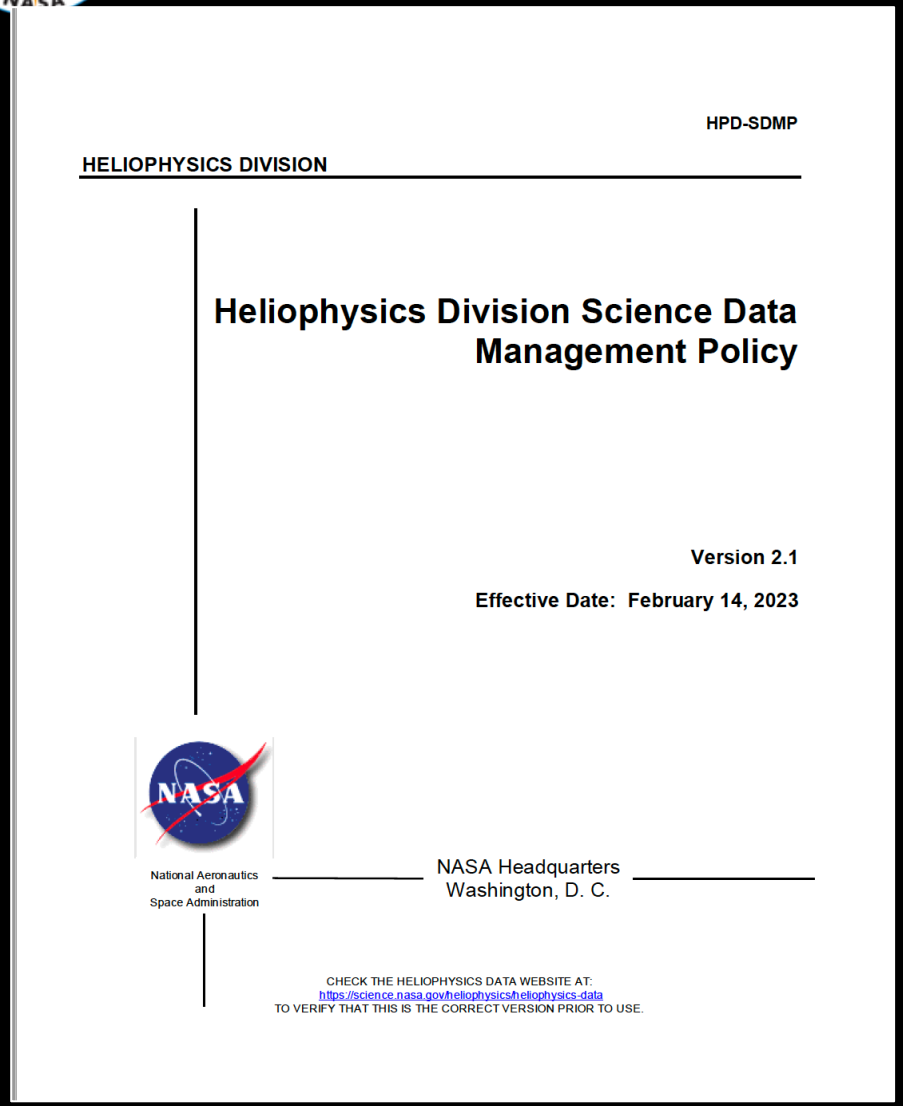
- Annual progress reports to NASA are part of terms of the award.
  - **GRANTS**: PI sends to NSSC-grant-report@mail.nasa.gov within 60 days of annual period of performance end date. A copy should be sent to the program officer at HQ.
  - **NASA Centers/government agencies**: send to program officer 30 days before end of FY.
- Submit no cost extension requests no earlier than 60 days prior to end of the award end date.
  - https://www3.nasa.gov/centers/nssc/forms/grantcooperative-agreement-no-cost-extension-request
- If PI will change institutions, notify the program officer as soon as possible.

For more information, see https://science.nasa.gov/researchers/sara/how-to-guide/

LWS Science Award Management (cont'd)

- Uncosted funds reflect on future program funding levels. Awards are expected to cost as proposed.
- For awards with uncosted funds >1 year's funding, additional year funding will be delayed.
- A revised spend plan and SOW will be requested and evaluated before additional funding is released.

HPD Data Policy for R&A Activities



HPD-SDMP

HELIOPHYSICS DIVISION

Heliophysics Division Science Data Management Policy

Version 2.1

Effective Date: February 14, 2023

National Aeronautics and Space Administration

NASA Headquarters
Washington, D. C.

CHECK THE HELIOPHYSICS DATA WEBSITE AT:
https://science.nasa.gov/heliophysics/heliophysics-data
TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE.

Version 2.1 outlines how HPD-funded research should make results available:

- Use the Heliophysics Digital Resource Library (HDRL) to access data and related documentation from the HSO and research efforts.
- HDRL ensures that all heliophysics data are citable using a persistent identifier such as Space Physics Archive Search and Extract (SPASE) registries or DOIs.
- HPD-funded R&A activities shall archive information of scientific utility, e.g., final simulation results necessary to reproduce results and data used to create tables, graphs, or figures from publications.
- Data users are strongly encouraged to cite the sources of the information used to conduct their peer-reviewed, published research using these identifiers.

LWS Infrastructure Program Elements