An EUV Wide-Field Imager and Spectrometer for the ISS

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Abstract

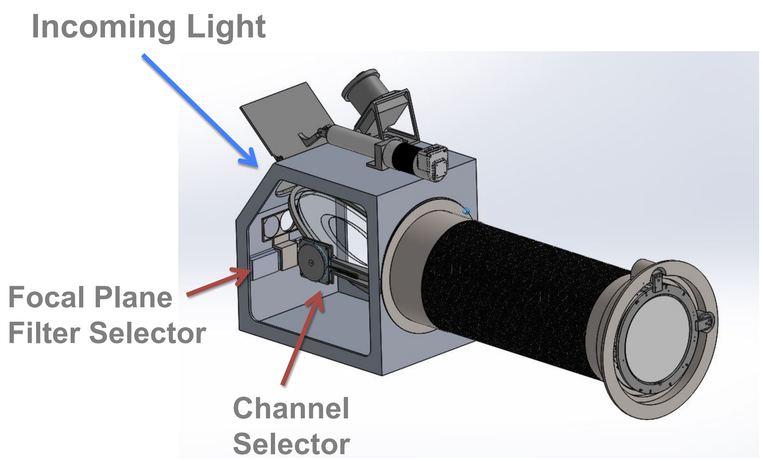
The Coronal Spectrographic Imager in the EUV, COSIE, combines a wide-field solar coronal EUV imager (EUVC) and an on-disk EUV imaging spectrometer (EUVS). Located on the International Space Station (ISS), the goal of the mission is to enhance our understanding of the dynamics of the Transition Corona (the region in which the coronal magnetic field transitions from closed to open), and to provide improved detection and tracking of solar eruptive events for space weather research.

Technical Overview

Design: SAO has produced a low-risk design for an EUV instrument with an MSFC pointing platform design

- **Non-occulting Coronagraph + Full-disk Slitless Spectrometer**
- Wavelength: 185-205 Å
- Field of view: Full disk out to 3+ $R_\odot$
- Cadence: 10 s to 1 minute
- Plate Scale: ~ 3 arcsec/pixel
- Pointing Stability: Pointing platform plus tip/tilt primary keeps image stable within the resolution element over the integration period
- Integration: ~ 4 s
- Sensitivity: 1000x current capability

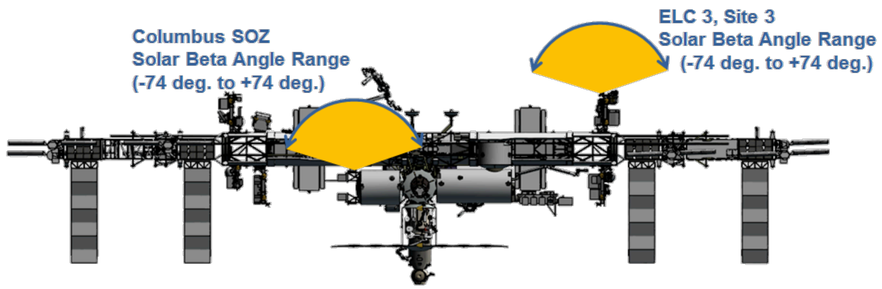
EUVC Instrument Design



Mission Goals and Objectives

1. Understand the physical processes that alter the magnetic connectivity of the corona from closed to open and open to closed.	A. Observe steady coronal structures and their source region from the solar disk to the upper corona.
	B. Observe the temporal changes of the magnetic connectivity due to solar activity.
	C. Understand the hot coronal plasma associated with the magnetic structures both on and off disk.
2. Understand the global thermal structure of the corona.	A. Observe the evolution of active regions and associated changes in the slow solar wind.
	B. Characterize the temperature profile of the hot plasma associated with the slow solar wind.
	C. Measure the temperature and density changes associated with EUV waves, streamers and coronal cavities.
3. Trace the early evolution of coronal mass ejections and prominences as they propagate into the interplanetary medium and create space weather.	A. Observe the locations, velocities and acceleration profiles of coronal mass ejections from their on-disk source regions to >2.5$R_\odot$.
	B. Characterize the background plasma environment before the CME eruption.
	C. Identify the CME shock structure and identify regions of possible particle acceleration into interplanetary space.

Mission Implementation



Solar viewing analysis for two representative ISS external site locations

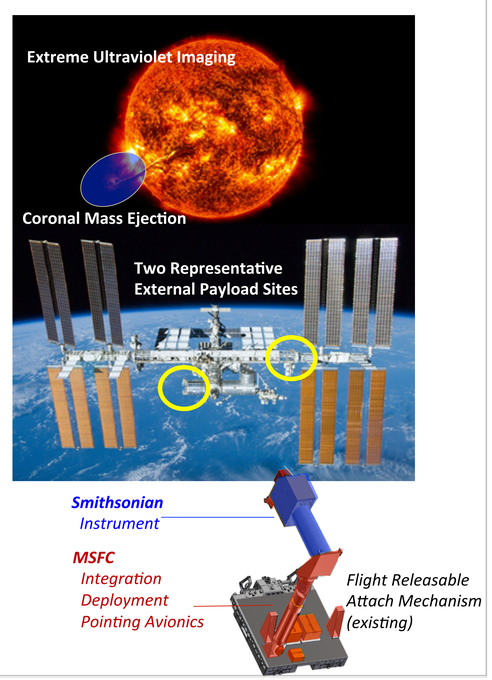
Solar Viewing Capabilities at ISS Mounting Locations	Solar Viewing Opportunities (Days/Year)	Worst Case Solar Viewing Time per Orbit	Worst Case Solar Viewing Time per Day	Total Solar Viewing Time per Year
Columbus SOZ or ELC 3-3	365 days	28 min	7.2 hrs	2,640 hrs

Novel graded filter, prime focus imaging, high throughput, give the coronagraph unprecedented sensitivity: 1,000X current capability.

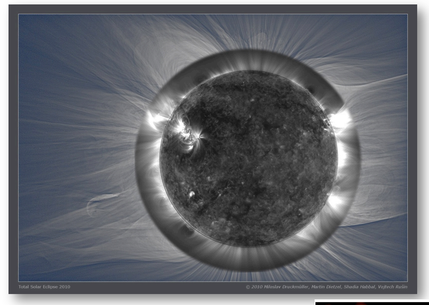
Additional scientific capability and value with overlap-o-gram channel.

- Slitless spectrometer disperses full solar image in spectral direction.
  - Compressed in λ direction for image separation.

- Heritage components.
- Less restrictions required for EUV versus white light coronagraph.
- No need for an occulter; not sensitive to dust or scattering, direct response to (CMEs).



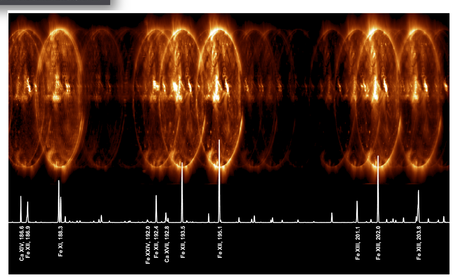
Mission Products

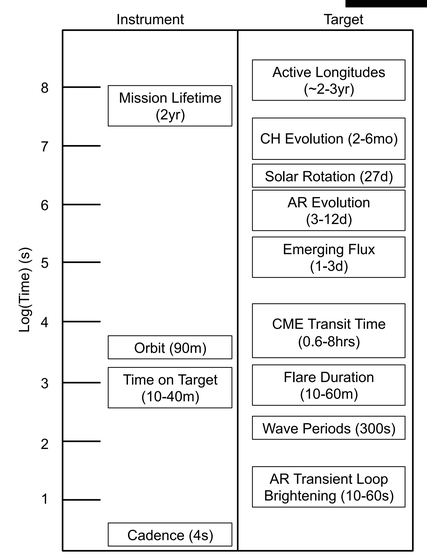


Spaceweather events and coronal magnetic connectivity are tracked through the corona:

EUV coronagraphs allow for visibility of both the source region *and* the propagating disturbance.

Spectral images provide plasma diagnostics (temperature, density and LOS velocity for fast flows ~100km/s).





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