The next-generation space solar observatory:

The SOLAR-C Mission

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SOLAR-C WG

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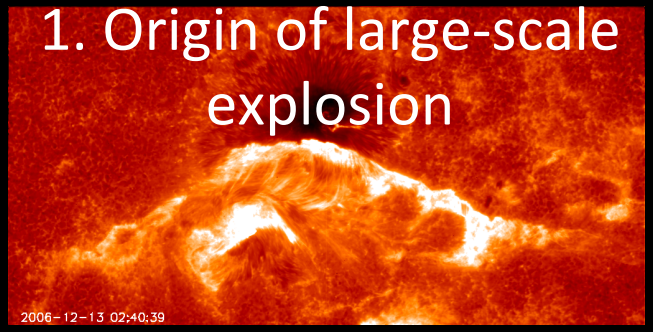
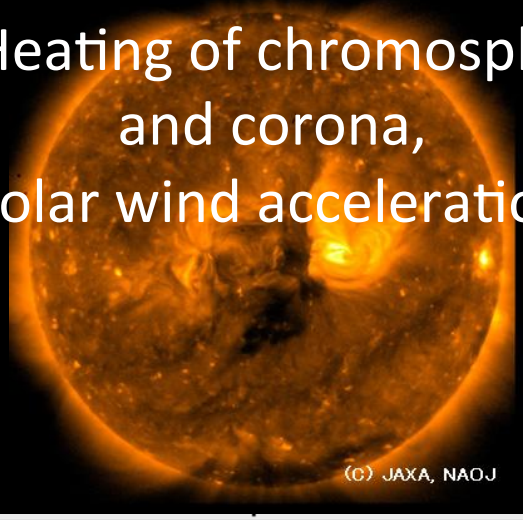
ISSI Coronal Rain

Basic Problems *in Helio-Physics*

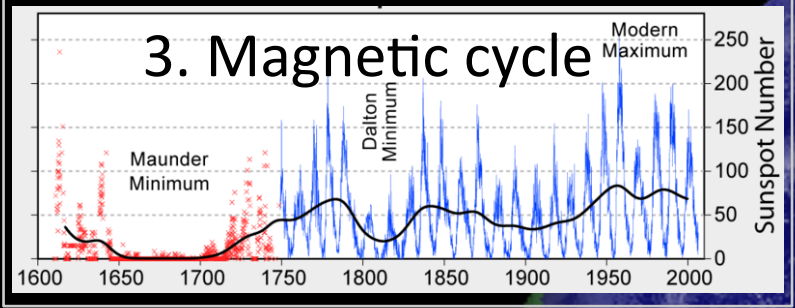
1. Origin of large-scale explosion



2. Heating of chromosphere and corona, Solar wind acceleration



3. Magnetic cycle



SOLAR-C

Planned satellite Solar observatory prepared by JAXA SOLAR-C W.G.

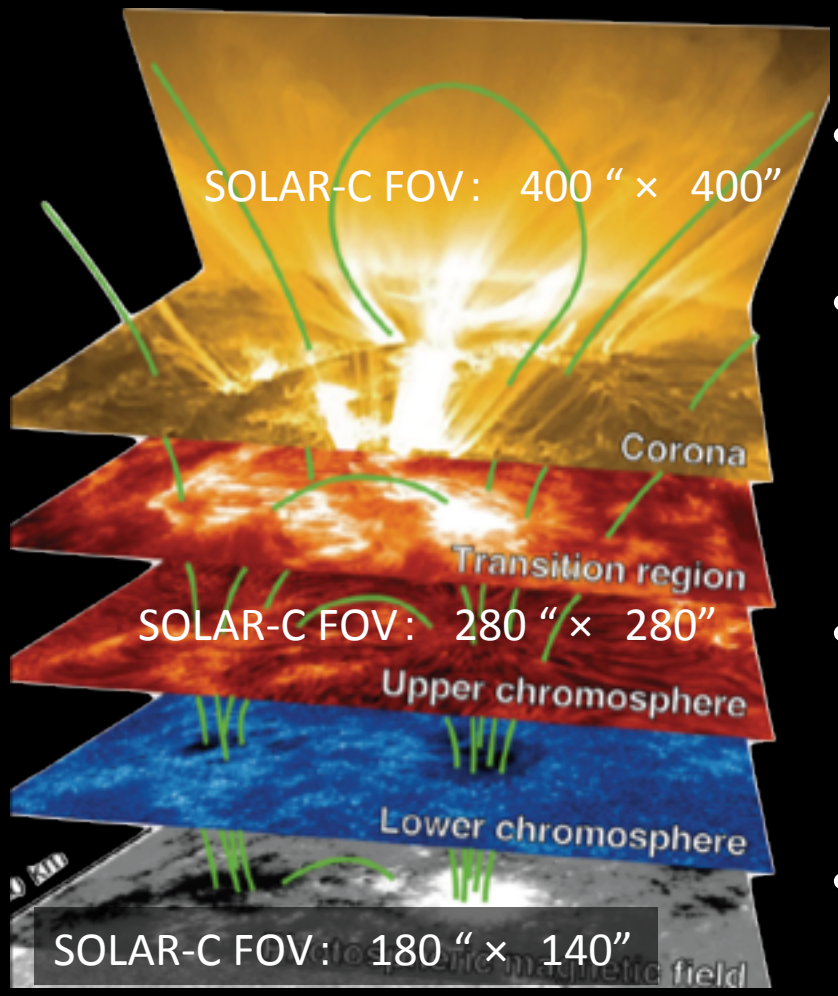
First determines 3D magnetic structures from unprecedented observations for elucidating basic problems in Helio-Phys.

Keywords:

- Chromospheric *B* measurements
- 0.1” – 0.3” spatial resolution (0.1” = 70 km)
- ~1s high-cadence observations
- high resolution spectroscopy

Science Objectives

Observations of All from photosphere to corona seamlessly as a system

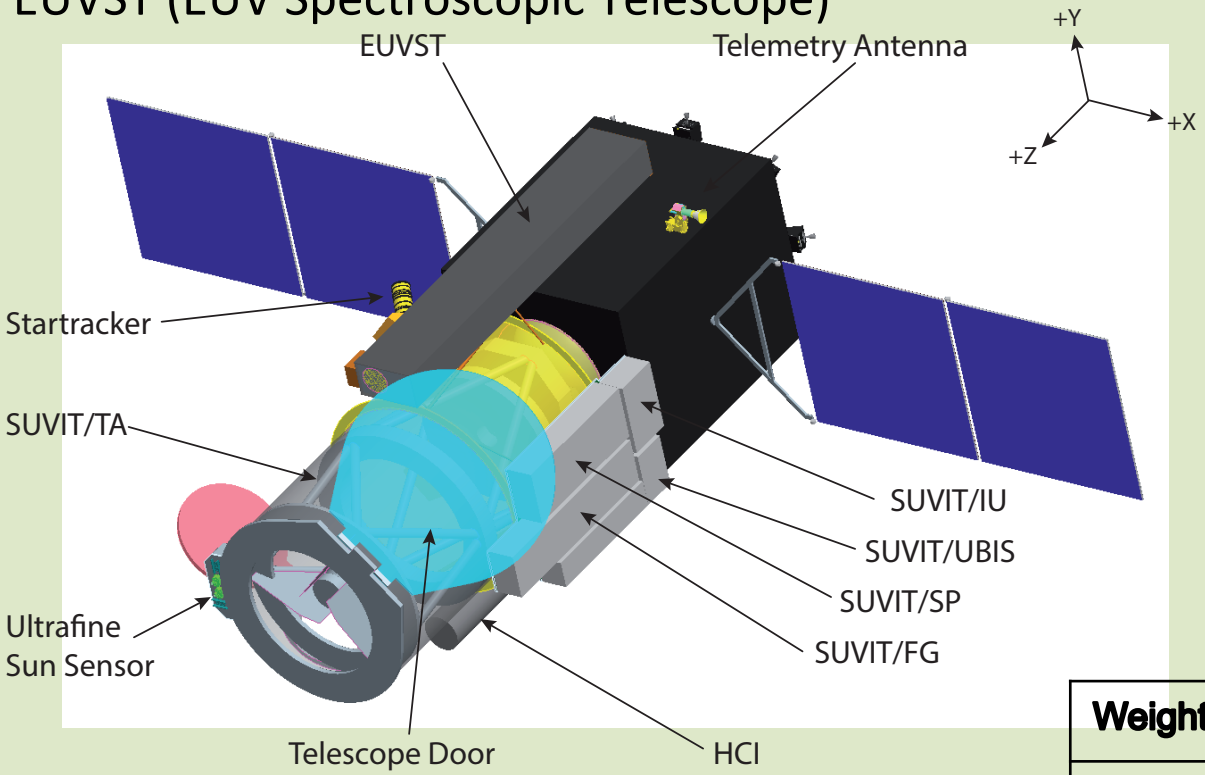


SOLAR-C will determine

- Physical origin of explosions that drive short-time geo-space variability
- Mechanisms responsible for
  - heating and dynamics of chromosphere & corona
  - acceleration of solar wind
- Fundamental physical processes
  - Magnetic reconnection, MHD waves, shocks, etc.
- Fine-scale magnetism and associated solar spectral irradiance

SOLAR-C Spacecraft

EUVST (EUV Spectroscopic Telescope)



50cm dia. telescope

Hinode

SUVIT TA

1.4 m diameter telescope

Chromospheric magnetic fields measurements

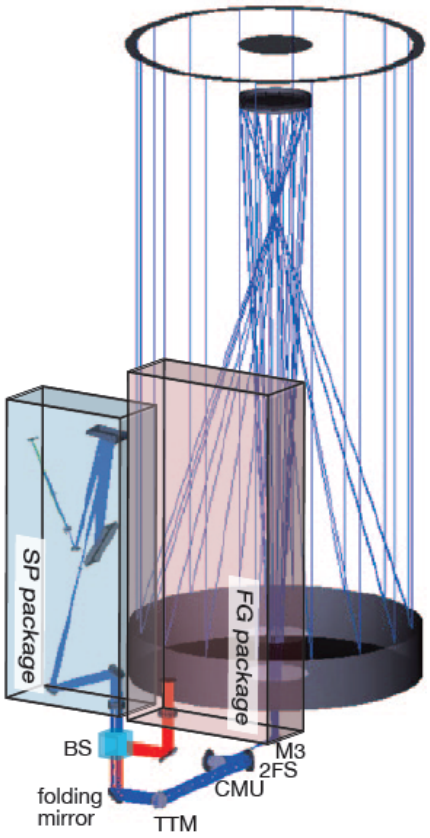
HCI (High Resolution Coronal Imager)

SUVIT: Solar UV-Visible-IR Telescope

Weight	**2300 kg (w/o fuel)**
Size	**3.7m x 3.2m x 7.1m**
Power	**5 kW generation @EOL**
Data rate and DR volume	**Average: 8 Mbps (×20 of Hinode)** **DR volume: 100GB**
Attitude control	**3-axis attitude control**
Orbit	**a geosynchronous orbit**

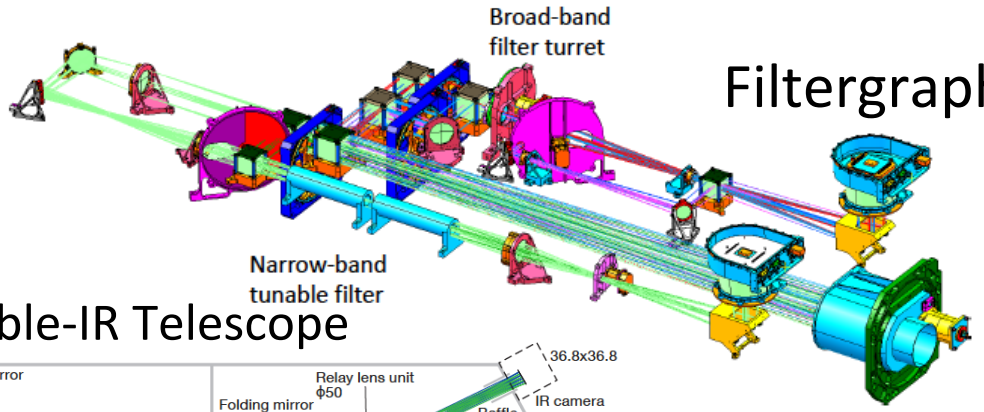
SOLAR-C payload

1.4m diameter telescope

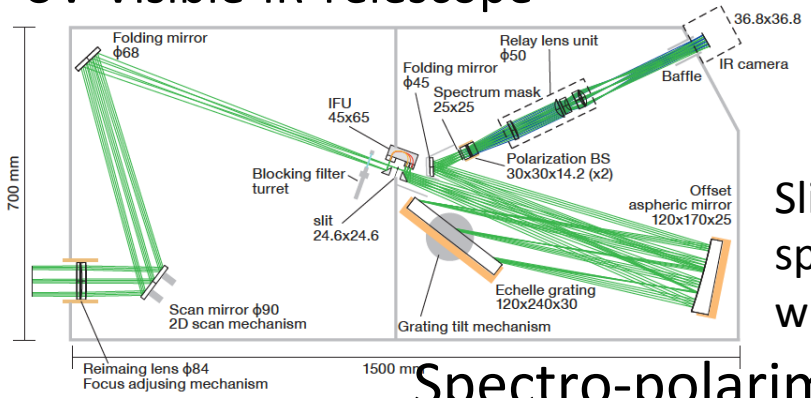


SUVIT

Solar UV-Visible-IR Telescope

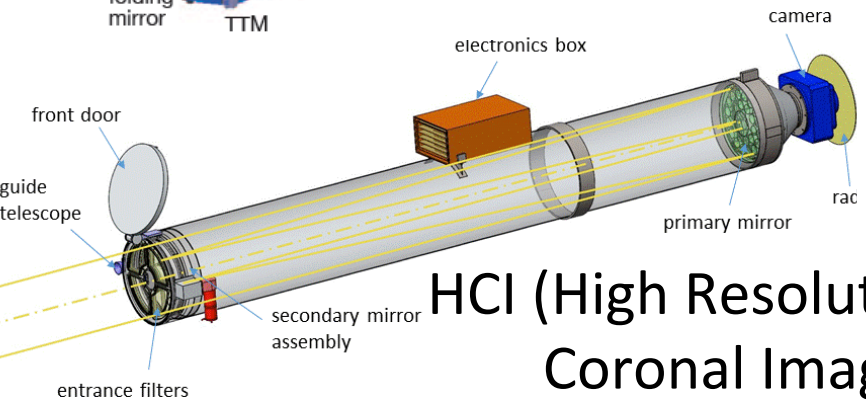


Filtergraph

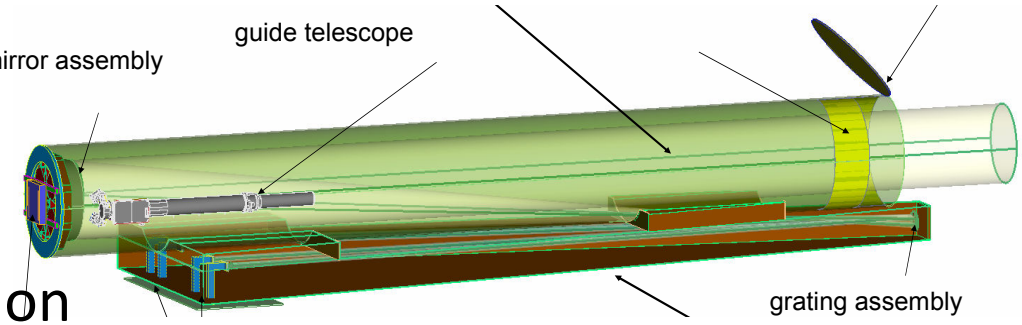


Slit scanning spectro-polarimter with IFU

Spectro-polarimeter

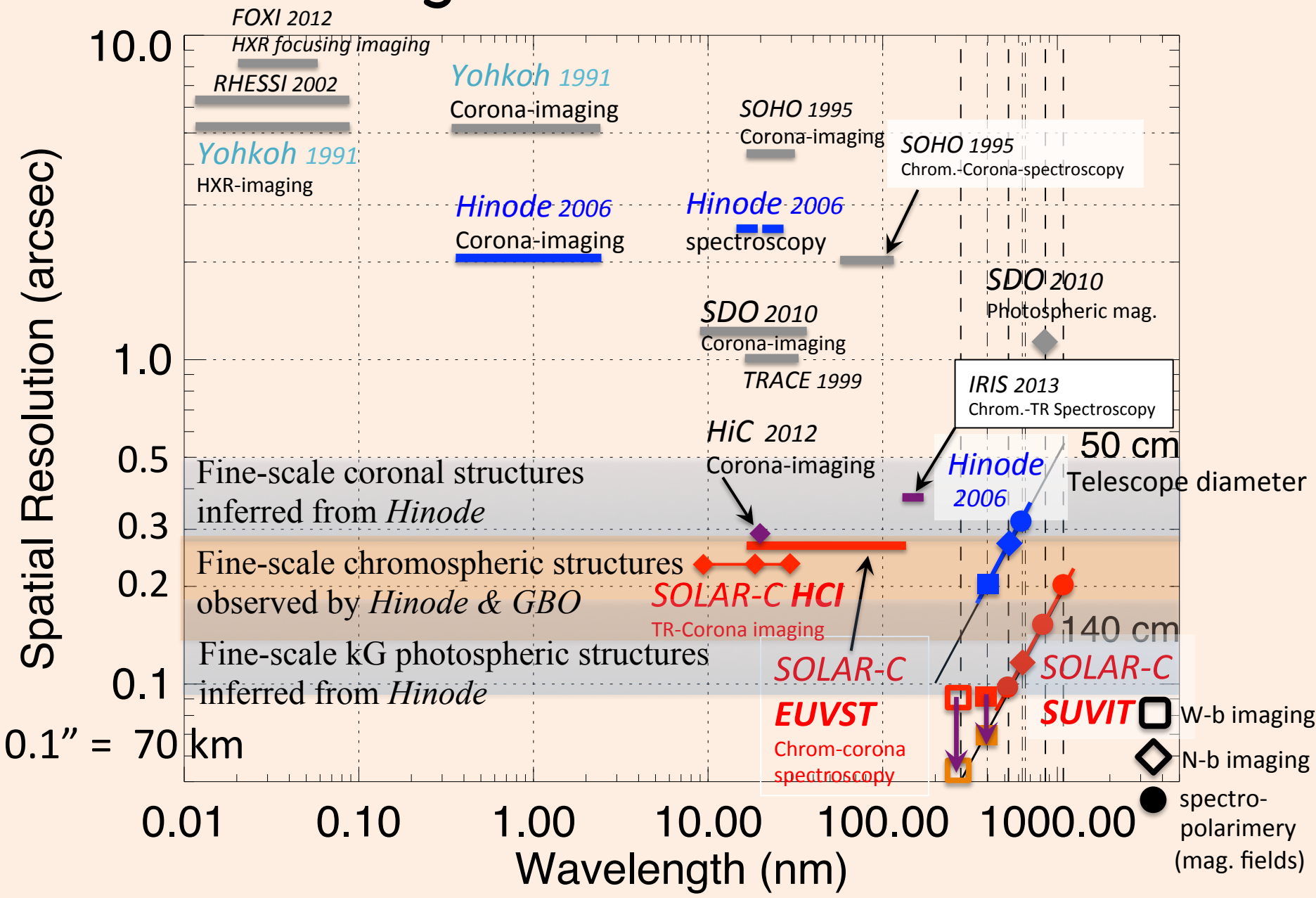


HCI (High Resolution Coronal Imager)

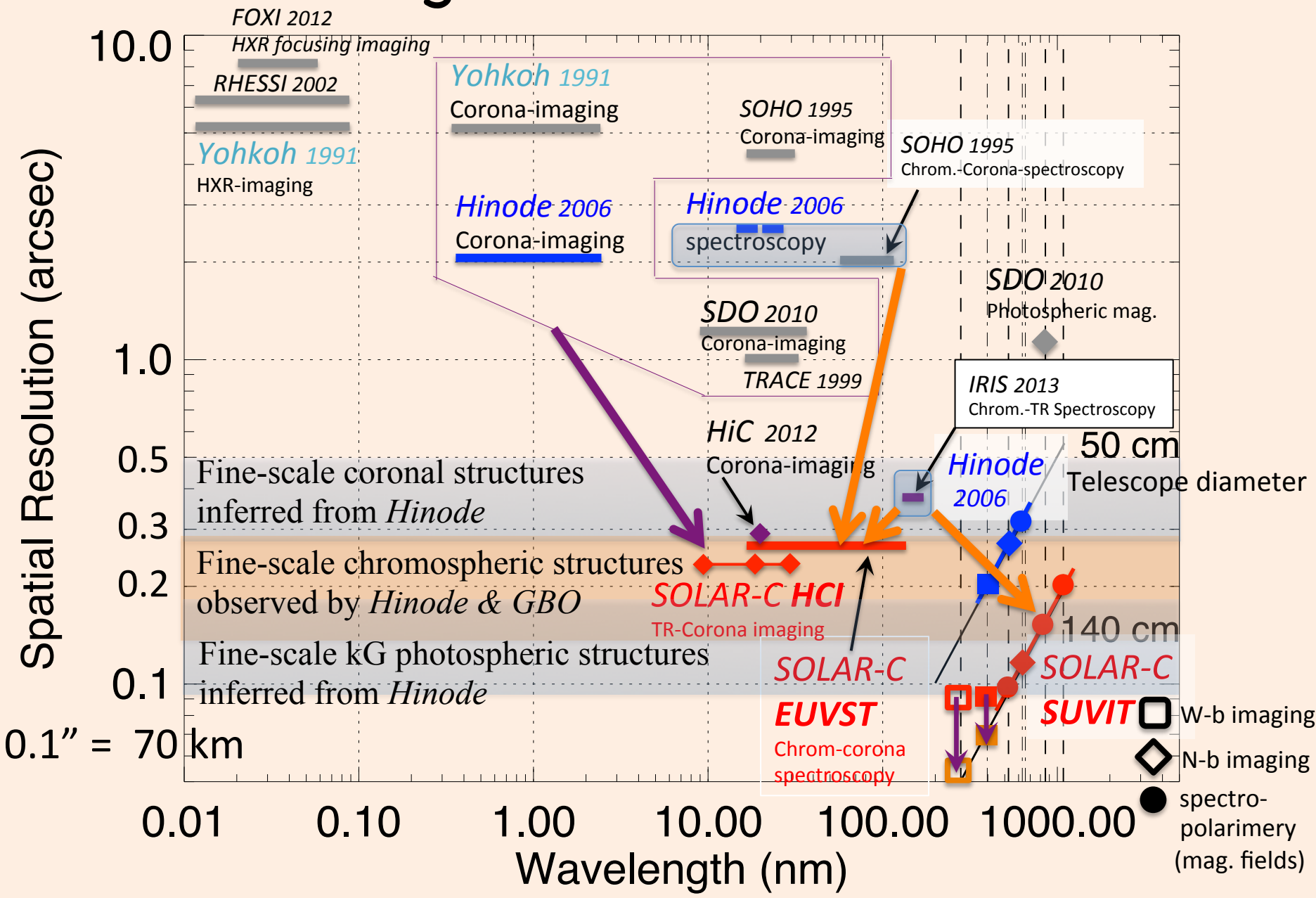


EUVST (EUV Spectrograph)

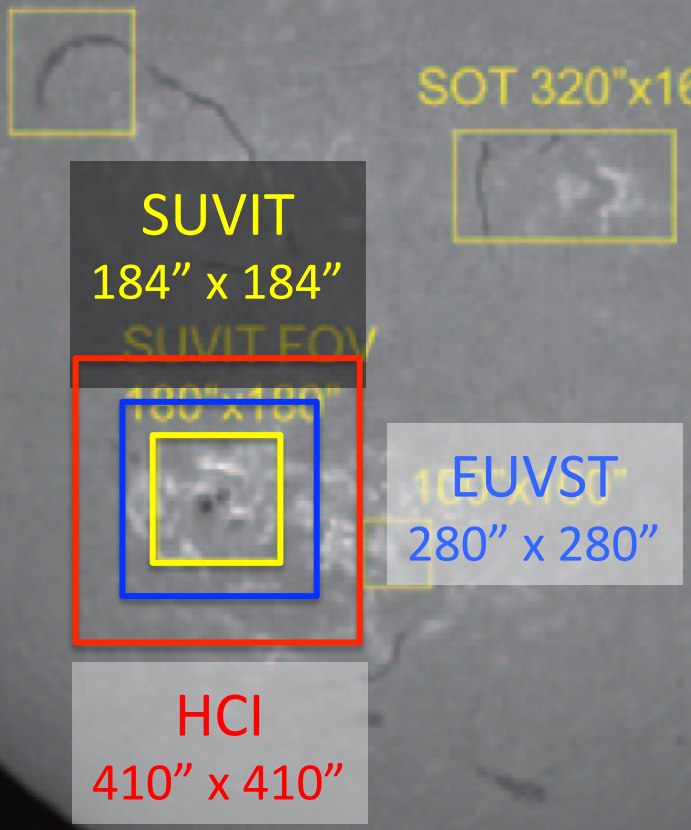
SOLAR-C High-resolution Observations



SOLAR-C High-resolution Observations

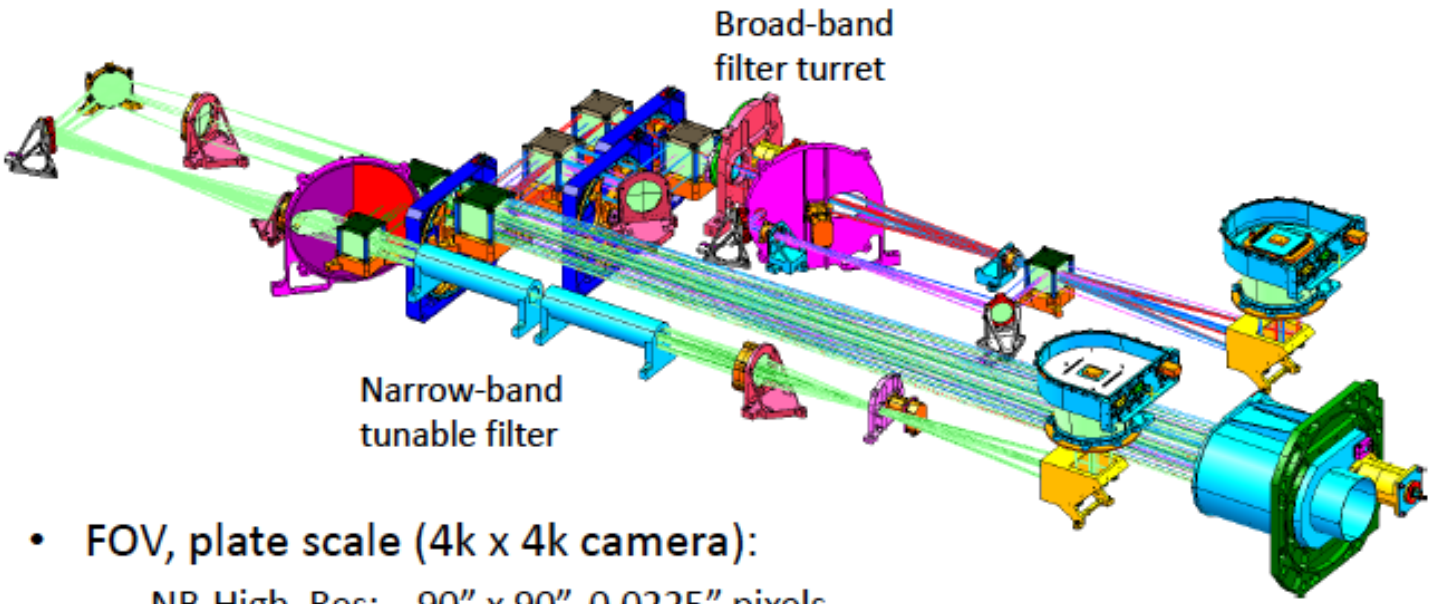


SOLAR-C: Field of View (FOV)



SUVIT			
	FG		SP
	WB	NB	
Hi-Res.	61"x61"	90"x90"	184"x143"
Wide FOV	184"x184"		

SUVIT Filtergraph (FG)



- **FOV, plate scale (4k x 4k camera):**
  - NB-High Res: 90" x 90", 0.0225" pixels
  - NB-Wide FOV: 180" x 180", 0.045" pixels
  - WB-High Res: 60" x 60", 0.015" pixels
  - WB-Wide FOV: 180" x 180", 0.045" pixels

Wide bands

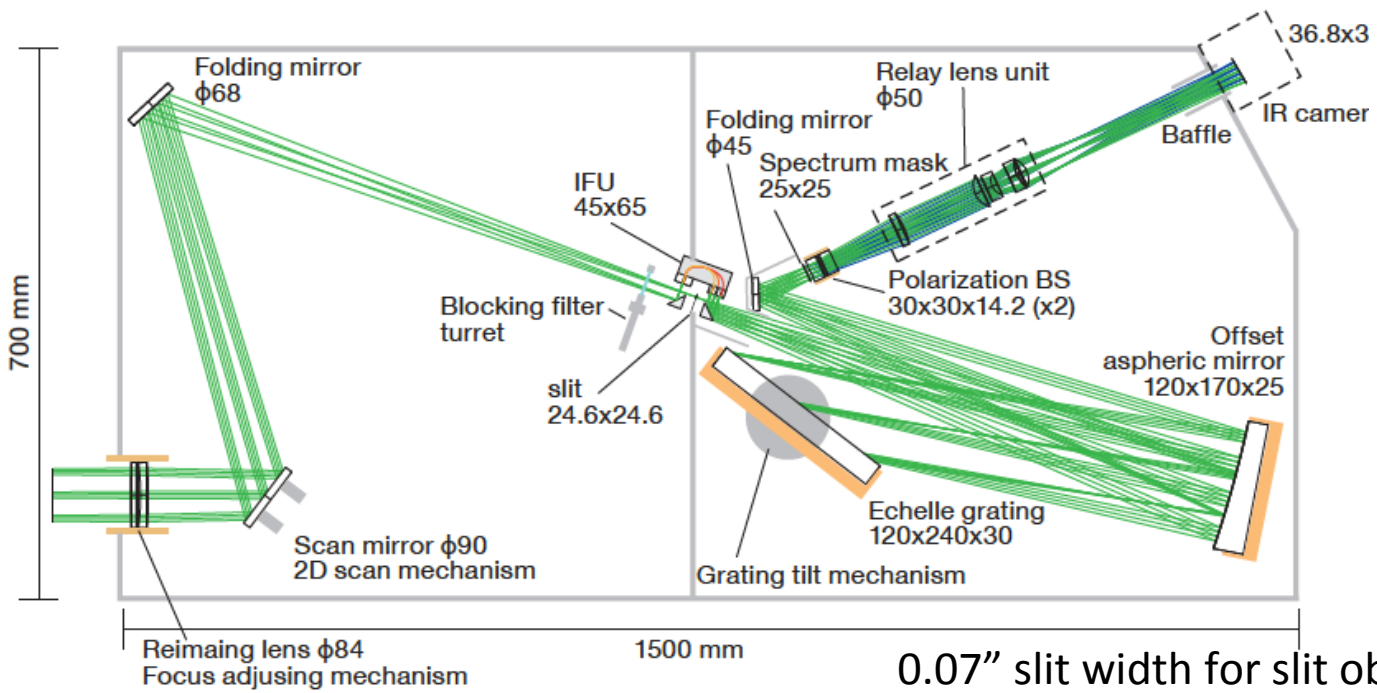
Pass-bands	279 nm	380 nm	393 nm	TBD
Spectrum lines	Mg II k/h	CN band	Ca II K	continuum

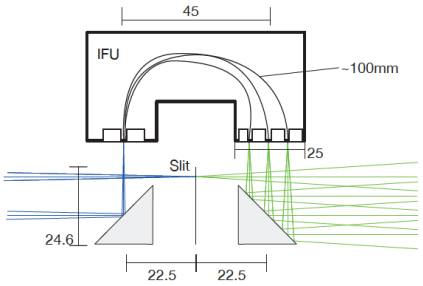
Narrow bands with a polarimeter

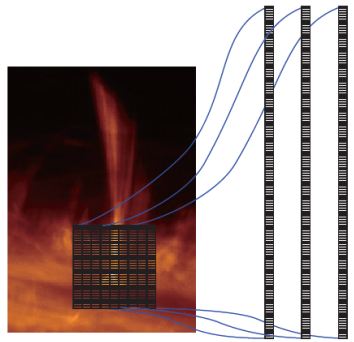
Pass-bands	517 nm	525 nm	589 nm	656 nm	854 nm
Spectrum lines	Mg I b	Fe I	Na I D	H I α	Ca II

SUVIT Spectro-polarimeter (SP)

to observe photspheric & chromospheric *mag.* fields







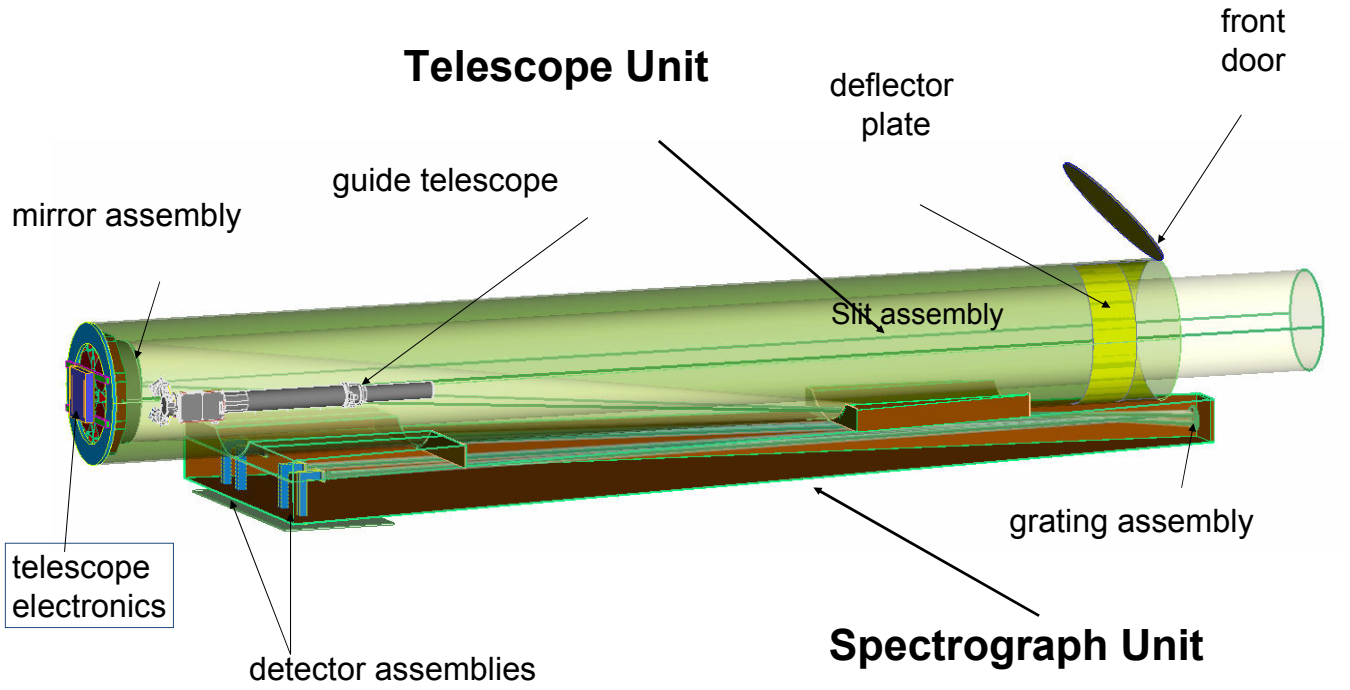
0.07” slit width for slit obs.
0.2” slit width for IFU

Wavelength bands	1083 nm	854 nm	525 nm
Spectrum lines	He I	Ca II	Fe I
Order	15	19	31
Wavelength sampling	45.2 mÅ	35.6 mÅ	21.9 mÅ

EUVST

- Optics: single off-axis mirror (30cmϕ, f=360cm)
  and a grating
- Telescope length: 430cm

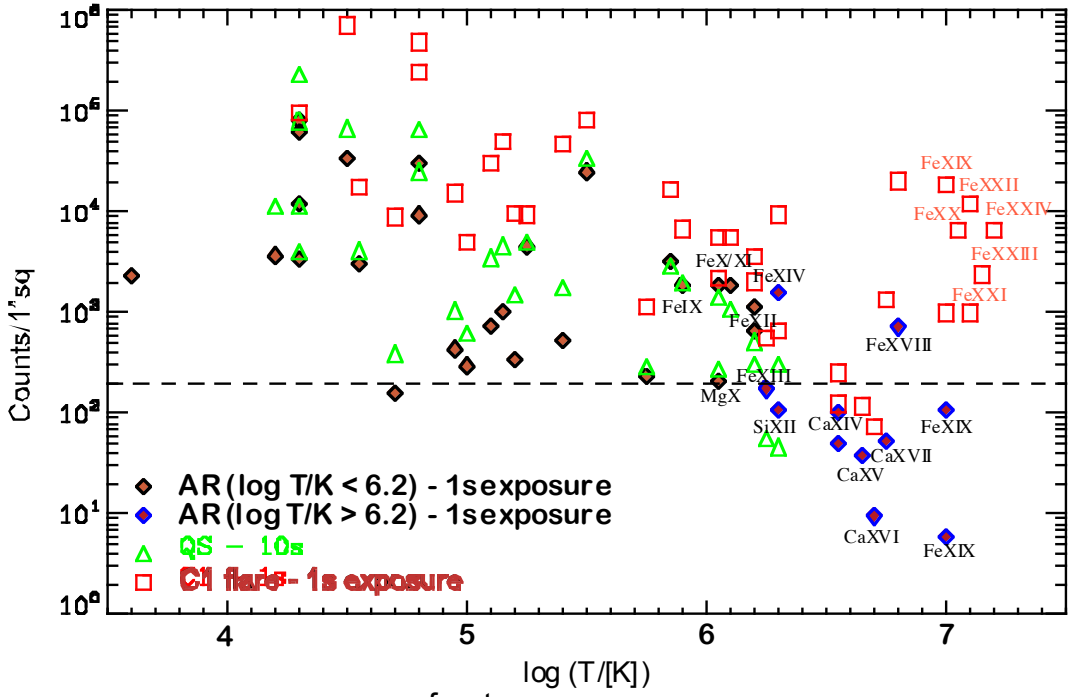
Field	Required value
Spatial resolution	$\leq 0.28''$
Spectral resolution	$\lambda/\Delta\lambda$ 17 000 to 32 000
Doppler shift accuracy	≤ 2 km s^{-1}
Doppler width accuracy	≤ 5 km s^{-1}
Temperature coverage	0.01 to 20 MK
Field-of-view	slit length 280″
raster coverage	300″ (w/o re-pointing)
Exposure times	$\leq$ 10 s (0.28″ sampling)
	$\leq$ 1 s (1″ sampling)
Mirror micro-roughness	about 3 Å rms or better

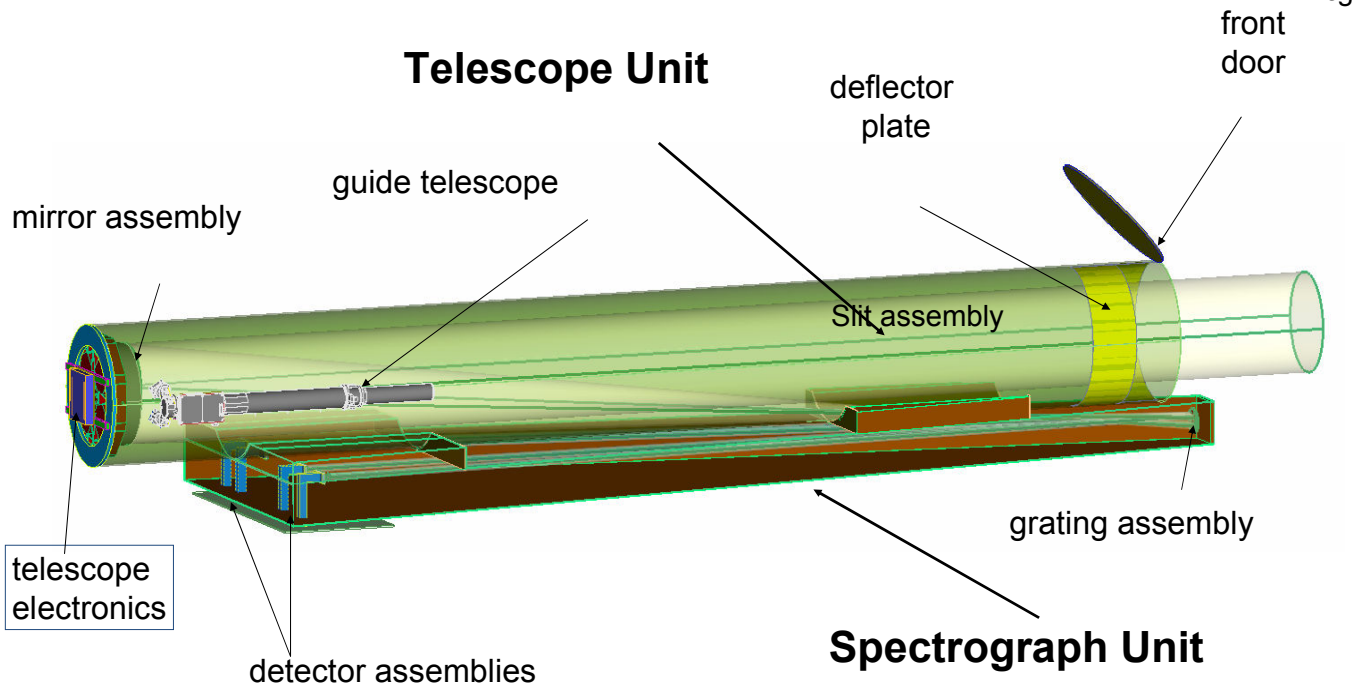


With low scattering optics, for exploring low EM regions (MR and CH).

EUVST

- Optics: single off-axis mirror (30cmϕ, f=360cm)
  and a grating
- Telescope length: 430cm

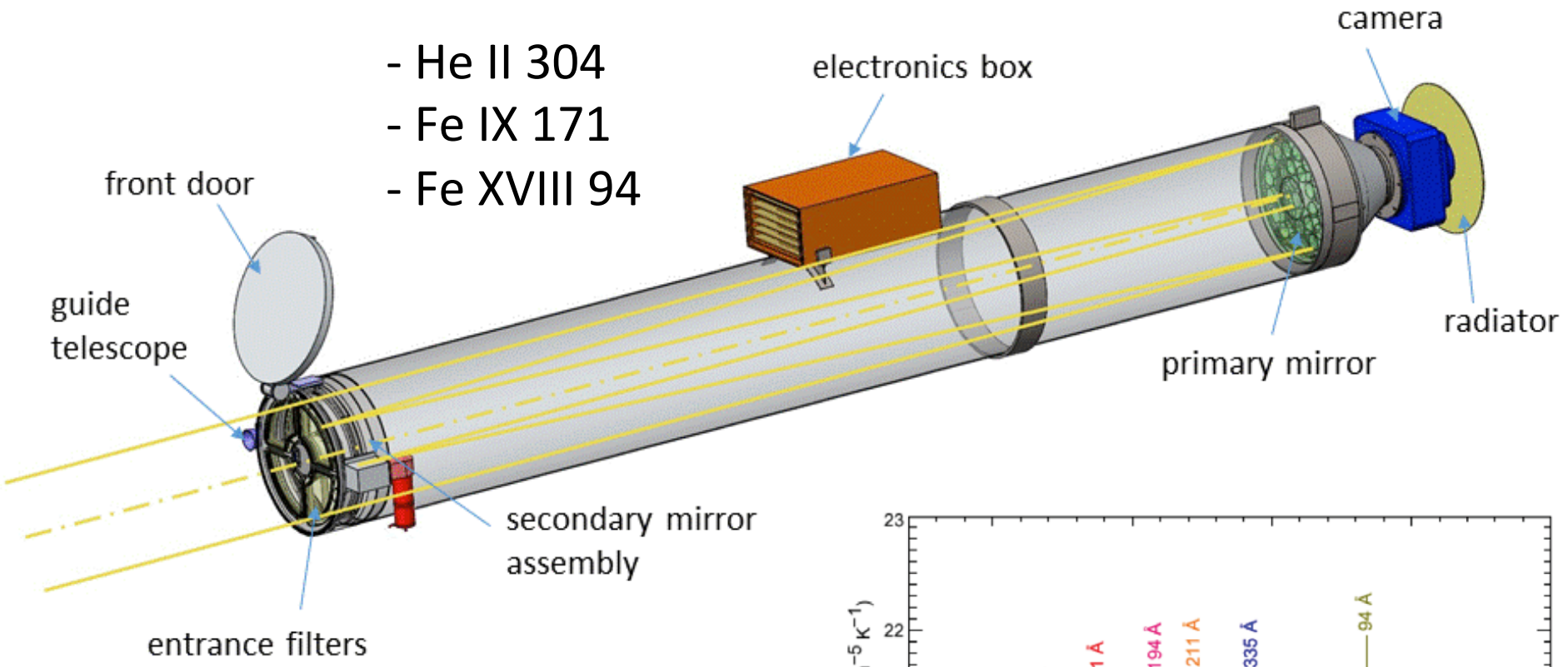




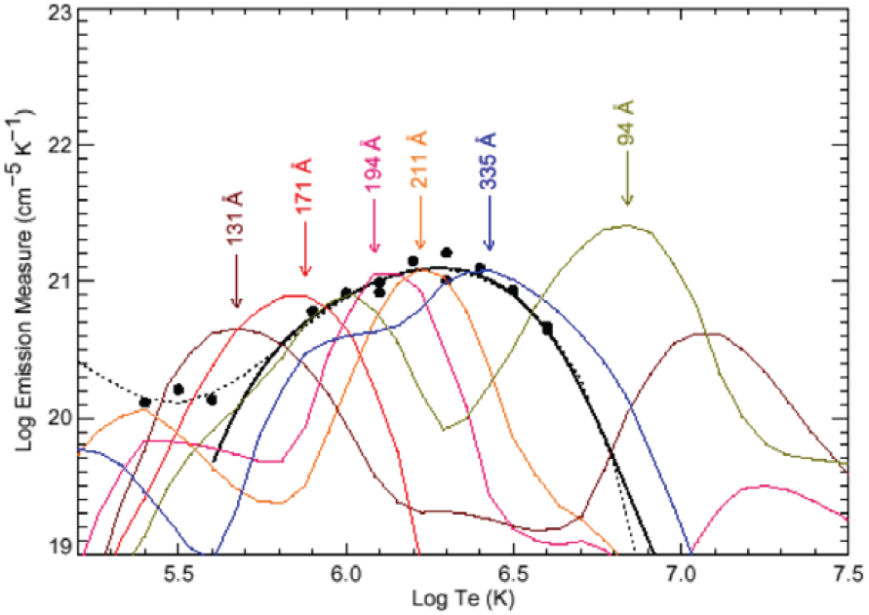
With low scattering optics, for exploring low EM regions (MR and CH).

High Resolution Coronal Imager (HCI)

- He II 304
- Fe IX 171
- Fe XVIII 94



	HCI	SDO/AIA
Optics	EUV normal-incidence	EUV normal-incidence
Spatial resolution	0.2”-0.3”	1.2”
Cadence	~<2.0 s (typ. 10 s)	12 s
Field of view	~400” × 400”	full Sun
Temperature coverage	5×10^4 K (He II 304Å) 6.3×10^5 K (Fe IX 171Å) 6.4×10^6 K (Fe XVIII 94Å)	5×10^4 K to 2.0×10^7 K in Table 4.4-3

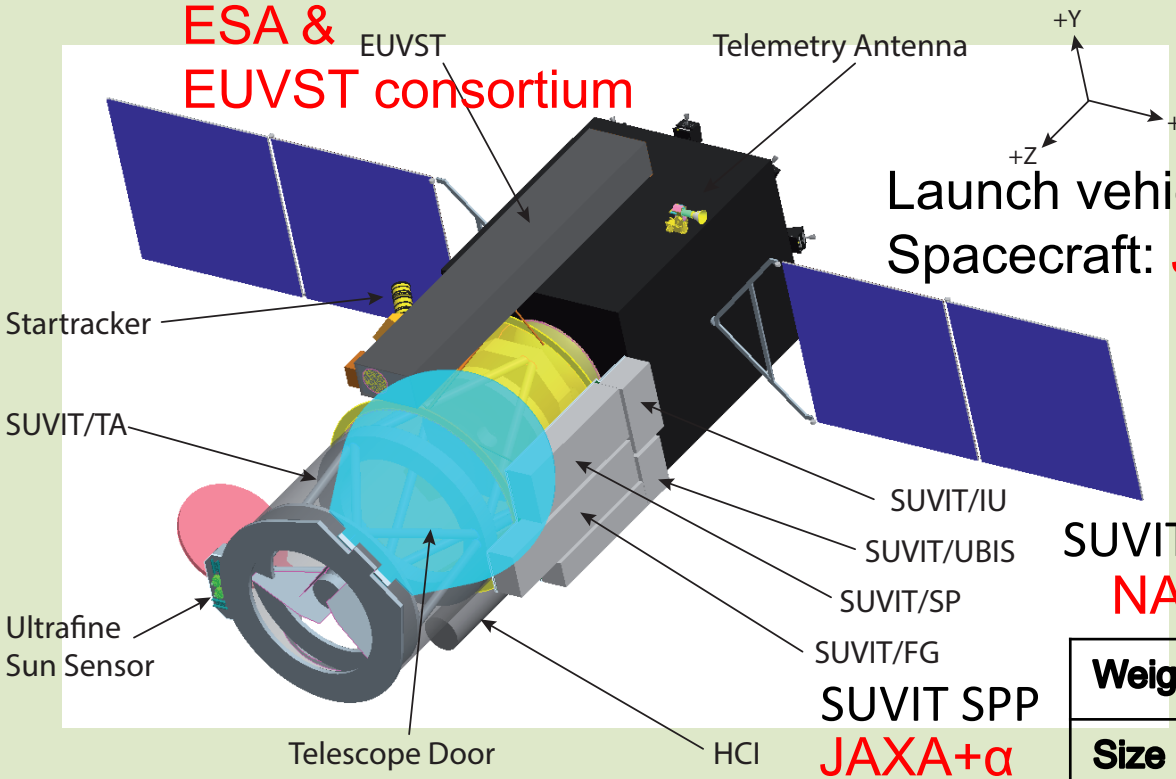


International Collaboration

A planned case of task share that world-wide solar physicists desire

EUVST (EUV Spectrograph)

ESA &
EUVST consortium



Launch vehicle: JAXA
Spacecraft: JAXA

Hinode

SUVIT FGP
NASA

SUVIT SPP
JAXA+α

SUVIT TA
JAXA+α

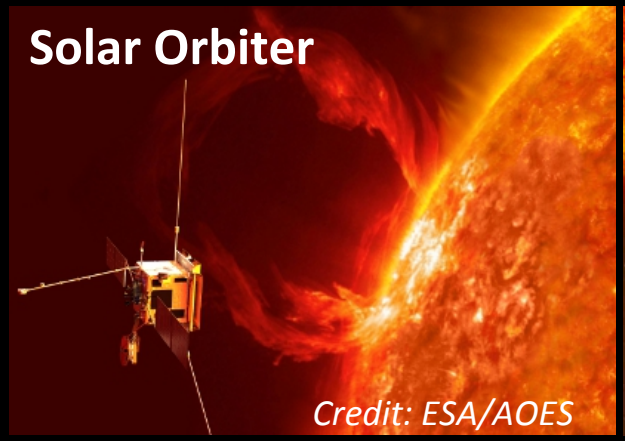
HCI (Coronal imager)
NASA

α: European countries

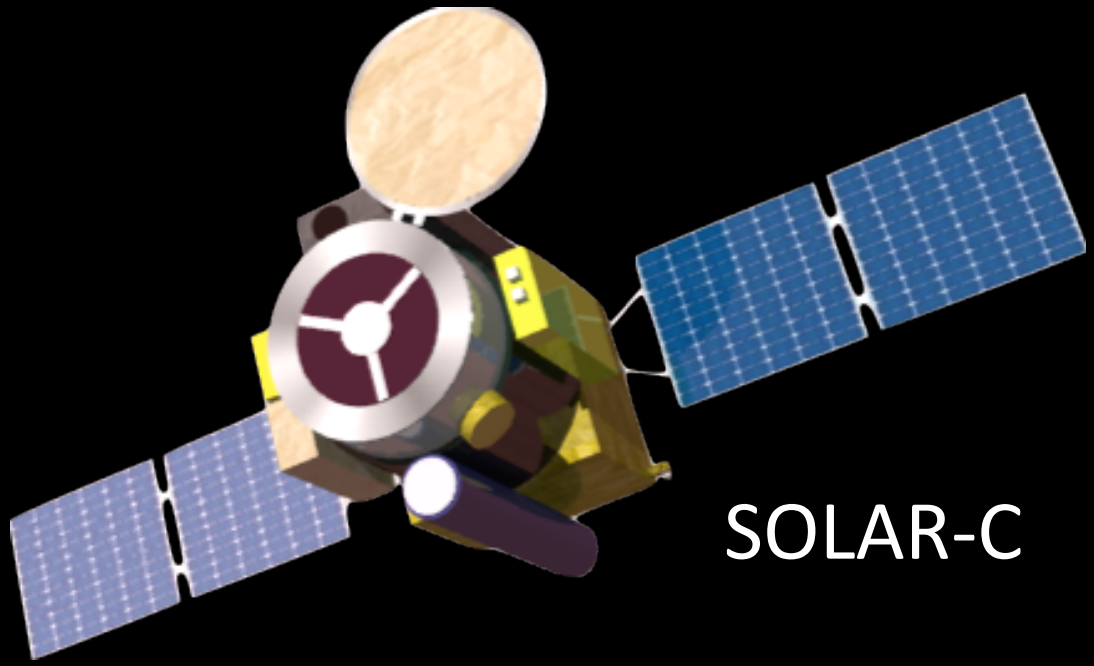
- Proposed to US Heliophysics Decadal Survey
- EUVST: proposed to ESA Cosmic Vision II
- Submitted to JAXA-AO

Weight	**2300 kg (w/o fuel)**
Size	**3.7m x 3.2m x 7.1m**
Power	**5 kW generation @EOL**
Data rate and DR volume	**Average: 8 Mbps (×20 of Hinode)** **DR volume: 100GB**
Attitude control	**3-axis attitude control**
Orbit	**a geosynchronous orbit**

Coordinated Observations



Solar Dynamic Observatory
or a mission of full-disk observations



Summary

- SOLAR-C is a mission to understand the causal linkage between solar magnetic fields and active phenomena on the Sun and in the heliosphere.
- SOLAR-C equips three major payloads to elucidate fundamental problems in Helio-physics
  by high-resolution (0.1”−0.3”) imaging & spectroscopy
  with temporally stable chromospheric magnetometry.
- All telescopes of the SOLAR-C have capability to observe coronal rains with enough spatial resolution, enough cadence, and enough coverage of temperature.