Some progresses for space observations of solar corona from China, instrument overview

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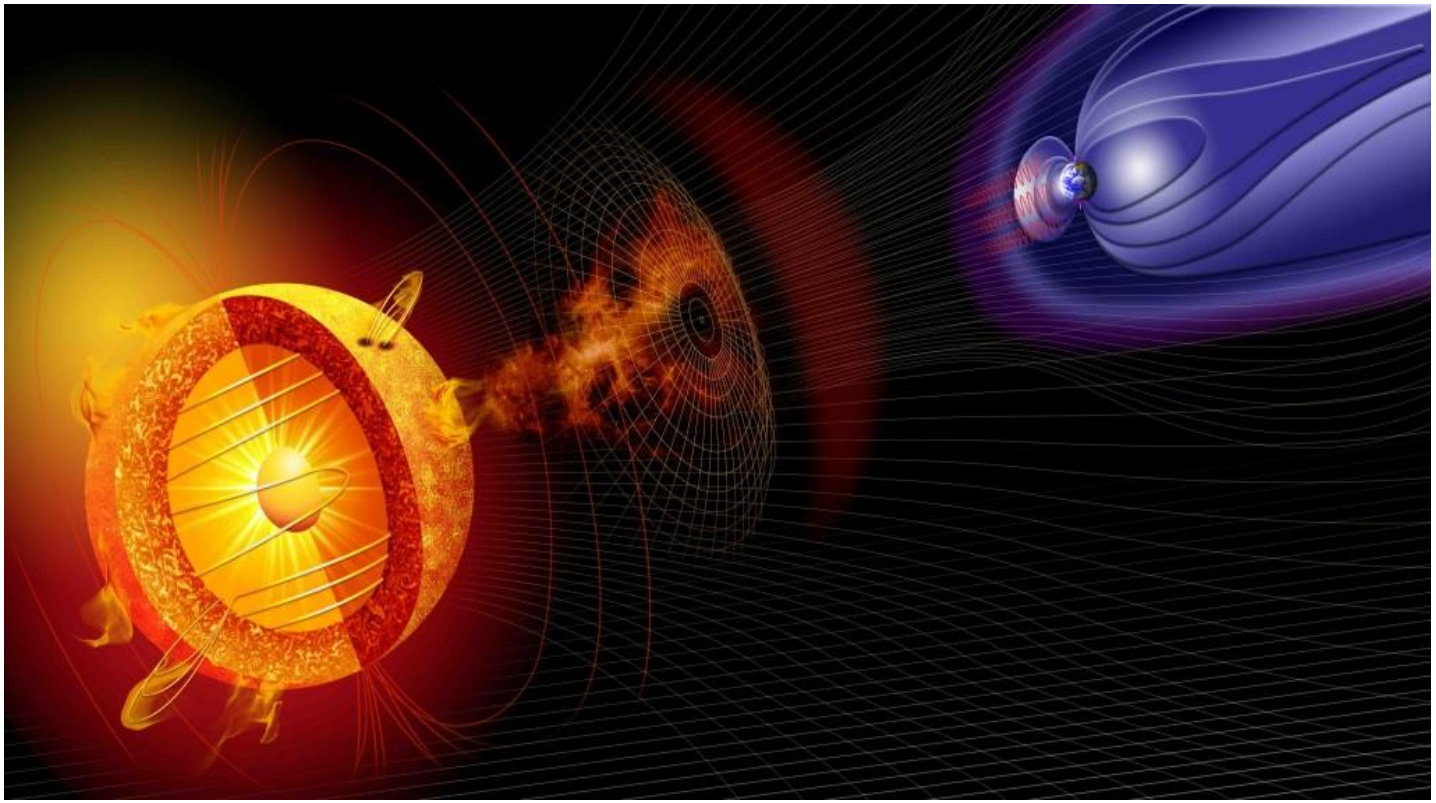
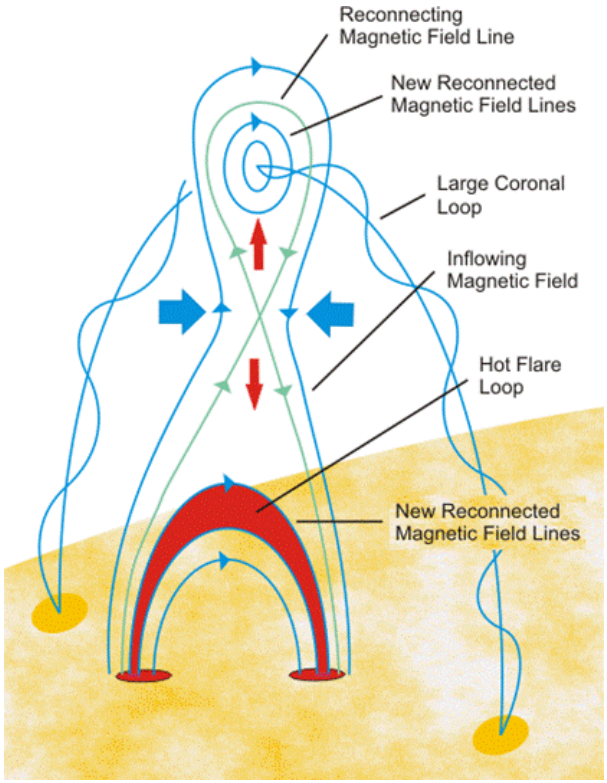
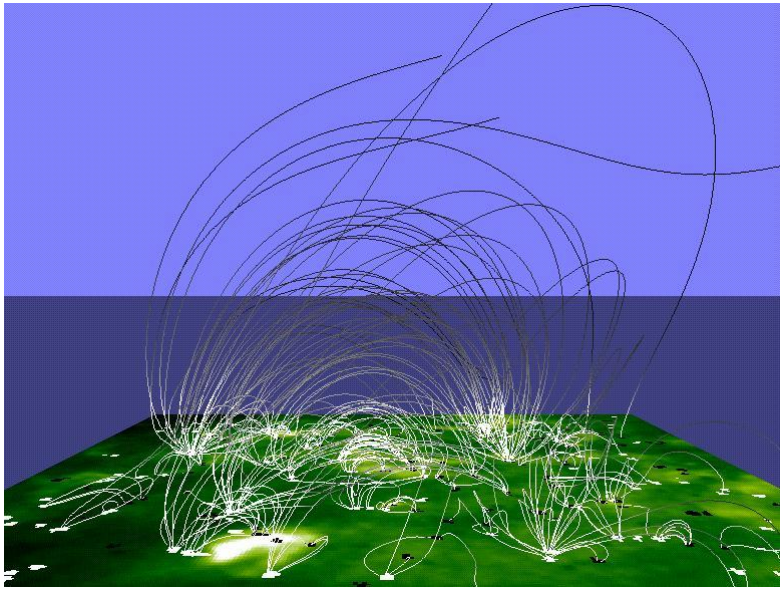


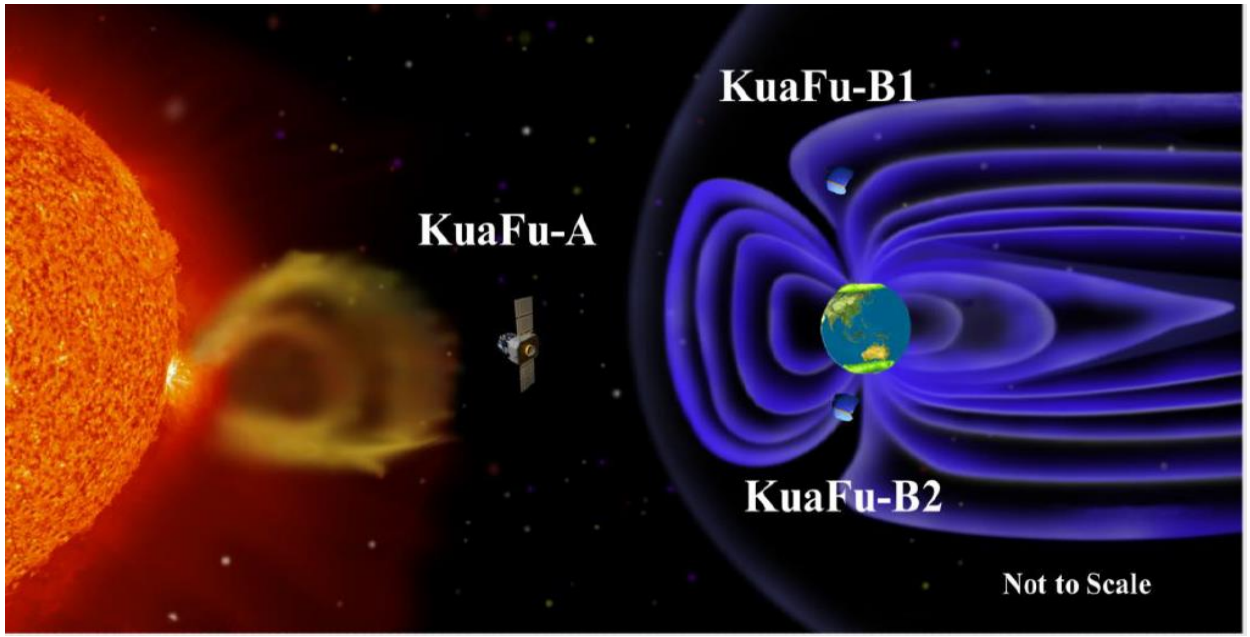
As the outermost layers of the solar atmosphere, the corona extends to distance of several sun radius from the top transition region. Some complex dynamical processes happened in the solar corona, including matter ejection, solar wind acceleration, plasma heating and magnetic reconnection.

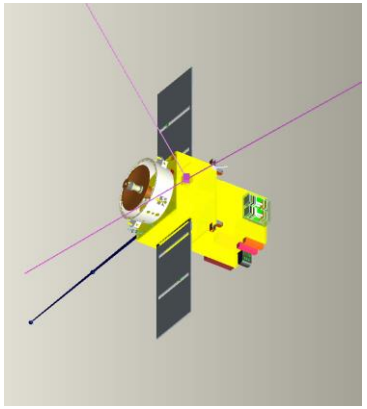
- To discover more delicate physical processes happened inside the solar corona, some Chinese instruments have been developed to record corona phenomena at high accuracy for space observations.
- One is a Lyman-alpha coronagraph using total reflection design for a future solar observation satellite on near earth orbit.
- Another one is a white light coronagraph for a future solar observation satellite on L5 point





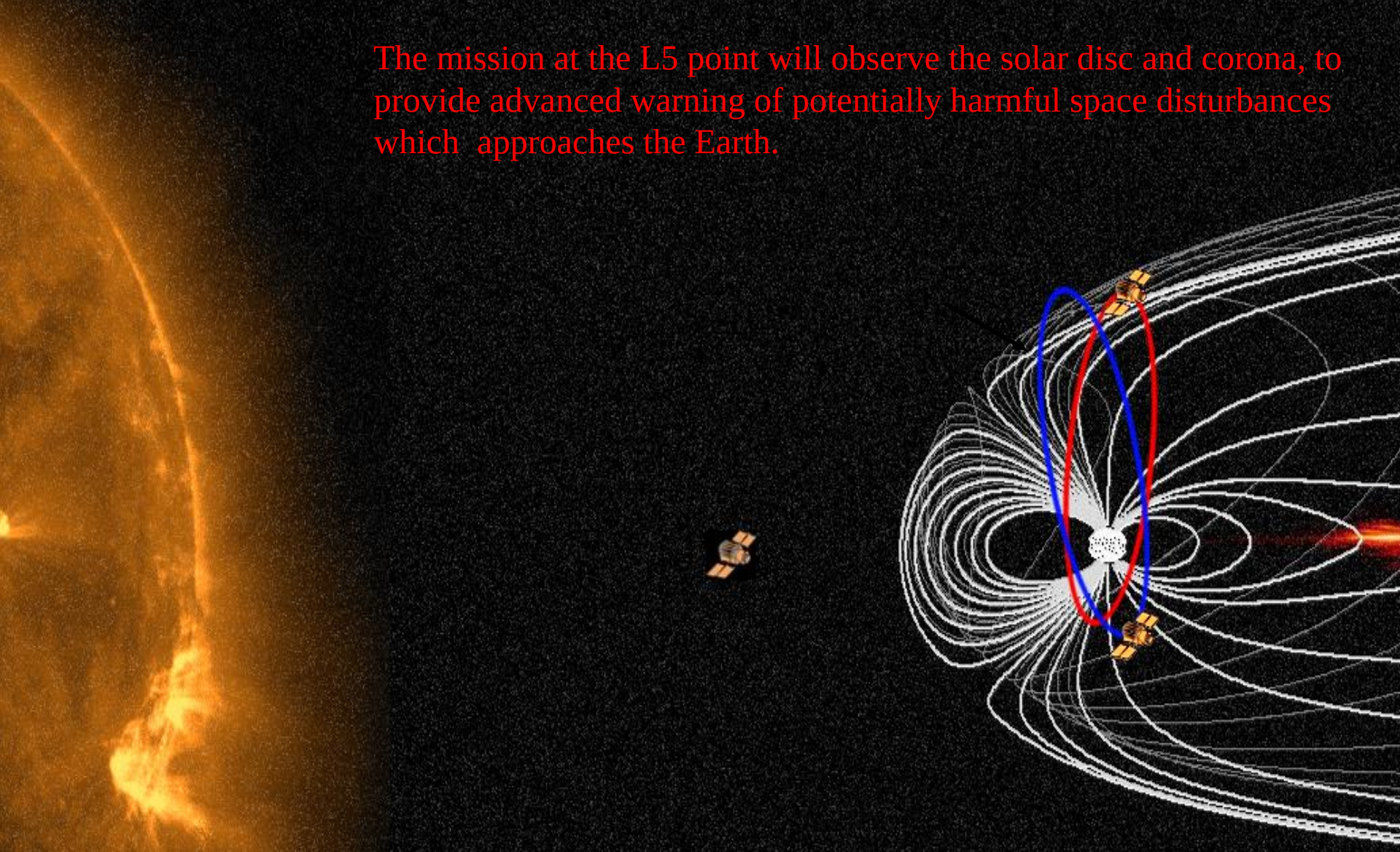
Kuafu plan





- The original three-satellite configuration in collaboration between Chinese Academy of Sciences and ESA is changed.
- Future mission may be placed at L5 point, instead of L1 point.
- Kuafu A satellite : 3-axis stabilized satellite

The mission at the L5 point will observe the solar disc and corona, to provide advanced warning of potentially harmful space disturbances which approaches the Earth.



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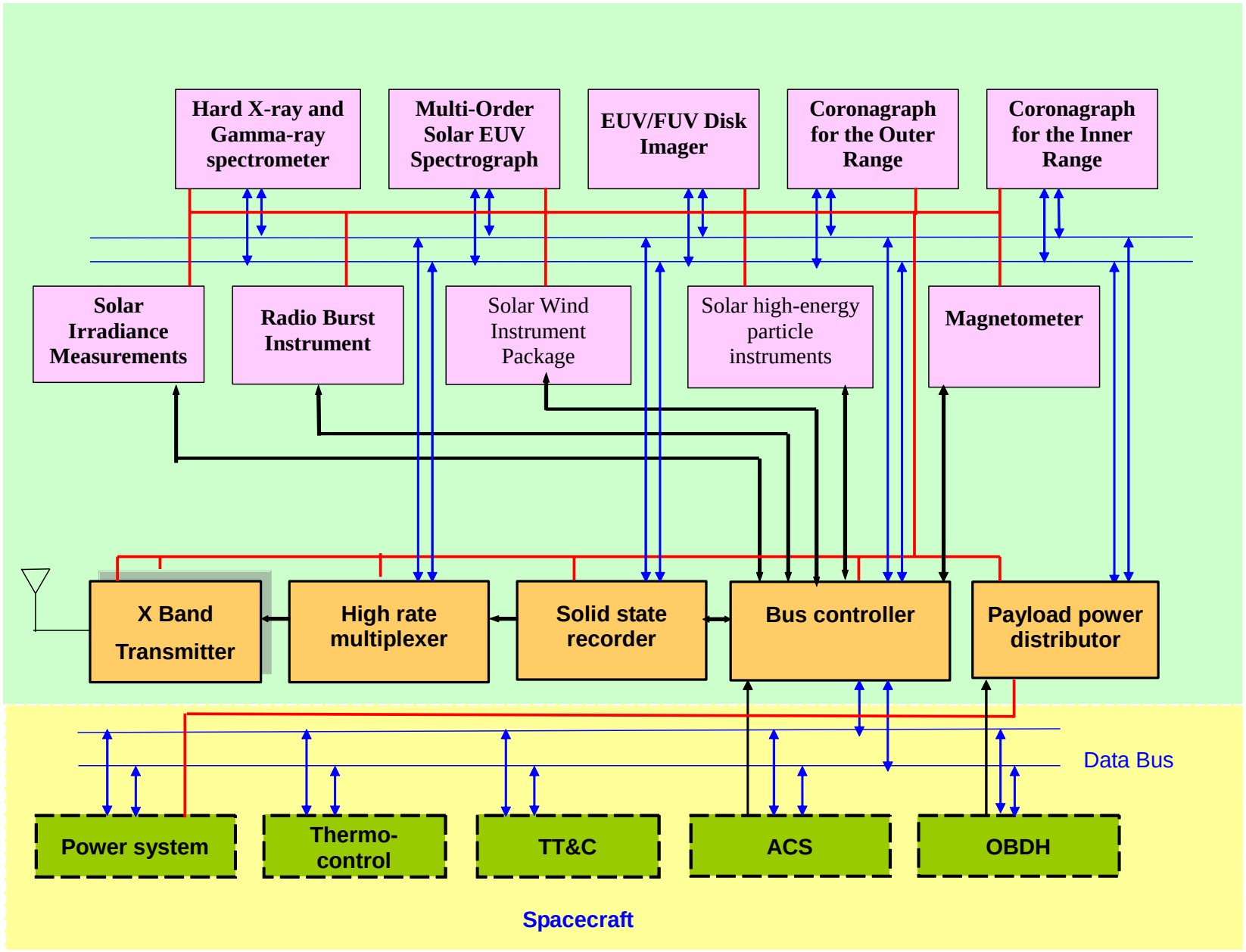
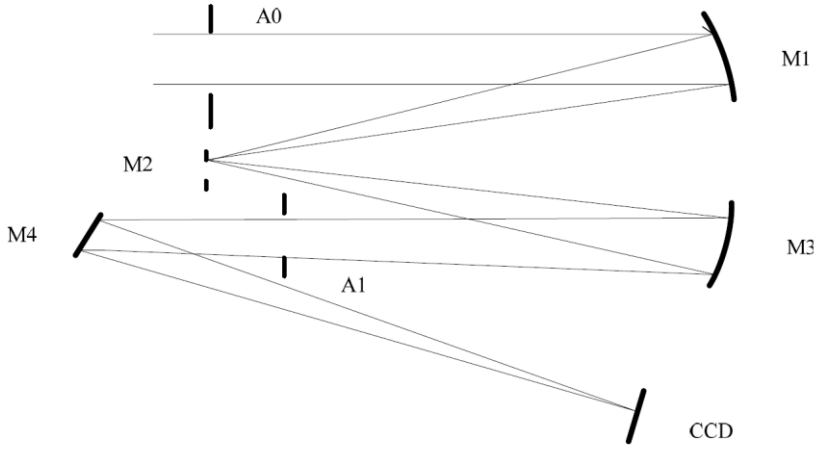

Hard X-ray and Gamma-ray spectrometer
Multi-Order Solar EUV Spectrograph
EUV/FUV Disk Imager
Coronagraph for the Outer Range
Coronagraph for the Inner Range
Solar Irradiance Measurements
Radio Burst Instrument
Solar Wind Instrument Package
Solar high-energy particle instruments
Magnetometer
X Band Transmitter
High rate multiplexer
Solid state recorder
Bus controller
Payload power distributor
Data Bus
Power system
Thermo-control
TT&C
ACS
OBDH
Spacecraft

Lyman-alpha coronagraph

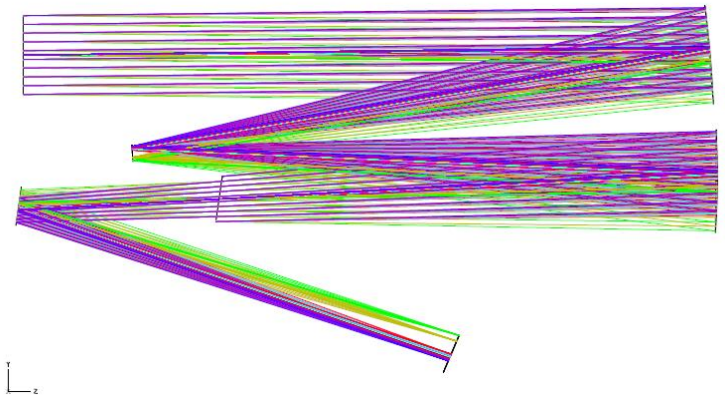
Brightness of the corona is very weak. It is not easy to handle instrument pupil edge diffraction and scattering caused by primary mirror in coronagraph design.
Lyman - Alpha radiation is the main components of the chromospheres spectrum.

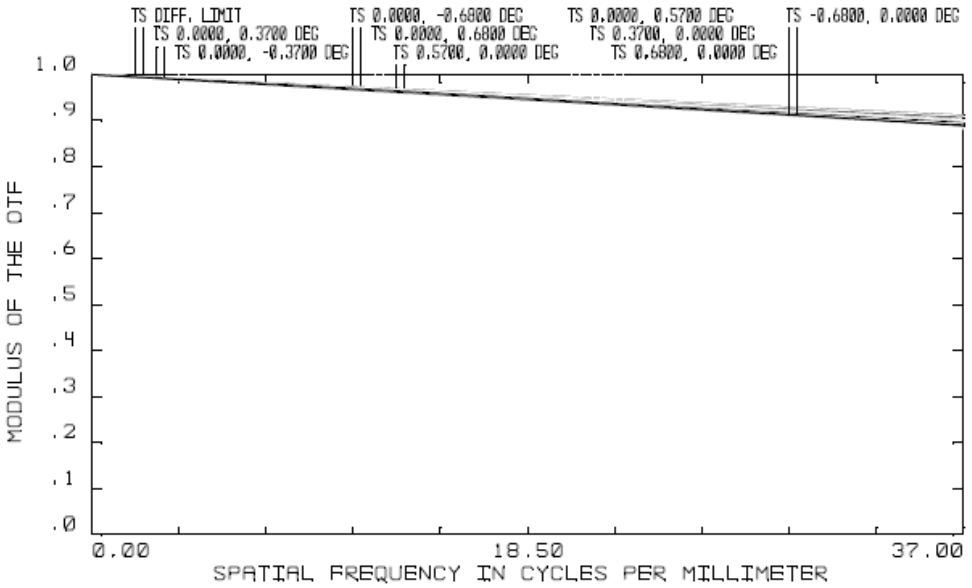
Field	$1.1\sim2.5R_{\odot}$
Wavelength	121.6nm
Resolution	9.4″
Entrance pupil	40mm
$F^{\#}$	14.75



Lyman-alpha coronagraph Total reflection design

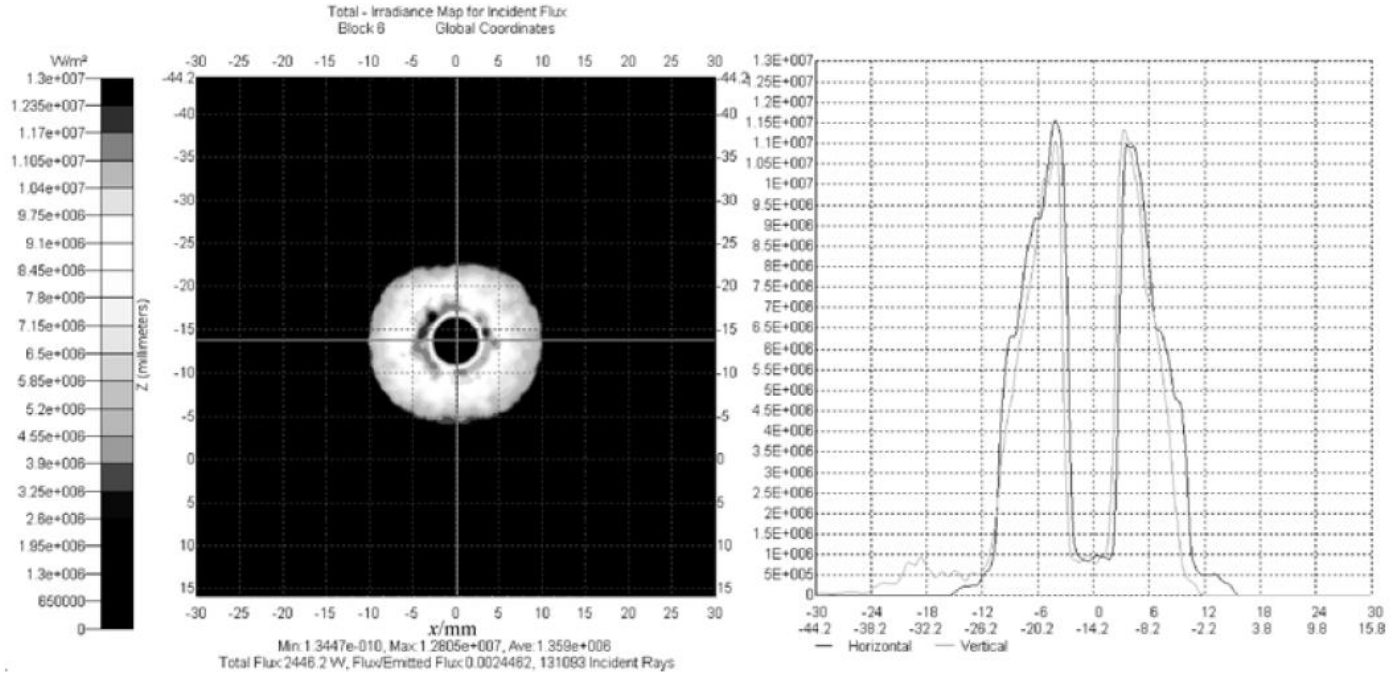
A reflection Lyman alpha coronagraph which diameter is 40 mm with focal length is 590 mm has been designed.





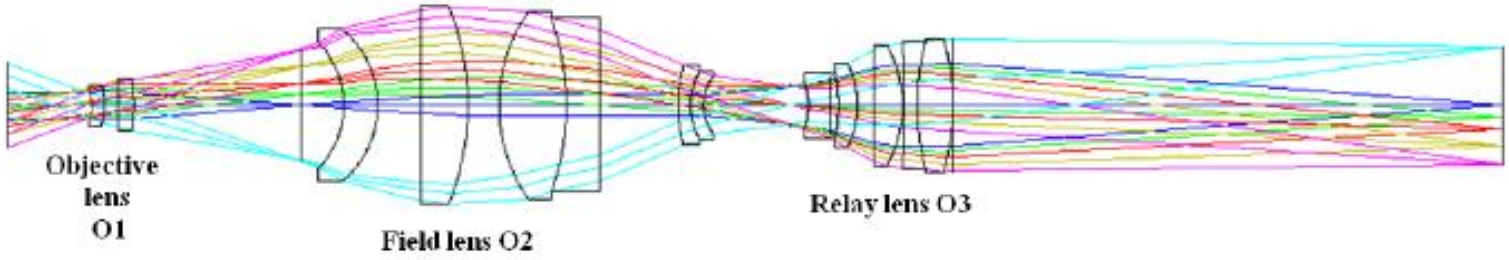
Comment	Radius /mm	Thickness /mm	Decenter /mm	Tilt/(°)
〈Entrance pupil〉	—	500	0	0
M_1	900.00	−448.00	Y:−35.0	0
M_2	−500.00	511.30	Y:−10.0	0
M_3	−580.00	−552.56	Y:18.05	0
M_4	Infinity	118.78	Y:2.50	X:45

Lyman-alpha coronagraph Simulation results



Incident angle of ray: 0 deg
Ray number: 200 million
Engergy of each ray: 1 W
Image energy: 2446 W

White light coronagraph optical system design

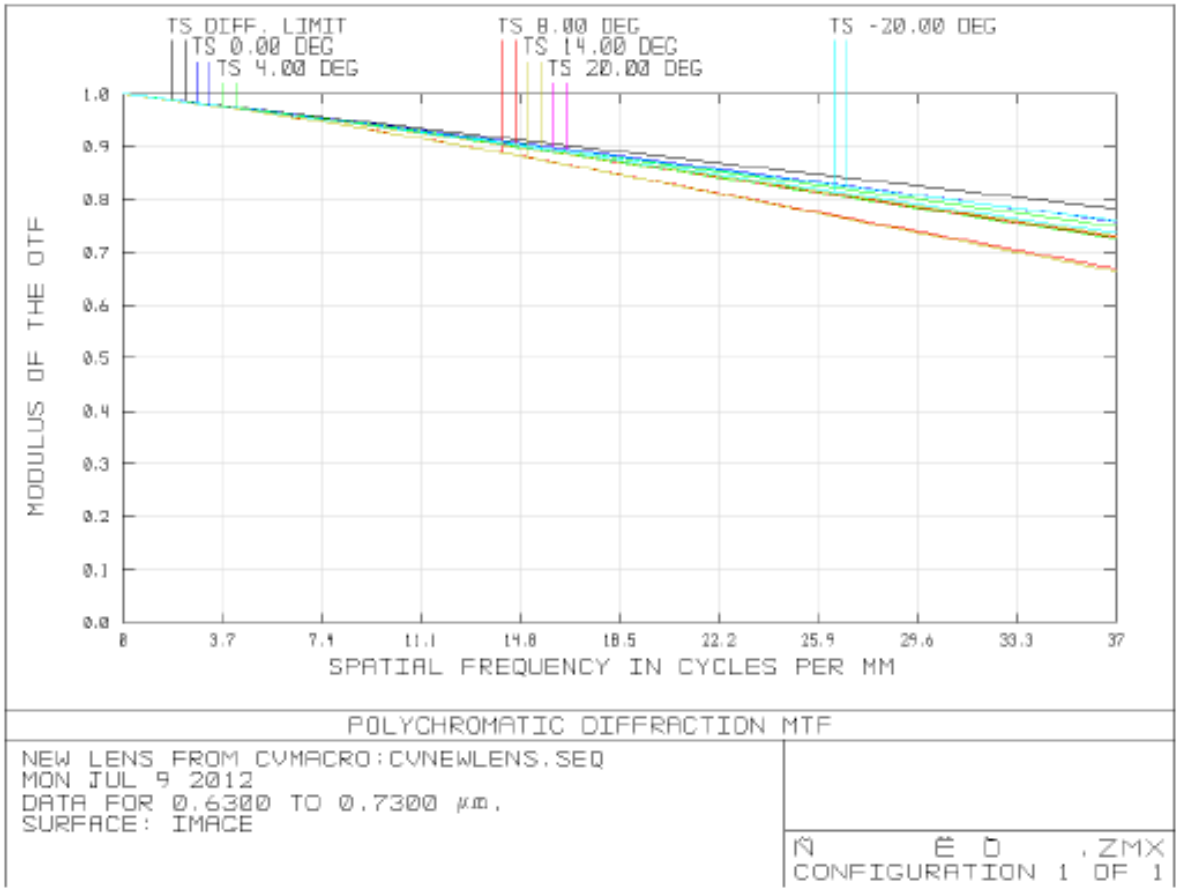


The white light coronagraph includes 13 lens.
O1: Imaging the corona at the field stop
O2: Establish collimation of the light
O3: Imaging of the corona at the detector

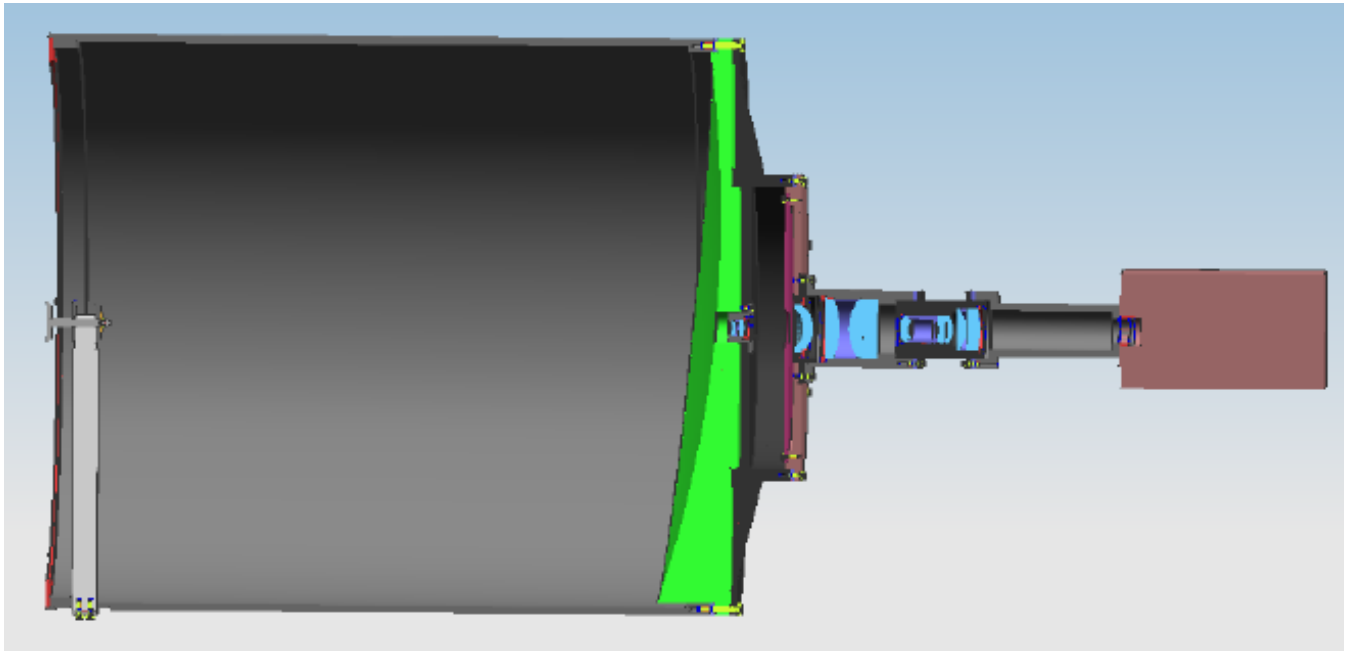
Field of view Sun centered	±20 deg
Pixel resolution	1.2 arcmin
Wavelength scope	630nm – 730 nm

Sun-Instrument distance	Field of view Sun centered
1 AU	72 R⊙
3 AU	215 R⊙

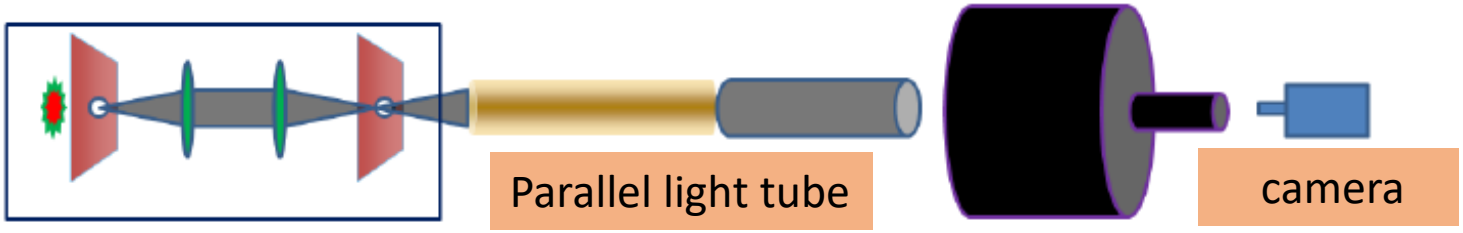
White light coronagraph transfer function

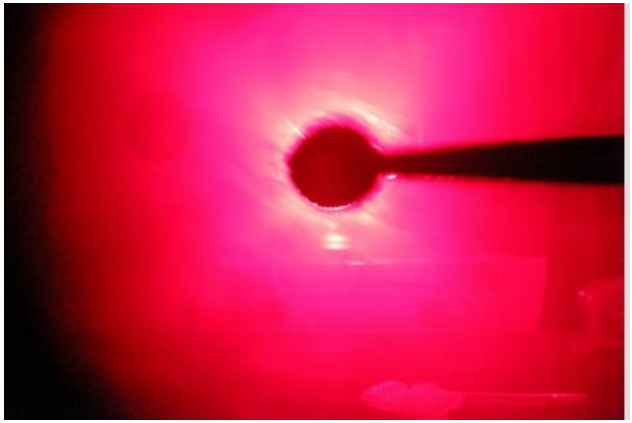


White light coronagraph
Sensor assembly



White light coronagraph Experiment





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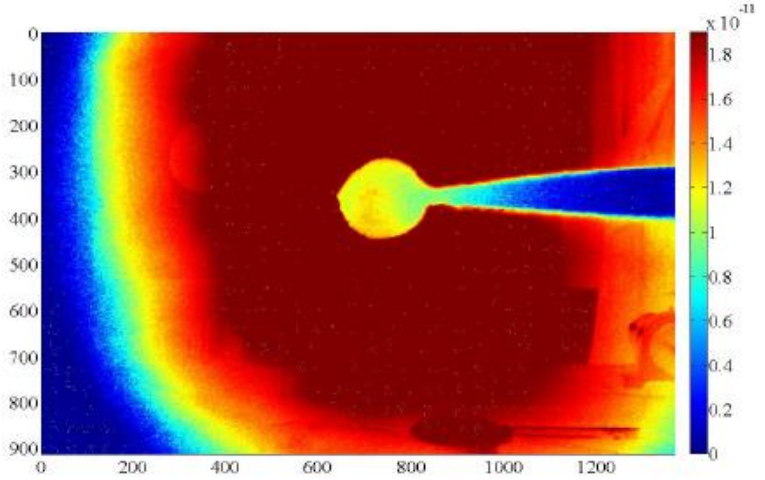

Stray light

Summary

Prephase A work.

Strong needs from the science side or the application side seems still open.

How to tell a story of why it is necessary?

Who needs the data?

Why they needs the data?

Future: Observation of corona and solar irradiance at L1 or L5

Thank you.