

PROBA2/SWAP & LYRA

NEW INSTRUMENTS FOR SPACE WEATHER MONITORING

Anik De Groof & PROBA2 Science Center team
ESA c/o Royal Observatory of Belgium

7th European Space Weather Week ☀ Brugge ☀ Nov 15-19, 2010





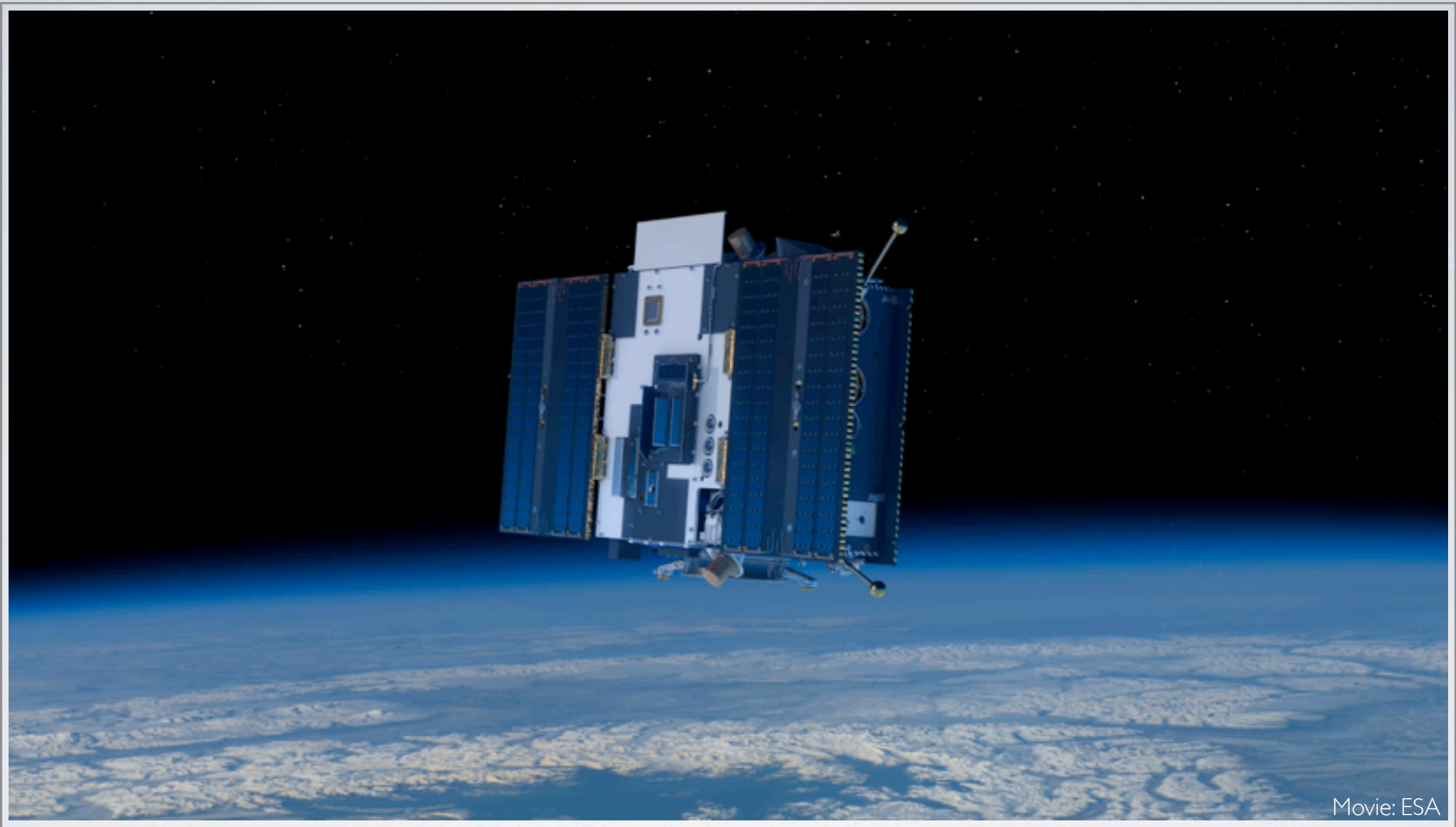
Movie: ESA

PROBA2

Project for **O**n-**B**oard **A**utonomy
Launched on Nov. 2, 2009

Microsatellite in sun-synchronous orbit ☀ 725 km altitude





ESA TECHNOLOGY & SCIENCE

4 innovative instruments - 17 technological experiments
SWAP and LYRA observe the Sun in EUV and XUV
nominal operations since March 2010



Redu, Belgium



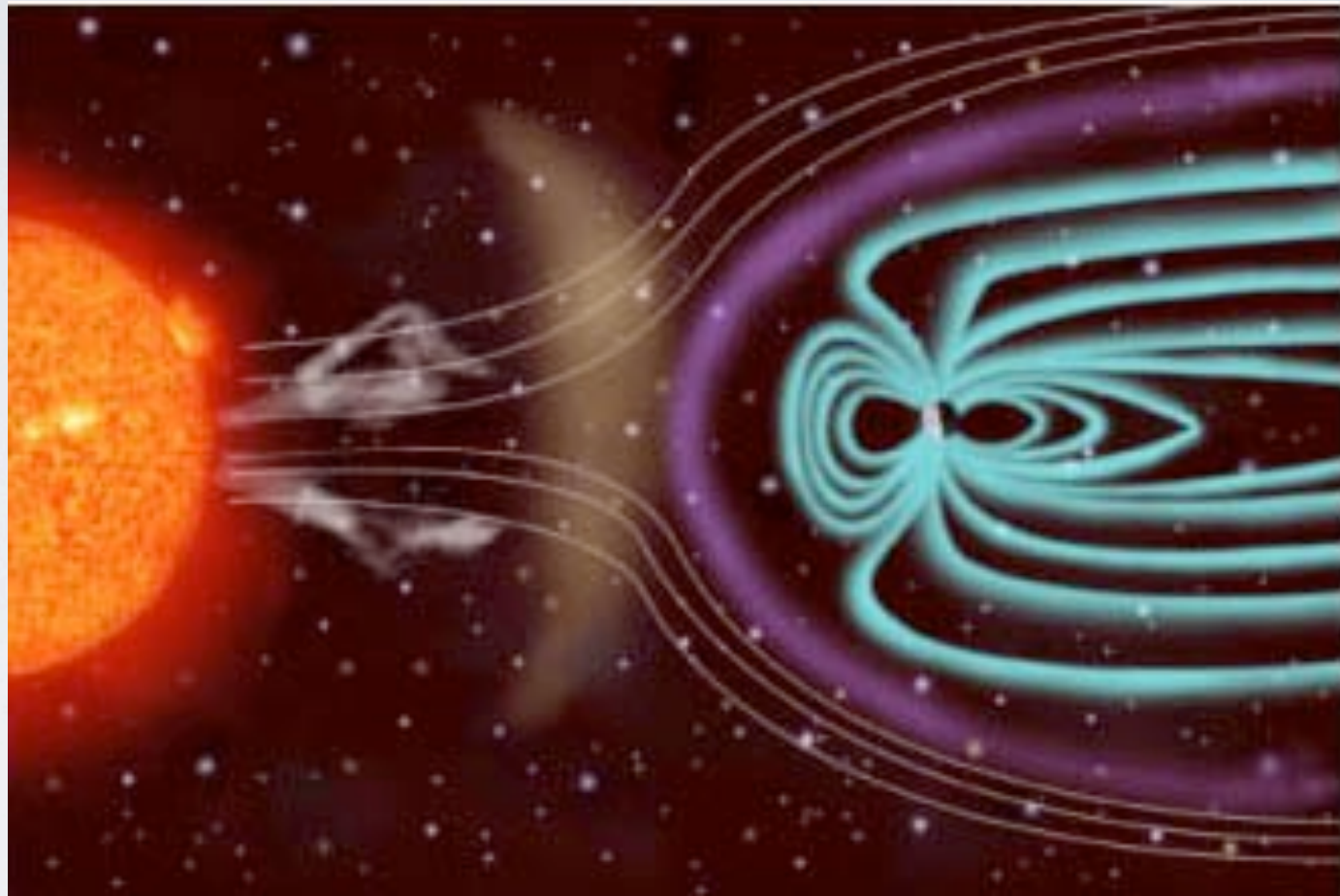
Royal Observatory of Belgium, Brussels

PROBA2 SCIENCE CENTER

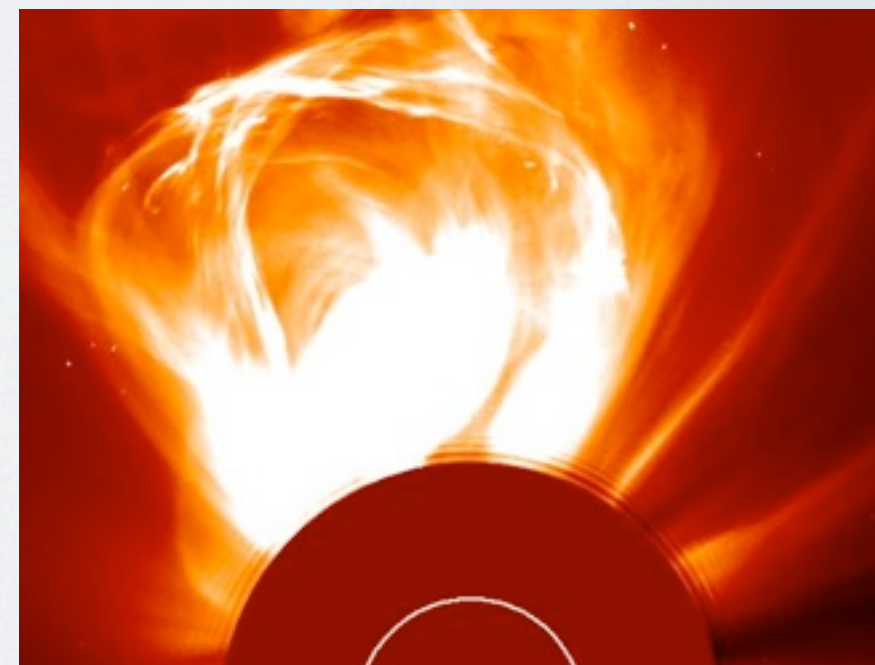
Instrument commanding & automatic data processing at ROB
~9 contacts per day over Redu (MOC) & Svalbard
near realtime data + **flexibility!**

SPACE WEATHER KEY PLAYERS

Solar wind

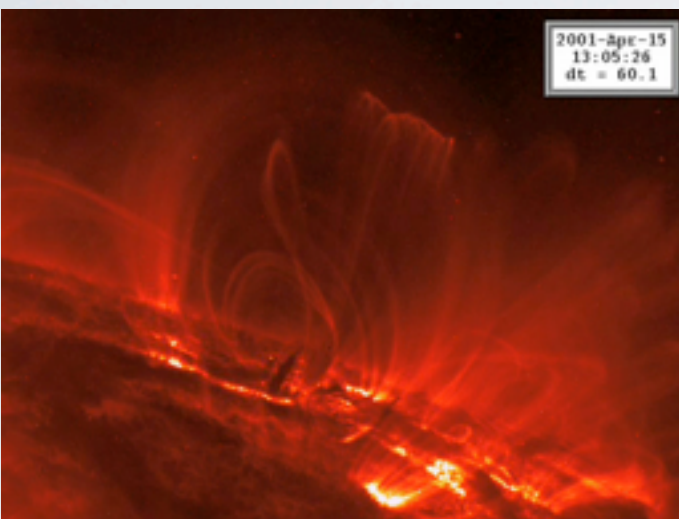


CMEs

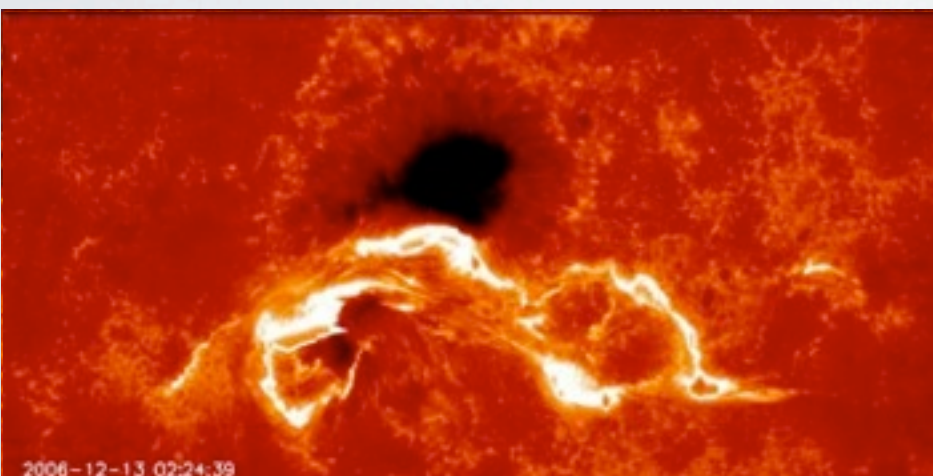


SOHO

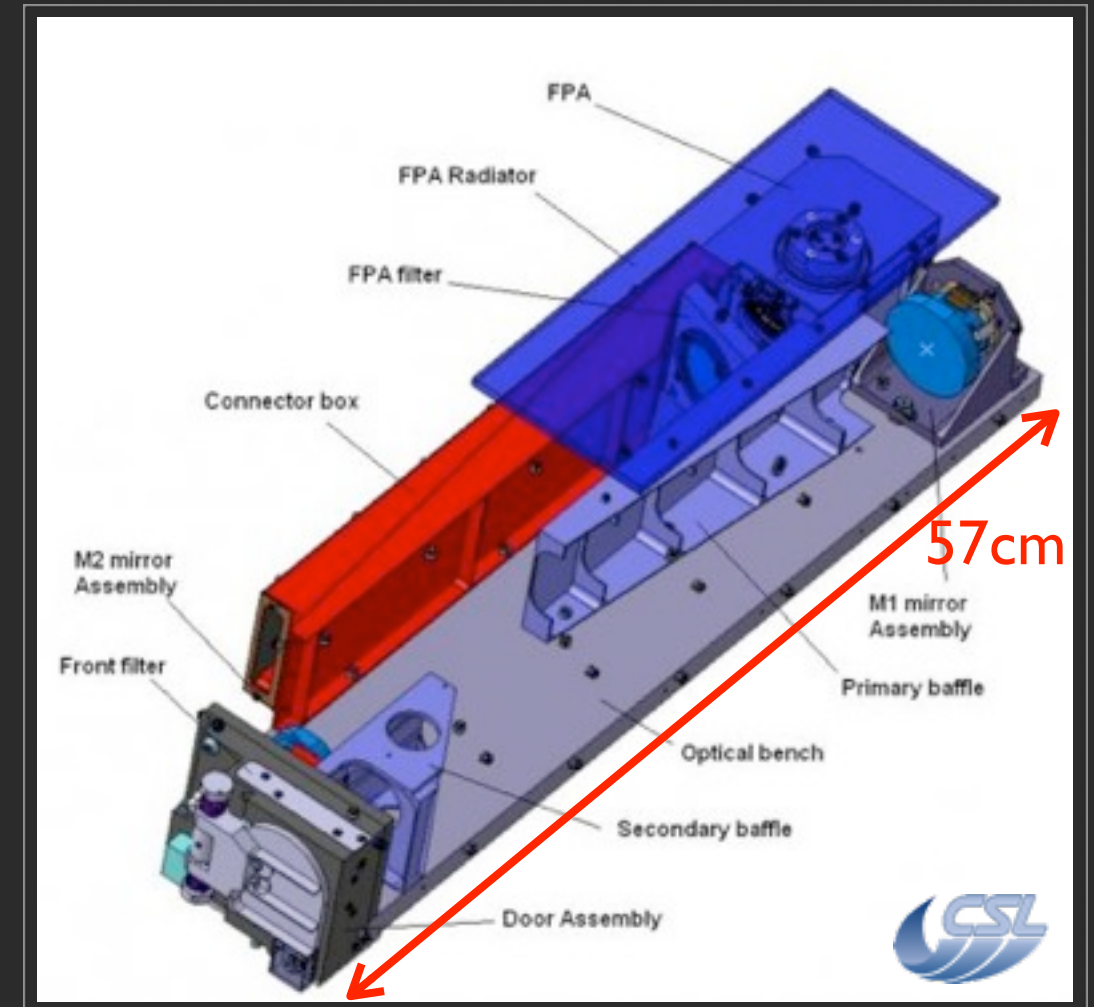
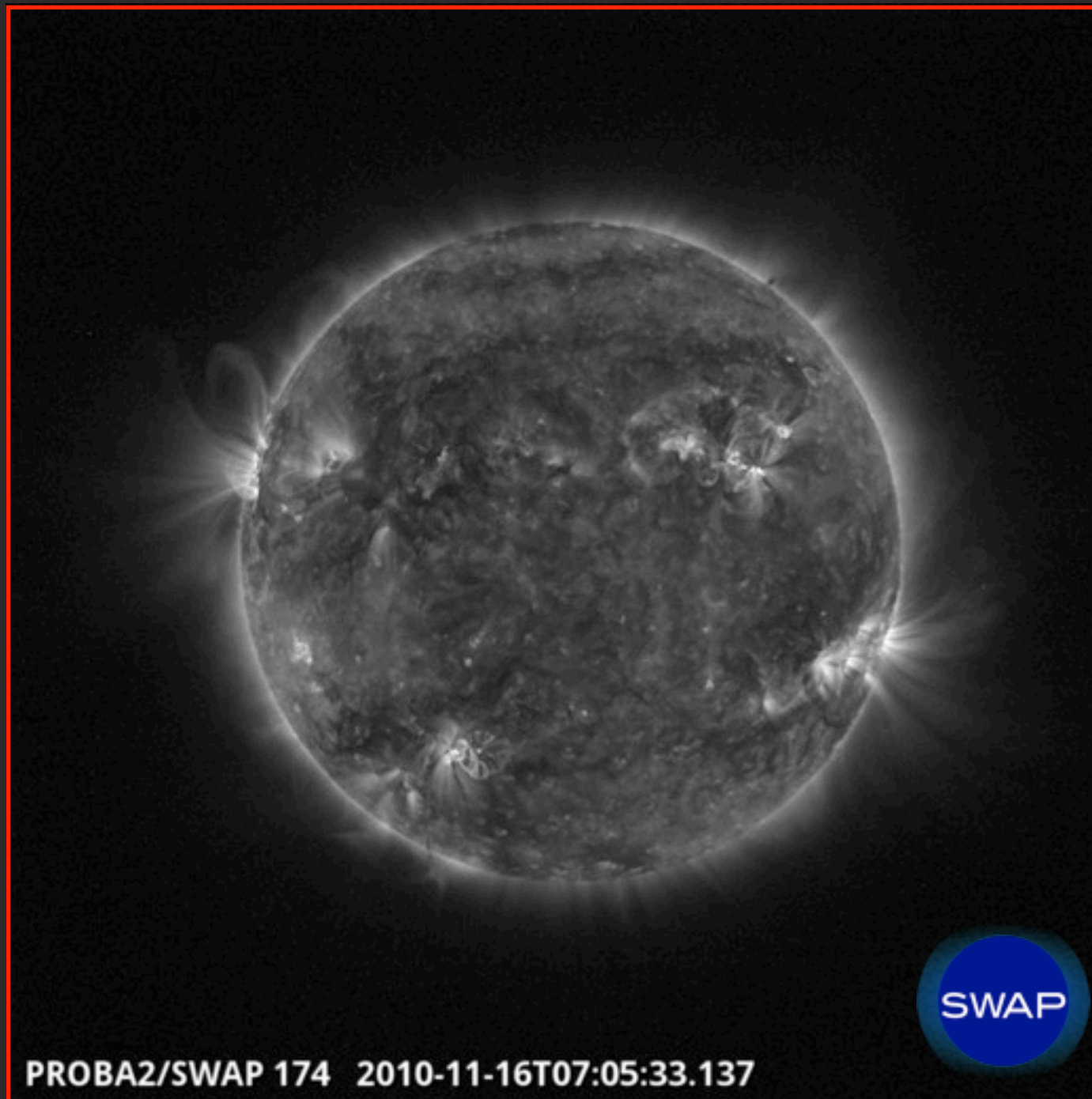
Solar flares



TRACE



Hinode

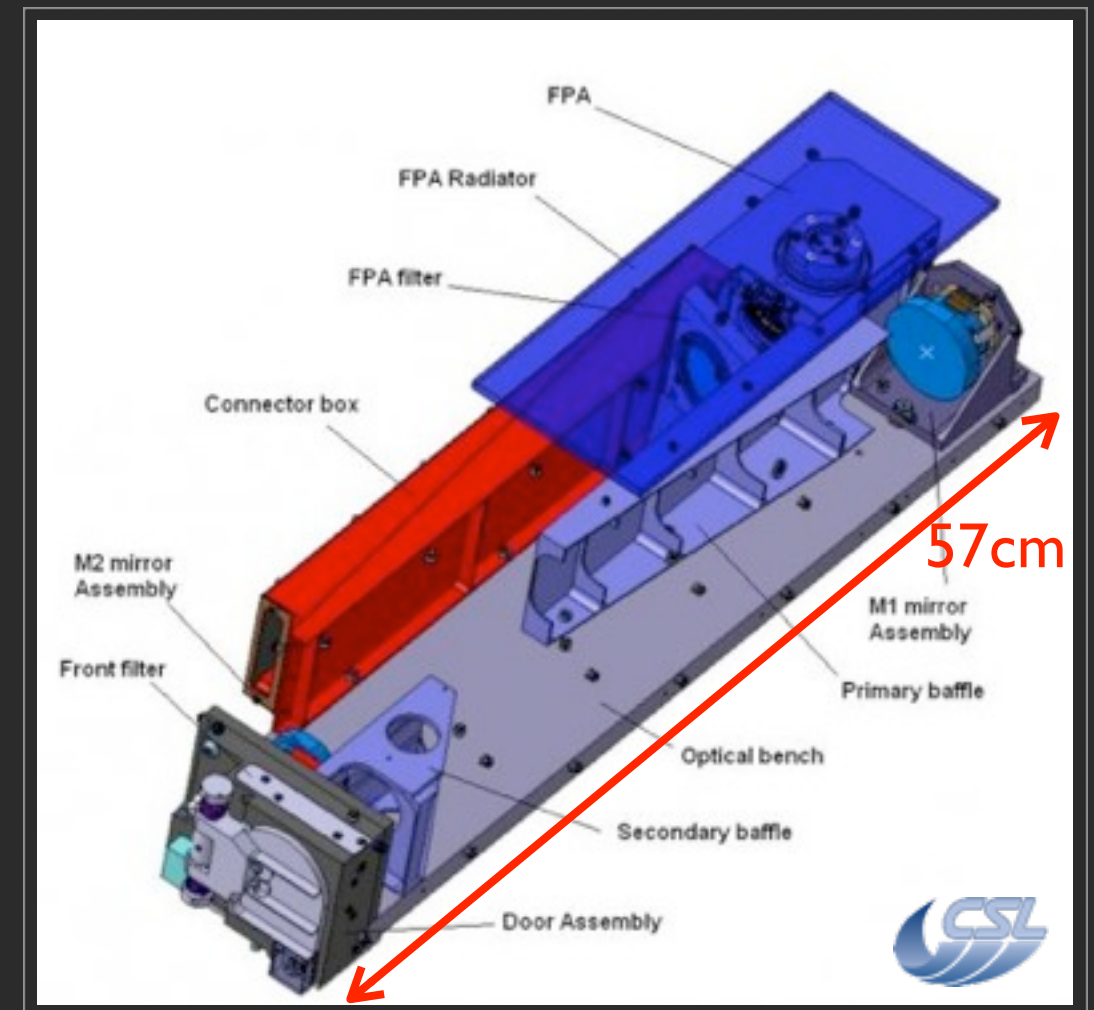
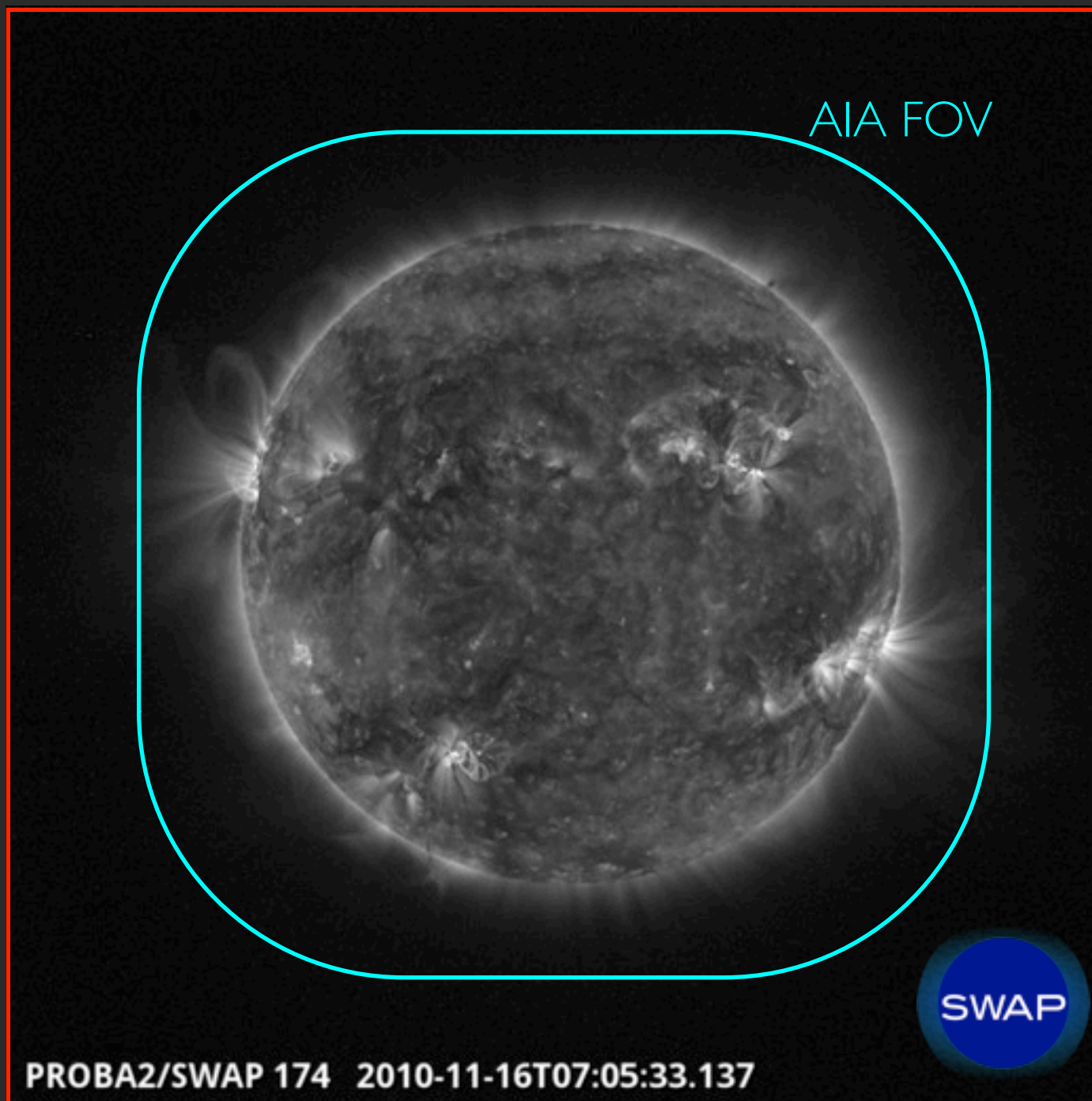


Exercise in miniaturization:
off-axis Ritchey-Chrétien scheme

SWAP EUV IMAGER

1 million° corona in EUV 17.4nm ☼ 1-2mins cadence (upto 30s)

large FOV ☼ 1Kx1K CMOS APS

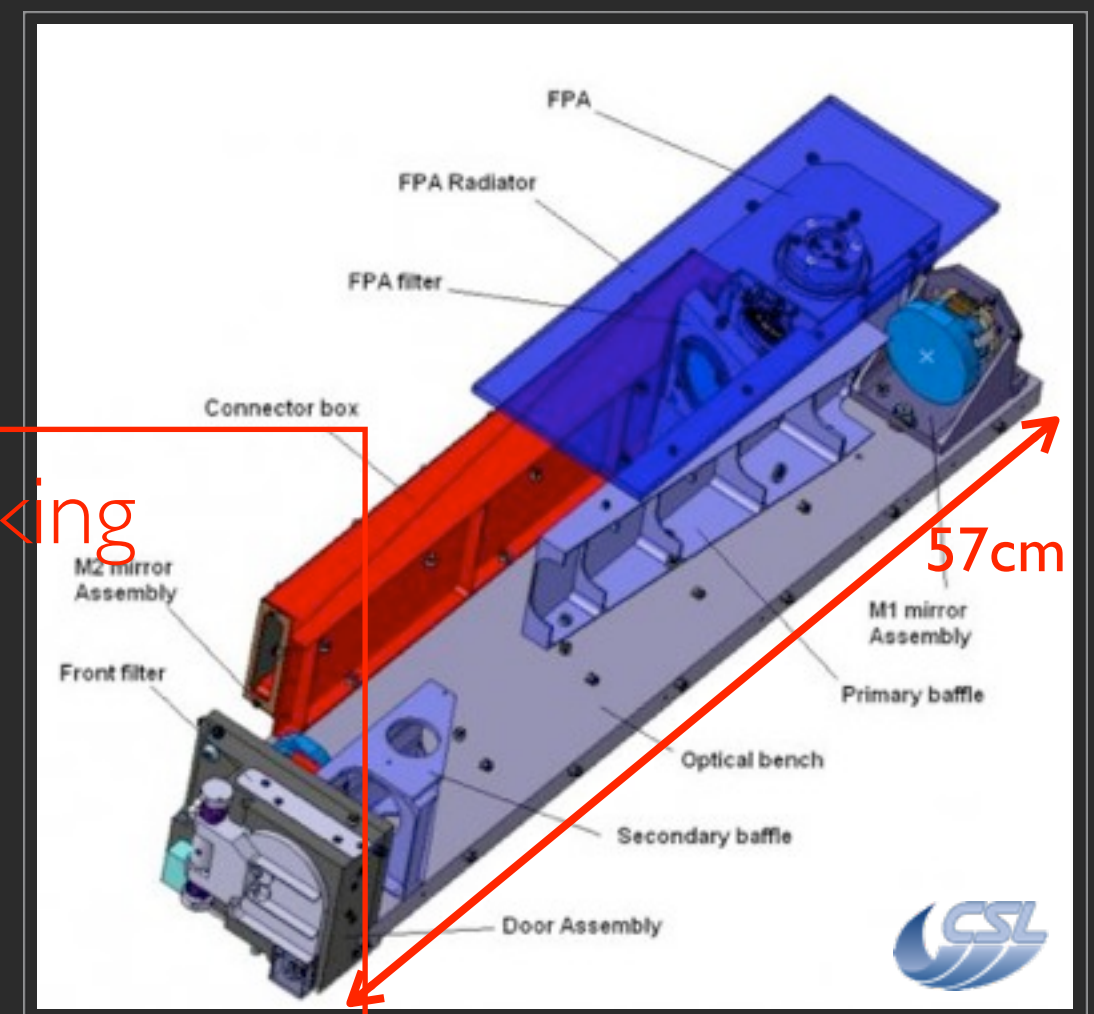
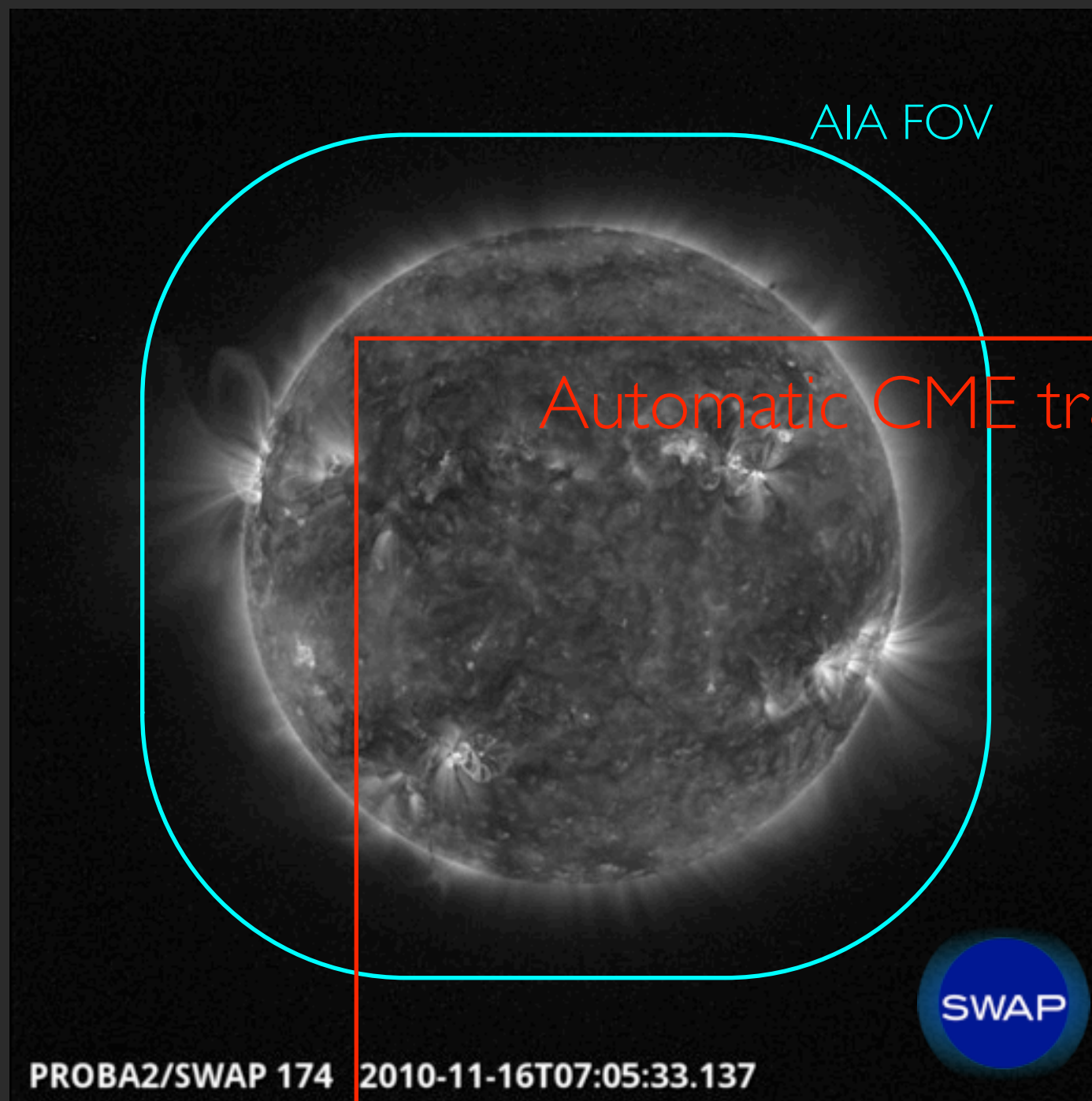


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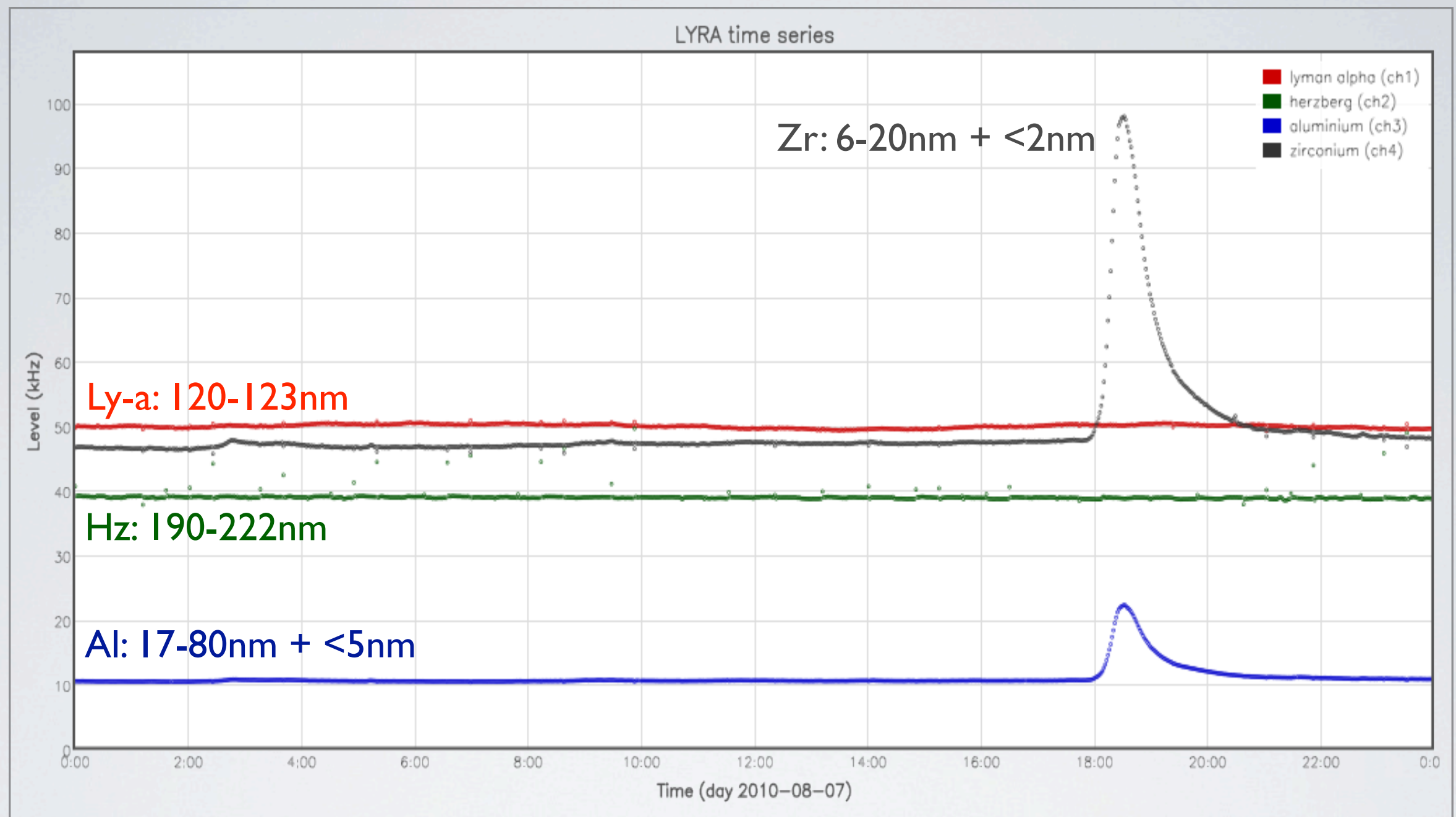


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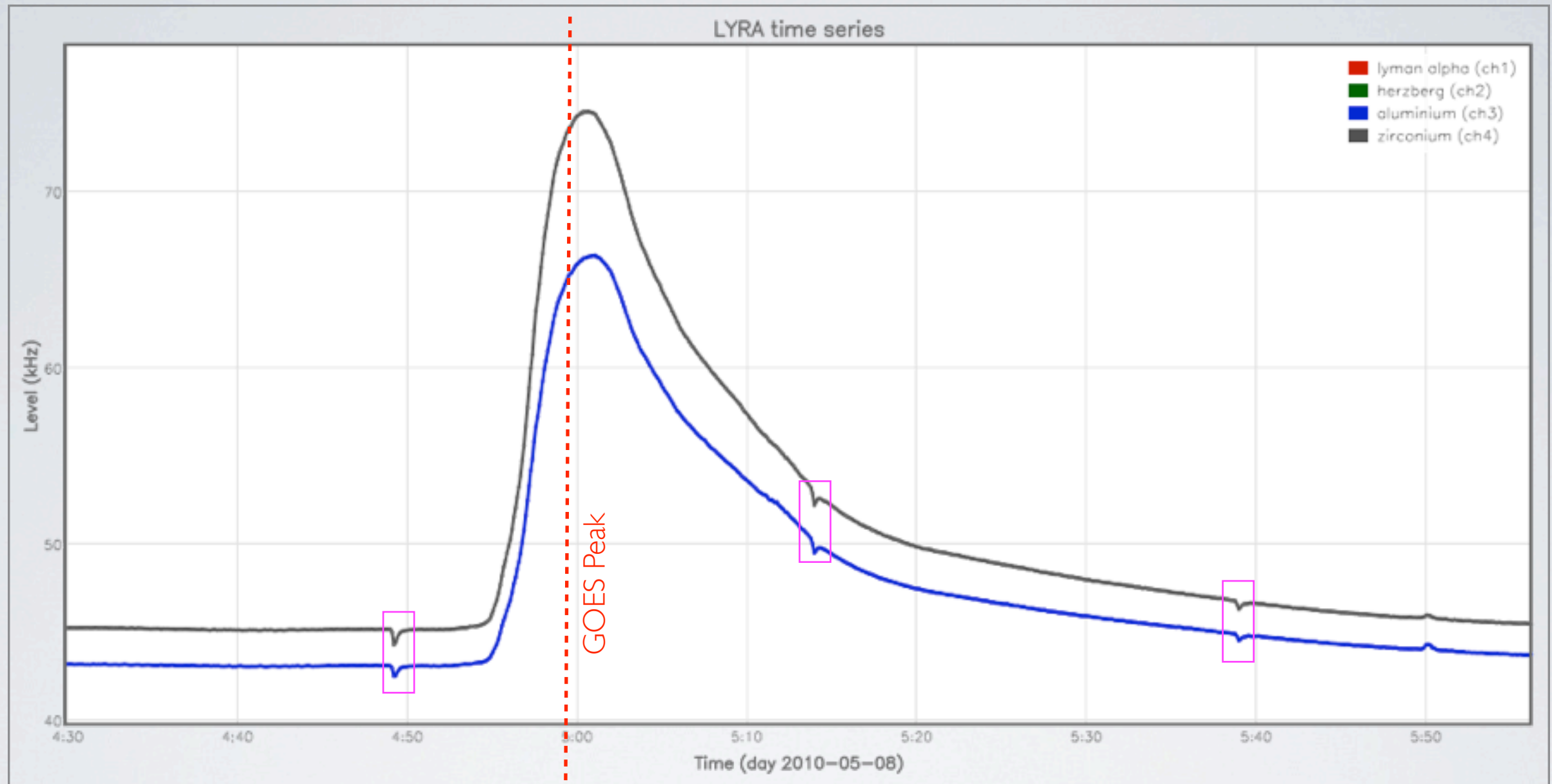
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LYRA RADIOMETER

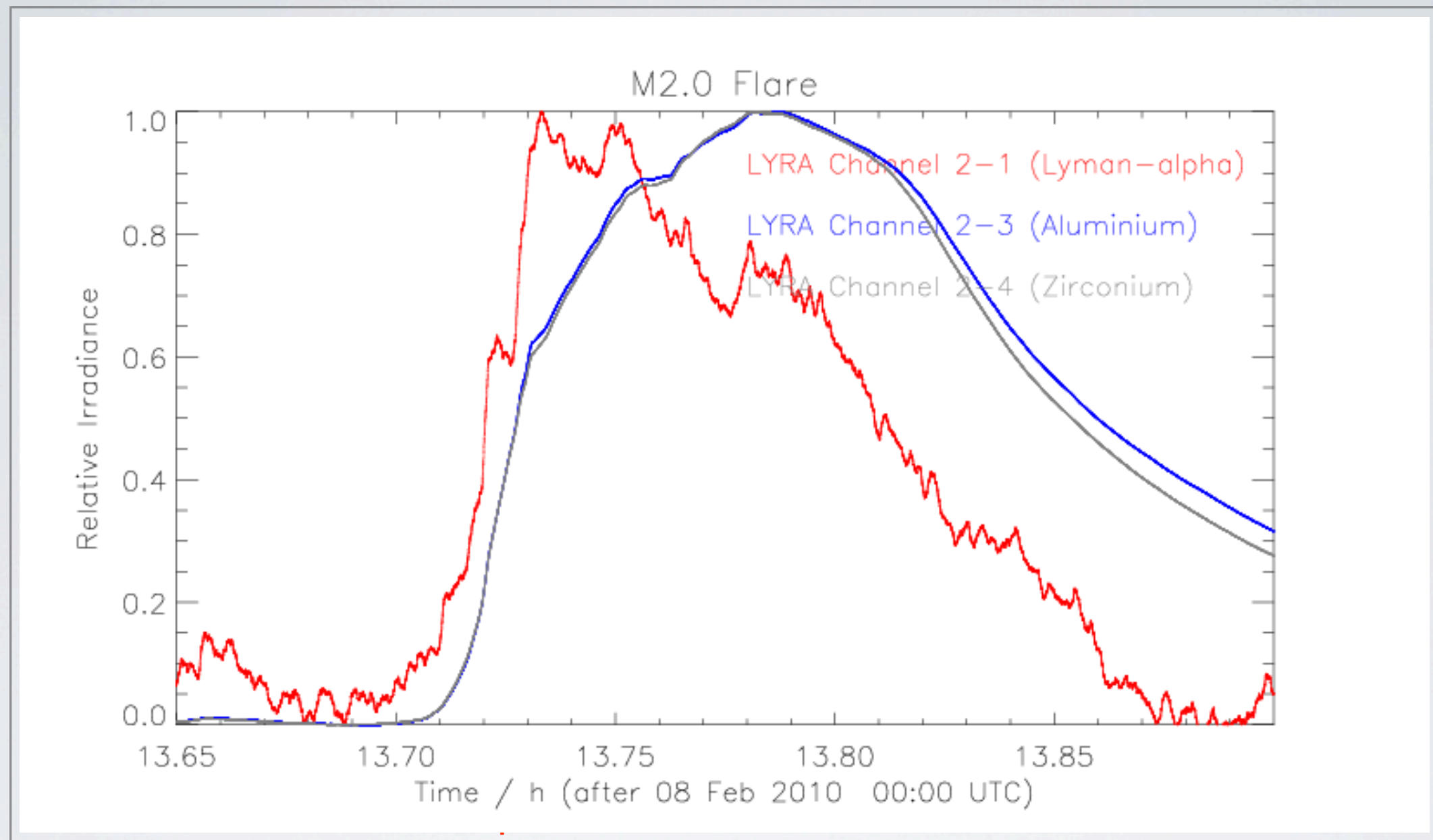
3 instrument units - 4 spectral channels per head
3 types of detectors: diamond PIN/MSM & silicon
high cadence up to 100Hz

SOLAR FLARES



LYRA senses all flares in Zr & Al up to **10ms resolution**
Good correlation to GOES flares with **better temporal resolution**
Different onset & peak times in different pass bands

SOLAR FLARES



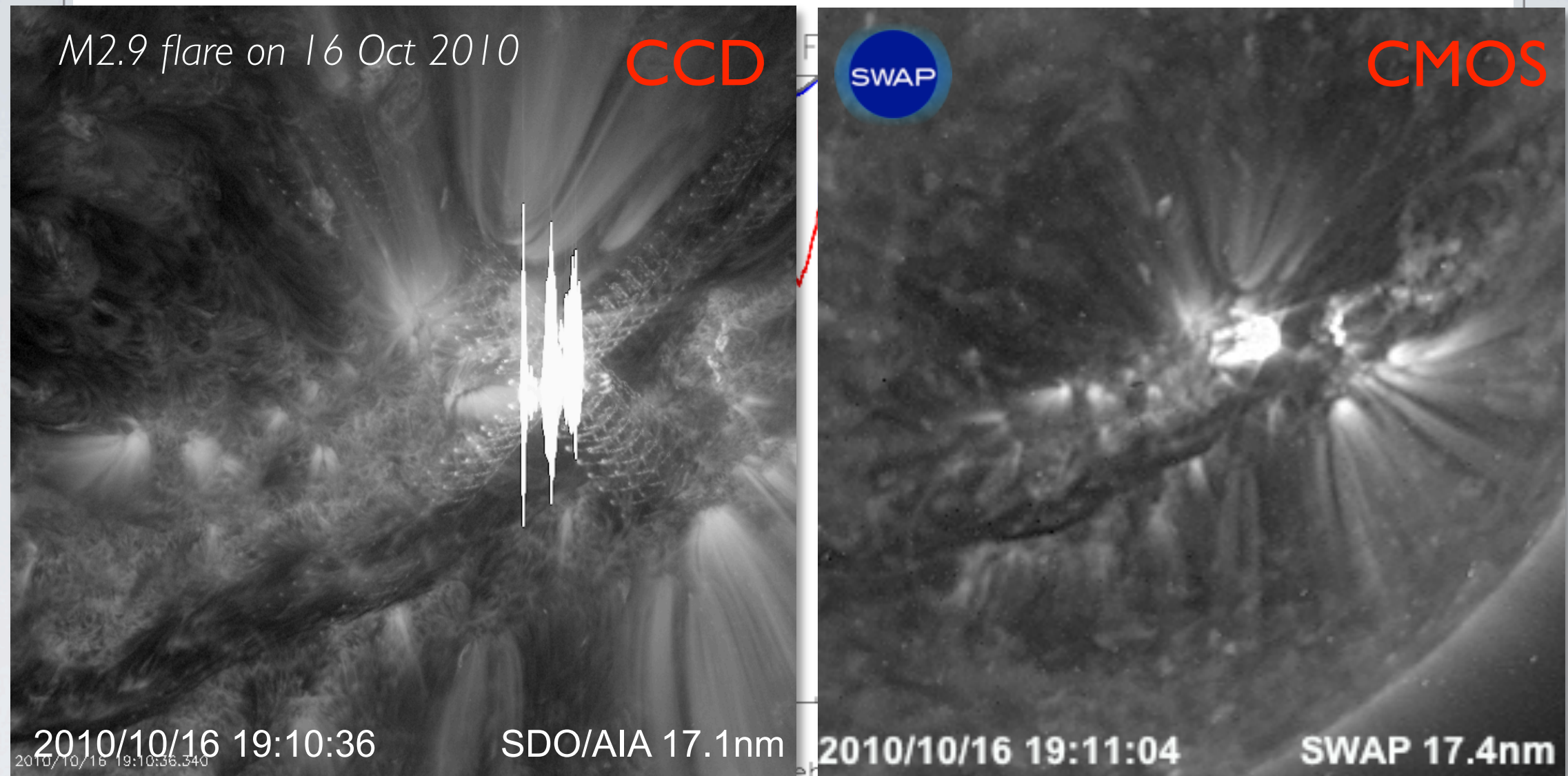
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Ly- α contribution for impulsive flares

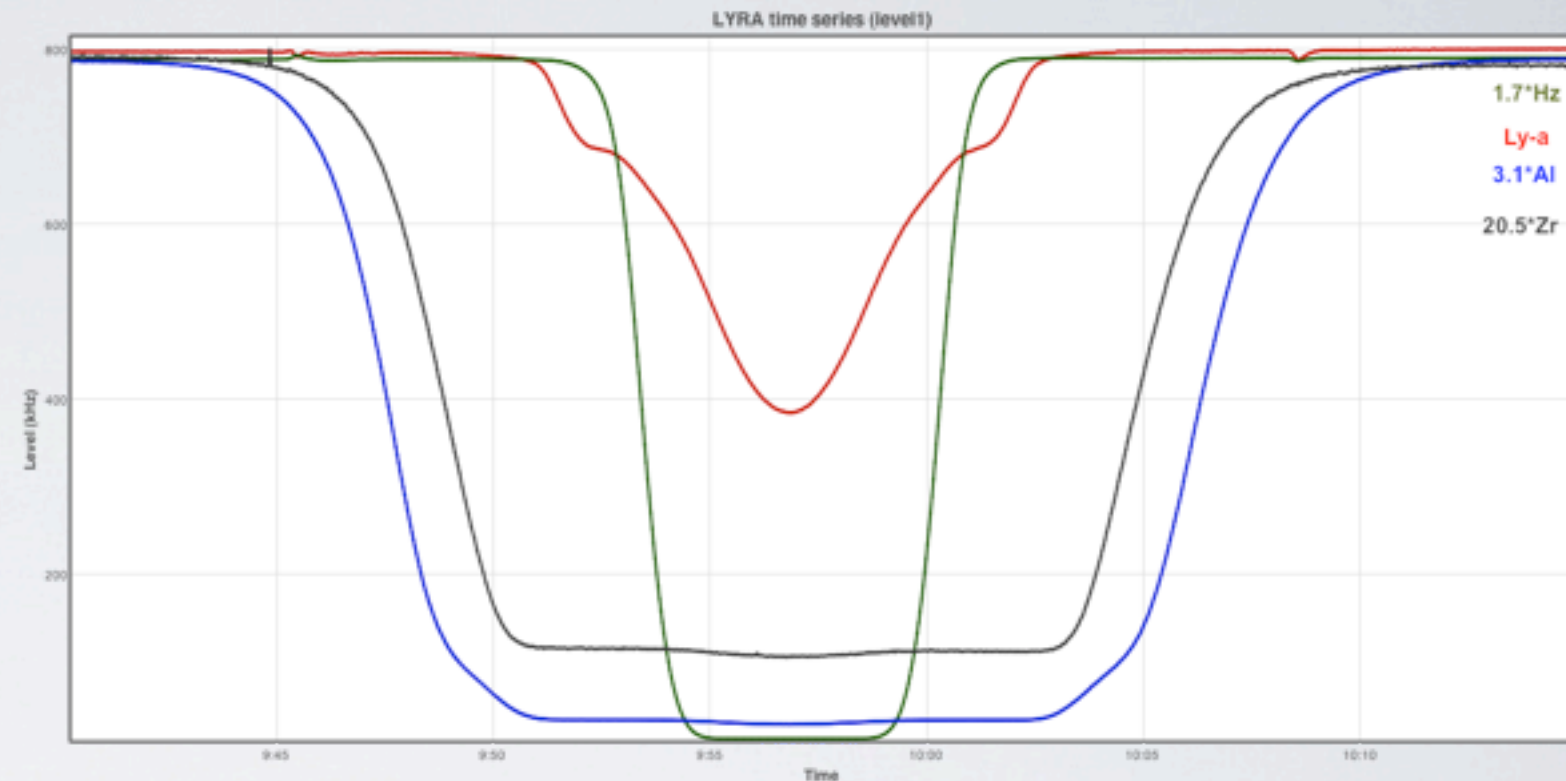
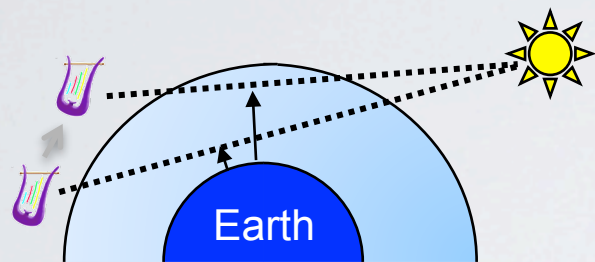
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LYRA DURING ECLIPSES

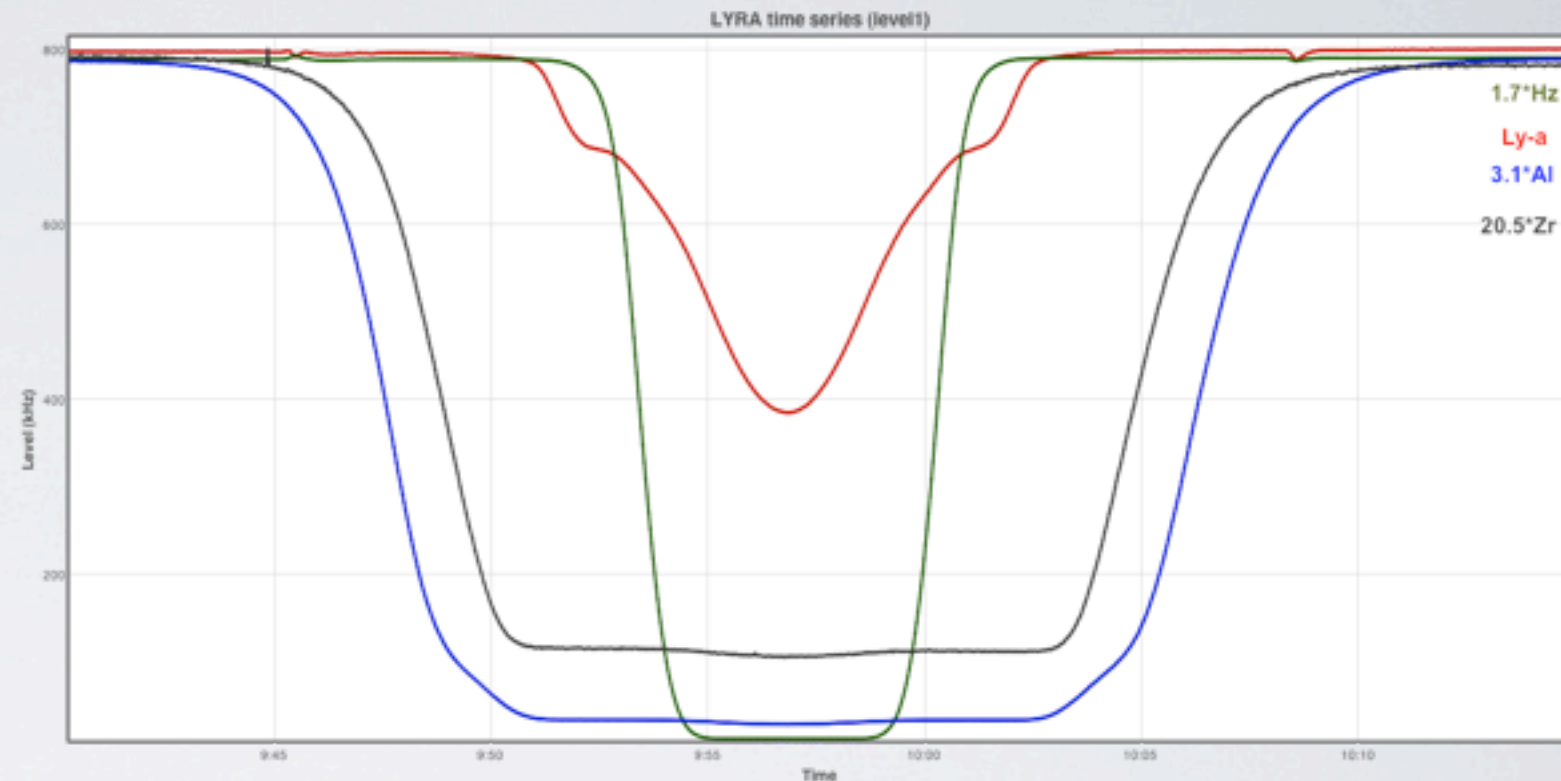
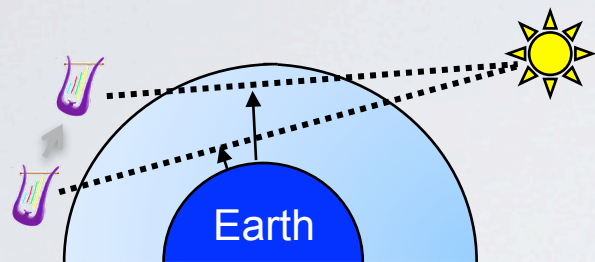
- > eclipse occultations by Earth's atmosphere
 - atmospheric layers are scanned



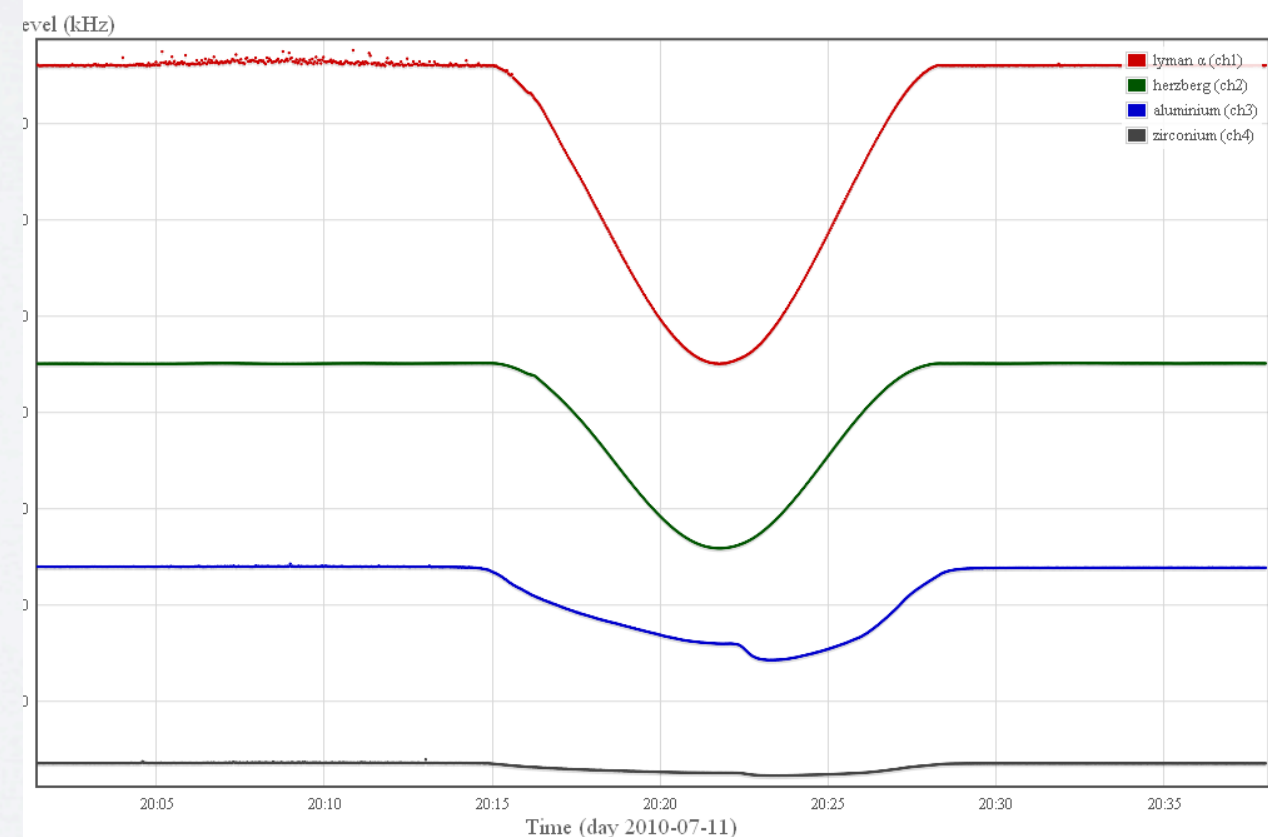
- > sun-moon eclipses
 - sources of irradiance

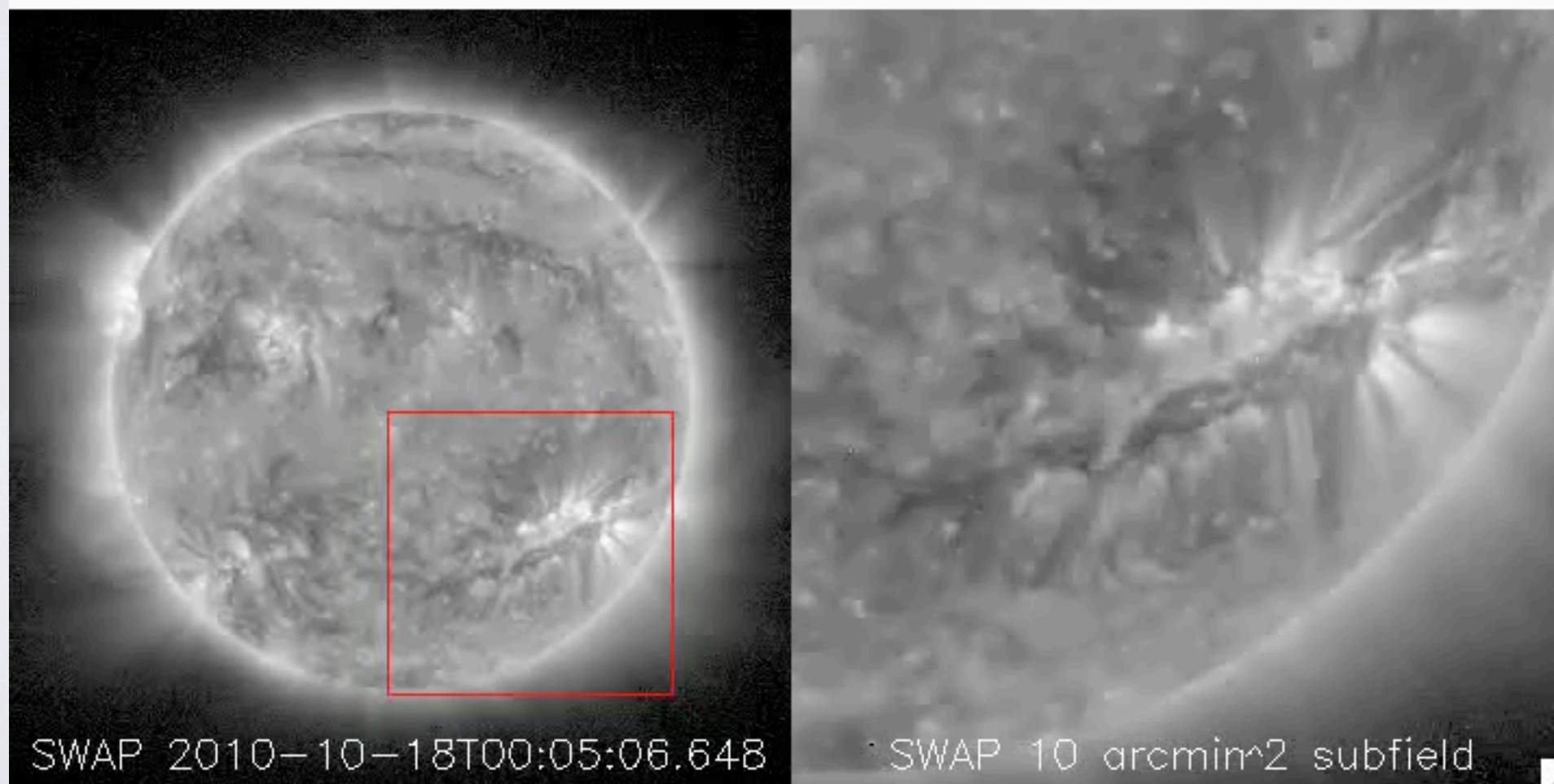
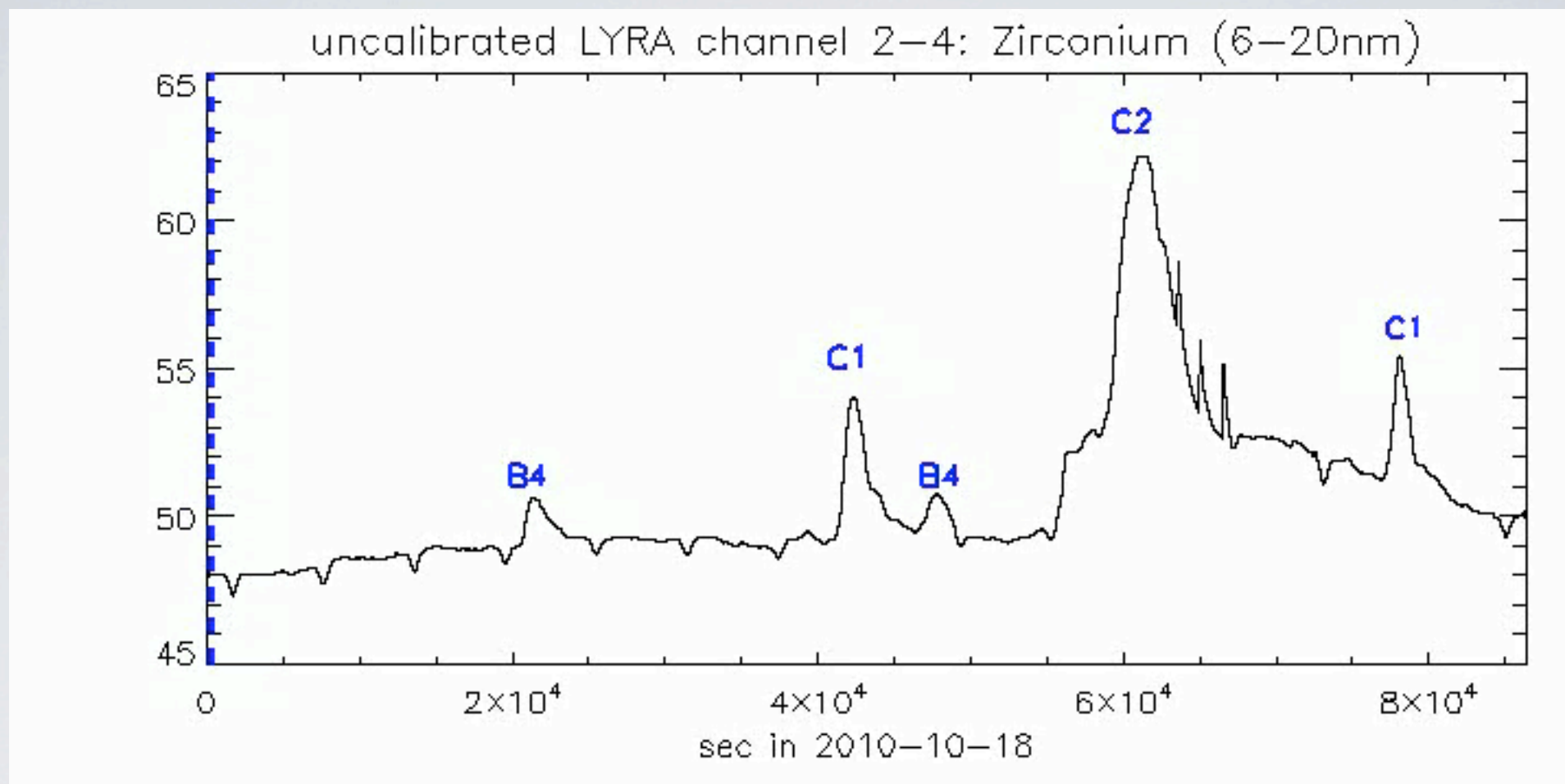
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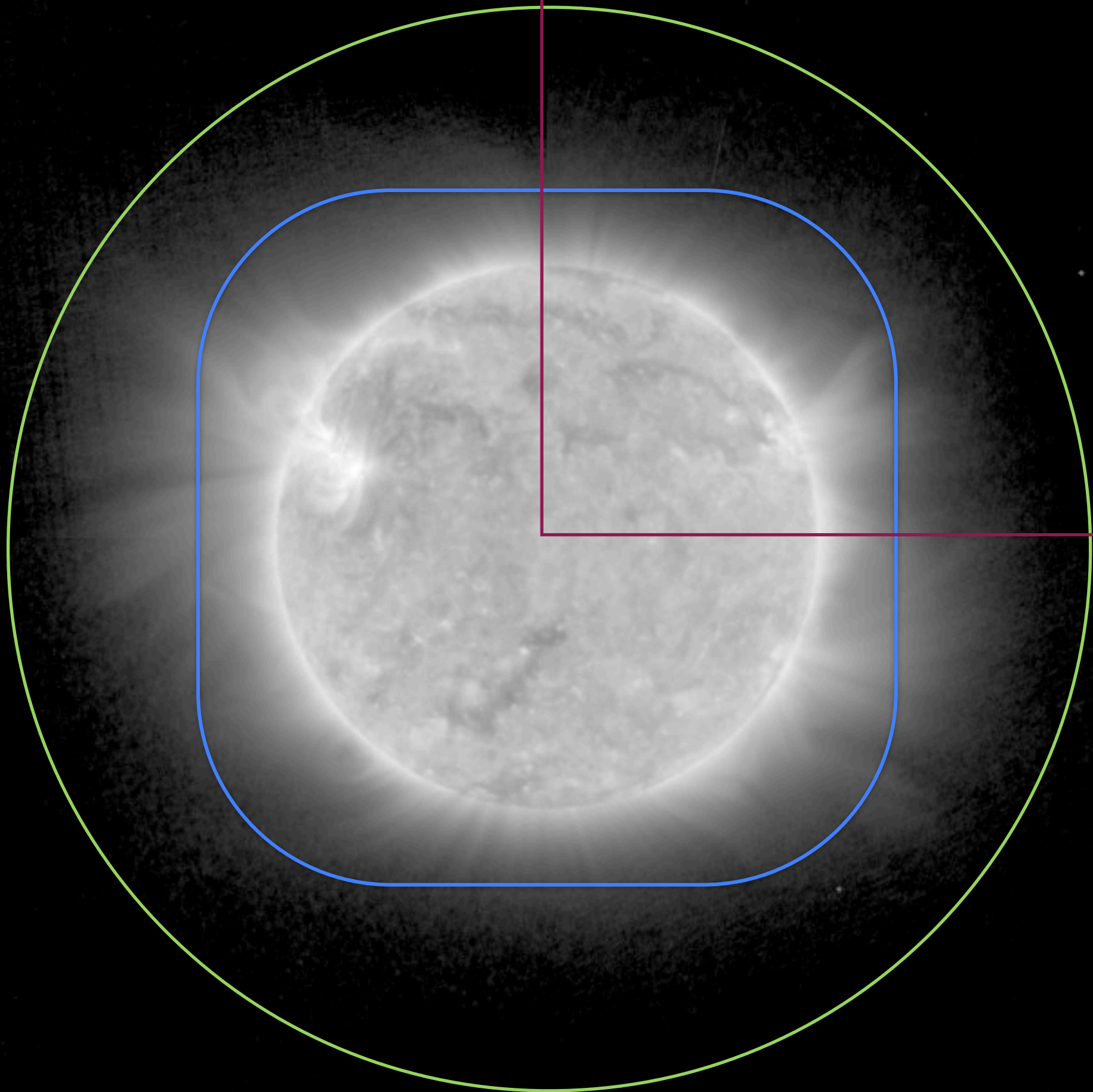


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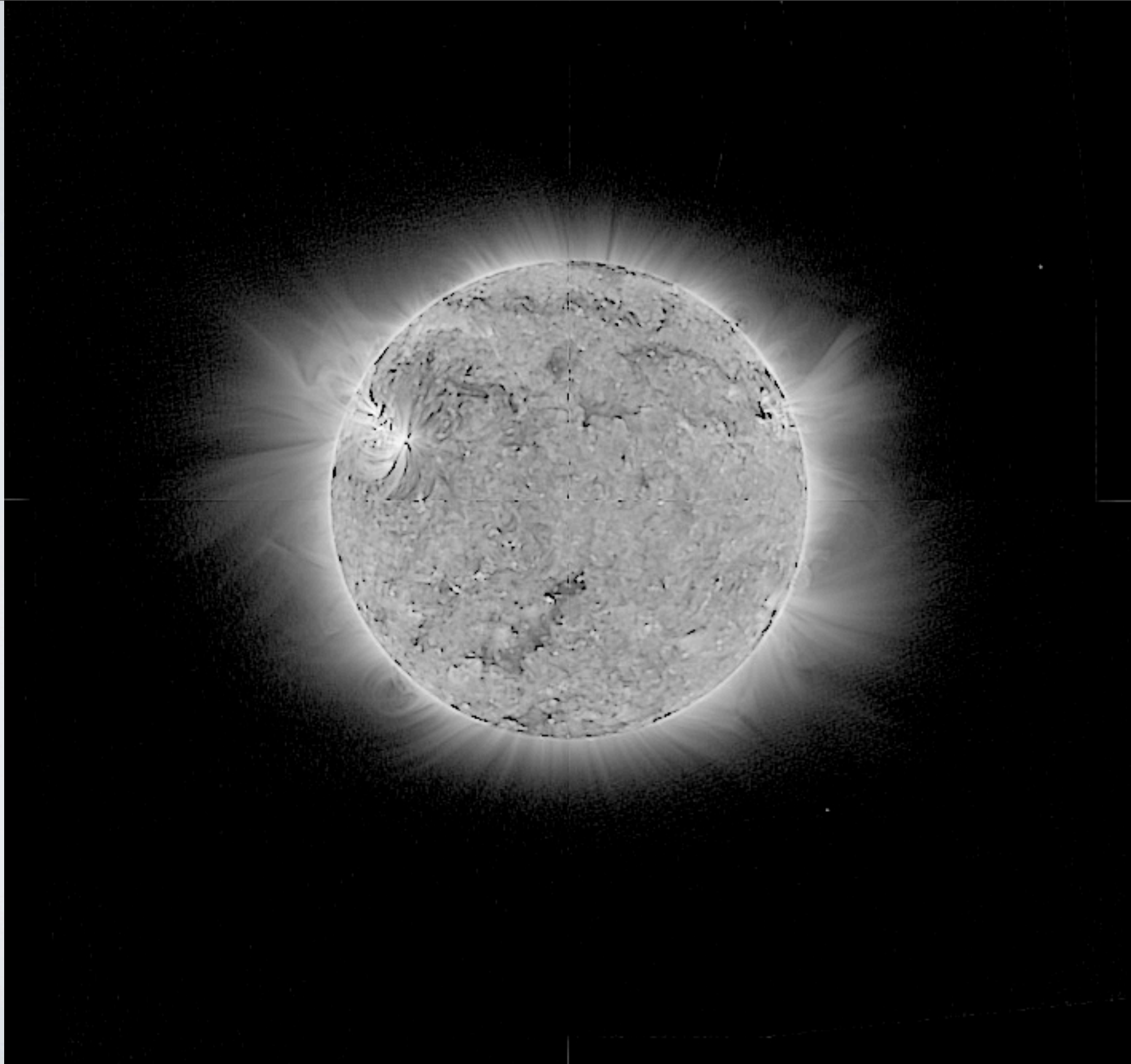


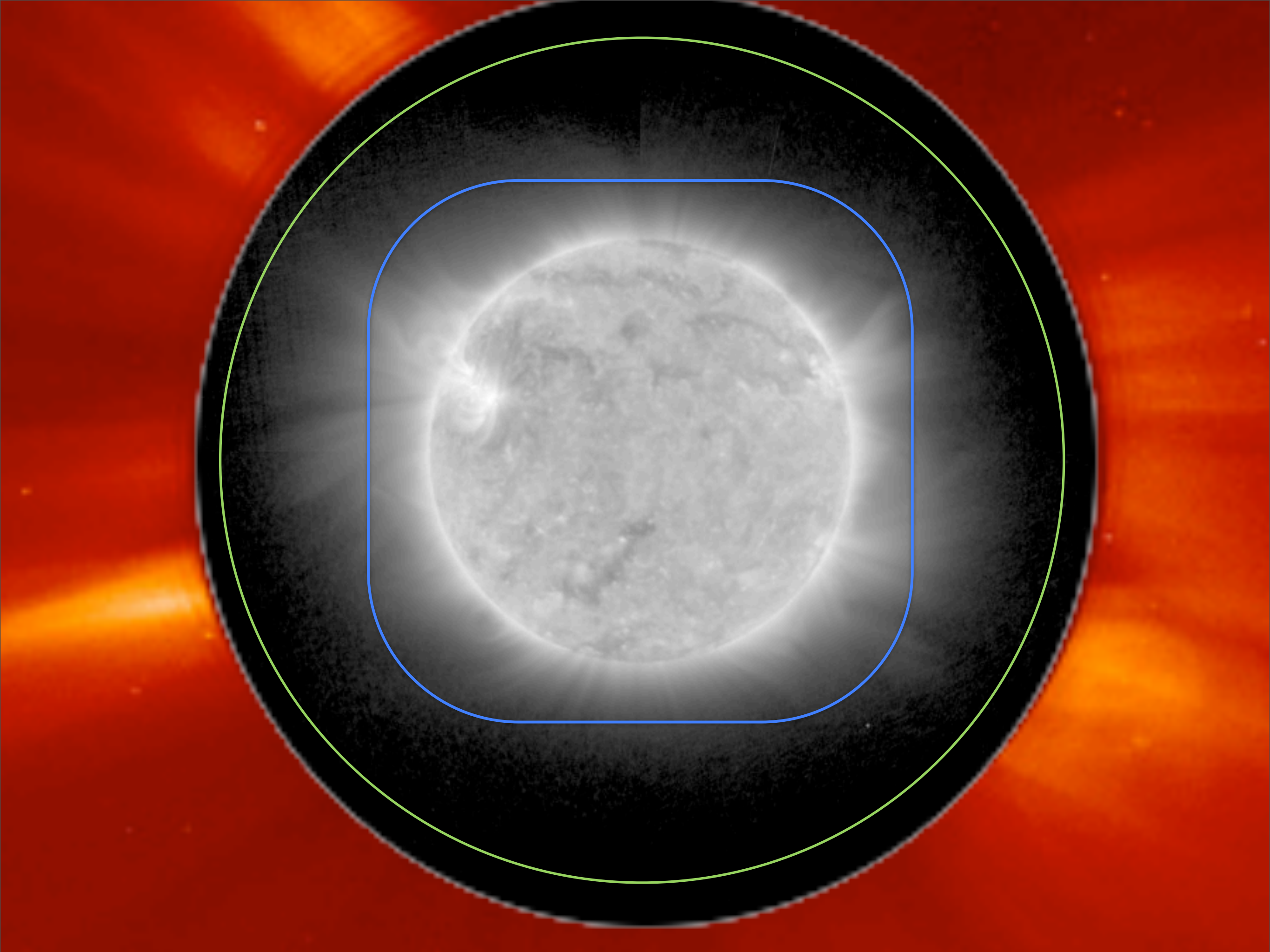


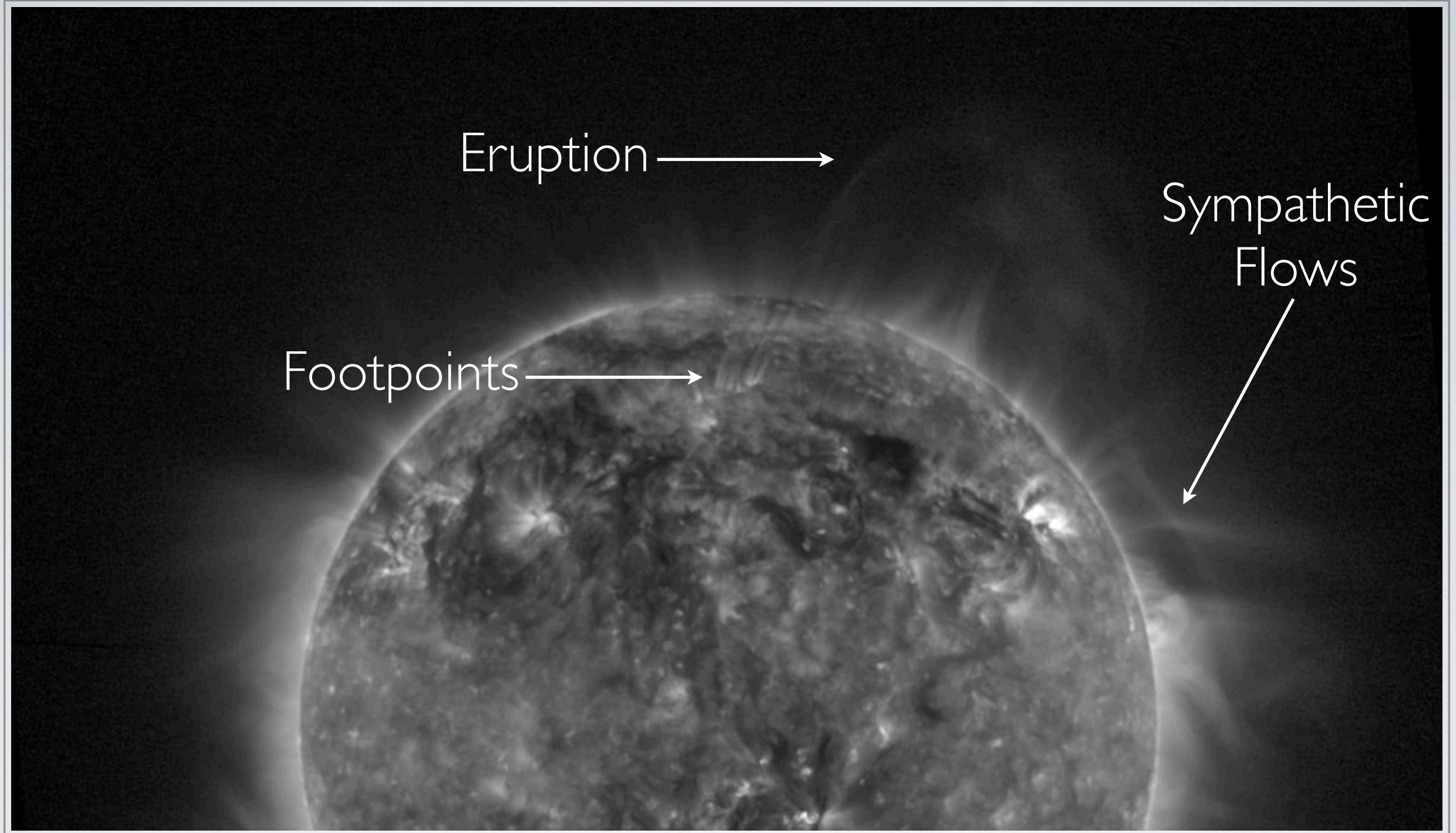
SWAP 2010-07-11



Work by Vladimir Slemzin (Lebedev) 11 July



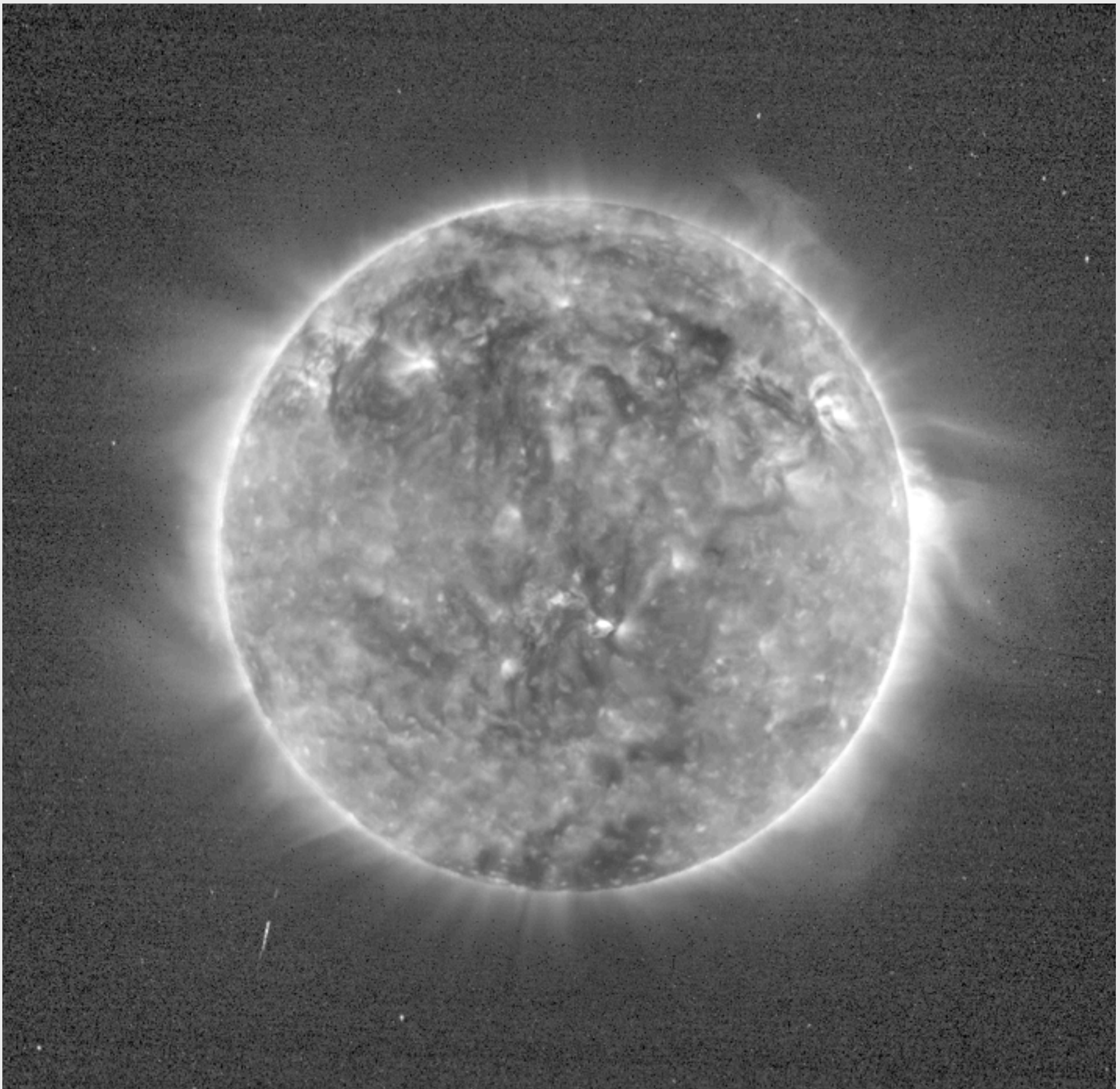




PROMINENCE ERUPTION

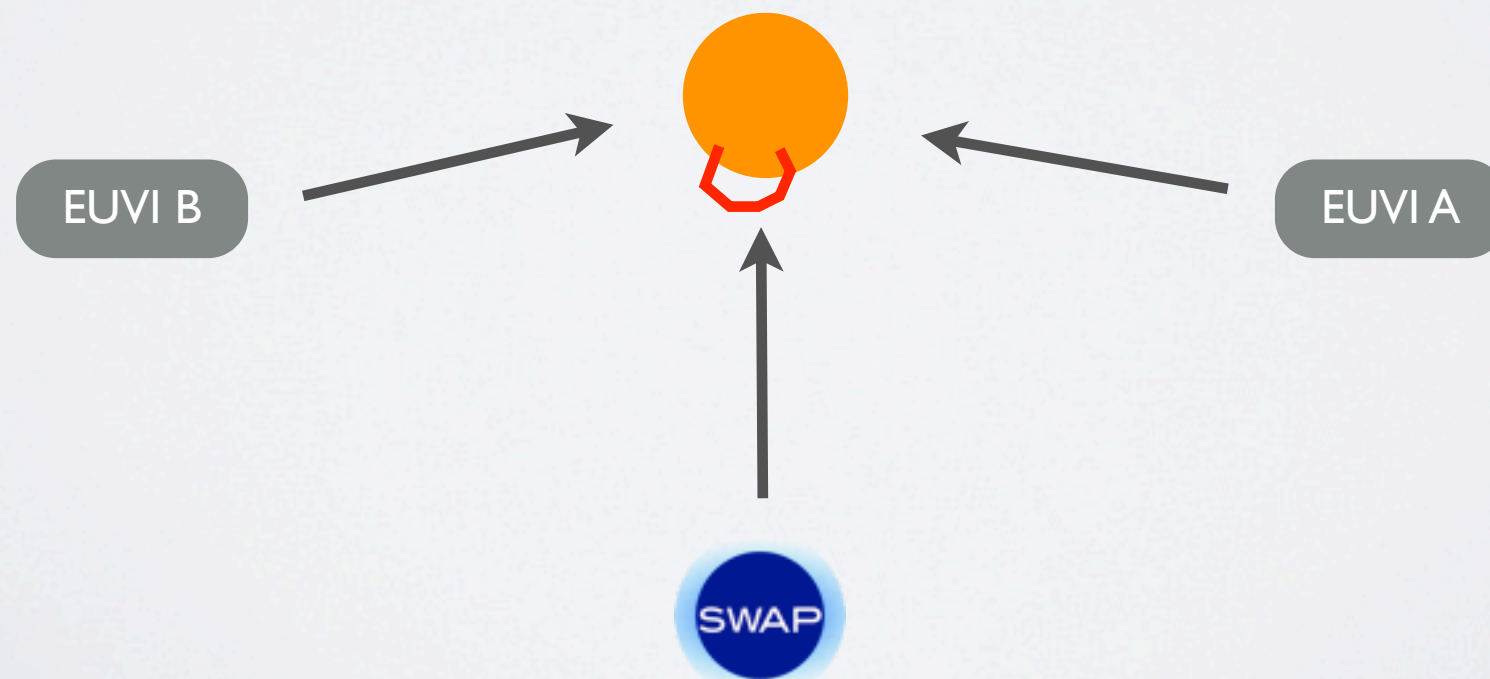
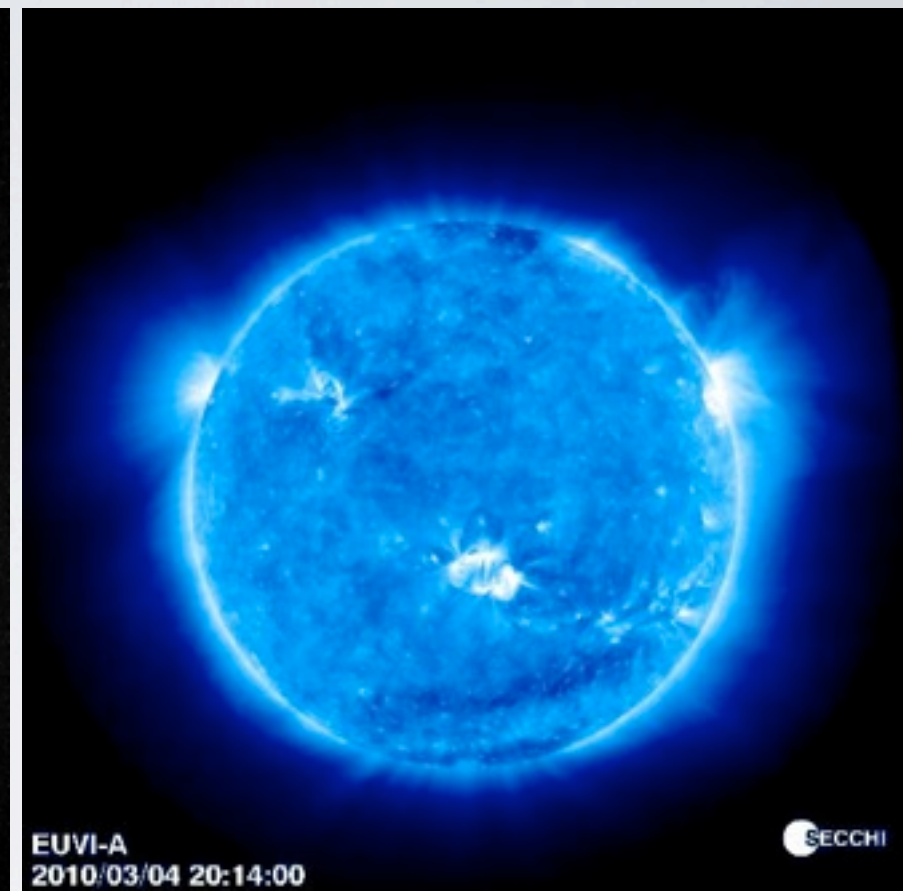
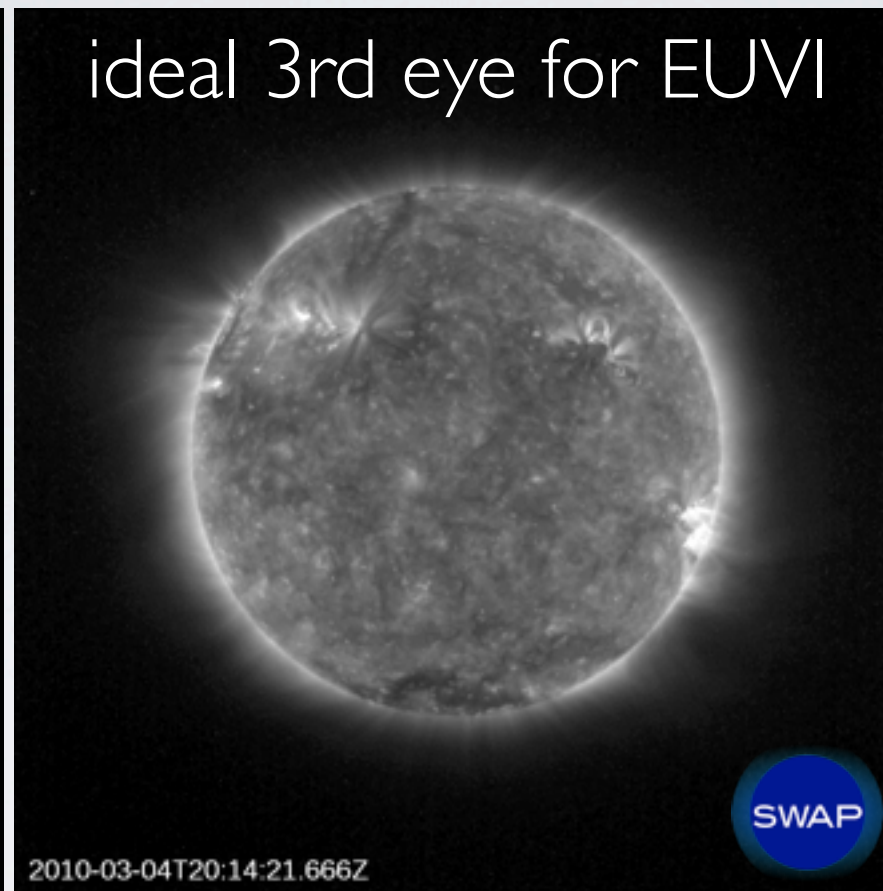
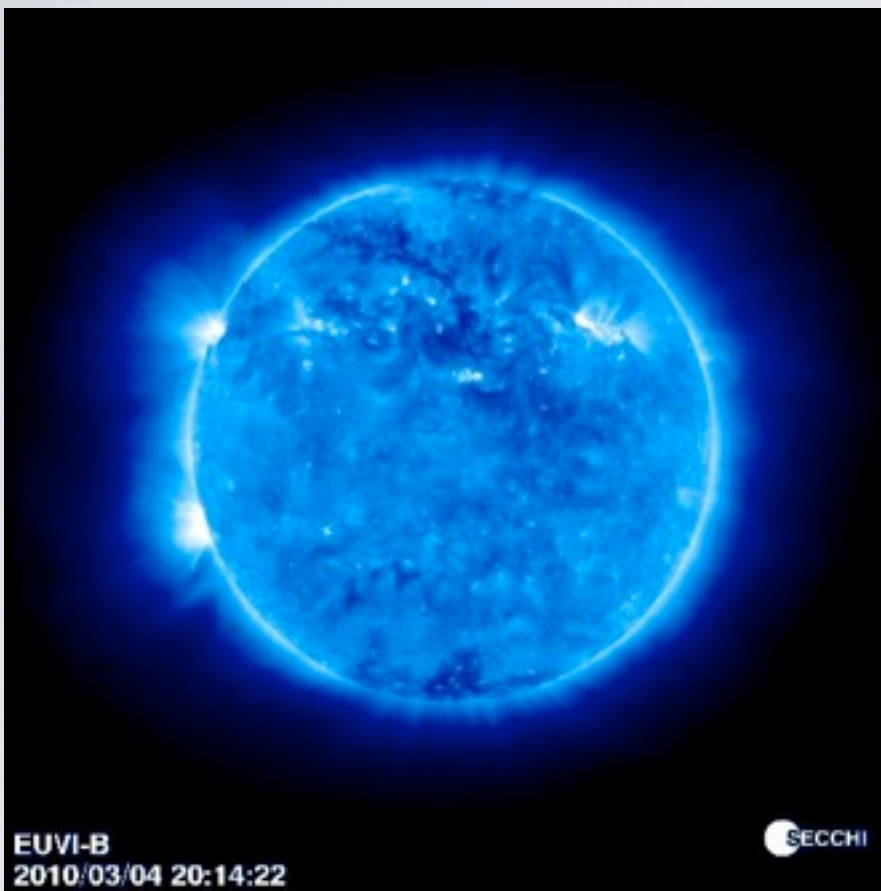
13 April 2010, 09:30 UTC





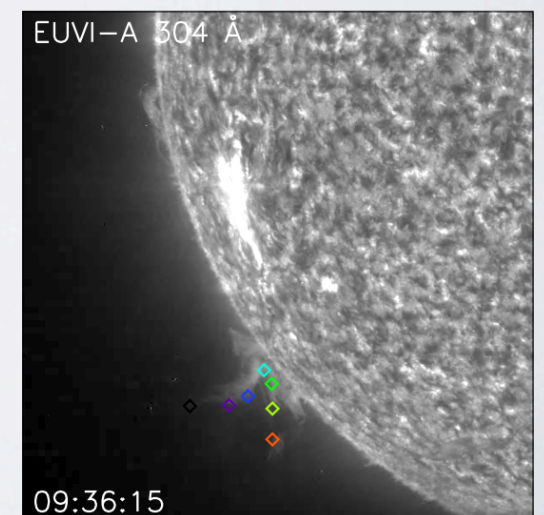
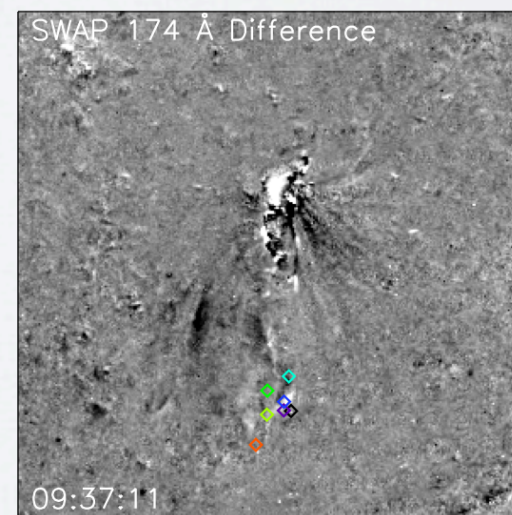
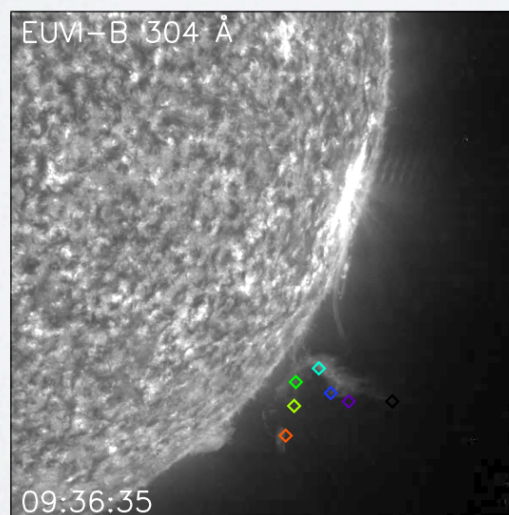
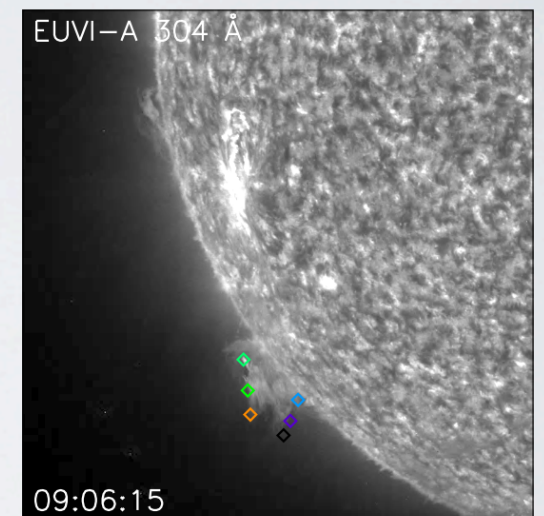
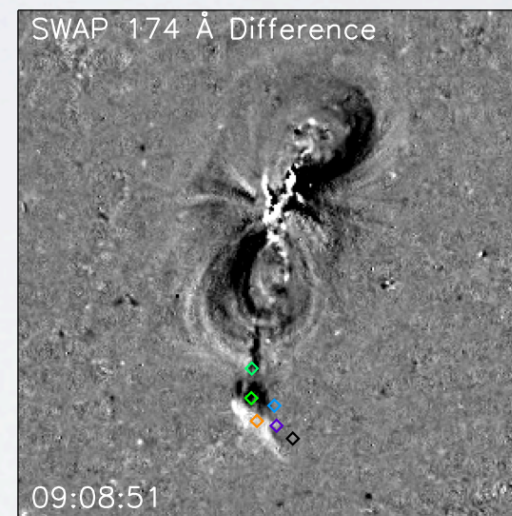
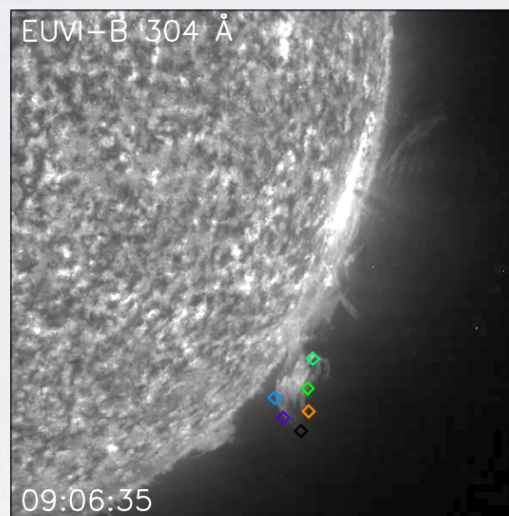
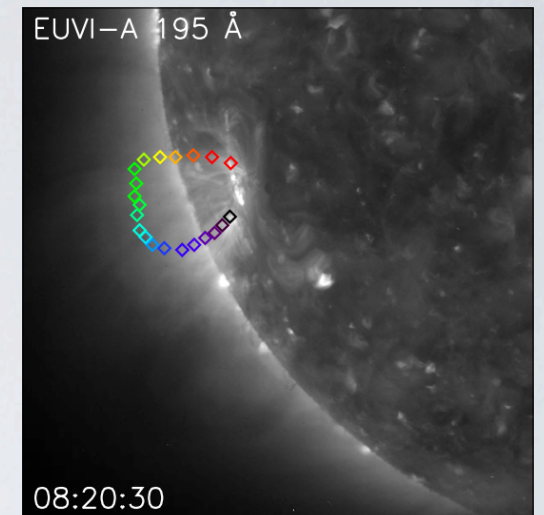
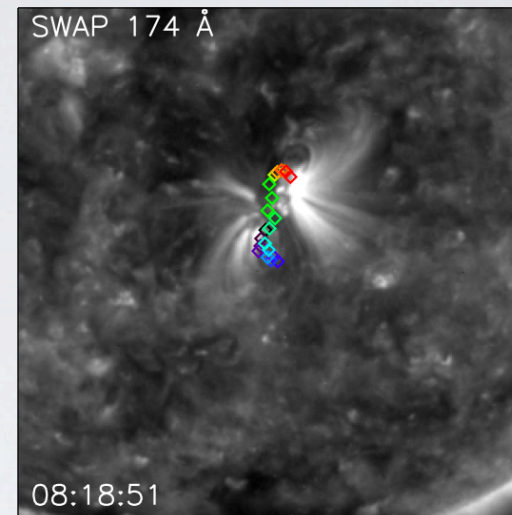
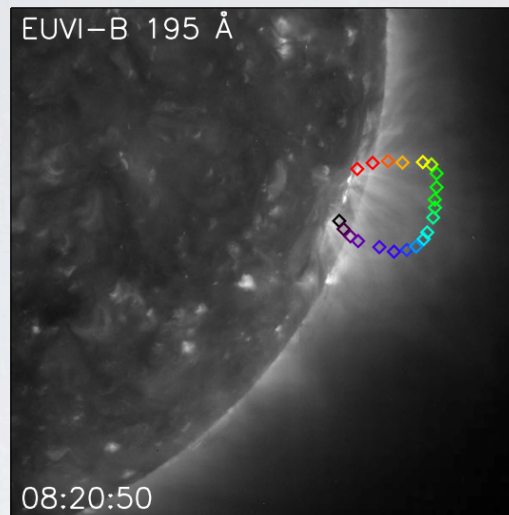
3D CME RECONSTRUCTIONS

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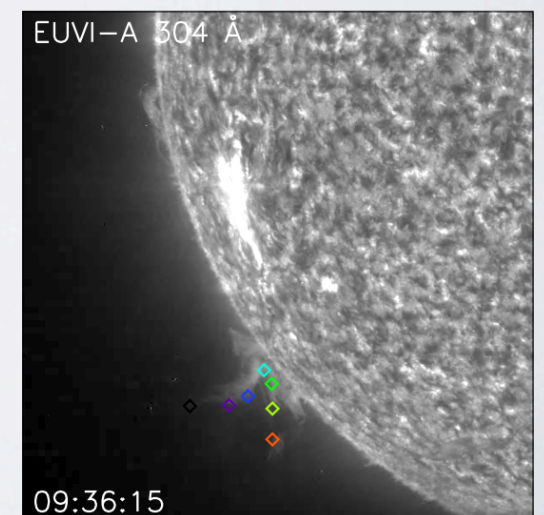
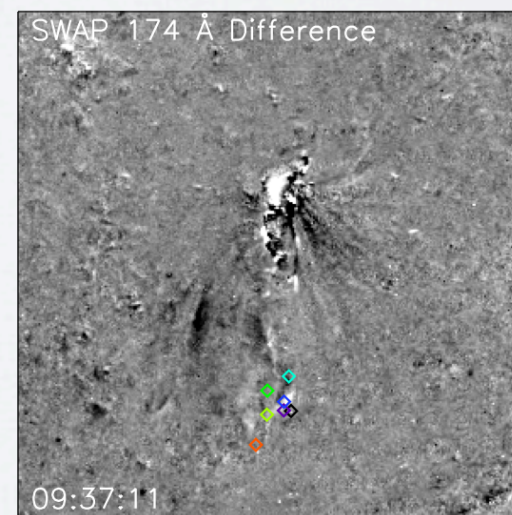
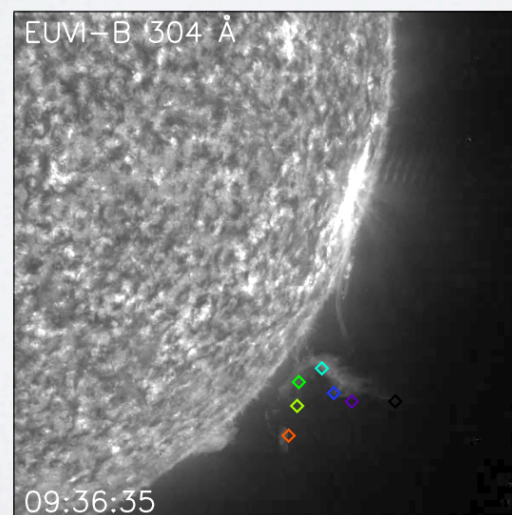
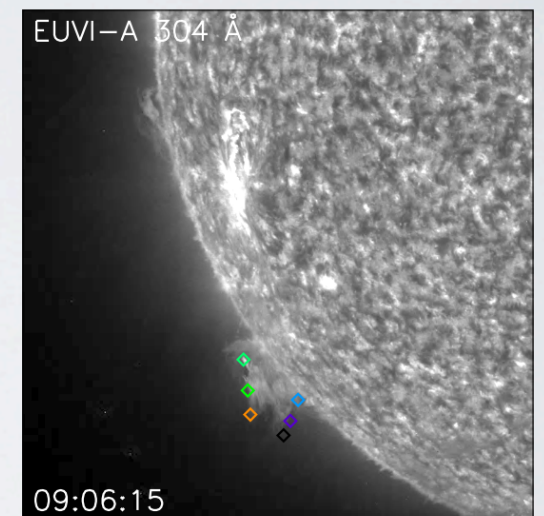
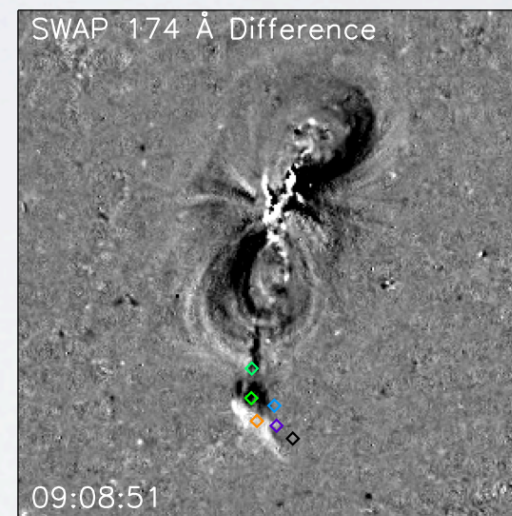
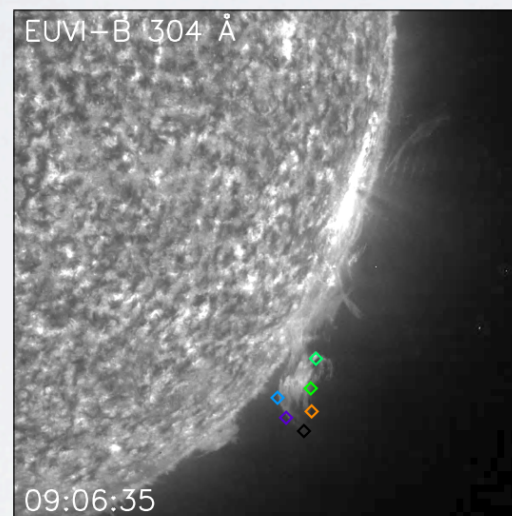
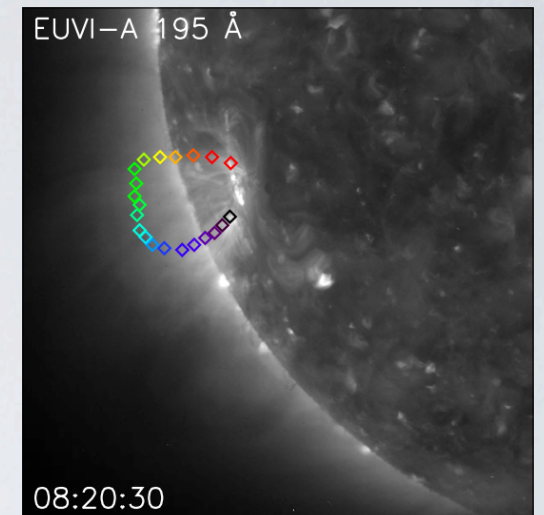
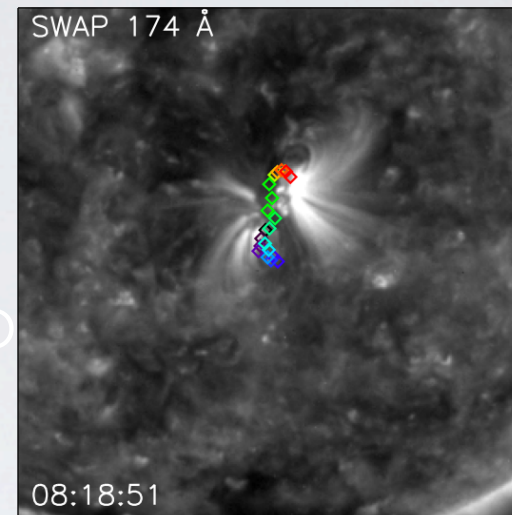
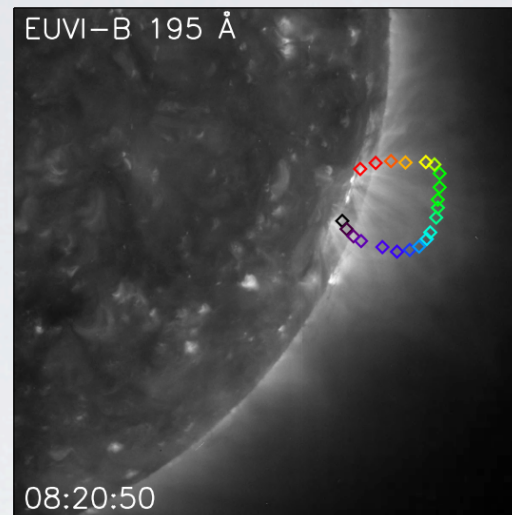
3 april 2010:
Earth-directed CME
event seen in
EUVI A, B and SWAP



Seaton et al, 2010

3D CME RECONSTRUCTIONS

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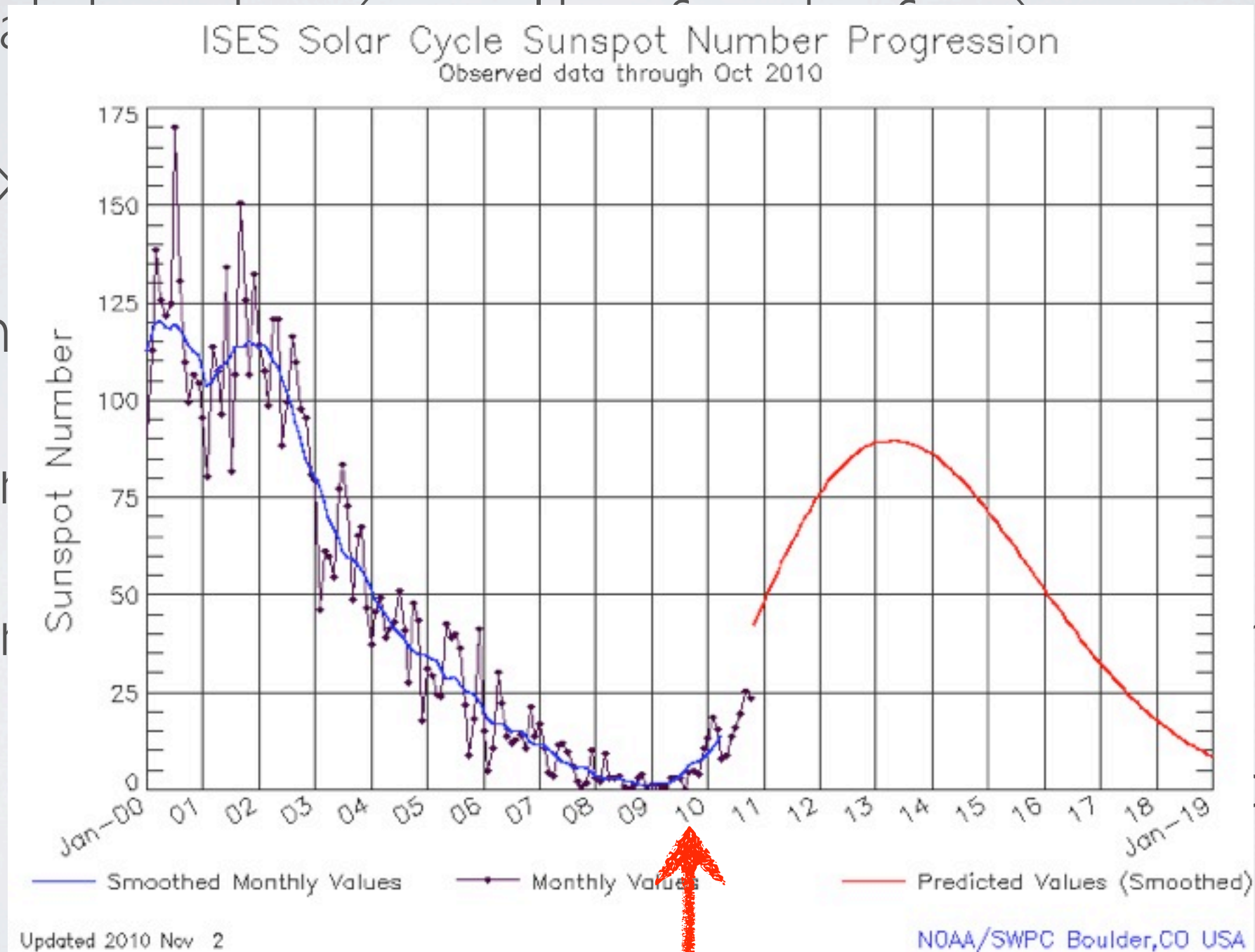
Seaton et al, 2010

OPPORTUNITIES FOR SCIENCE & SPACE WEATHER

- Near real-time data (upto 1 hr after the facts)
- Very flexible commanding
 - commanding is web-based
 - quick reaction to solar events
- On-board autonomy: CME tracking - priority numbering - ...
- Waiting for intense (off-limb) solar events to fully exploit all this

OPPORTUNITIES FOR SCIENCE & SPACE WEATHER

- Near real
- Very flex
- comm
- quick
- On-board
- Waiting



MORE TO COME!

ring - ...

exploit all this

OPEN DATA POLICY

Data are freely available to all users on

<http://proba2.sidc.be/swap/data/xxx>
[lyra](#)

All data ordered in year/month/day folders

Fancy data browser to come

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SWAP

quicklook PNG ([qlviewer](#))

lv0 FITS: raw data ([eng](#))

lv1 FITS: science data ([bsd](#))

daily mp4 movies ([mpg](#))

SWAP average intensity ([swavint](#))

SWAP tree in SSW IDL:

<http://www.solarmonitor.org/objects/swap/>

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LYRA

3-days uncalibrated quicklook

([DailyImage](#))

lv1 FITS: raw data ([eng](#))

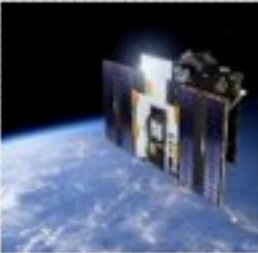
lv2 FITS: calibrated data ([bsd](#))

lv3 FITS: 1 min averaged, in W/m^2

lv4 FITS: idem in PNG

FOR MORE INFORMATION

<http://proba2.sidc.be/>

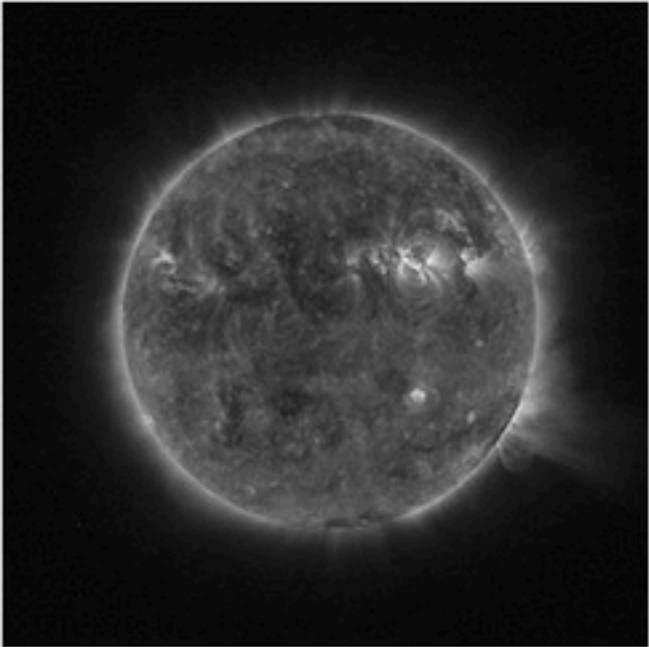


PROBA2 SCIENCE CENTER

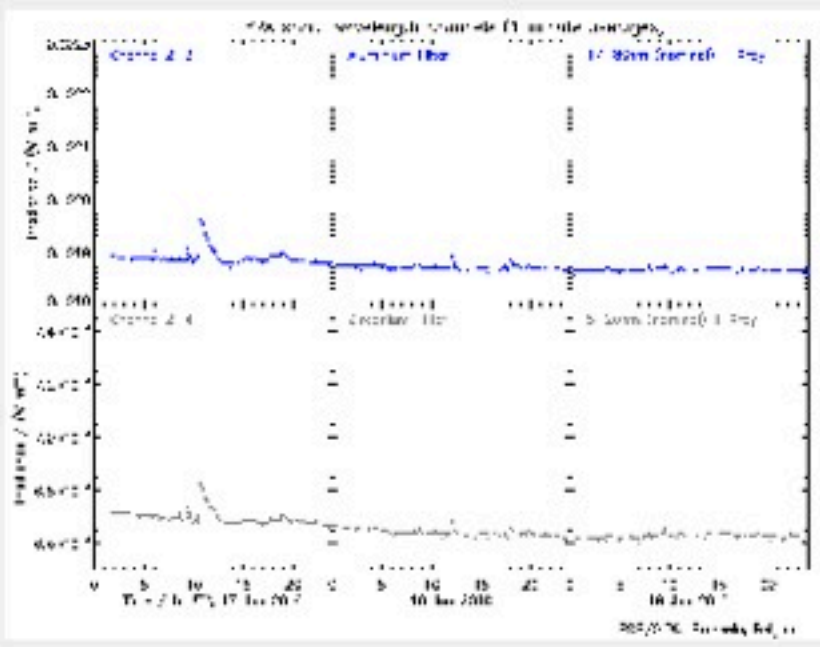
[Home](#) [About](#) [SWAP](#) [LYRA](#) [Data](#) [Community](#) [Meetings](#) [Outreach](#) [Gallery](#)

Last update: 27th of October 2010

Welcome to the PROBA2 science center.



Watch the latest SWAP image or movie

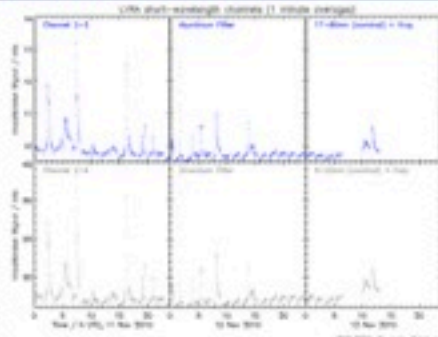


Go to the latest 3-day LYRA curve
Most recent data only available as FITS

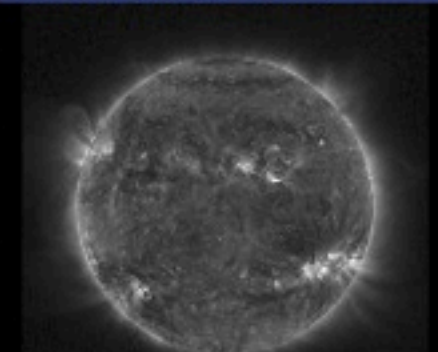
Latest news

- 19 October 2010
PROBA2 eclipse season 2010 has started
- 14 October 2010
SWAP Bake-out campaign
- 12 July 2010
Solar eclipse seen by PROBA2

Latest LYRA curve



Latest SWAP movie



Data gaps or unusual data? Please consult the Google Calendars for [SWAP](#) and [LYRA](#) to find out about special campaigns and off-pointing sequences (commanded via SWAP but also affecting LYRA signals).

FOR MORE INFORMATION

<http://proba2.sidc.be/>



PROBA2 SCIENCE CENTER

Home About SWAP LYRA **Data** Community Meetings Outreach Gallery OK Last update: 27th of October 2010

Home page » Data

SWAP & LYRA Data Distribution

Raw PROBA2 data is received at [ESA's](#) ground station in Redu and transferred to the PROBA2 Science Center (P2SC) via ftp link. Once received by the P2SC, the data are automatically processed, calibrated, and prepared for public distribution. All data are freely available to the public. The links to the FITS files and quicklook data are listed below.

PROBA2 has begun its scientific mission in March 2010 and the data of [SWAP](#) and [LYRA](#) are freely available. Apart from the quicklook images, several levels of science data products are released. Some levels of calibrated data are still under construction or are released in beta version.

For the time being we have online the following FITS files and quicklook PNG files in YYYY/MM/DD directories:

SWAP:

- SWAP raw images, i.e. [level0](#) data, e.g. <http://proba2.oma.be/swap/data/eng/2010/05/01/>
- SWAP calibrated images, i.e. [level1](#) data e.g. <http://proba2.oma.be/swap/data/bsd/2010/05/01/>
- SWAP quicklook data (png files), e.g. <http://proba2.sidc.be/swap/data/qlviewer/2010/05/01/>
- SWAP daily movies (mp4 files) at <http://proba2.sidc.be/swap/data/mpg/movies/overview.php>

LYRA:

- LYRA raw 'standard' time curves, i.e. [level1](#) data, e.g. <http://proba2.oma.be/lyra/data/eng/2010/05/01/>.

These LYRA FITS files are automatically generated and always show the latest data available. The other data formats listed below are generated quasi-manually and are not yet available for the most recent data. Please contact swap_lyra@sidc.be if you are

<http://proba2.sidc.be/>

