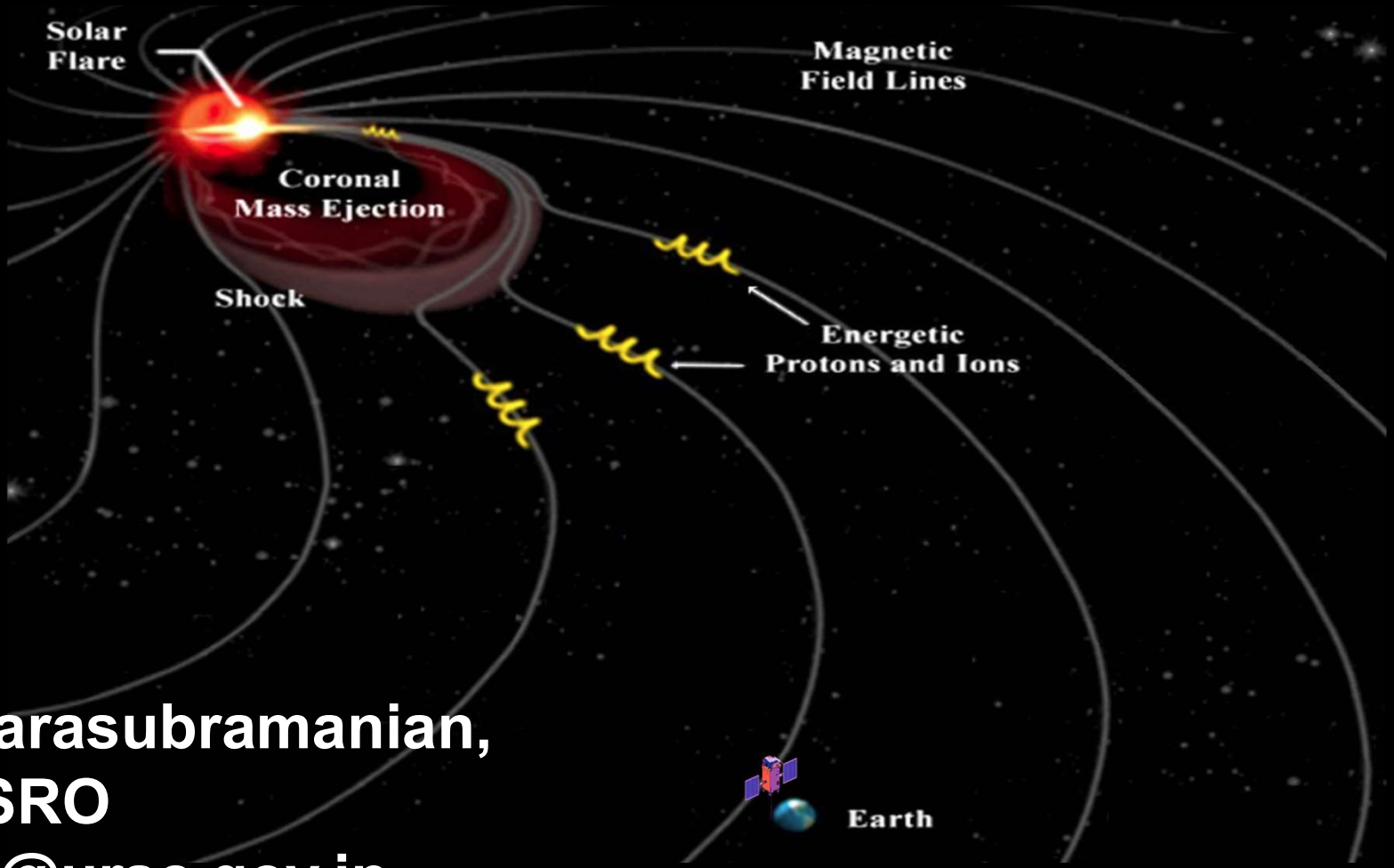
Aditya-L1



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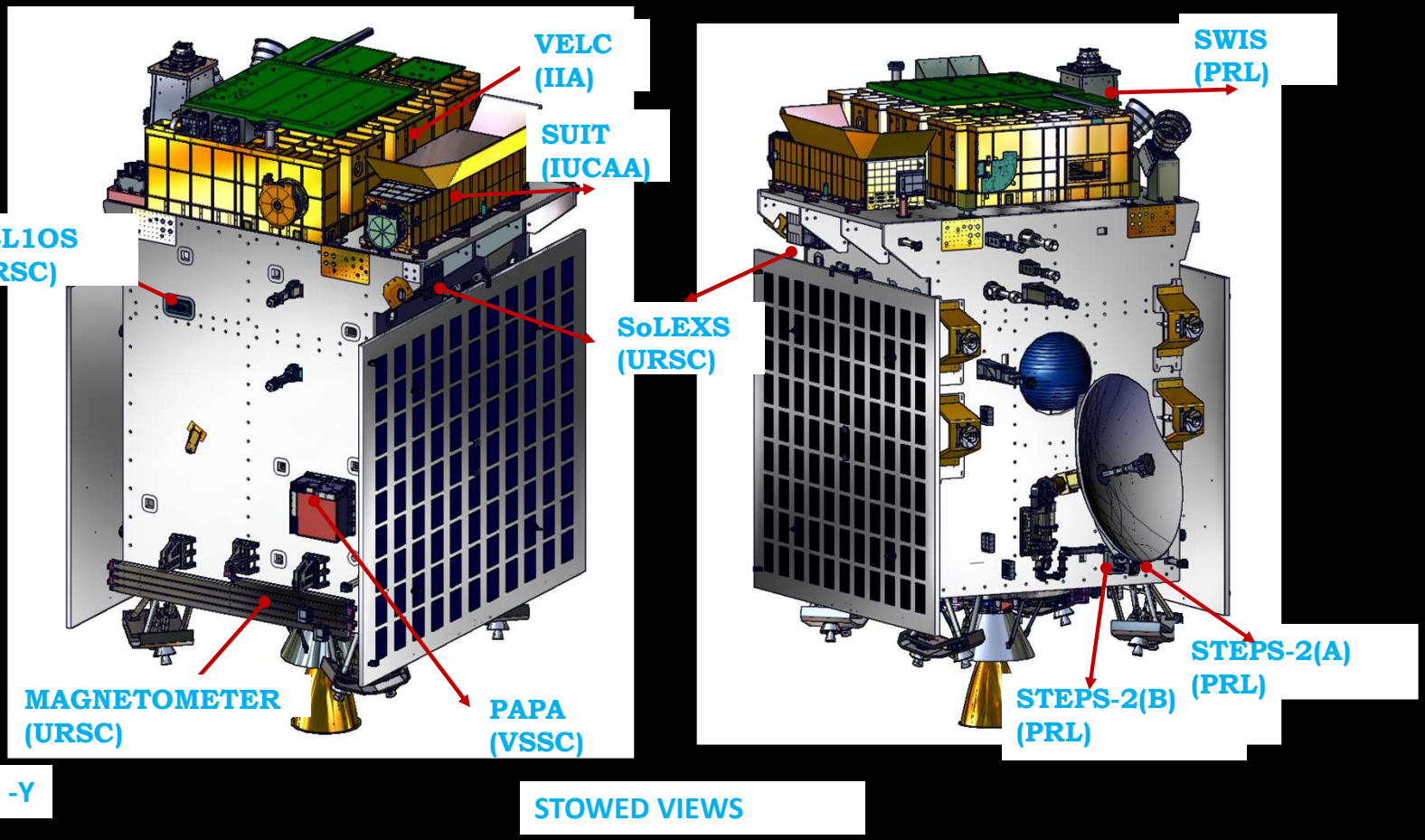
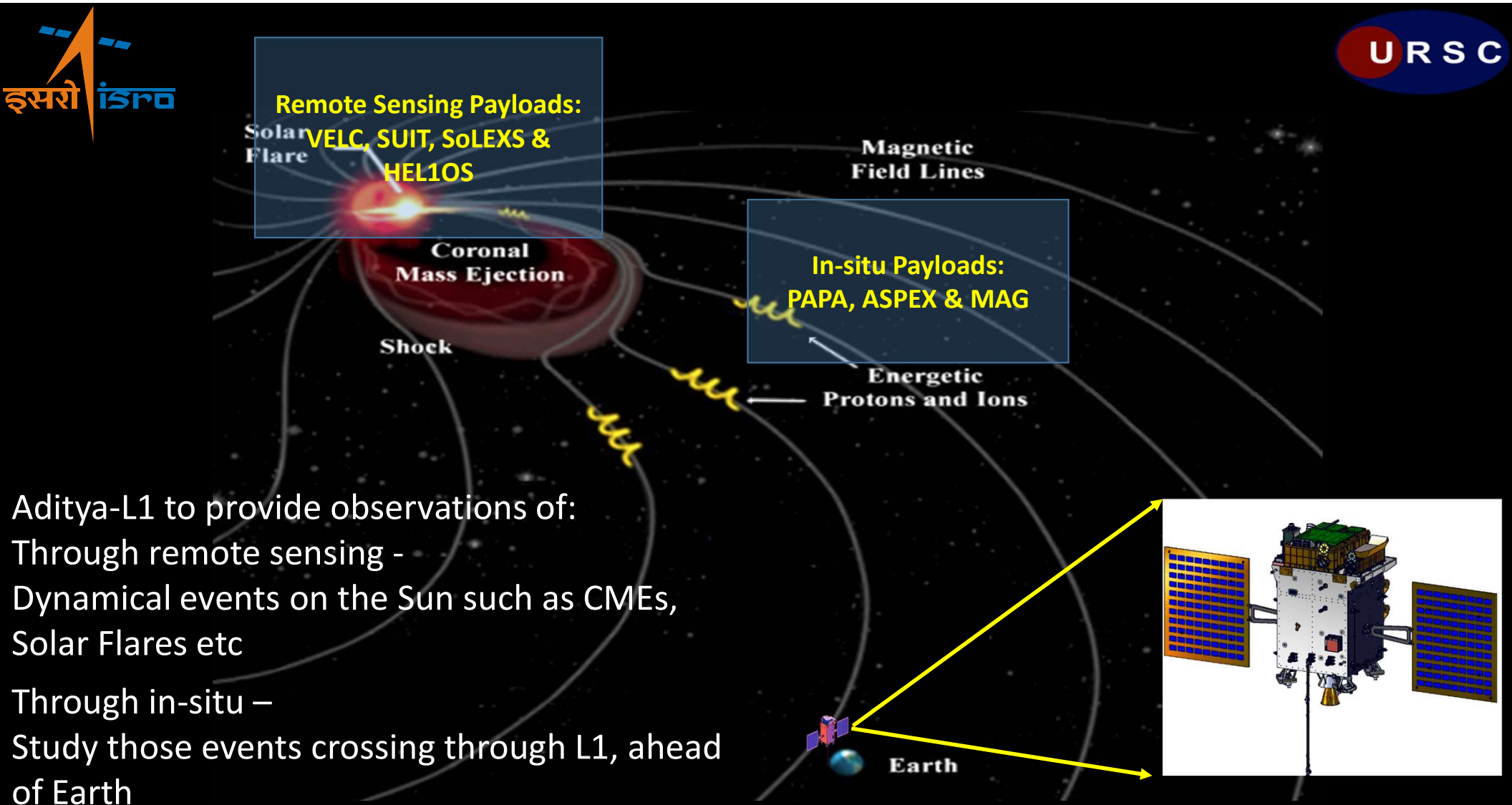
URSC/ISRO
sankark@ursc.gov.in

Courtesy: Nunez et al., 2016

Aditya-L1



STOWED VIEWS



Aditya-L1 to provide observations of:
Through remote sensing -
Dynamical events on the Sun such as CMEs, Solar Flares etc

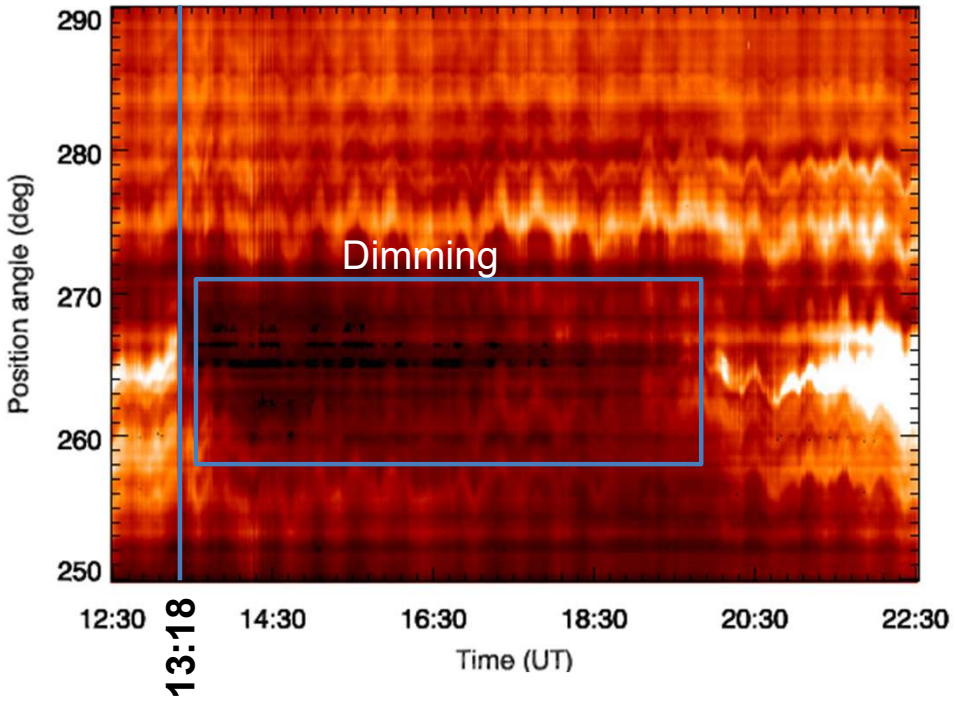
Through in-situ –
Study those events crossing through L1, ahead of Earth

Deployed View

Proposed Primary Science Goals

- Address plasma diagnostics of large and small-scale structures in the corona
- Address origin and dynamics of CME's and Flares → drivers for space weather models
- Explore Coronal magnetic topology & Active region Coronal magnetic fields
- Coronal Abundance studies & FIP variations during solar flares
- Prominence Studies → Quiescent and eruptive prominences
- Measure and monitor the spatially resolved solar spectral irradiance in the Near UV
- Study the directional and energy anisotropy of solar wind using Multi-direction observations
- Origin of supra-thermal and energetic particles → isolate the flare related accelerated energetic particles to that of CME shock related

Capability – CME Dynamics



ıysical Journal Letters, 976:L6 (8pp), 2024 November 20
https://doi.org/10.3847/2041-8213/ad8c45
ıor(s). Published by the American Astronomical Society.
CESS

Results on the Onset of a Coronal Mass Ejection from 5303 Å Emission Line Observations with VELC/ADITYA-L1

. Ramesh, V. Muthu Priyal, Jagdev Singh, K. Sasikumar Raja, P. Savarimuthu, and Priya Gavshinde
Indian Institute of Astrophysics, Koramangala 2nd Block, Bangalore 560034, Karnataka, India
Received 2024 September 30; revised 2024 October 29; accepted 2024 October 29; published 2024 November 13

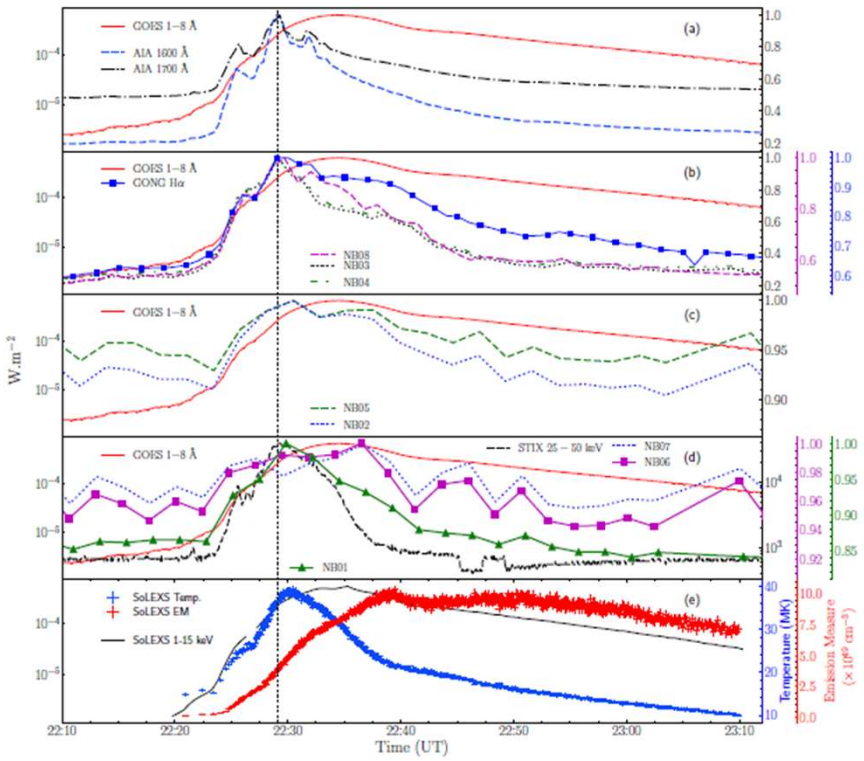
The dimming observed in the present case is due to CME-induced depletion of coronal material

Probably the first dimming detection in the Green line emission due to CME; earlier dimming are observed in EUV and X-rays

CME in the SOHO/LASCO FOV estimates that its onset time at r = 1 R_e is ≈13:48 UT (second order fit to h-t plot).
The corresponding time, based on linear fit is ≈12:36 UT.

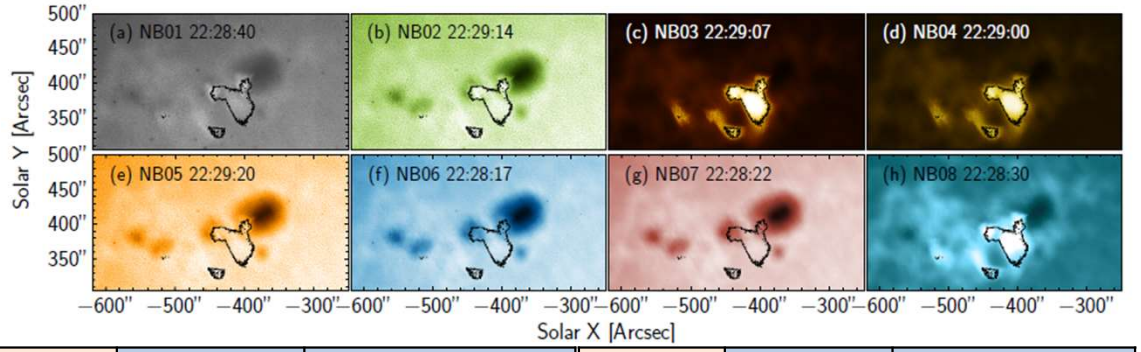
More details of VELC: Last Talk **Published in ApJL**

Capability – Flare
(First Multi-Payload Science from Aditya-L1)



Under review ApJL

SUIT Multi-filter observation of the Flare



1	NB01	214	5	NB05	283.2
2	NB02	276.7	6	NB06	300
3	NB03	279.6	7	NB07	388
4	NB04	280.3	8	NB08	396.85

To the best of our knowledge, this is the first such observation in the blue wing of Mg II (NB02 filter; Deeper in chromosphere)

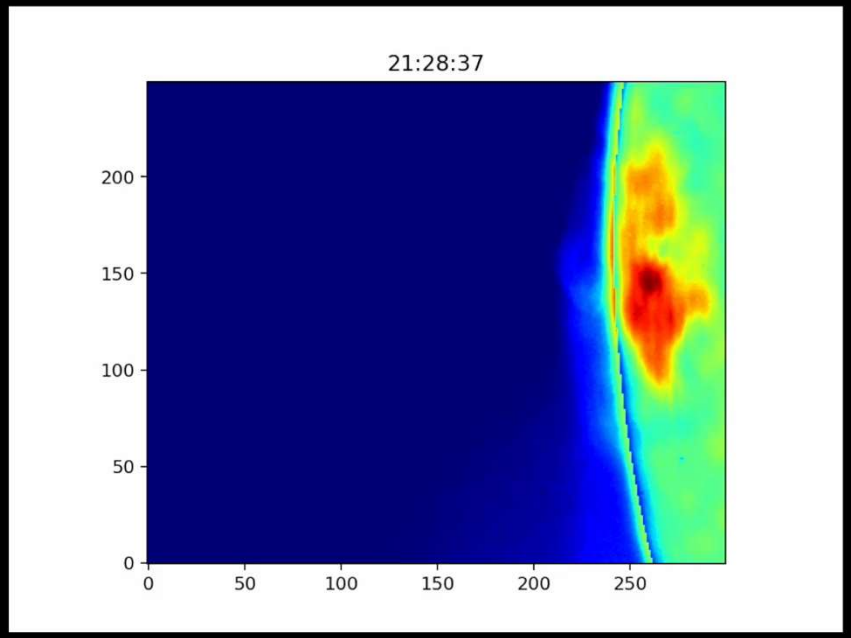
Near and Mid Ultra Violet Observations of X-6.3 flare recorded by the Solar Ultraviolet Imaging Telescope on 22nd February, 2024

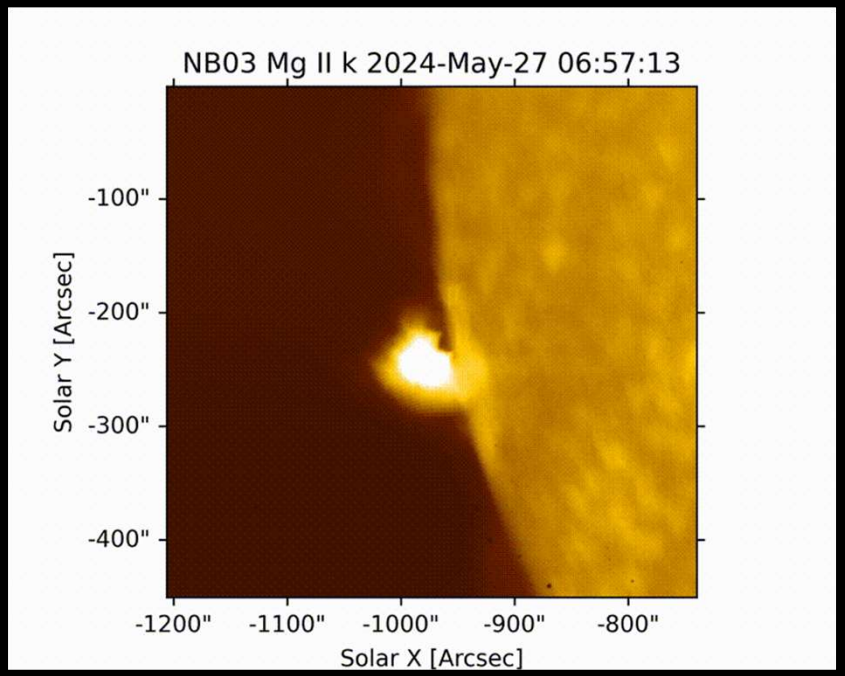
Soumya Roy, Durgesh Tripathi, Sreejith Padinhatteeri, A. N. Ramaprakash, Abhilash R. Sarwade, Nived V. N., Janmejoy Sarkar, Rahul Gopalakrishnan, Rushikesh Deogaonkar, K. Sankarasubramanian, Sami K. Solanki, Dibyendu Nandy, and Dipankar Banerjee

Flare Science from Aditya-L1

Capability – On-board Flare Detection and Mode change

2023 New Year Eve Flare

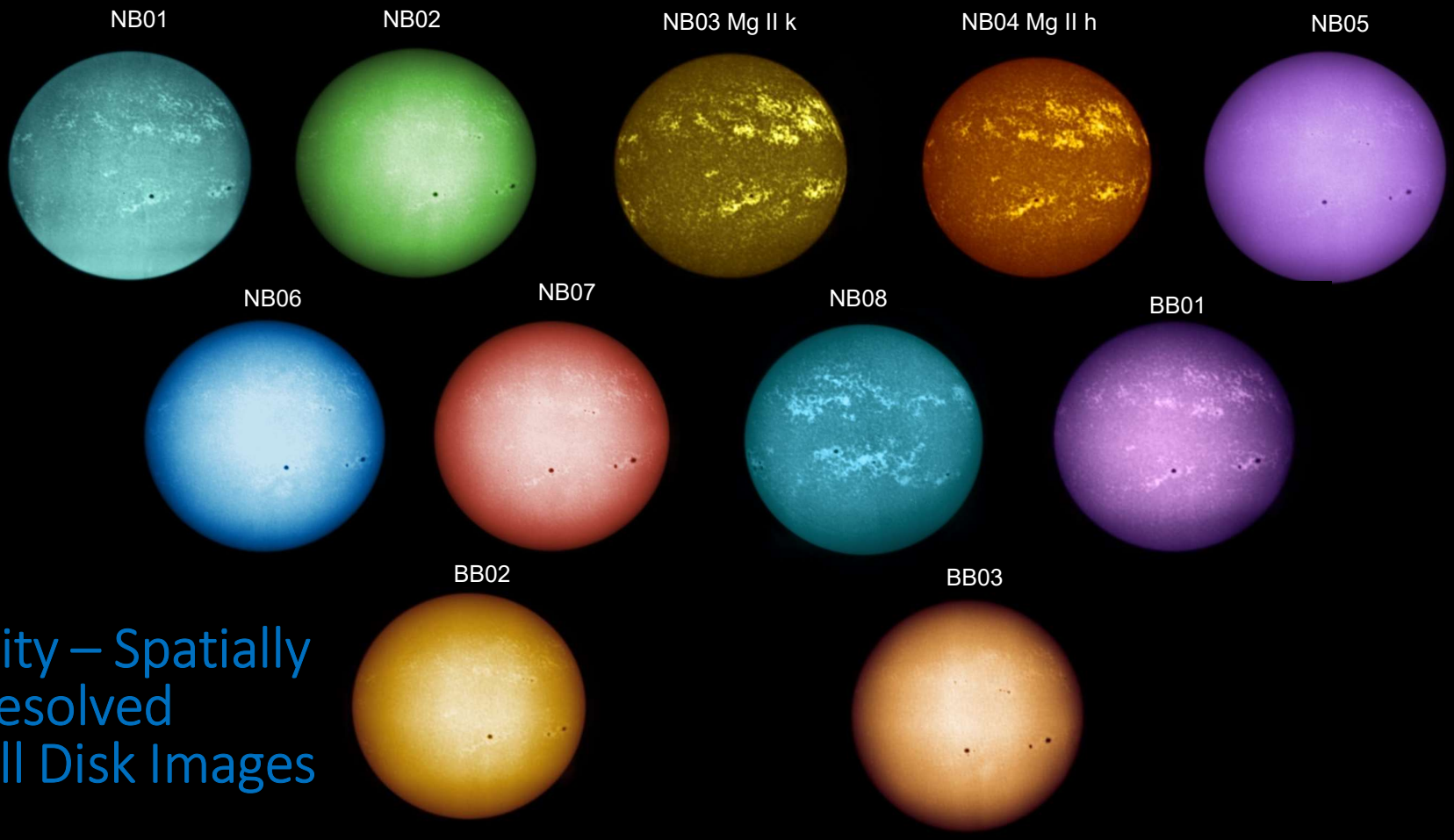




X-class flares &CMEs: Couple of Examples

In preparation for ApJL

Full Disk Images from SUIT

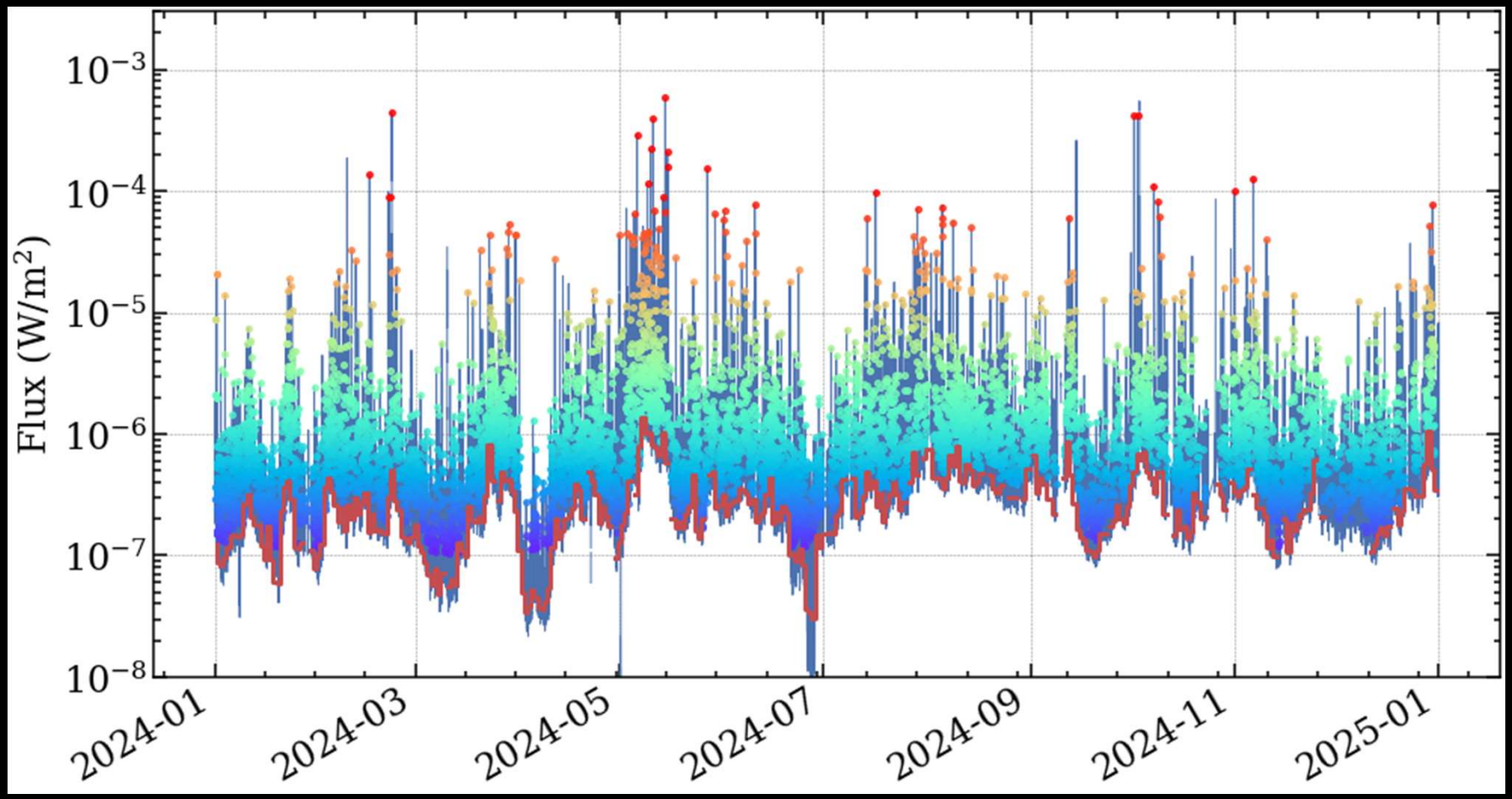


Capability – Spatially Resolved NUV Full Disk Images

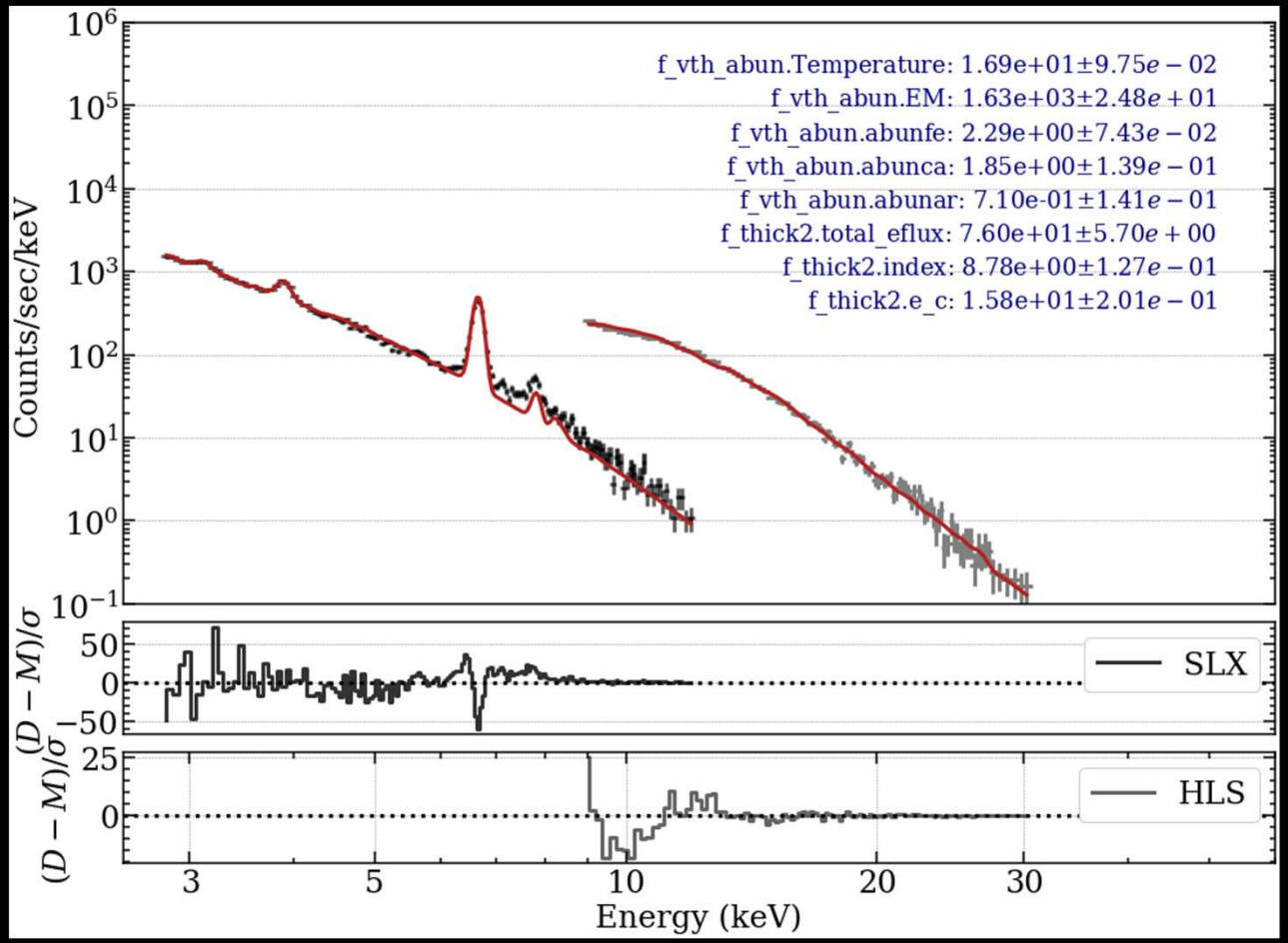
Observation modes

Synoptic mode	Flare mode	Custom mode
• Full resolution (4k X 4k) • All science filters • Every 2.5 hours.	Flare Flags: • SUIT Binned images, • SoLEXS, HEL1OS.	Tailored configurations beyond predefined modes.
• 2 x 2 binned full disk: Mg II h (NB04) • Every minute.	• Partial disk view of the flaring region.	• Custom filter selection • Custom cadence • Custom RoI.
• Region of interest. • ~64 s cadence for each filter. • All filters.	• Onboard region of interest localization, tracking, and auto exposure adjustments.	Limited only by payload data budget and operational constraints.
In regular use.	In regular use.	Prog seq made with request from team members. Tested and demonstrated.

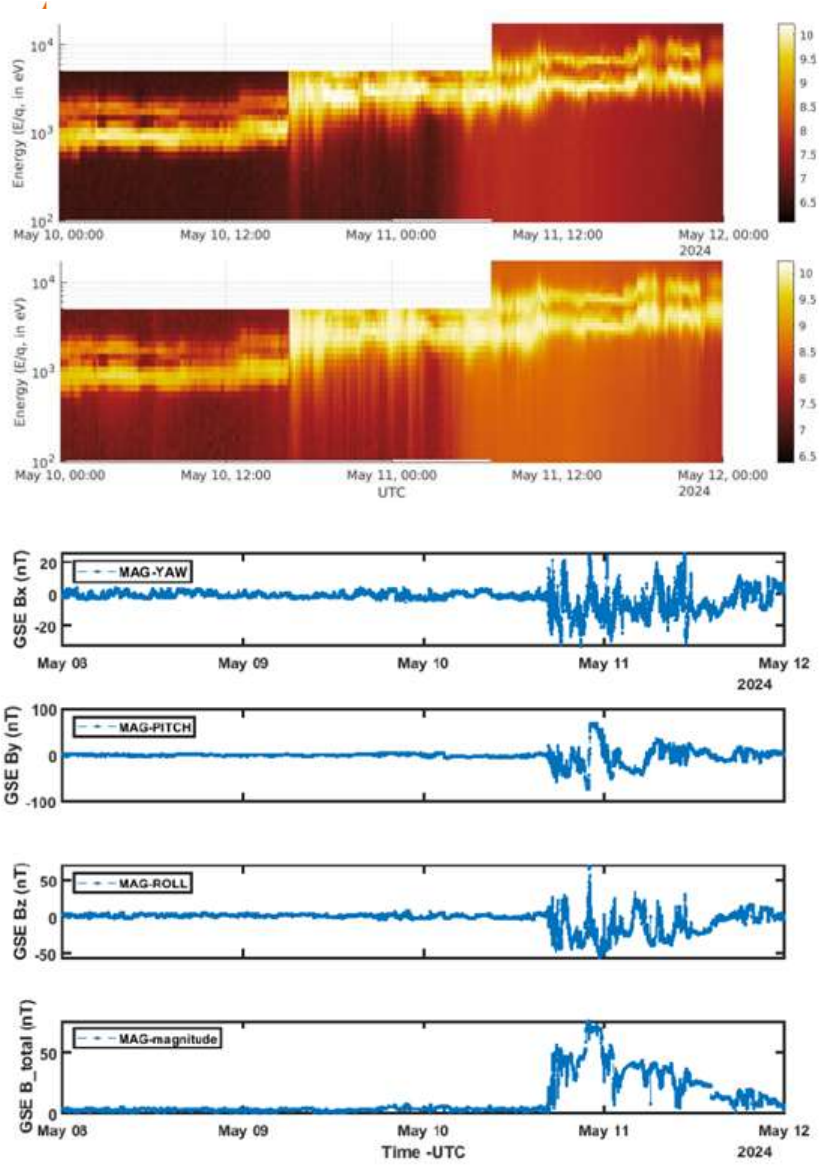
Uninterrupted Flare Observations

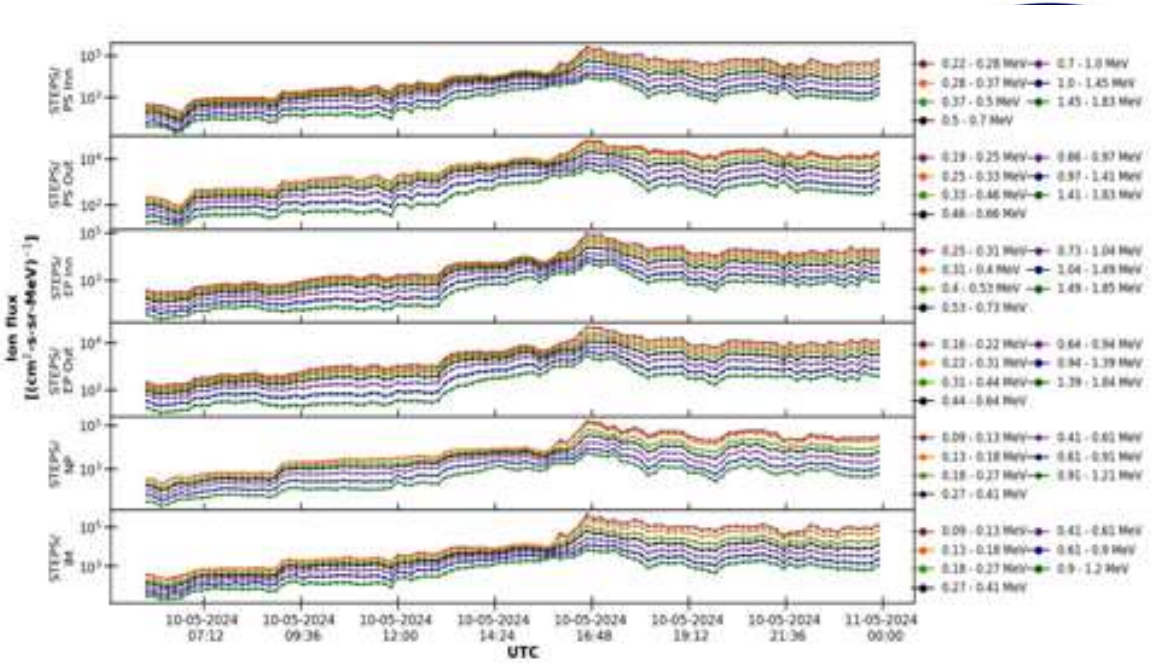


Solar Flare X-ray Spectra



A unique combination of experiment for uninterrupted Solar Flare studies





In-situ Experiments: May 11th Event

Capability – Directional Measurement Along with Magnetic Field

Science Uniqueness of Aditya-L1

- CME dynamics close to the disk (1.05Rsun) providing information in the acceleration regime which is not observed consistently
- Spatially resolved solar disk observations in the near UV providing information on the radiation output from different structures
- On-board intelligence for Flares - optimized observations and data volume
- Flare observations→ all flares observed without break or sensitivity change
- Solar wind electrons, protons, and alpha particles fluxes with direction information

Aditya-L1 Topical Collection: Solar Physics, 2025

Proposed & Achievable Science Cases

- Address plasma diagnostics of large and small-scale structures in the corona
- Address origin and dynamics of CME's and Flares → drivers for space weather models
- Explore Coronal magnetic topology & Active region Coronal magnetic fields
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SolarNews

The Electronic Newsletter of the AAS Solar Physics Division

Volume 2025 Number 02 – 15 January 2025

Sherry Chhabra, SolarNews Editor (solarnews.editor@aas.org)

Aditya-L1 Space Solar Observatory Data is Released

Posted by: Sankarasubramanian Kasiviswanathan

Aditya-L1 is India's first Solar and Heliospheric Observatory class mission to study the Sun and its influence in the inter-planetary medium. On January, 6-2025, Aditya-L1 completed its one year of operation at the first Sun-Earth Lagrangian point (L1). All its seven payloads completed its performance verification and currently in science operation. On this occasion, the science ready data from Aditya-L1 is released to the Indian and global solar and heliospheric community. The data can be downloaded from Indian Space Research Organization (ISRO's) science data dissemination portal using the following website: pradan.issdc.gov.in

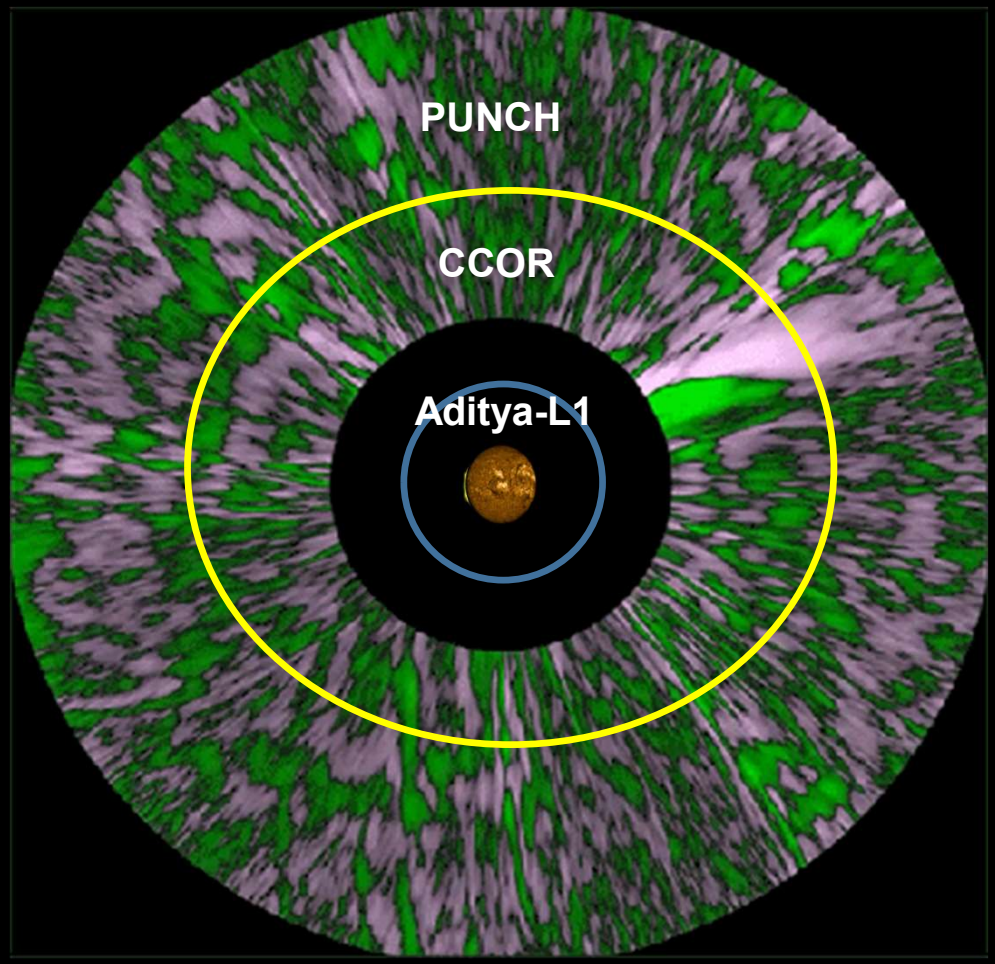
The user needs to register, if not already registered in PRADAN, in order for ISRO to keep a statistic of the user database. The details of the data and its user manual can also be found for each of the payloads in this website, after logging in. Currently, an identified set of science ready data is posted to the community with all the relevant details including the published instrument papers. We strongly urge users to make use of the data for a successful science accomplishment from Aditya-L1. We will update as and when more data is released for the scientific community and also the upcoming proposal submission form for your own scientific proposals.

—

On-behalf of Aditya-L1 P/L Teams

Synergy with Other Observatories

- 2025 will add new solar & Heliophysics missions
  - Proba-3, PUNCH, IMAP, and SWFO-L1
- Joint Observation Campaign – SO, SPP, Proba-3, PUNCH, CCOR, IMAP, and SWFO-L1
- It's an exciting time to be a Solar and/or Helio-physicist



10% of Aditya-L1 observatory time will be available for Multi-observatory proposal