Updates on Aditya-L1 mission and Possible Coordinated Observations

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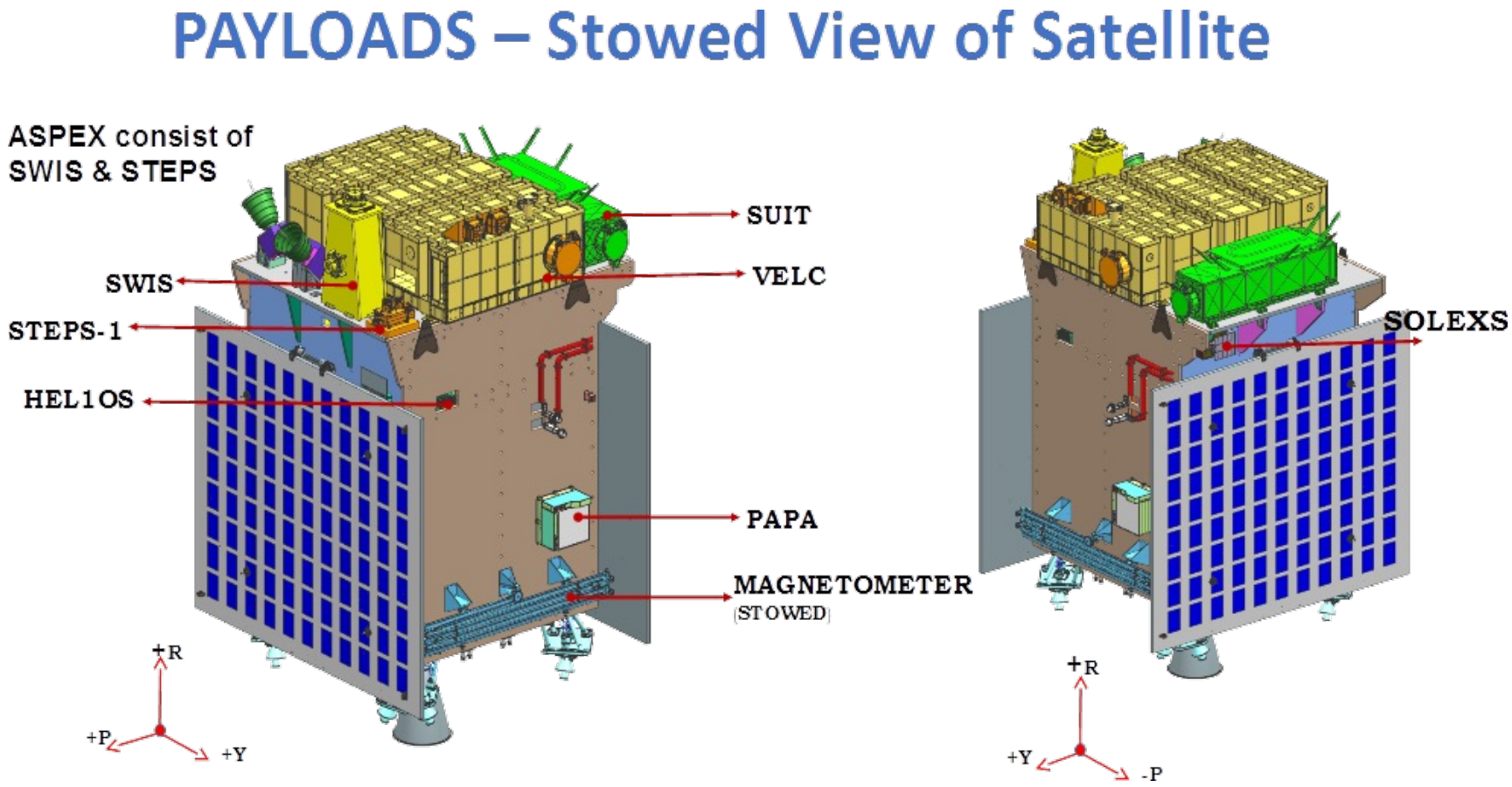
On behalf of Aditya-L1 Science Working Group

Aditya-L1 mission

All Instruments delivered, integration continuing (expected launch 2023)

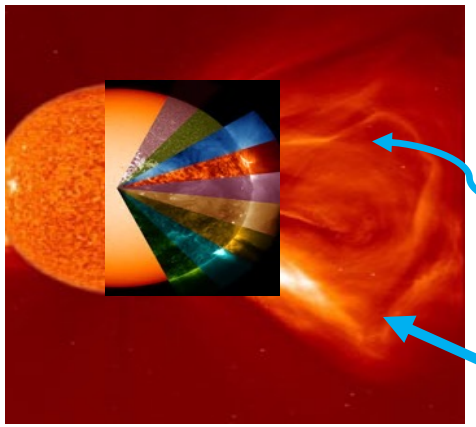
Salient Features:

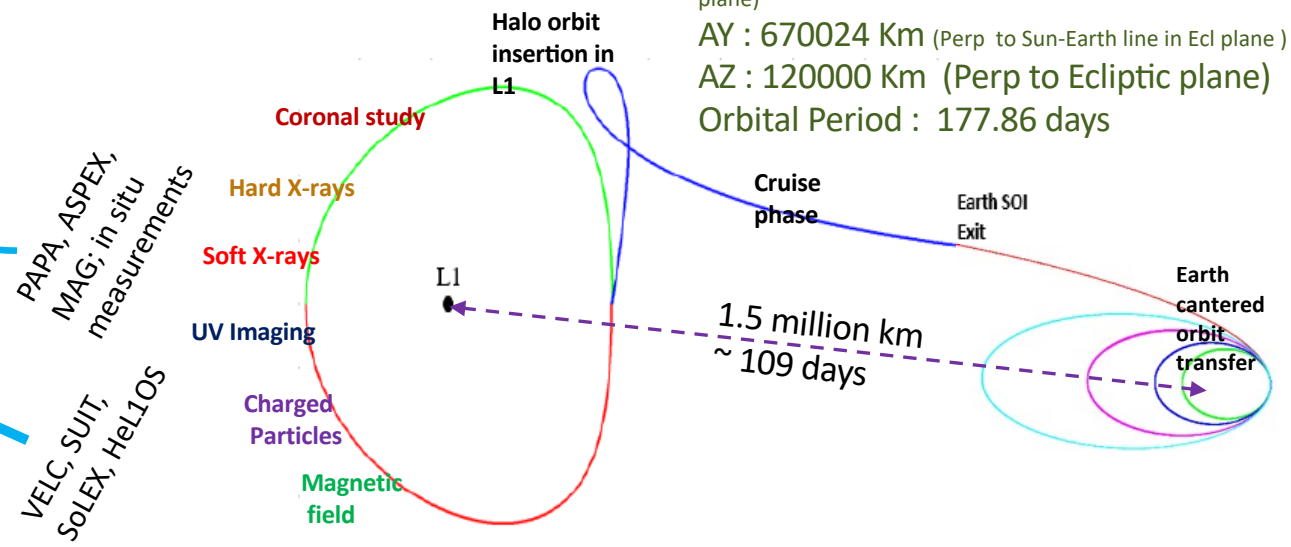
- Multi payload – observatory class
- Multi-wavelength – covering different atmospheric layers
- 4 Remote sensing & 3 In-situ observations – establishing connecting between source and in-situ (space weather)
- Capability to address many scientific problem in solar as well as space weather aspects



Aditya L1 – Upcoming Indian Solar Mission

Continuous observation of the Sun from Earth-Sun Lagrange points L1





Halo orbital parameters

AX : 208951 Km (along Sun-Earth line in Ecliptic plane)

AY : 670024 Km (Perp to Sun-Earth line in Ecl plane)

AZ : 120000 Km (Perp to Ecliptic plane)

Orbital Period : 177.86 days

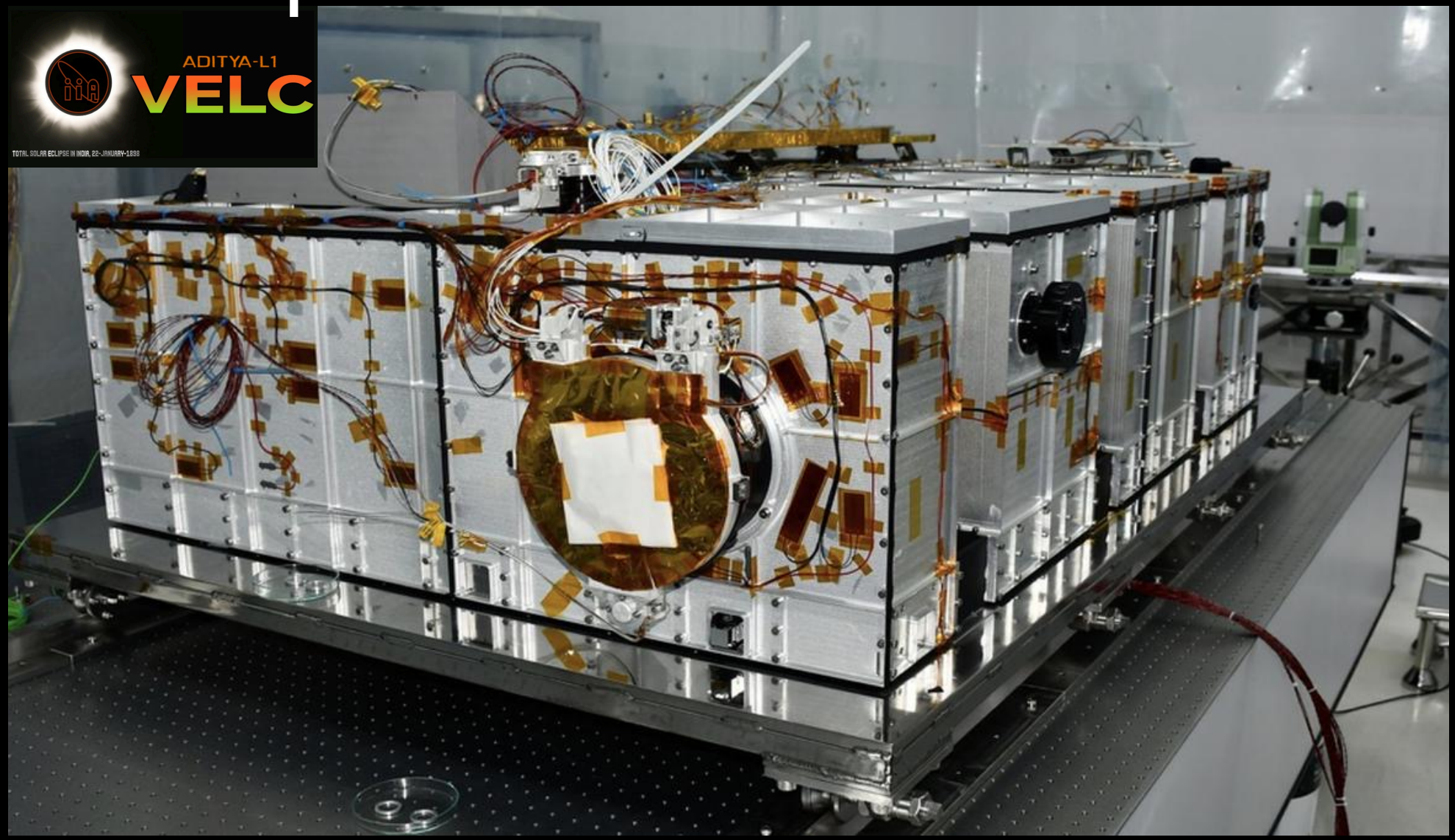
Payloads:

1. **VELC:** Visible Emission line Coronagraph
2. **SUIT:** Solar Ultra Violet Imaging Telescope
3. **HEL1OS:** High Energy L1 Orbiting X-ray Spectrometer
4. **SoLEXS:** Solar Low Energy X-ray Spectrometer
5. **PAPA:** Plasma Analyzer Package for ADITYA
6. **ASPEX:** Aditya Solar wind Particle Experiment
7. **MAGNETOMETER**

Major objectives:

- Understanding the Coronal Heating and Solar Wind Acceleration.
- Understanding initiation of Coronal Mass Ejection, flares and near-Earth space weather.
- Coupling and Dynamics of the Solar Atmosphere.
- Solar wind distribution and temperature anisotropy.

Status Update: VELC



Courtesy: IIA

Status Update: SUIT

Courtesy: IUCAA

The complete list of payloads: (ISRO website)

Visible Emission Line Coronagraph (VELC): To study the diagnostic parameters of solar corona and dynamics and origin of Coronal Mass Ejections (3 visible and 1 Infra-Red channels); magnetic field measurement of solar corona down to tens of Gauss – Indian Institute of Astrophysics (IIA)

Solar Ultraviolet Imaging Telescope (SUIT): To image the spatially resolved Solar Photosphere and Chromosphere in near Ultraviolet (200-400 nm) and measure solar irradiance variations - Inter-University Centre for Astronomy & Astrophysics (IUCAA)

Aditya Solar wind Particle Experiment (ASPEX) : To study the variation of solar wind properties as well as its distribution and spectral characteristics – Physical Research Laboratory (PRL)

Plasma Analyser Package for Aditya (PAPA) : To understand the composition of solar wind and its energy distribution – Space Physics Laboratory (SPL), VSSC

Solar Low Energy X-ray Spectrometer (SoLEXS) : To monitor the X-ray flares for studying the heating mechanism of the solar corona – ISRO Satellite Centre (ISAC)

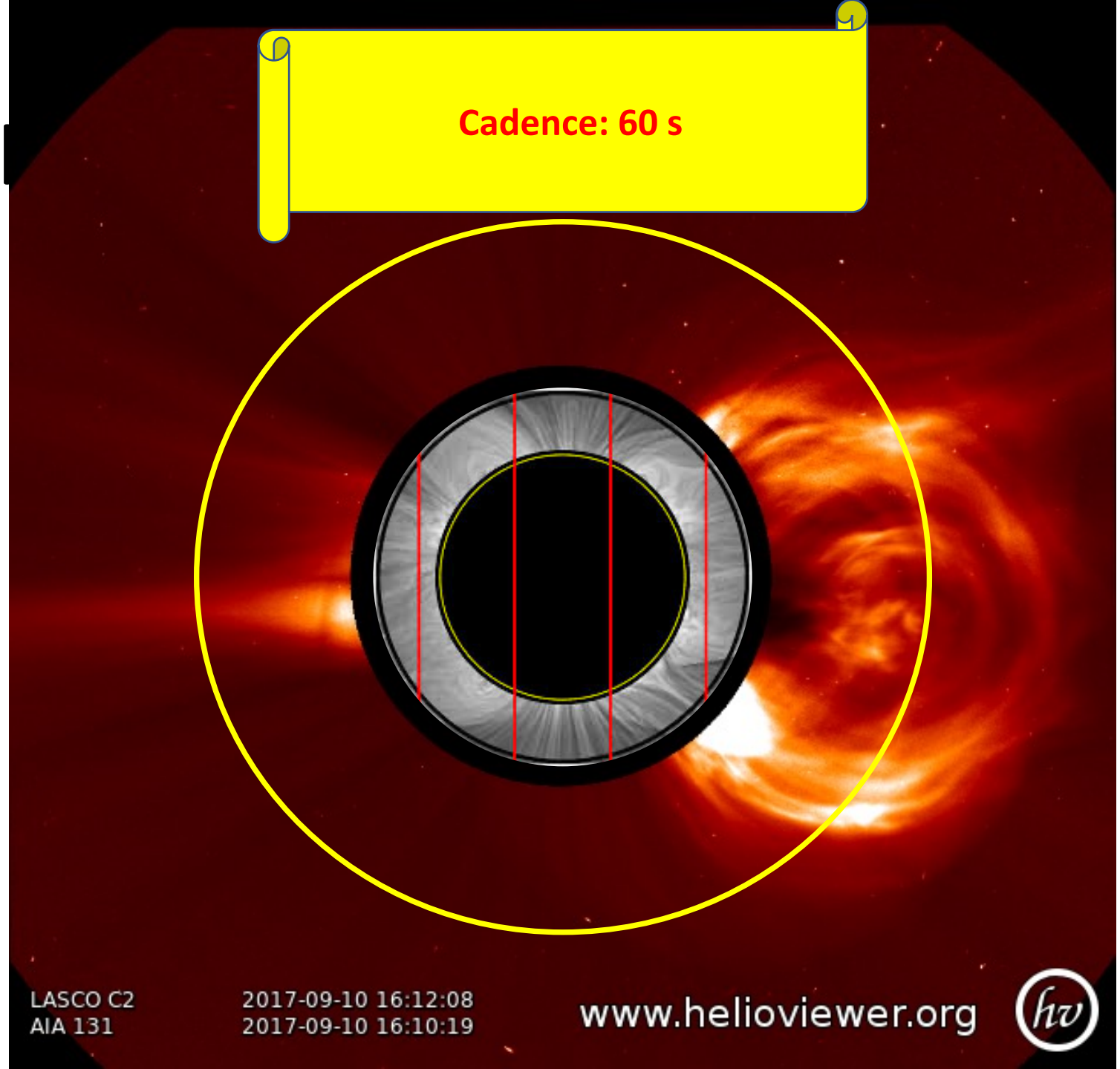
High Energy L1 Orbiting X-ray Spectrometer (HEL1OS): To observe the dynamic events in the solar corona and provide an estimate of the energy used to accelerate the particles during the eruptive events - ISRO Satellite Centre (ISAC) and Udaipur Solar Observatory (USO), PRL

Magnetometer: To measure the magnitude and nature of the Interplanetary Magnetic Field – Laboratory for Electro-optic Systems (LEOS) and ISAC.

Comparison of ADITYA-L1 VELC with other space based coronagraphs

	SOHO			STEREO		ADITYA-L1
Instrument	**LASCO C1**	**LASCO C2**	**LASCO C3**	**COR1**	**COR2**	**VELC**
FOV ($R_\odot$)	1.1 - 3.0	1.5 - 6.0	3.7 - 30	1.2 - 4.0	2 - 15	1.05 - 3
Occulter Type	Internal	External	External	Internal	External	Internal
Pixel Resolution	5.6”	11.4”	56.0”	3.75”	14.7”	2.51”
Objective Element	Mirror	Lens	Lens	Lens	Lens	Mirror
Aperture Size (mm)	47	20	9	36	34	192

CME Ol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LASCO C2
AIA 131
2017-09-10 16:12:08
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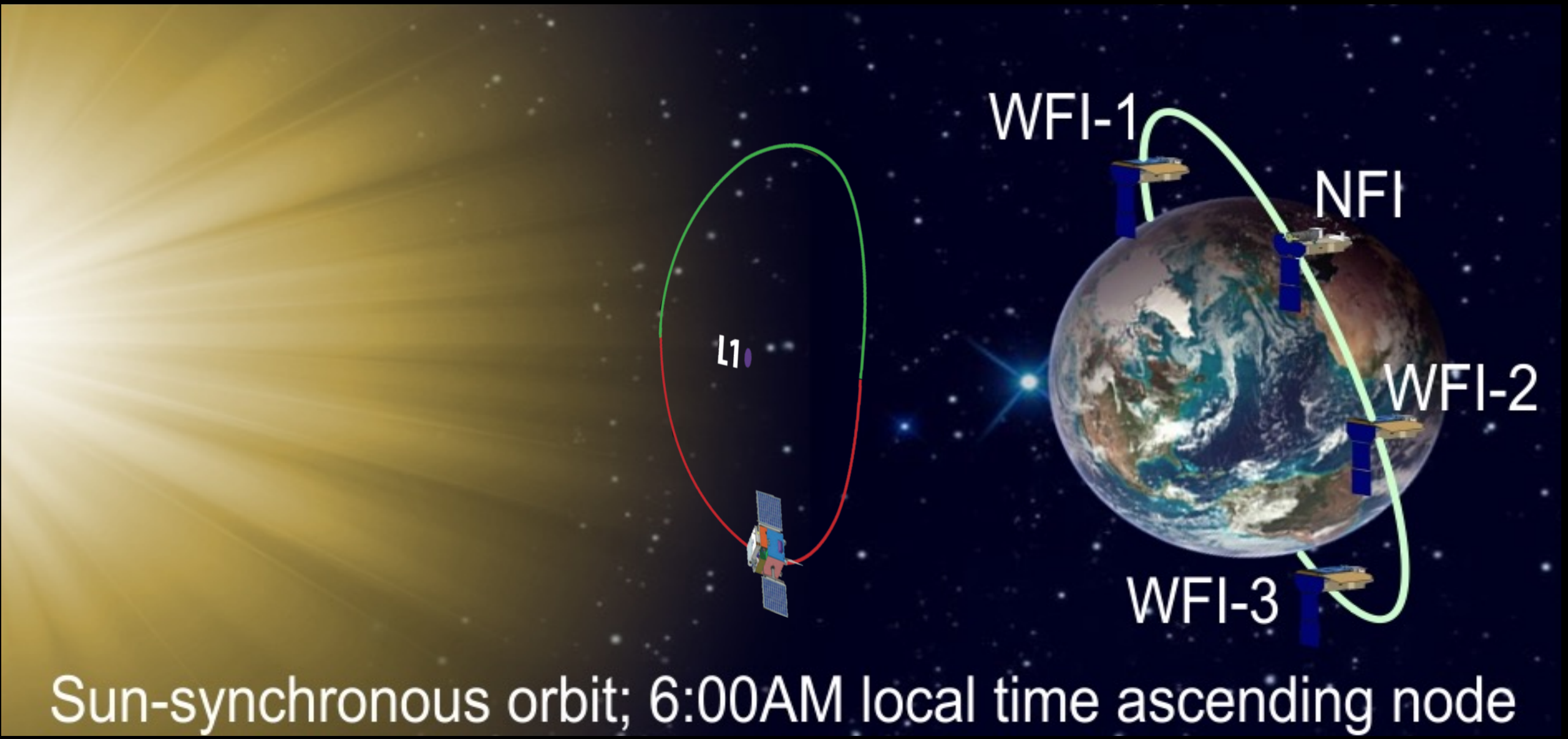
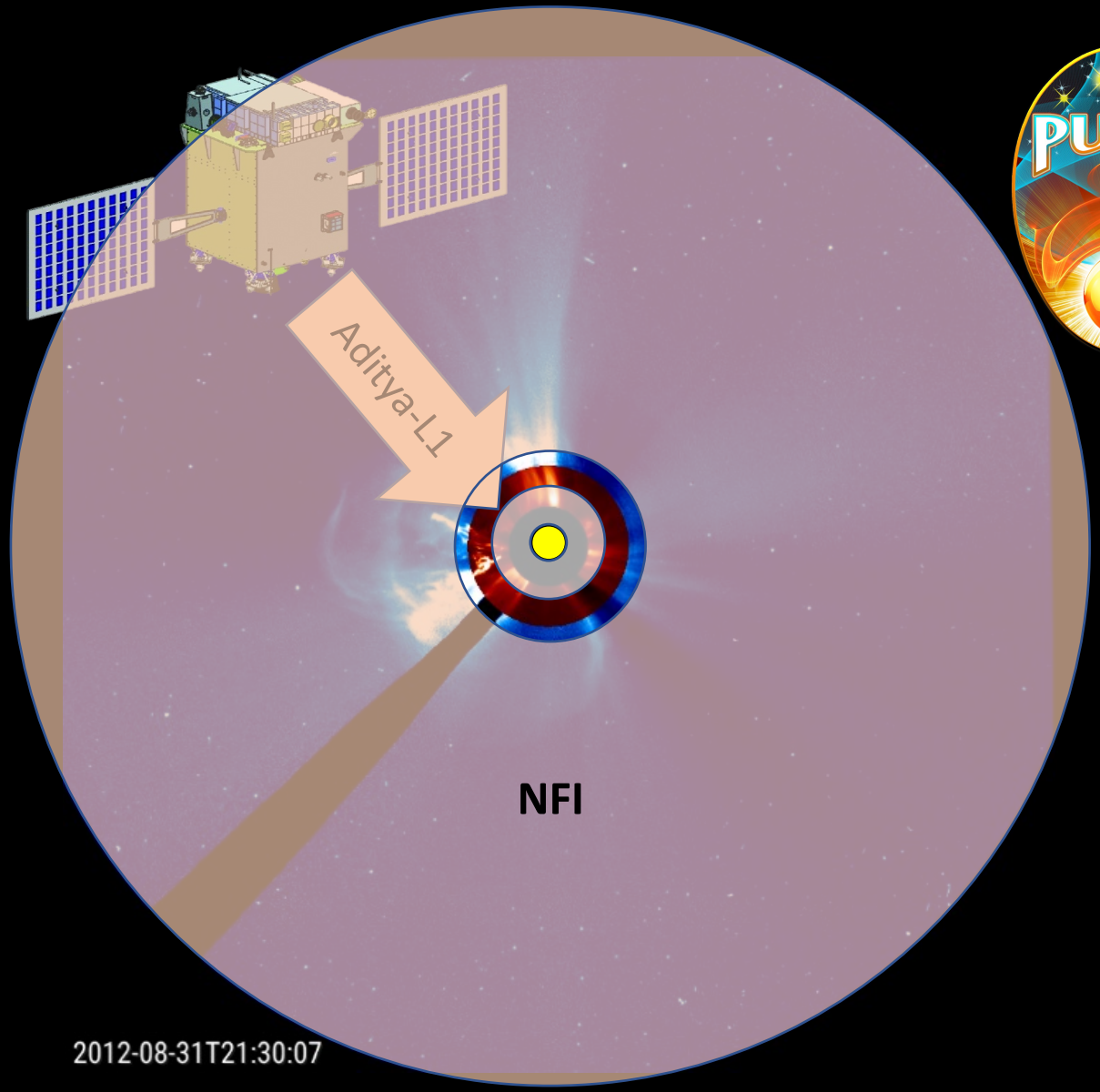
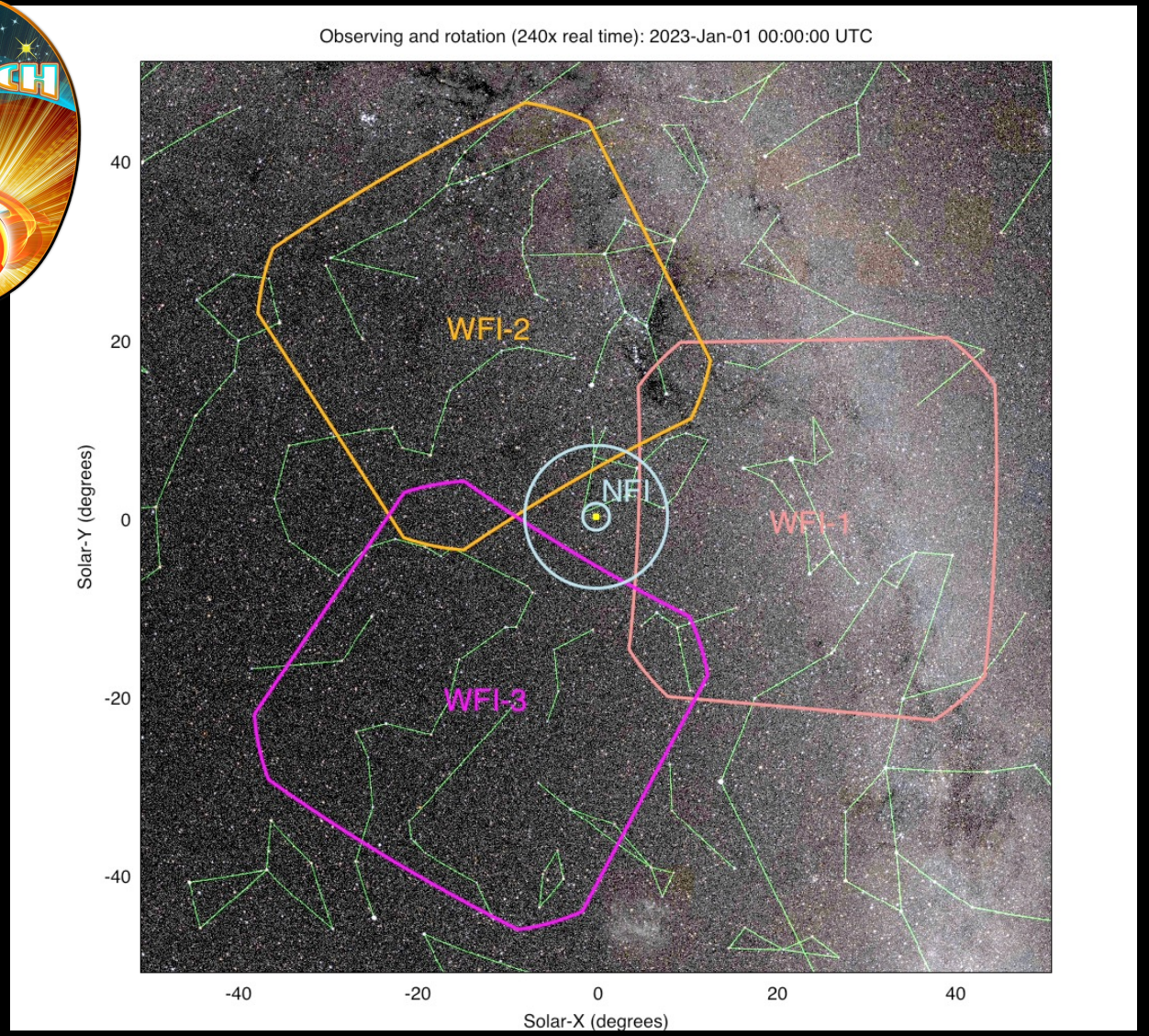
www.helioviewer.org

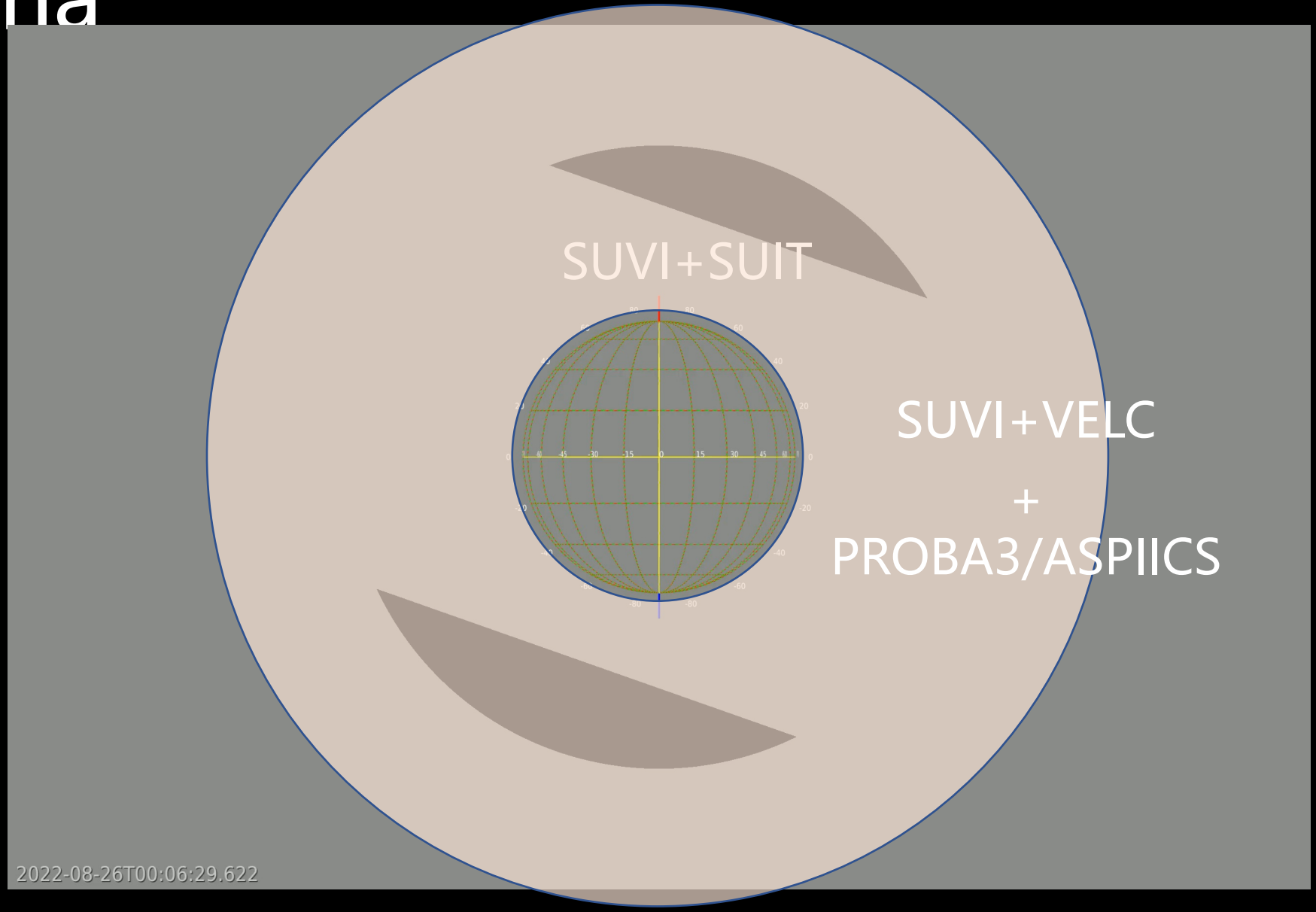

WFI-1
NFI
WFI-2
WFI-3
L1
Sun-synchronous orbit; 6:00AM local time ascending node

Coordinated Science





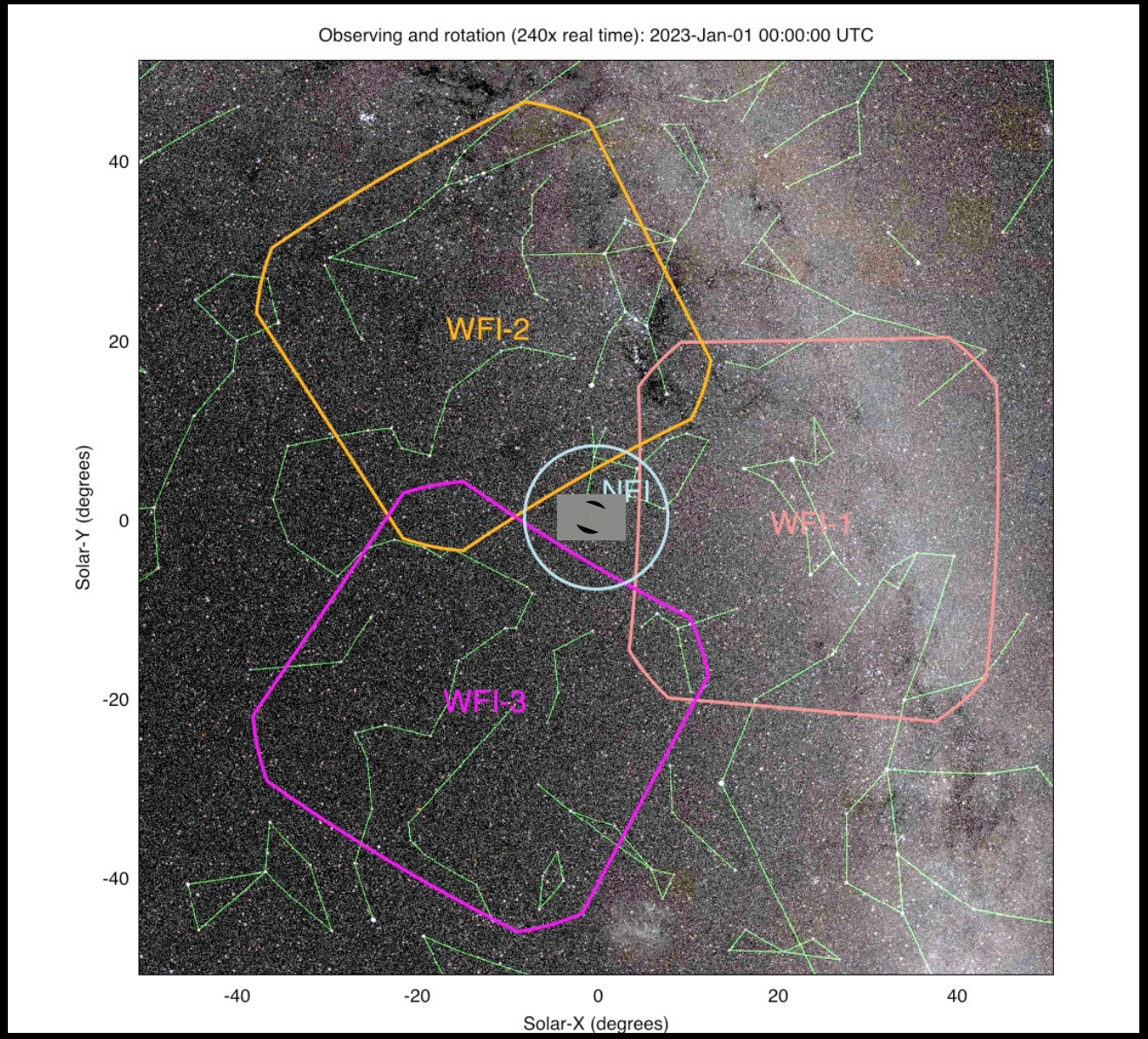
Coordinated Science: Inner + Middle Corona



Credit: Dan Seaton

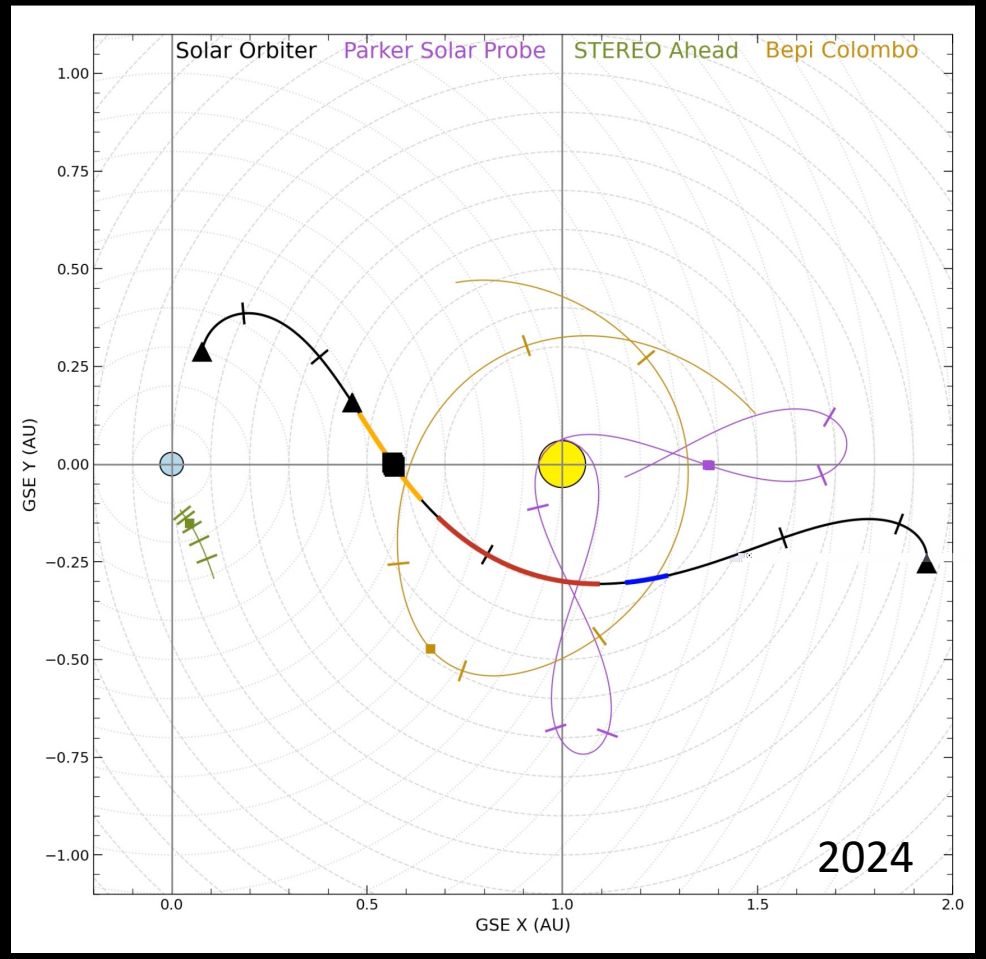
Coordinated Science: To Heliosphere

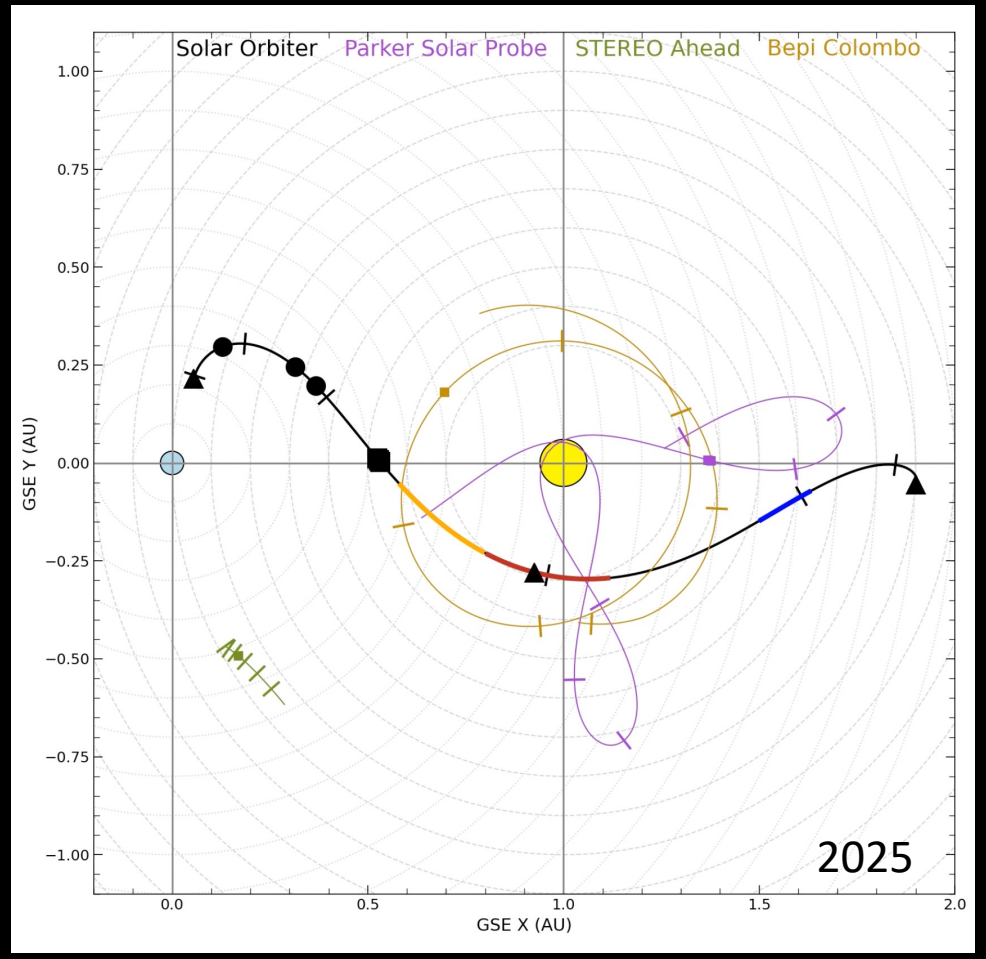
Tracking of flows and transients from inner corona to outer heliosphere

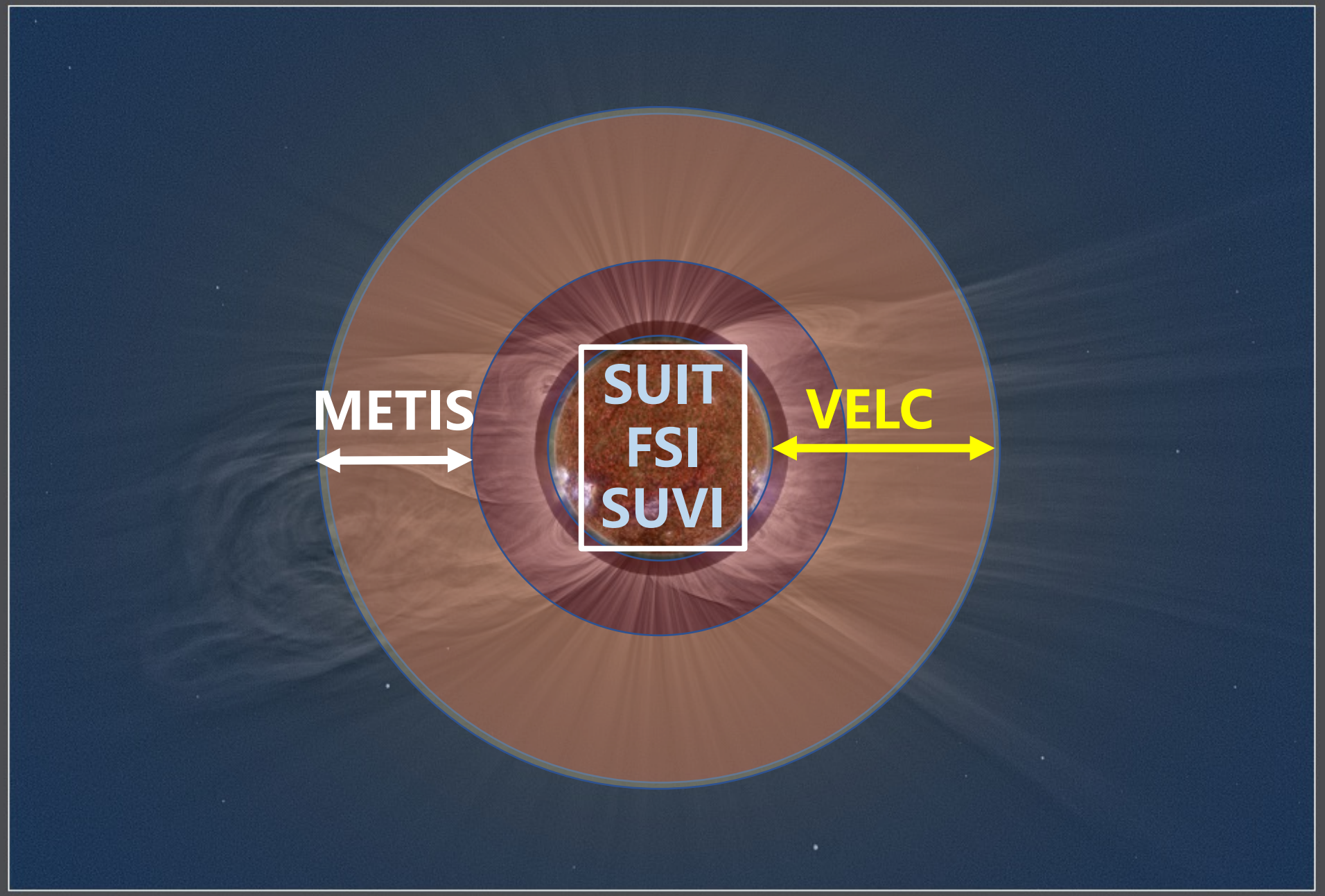


Coordinated Science: SolO Conjunction

March 2024, 2025: Solar Orbiter crosses Sun-Earth line





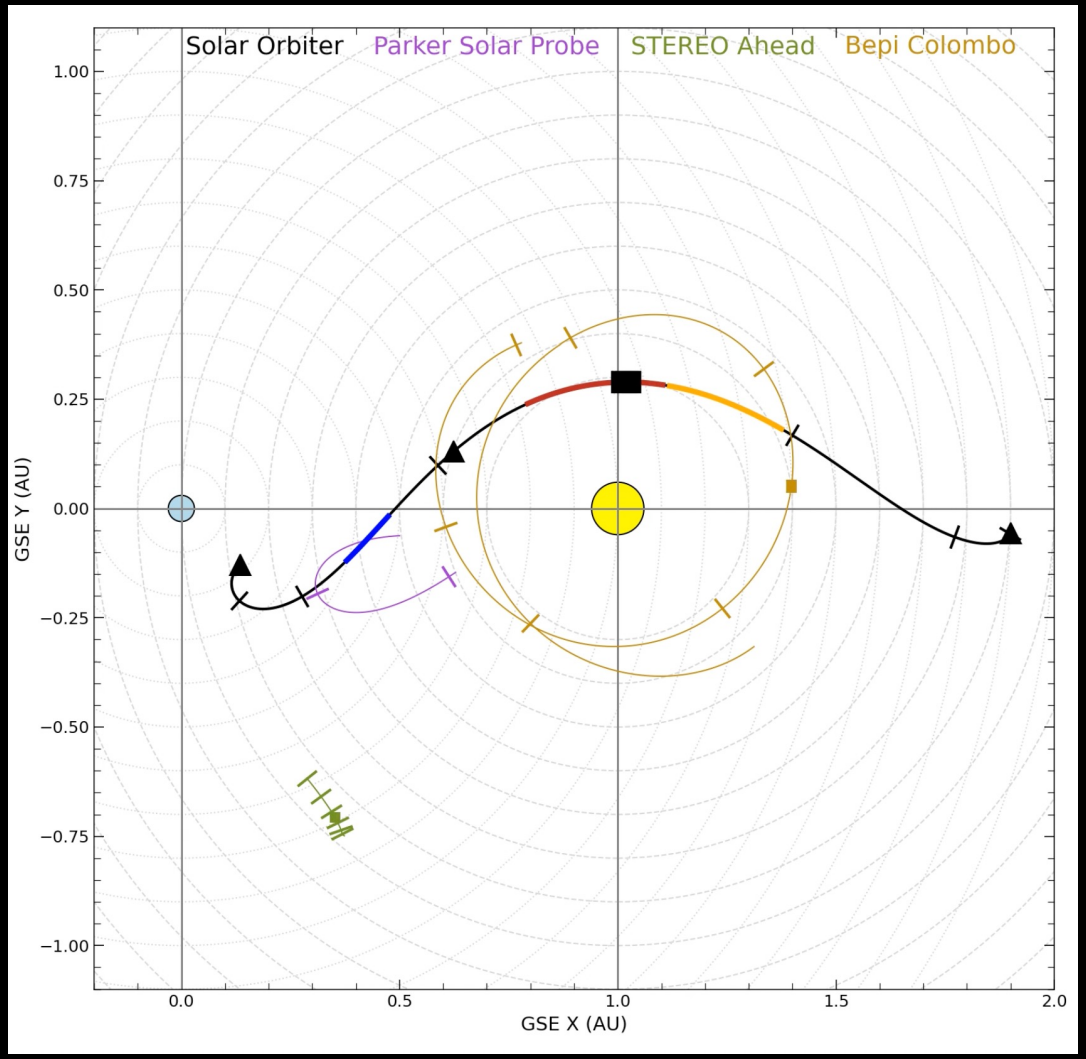


Total Solar Eclipse 2020

Coordinated Science: Future Conjunction

September 2025

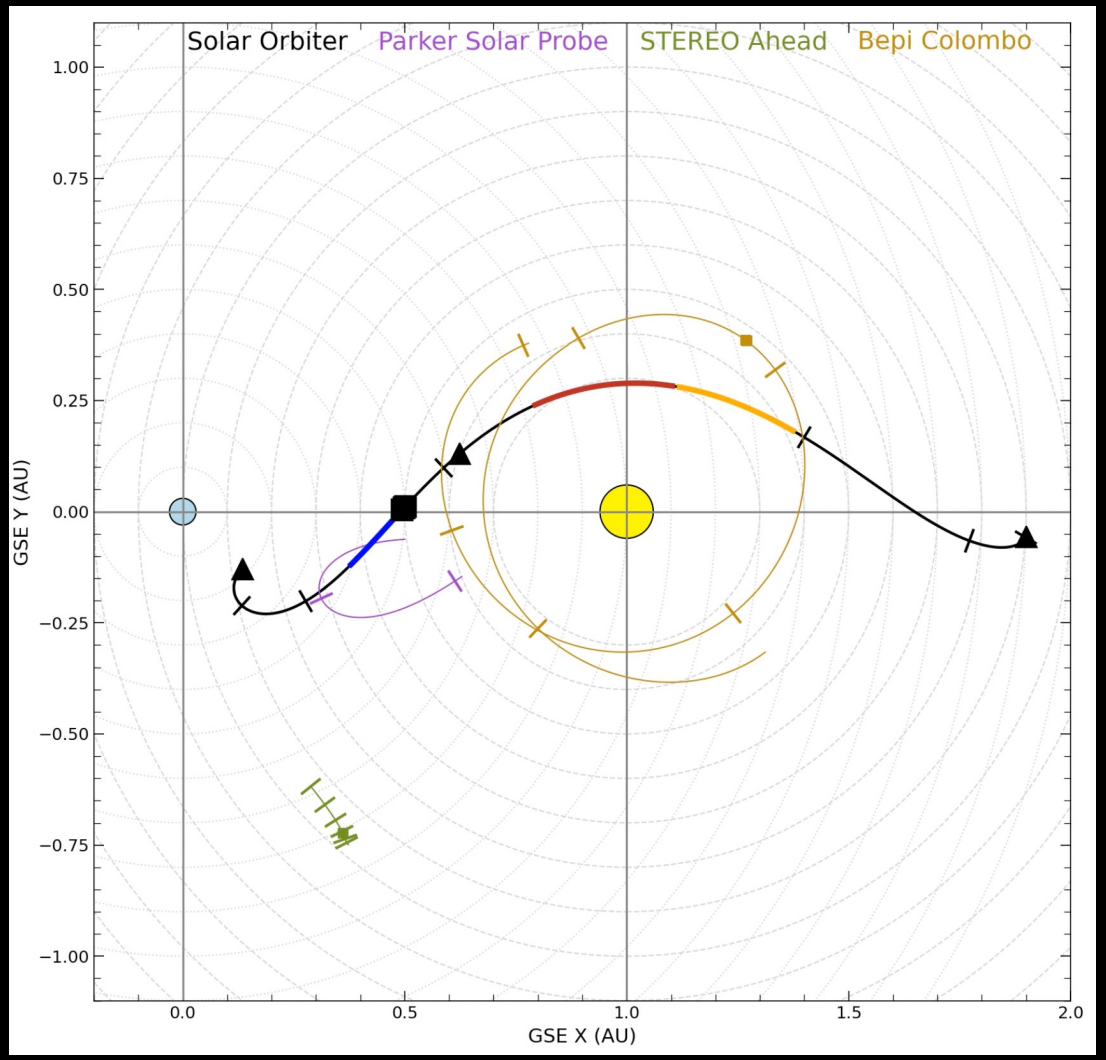
- Solar Orbiter in quadrature with Sun-Earth line
- Multiwavelength study of flows and transients from inner corona to heliosphere with remote sensing instruments onboard Aditya-L1, Solar Orbiter, PROBA3, SDO, uCoMP, GOES, STEREO, along with PUNCH
- Remote sensing + in-situ multiple possibilities



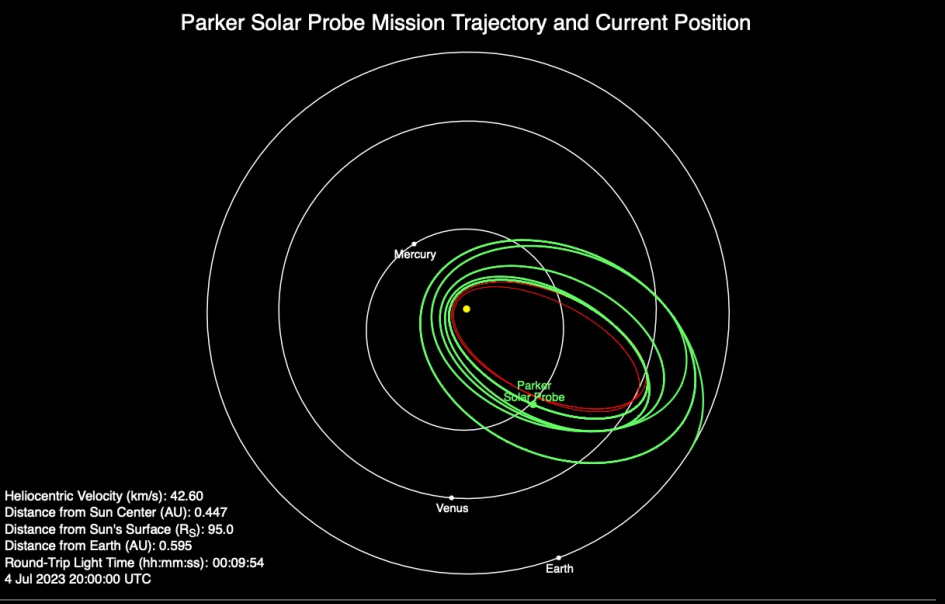
Coordinated Science: Future Conjunction

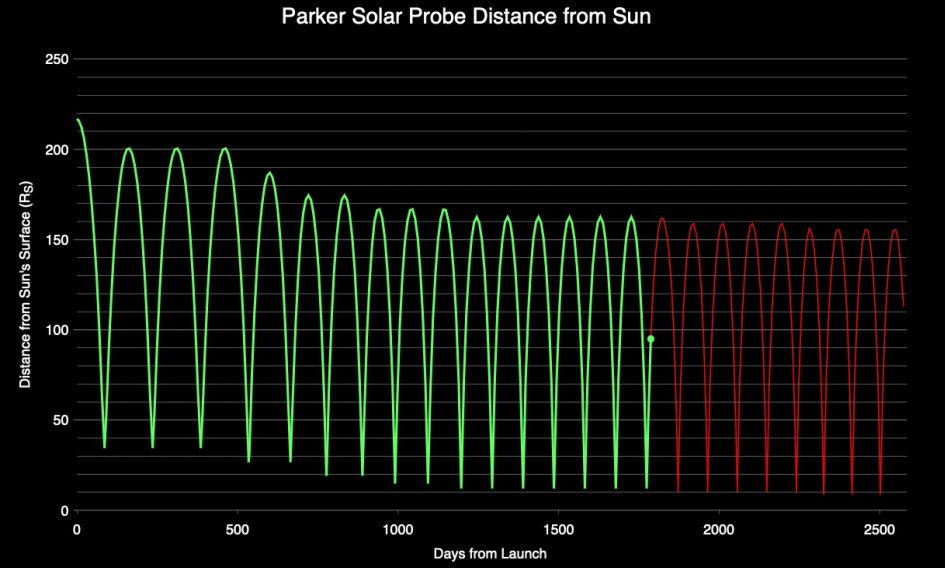
October 2025

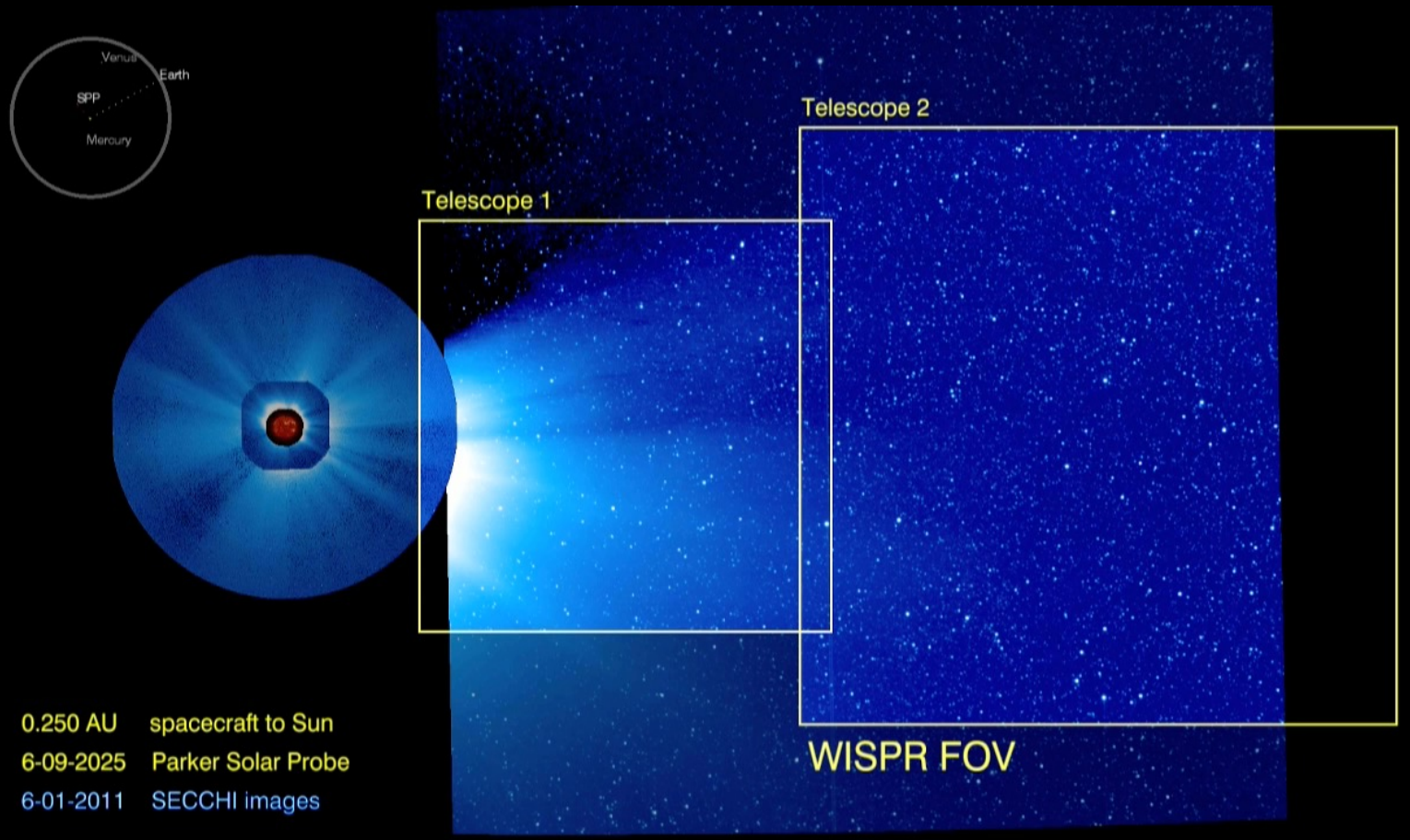
- Solar Orbiter in Sun-Earth line and 20°above ecliptic
- Multiwavelength study of Earth-directed flows and transients with remote sensing and in-situ instruments onboard Aditya-L1, Solar Orbiter, PROBA3, SDO, uCoMP, GOES, STEREO, along with imaging observations from PUNCH



Coordinated Science: PSP Conjunction







- WISPR in future perihelia will have significant overlap with VELC FOV.
- Significant coordinated observations possible along with other remote sensing and in-situ instruments.

Some Possible Outcomes

- Enhanced understanding of kinematics of large-scale transients from inner corona to heliosphere.
- Understanding of where and how anti-Sunward moving structures accelerate.
- Identify where do the coronal inflows terminate.
- Thermodynamics of the transients and solar wind flows can be understood which are observed in heliosphere.
- Imaging and in-situ observations of transients as well as background can help constrain the space weather forecasting models.
- Improve understanding of the coupling of sub-structures of the observed dynamic structures.
- Origin and evolution of small- and large-scale structures.

Aditya-L1 Support Cell (AL1SC)

What do we do?

What do we do?

What do we do?

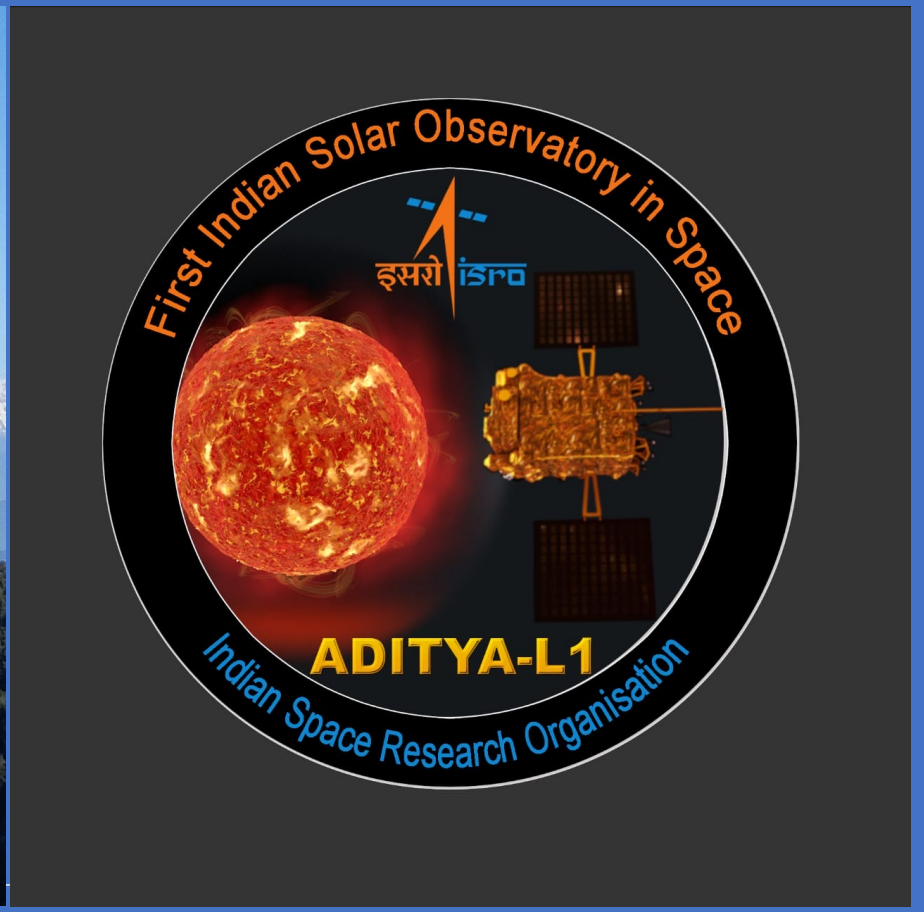

Department of Physics welcomes you at
3rd ADITYA - L1 Workshop, 25-27 February, 2023 | IIT (BHU) Varanasi

What do we do?

Aditya-L1 first workshop in June 2022

Aditya-L1 second workshop in November 2022

Aditya-L1 third workshop in February 2023



THANK YOU!

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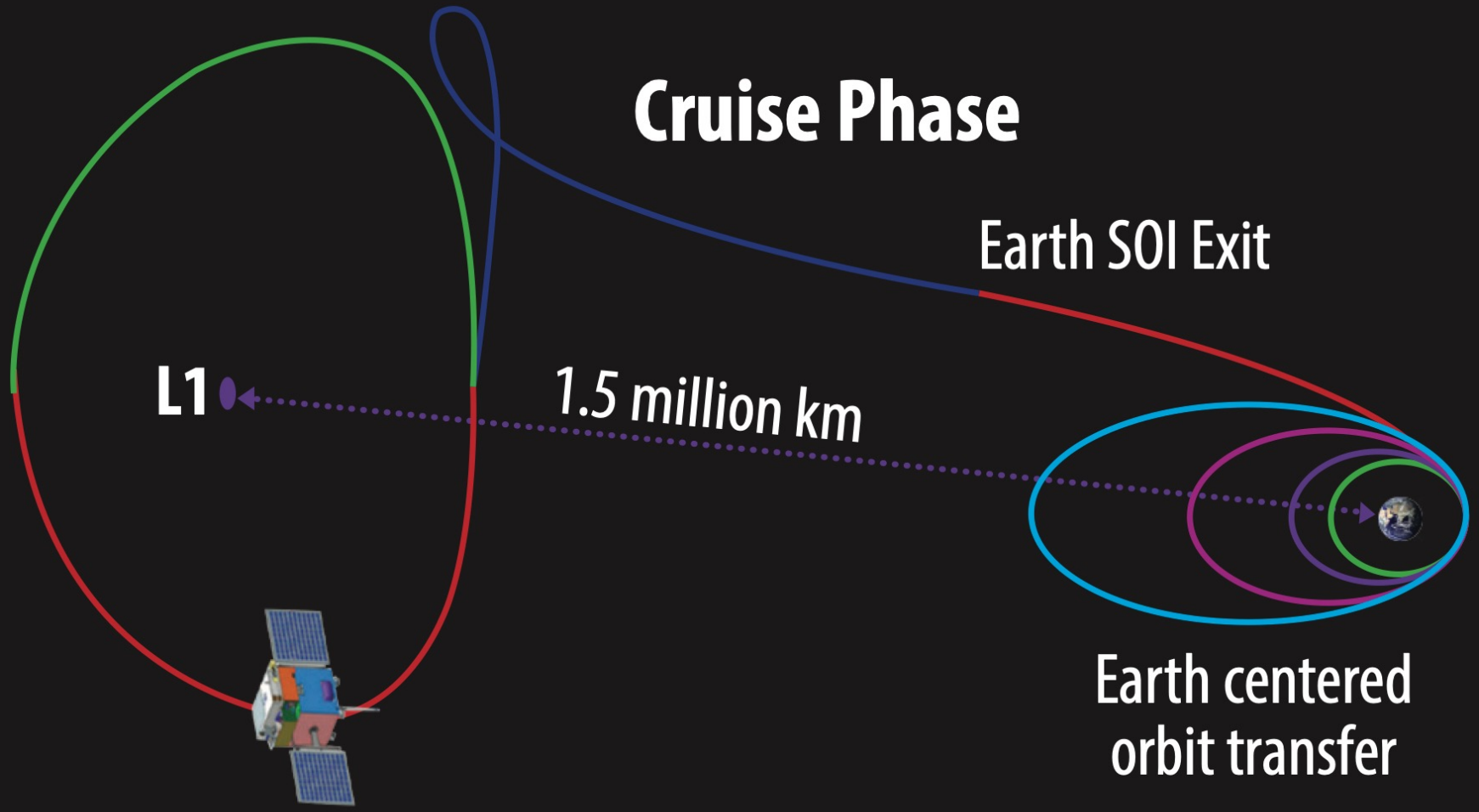
ADITYA-L1 TRAJECTORY TO L1

Halo orbit insertion in L1



PSLV