SOLAR-Cと海外太陽関連ミッション：科学的位置づけと観測連携

SOLAR-C – other solar missions:
Science targets and synergies

清水敏文

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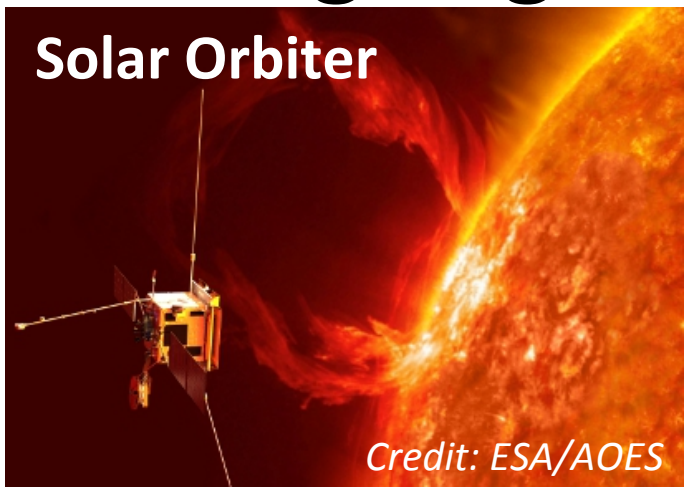
On-going solar mission plans



- Approach the Sun to as close as 0.28 AU with max. heliolatitude of 25 deg (nominal 7 years)
- Launch in 2017, nominal mission period till 2024

(Muller+13)

- Approach the Sun to as close as 8.5 solar radii.
- Launch in 2018, the closest approach at 2025 with Venus flybys.

- **India Aditya-1** (launch: 2017-18) at L1 halo orbit
  solar visible coronagraph, UV full-Sun imager, high E spectrometer etc

Top-level scientific goals

Solar Orbiter

- **What drives the solar wind** and **where** does the coronal magnetic field originate from?
- How do solar transients **drive heliospheric variability**?
- How do solar eruptions **produce energetic particle radiation** that fills the heliosphere?
- How does **the solar dynamo work** and drive connections between the Sun and the heliosphere?

Solar Probe Plus

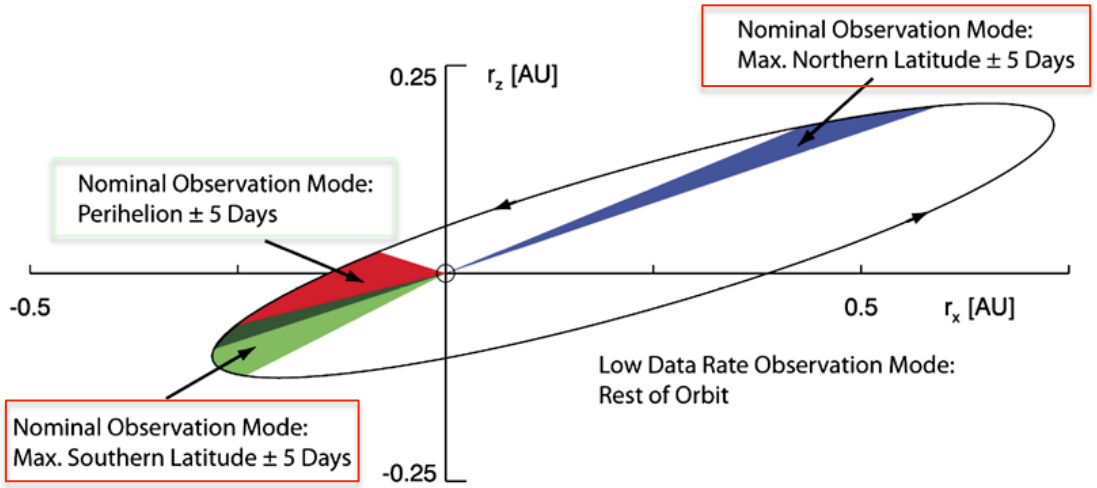
- Determine **the structure and dynamics of the magnetic fields at the sources of solar wind**.
- Trace **the flow of energy that heats the corona and accelerates the solar wind**
- Determine **what mechanisms accelerate and transport energetic particle**
- Explore **the influence of dusty plasma** on solar wind and energetic particle formation

Unique and different approaches to fundamental questions

- **"In-situ" measurements of solar winds (particles, magnetic field)** at the points closer to the Sun

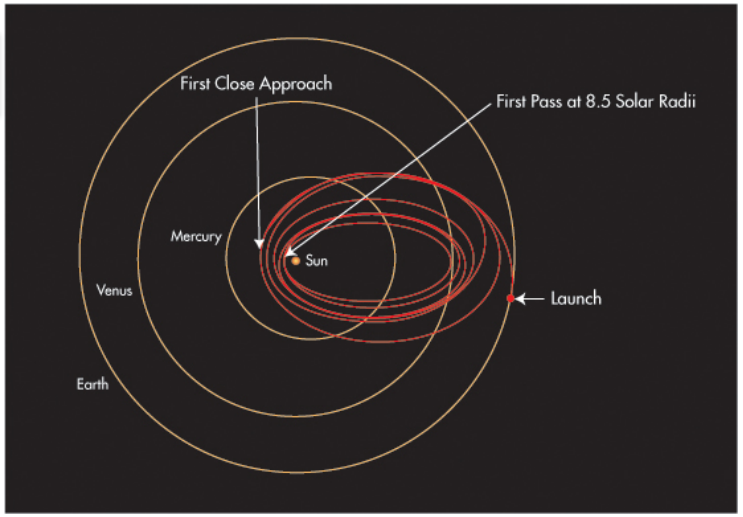
Solar Orbiter

Close approach, 0.28 AU
Inclination 25deg max (in nominal 7 years)



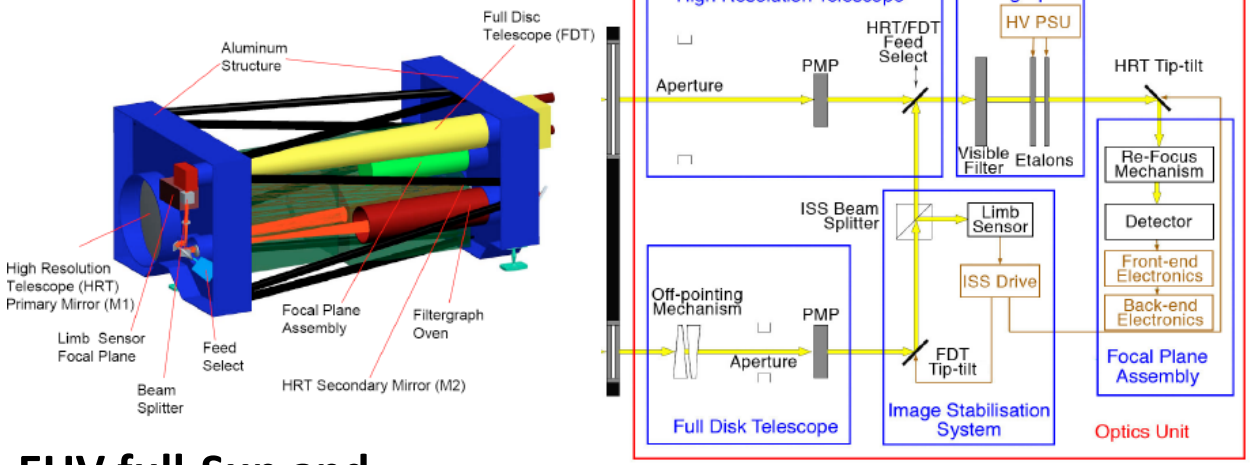
Solar Probe Plus

Close approach, 8.5 Rs

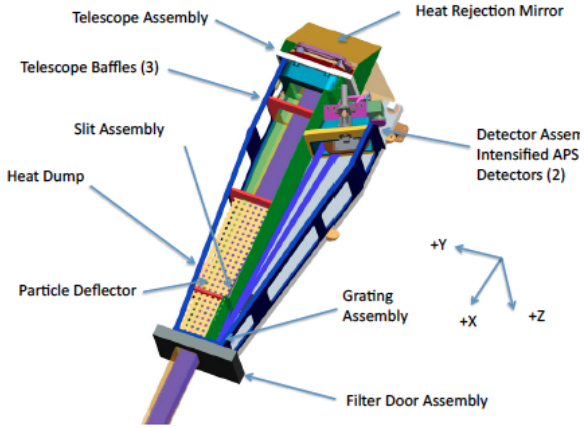


Solar Orbiter: Remote sensing telescopes

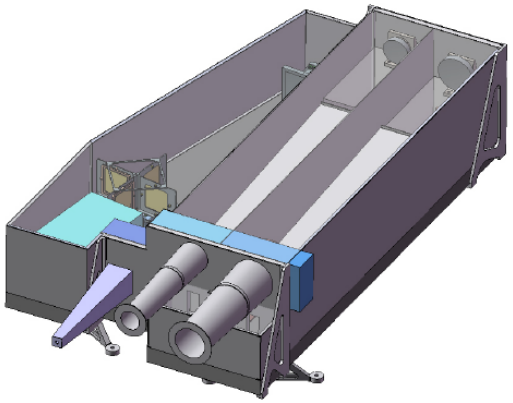
Polarimetric and Helioseismic Imager (PHI)



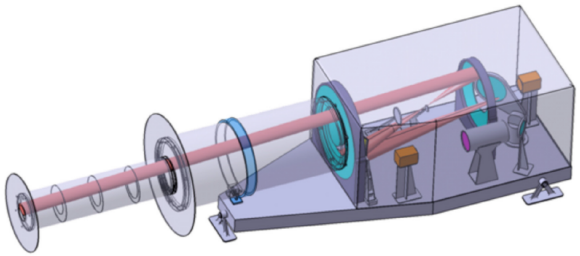
EUV spectral Imager (SPICE)



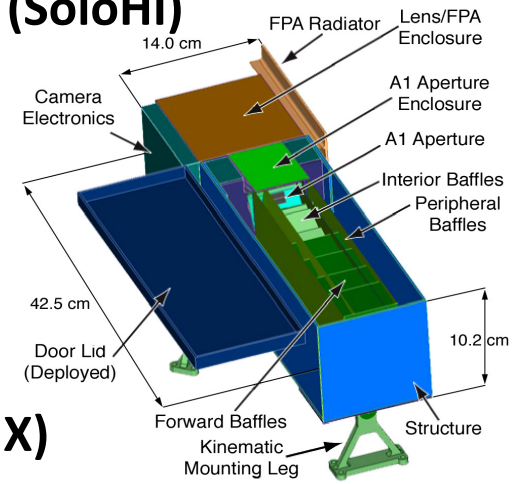
EUV full-Sun and high-reso. Imager (EUI)



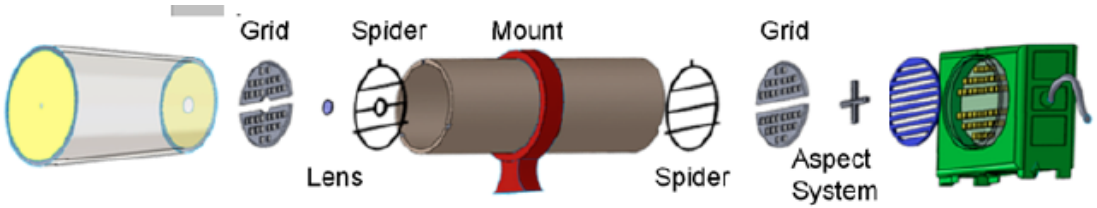
Coronagraph (METIS)



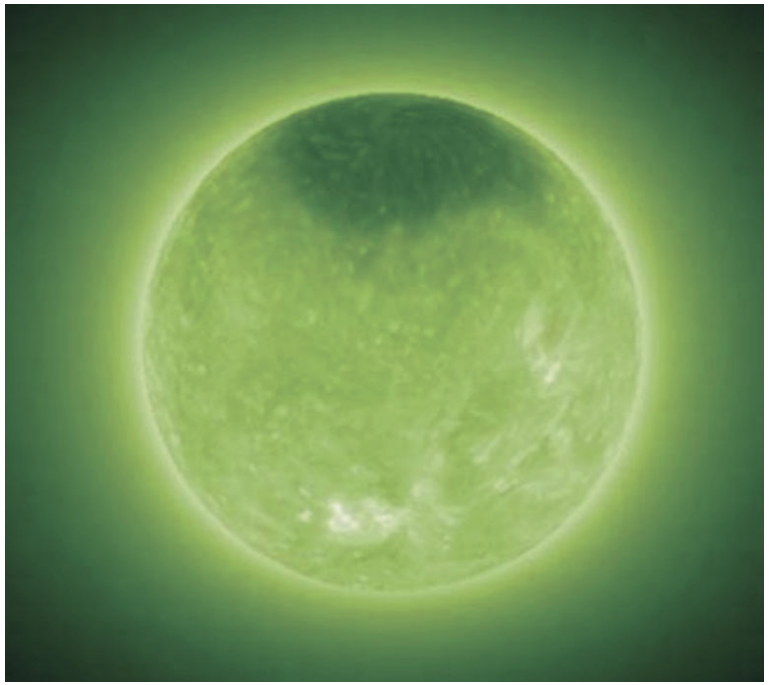
Heliospheric Imager (SoloHI)



X-ray spectrometer/telescope (STIX)



Solar Orbiter: Remote sensing telescopes



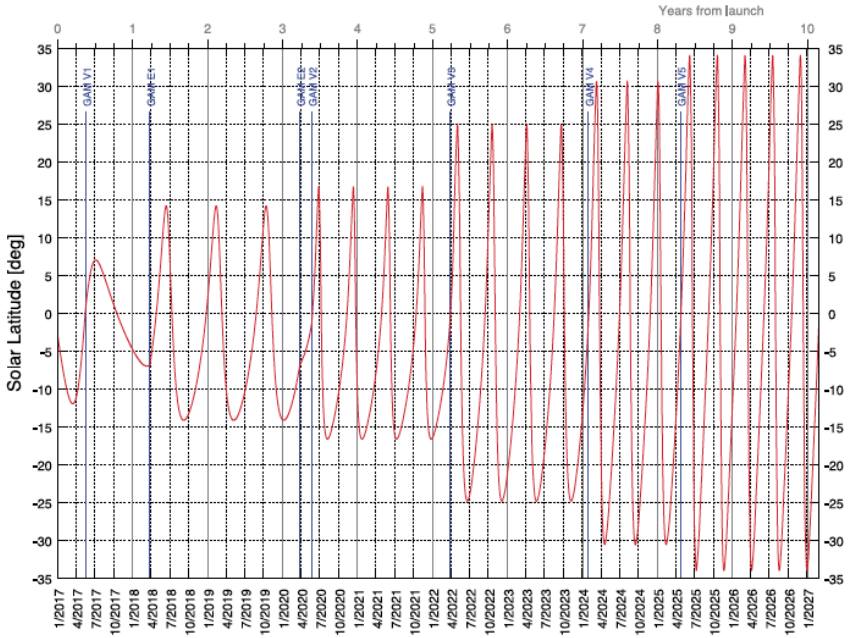
Simulated UV corona from 35deg lat.

- EUV full-Sun and high-reso. Imager (EUI)
- Coronagraph (METIS)
- Heliospheric Imager (SoloHI)
- EUV spectral Imager (SPICE)
- X-ray spectrometer/telescope (STIX)
- Polarimetric and Helioseismic Imager (PHI)

■ **Close-up imagery** (EUI, SPICE, PHI)

Resolving ~200km @ perihelion

low telemetry 150kbps@1AU (cf. Hinode S 262kbps)



■ **"Chasing" the Sun**

■ **Viewing from high latitudes**

Helioseismology

should be linked to Solar-D (plan-A)

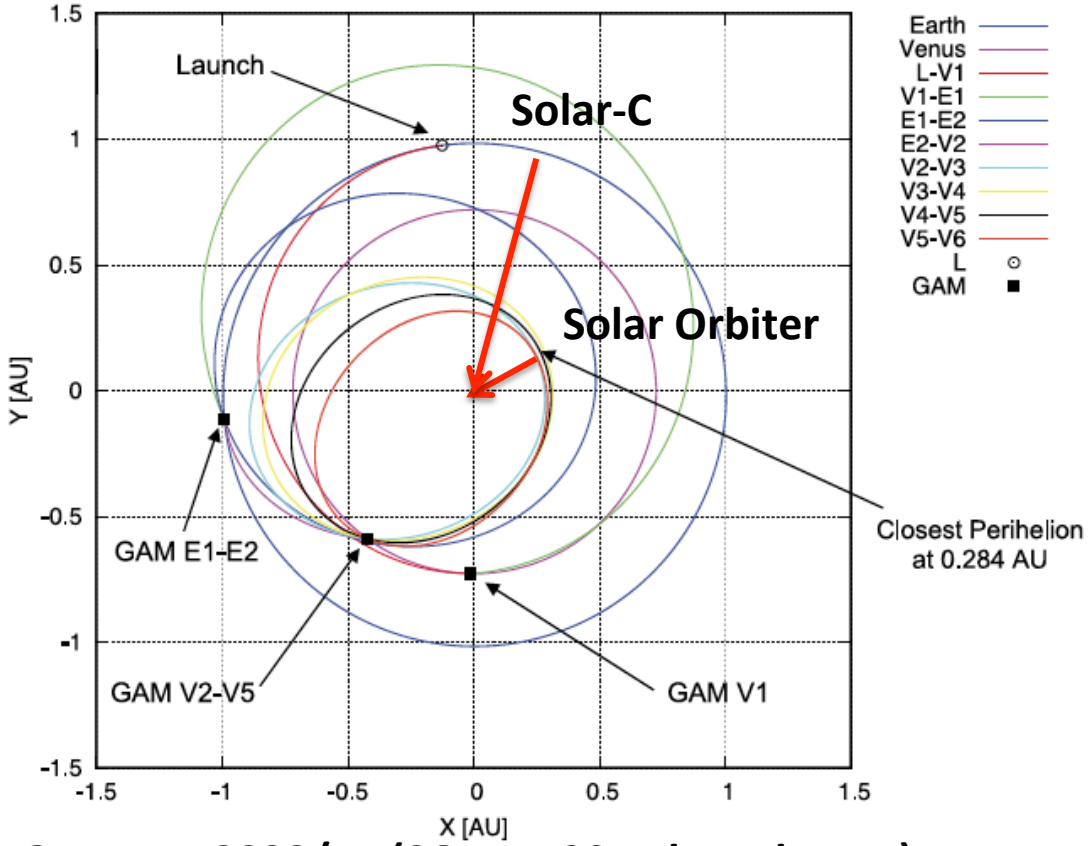
■ **Short limited periods**

+/- 5days @perihelion, max N/S lat.

Note: in-situ instruments at all the times

Synergies with Solar-C (1)
The first stereoscopic views

- **3D coronal magnetic structures with high spatial (200km) resolution**
  (Solar-C/XIT - SO/EUI)
- **3D flow structures in the corona** (Solar-C/EUVST – SO/SPICE)



- **Stereoscopic measurements of magnetic fields at the photosphere**
  (Solar-C/SUVIT – SO/PHI)

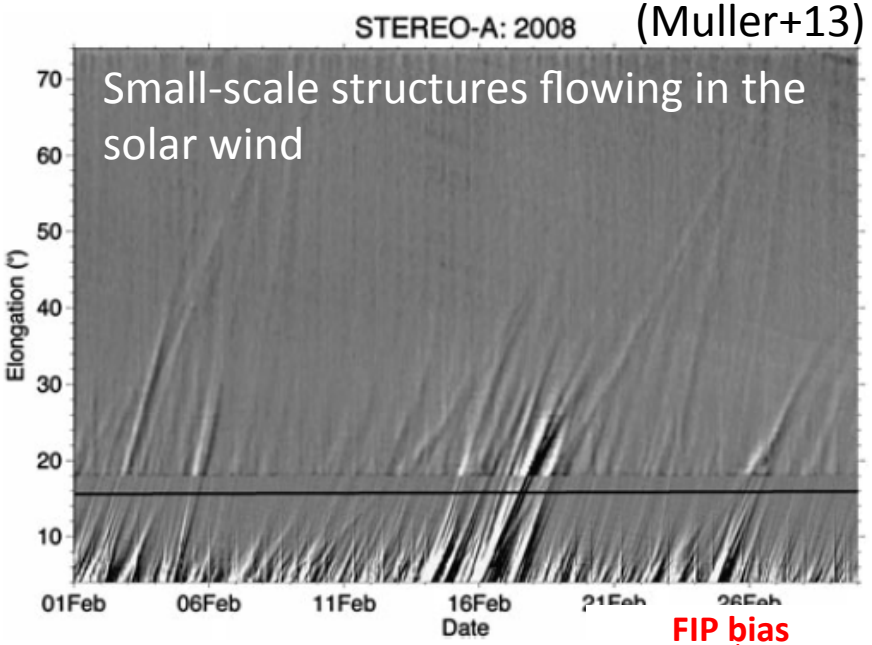
  The most confident way for fully resolving the 180 deg ambiguity

Guess on 2022/11 (SO: Jan 2017 launch case)

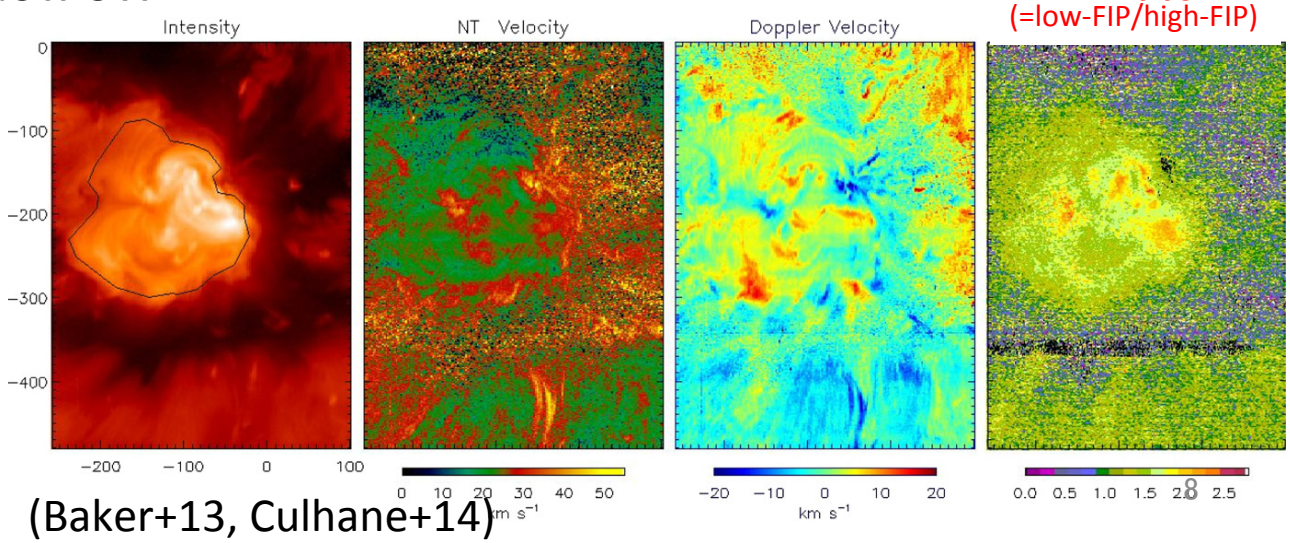
Synergies with Solar-C (2)
In-situ measurements at 10Rs and 0.25AU

- "In-situ" measurements of ion composition in solar winds
- FIP (first ionization potential) bias **for identifying the source of solar wind**
  - EUV spectral lines
  - Low-FIP (< 10 eV, e.g., Si, Mg, Fe)
  - High-FIP (> 10 eV, e.g., S, O)
  - Photospheric (~1) @fast SW, Coronal (2-4) @Slow SW
- **Unevolved small-scale solar wind structures**, recorded at positions closer to the Sun.
- Solar-C/EUVST – SO/SPP "in situ"

(Muller+13)



FIP bias
(=low-FIP/high-FIP)



(Baker+13, Culhane+14)

Summary: Synergies

3-D magnetic and plasma structures at the solar end, revealed by spectroscopic measurements with highest spatial resolution at high cadence

Solar-C

Coronal heating/solar wind
Dynamics including flares

Equivalent imaging/spectroscopic measurements **from a different position** at limited periods

"In-situ" measurements at the positions closer to the Sun