The SOLAR-C Mission: a satellite mission for a high-throughput EUV Imaging Spectroscopy of the Sun

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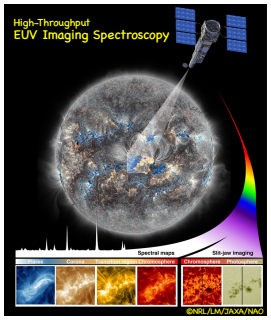
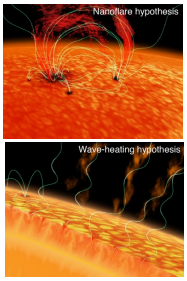
Mission Objectives:

The SOLAR-C project aims to explore key propositions in space science of
how the plasma universe is created and evolves, and
how the Sun influences the Earth, other interplanetary objects, and the heliosphere.

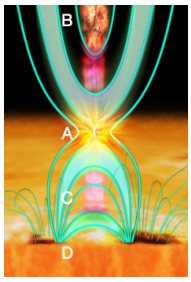
Primary Scientific Goals:

1. To understand how fundamental processes lead to the formation of the solar high-temperature atmosphere and the solar wind, and
2. To understand how the solar atmosphere becomes unstable, releasing the energy that drives solar flares and eruptions.





For understanding fundamental processes forming high-temperature atmosphere and solar wind acceleration



For identifying driving physical processes of the solar explosions that influence the Earth.

Science Payload:

The SOLAR-C observatory has three science payloads:

- EUV Imaging Spectrograph
  - ➢High-throughput performance over each spectral band in EUV
- UV Slit-jaw imager
  - ➢To watch the spectrograph slit position and monitor the photosphere and chromospheric dynamics
- EUV Solar Spectral Irradiance Monitor (SoSpIM)
  - ➢To monitor the solar EUV spectral irradiance by the Sun as a star approach

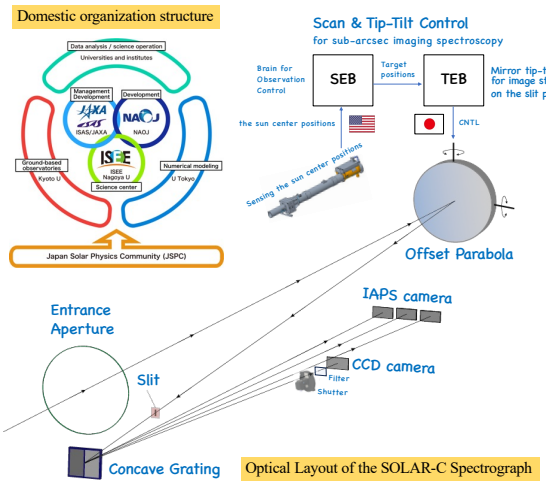
These are developed in an international collaboration of JAXA, NASA, ESA, and a few European countries (France, Germany, Italy, and Switzerland). NAOJ (solar physics group + ATC) has extensively contributed to developing the imaging spectrograph.

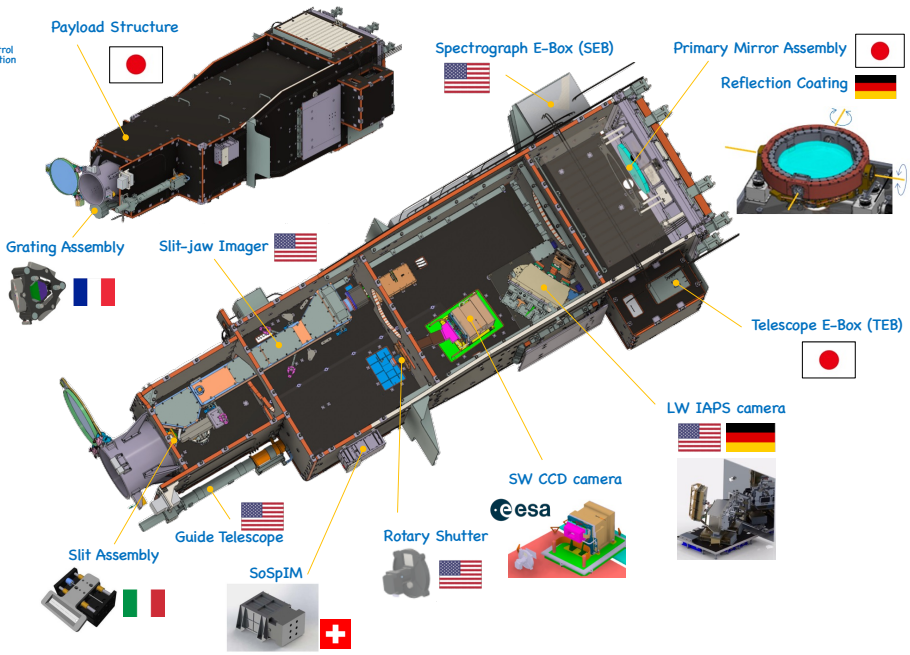
Launch vehicle and satellite characteristics

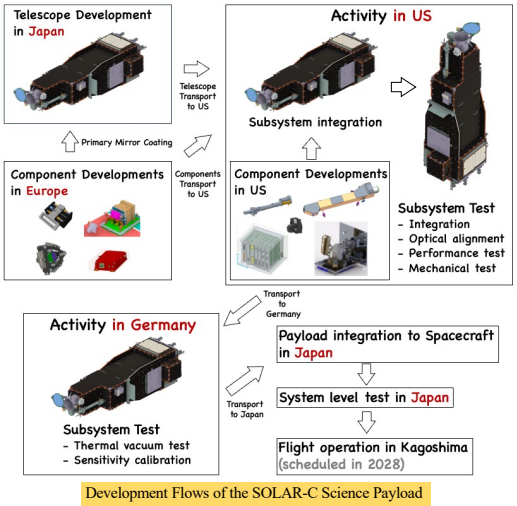
Launch Vehicle	JAXA Epsilon-S Rocket
Satellite mass	< 600 kg (nominal)
Satellite orbit	Sun-synchronous orbit of > 600 km altitude
Attitude control	three-axis stabilized

Science Payload Characteristics

	Imaging Spectrograph	Slit-jaw Imager	SoSpIM (Solar Spectral Irradiance Monitor)
Telescope: offset-parabola primary	Primary mirror diameter: 28 cm Primary mirror focal length: 280 cm		No focusing optics: Aperture ϕ 7.6 mm x 3 for each band
Spatial Resolution (goal)	300 km or 0.4 arcsec	300 km or 0.4 arcsec	Full Sun
Temporal Resolution	0.5 sec	1 sec	Cadence: 20 Hz
Observing Wavelengths	17-22 nm 46-128 nm	Continuum: 283.3 nm Mg I: 285.2 nm Mg II: 279.6 nm	Band A (EUV): 17 - 22 nm Band B (Lyα): 112-128 nm
Field of view	280×280 arcsec^2	280×280 arcsec^2	$\pm$0.77 deg
Wavelength Resolution	$\lambda/\Delta\lambda$: 5,000-10,000	Band pass $\Delta\lambda$: ~0.2 nm	$\Delta\lambda$~ 5 (16) nm for Band A (B)
Plasma T_e to be observed	0.02-15 MK	6,000-10,000 K	Band A (B): $10^{6.4-7.2}$ K (10^4 K)







Project Status: currently in the Phase-A study

2018 Jan: Mission proposal to JAXA
2020 Apr: Selected as the 4th Competitive Medium Class Mission
2022 July: Mission Definition Review
2022 Nov: Start JAXA SOLAR-C Pre-Project
2022 Dec: System Requirement Review
2023 Nov: System Definition Review scheduled

2028 a target launch timing

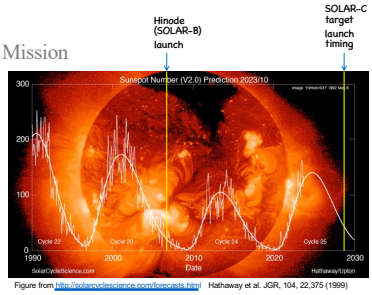


Figure from http://solarcyclescience.com/forecasts.html Hathaway et al. JGR, 104, 22,375 (1999)