

# SPACE WEATHER SERVICES PROVIDED BY PROBA2

D. Berghmans, PROBA2 Science Consortium & Guest investigators  
Royal Observatory of Belgium

SWWT plenary meeting ☀ Brussels, Belgium ☀ June 28, 2011



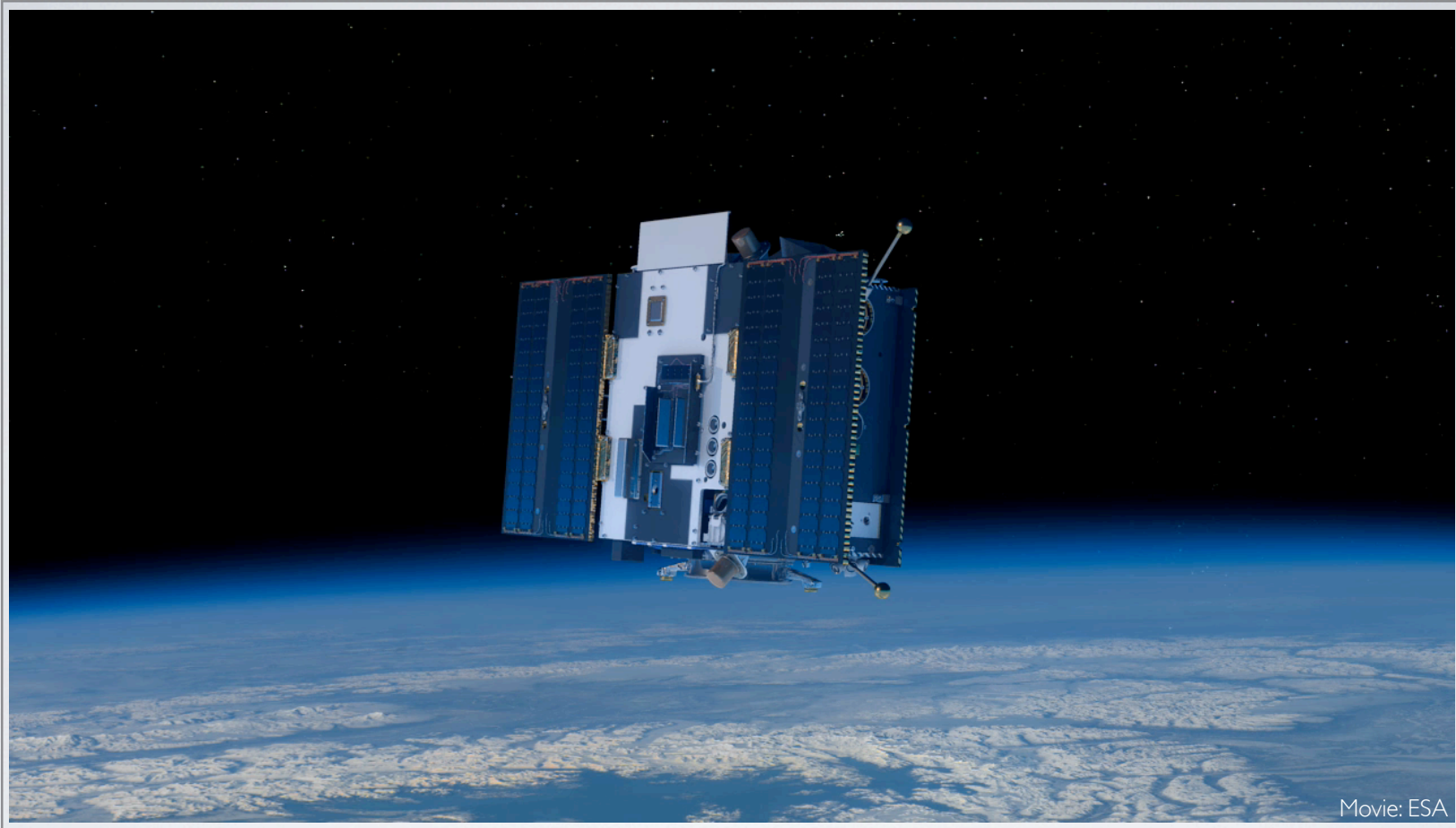


FUNDING & COLLABORATION ?





PROBA2 Guest Investigator grants  
Write 3 pages by Thursday

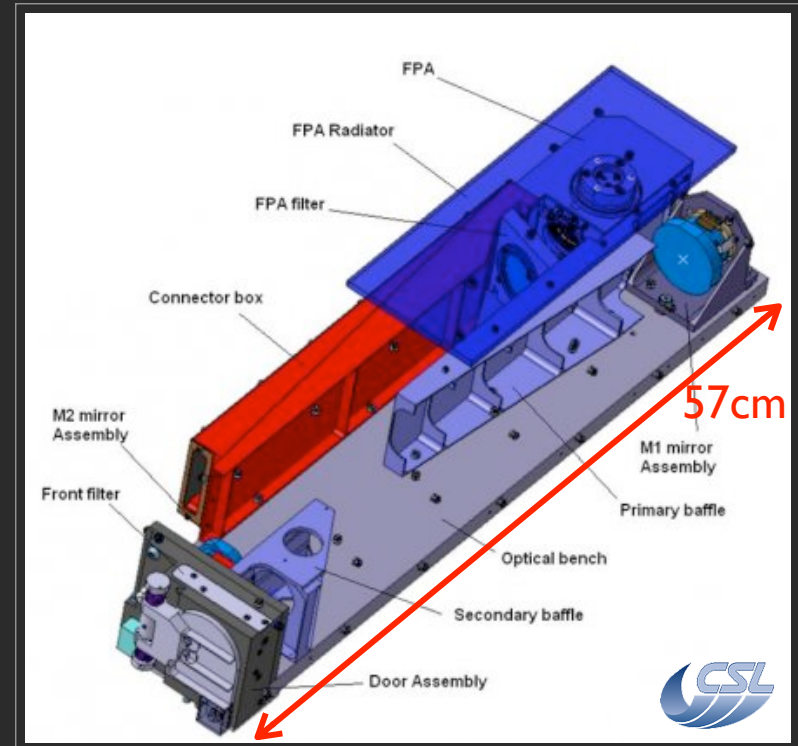
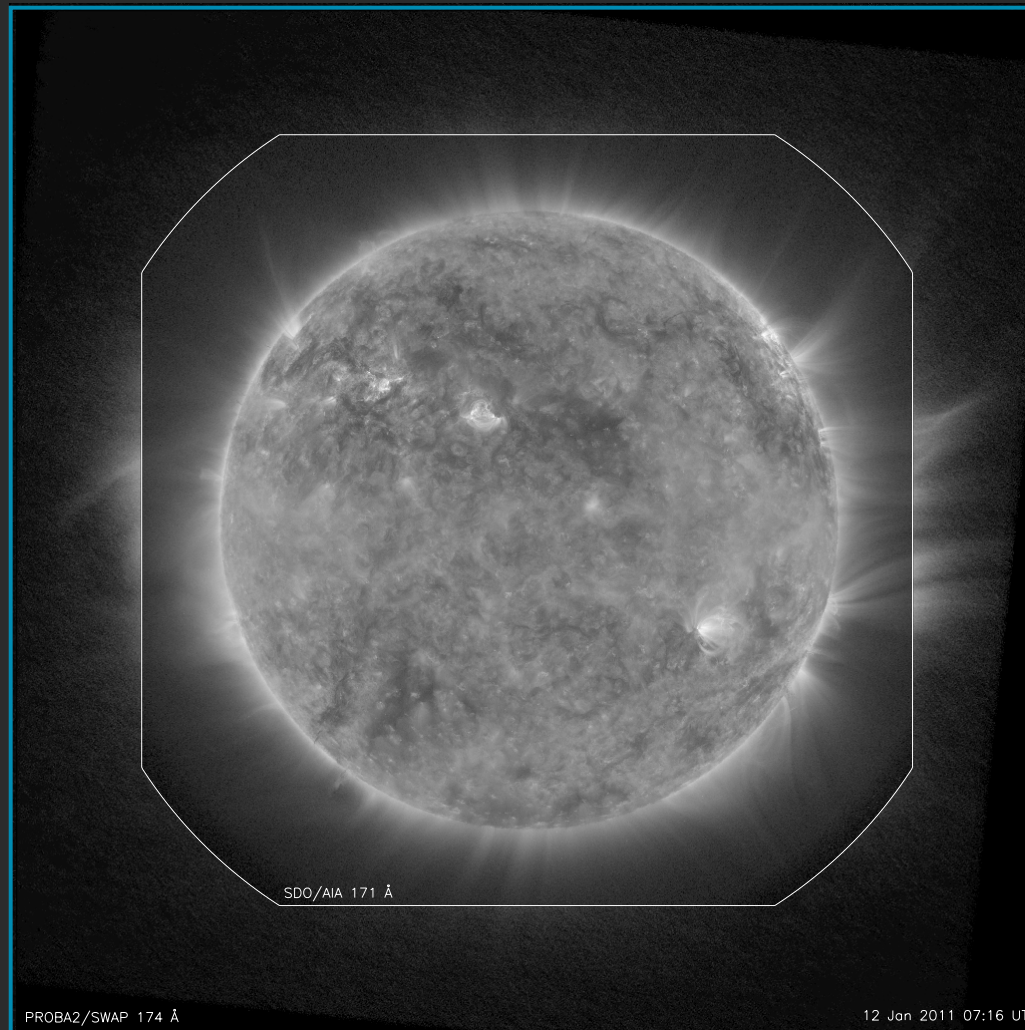


# PROBA2

Launched on Nov. 2, 2009

ESA microsatellite in sun-synchronous orbit ☀ 725 km altitude





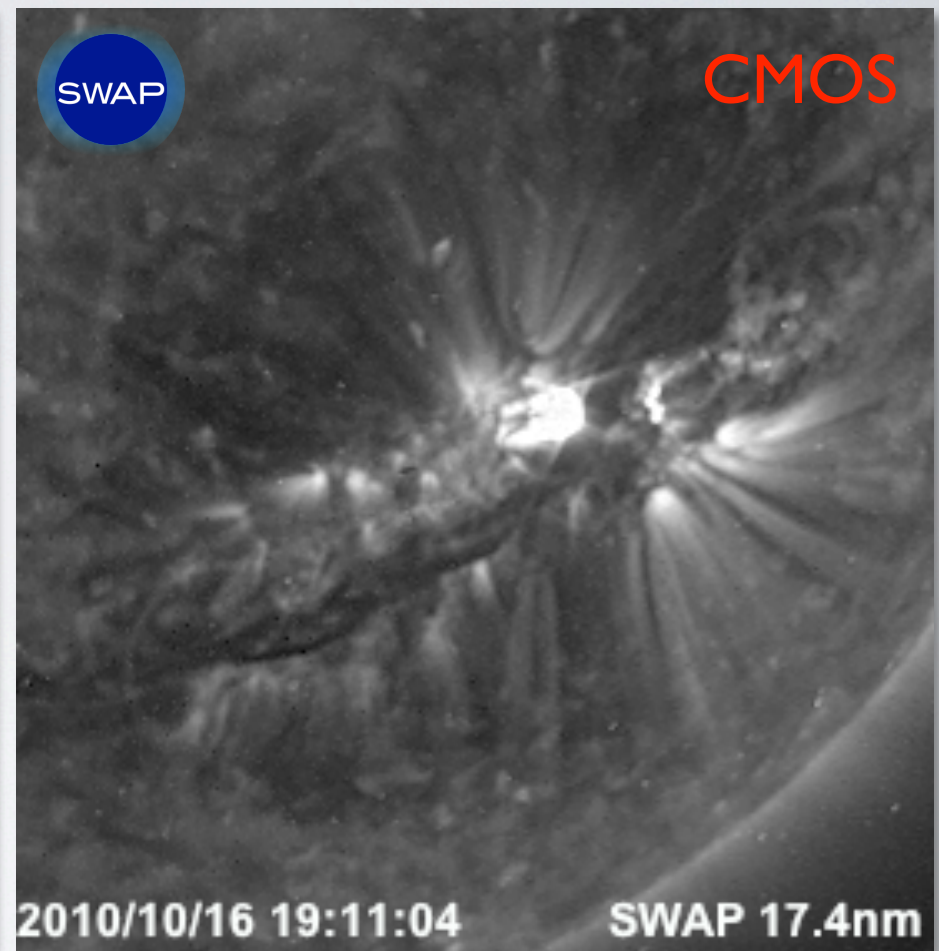
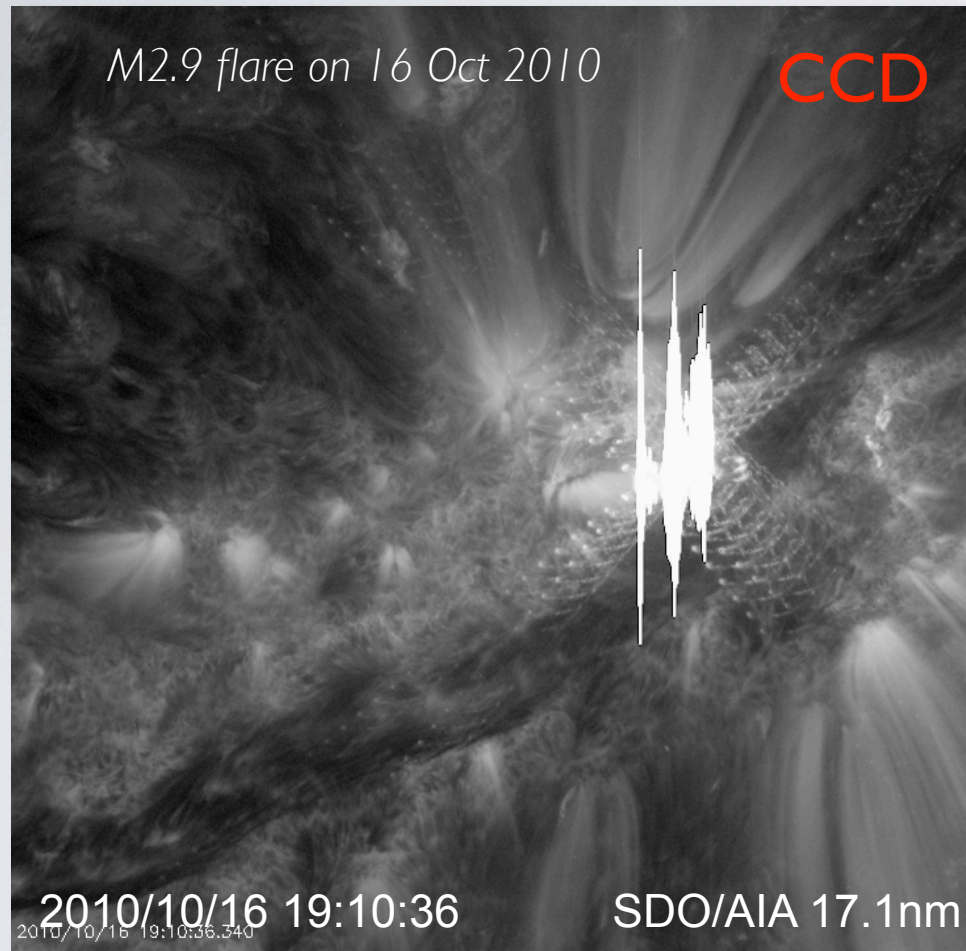
*Berghmans et al. 2006, Adv. in Space Research*  
*Halain et al. 2010, SPIE 7732*

# SWAP EUV IMAGER

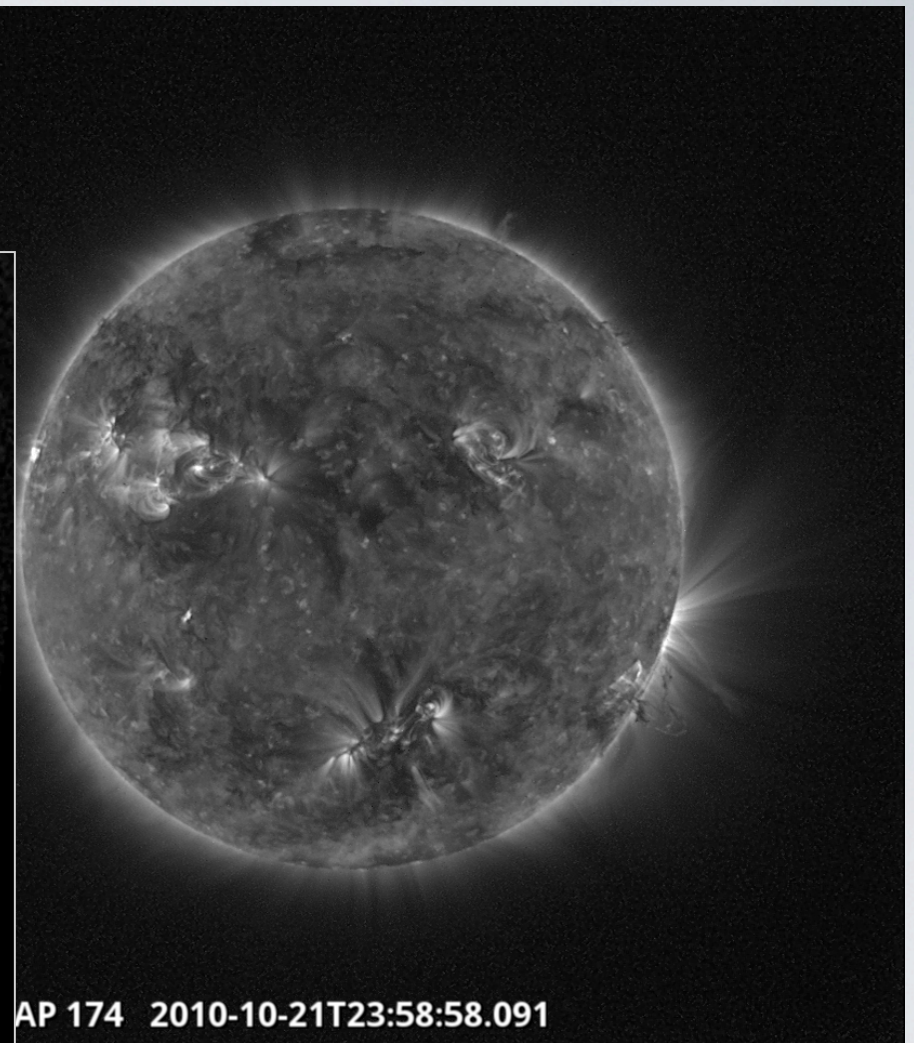
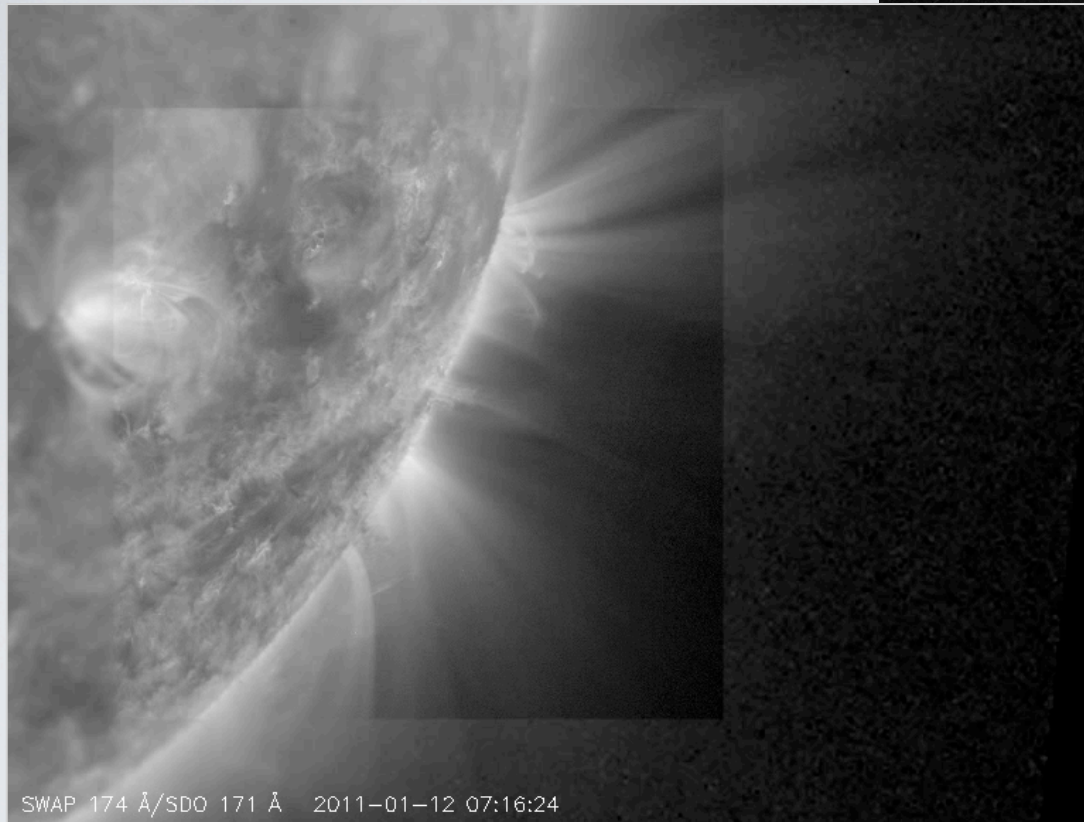
1 million° corona in EUV 17.4nm ☼ 1-2mins cadence (upto 20s)

large FOV ☼ 1Kx1K CMOS APS

# SOLAR FLARES

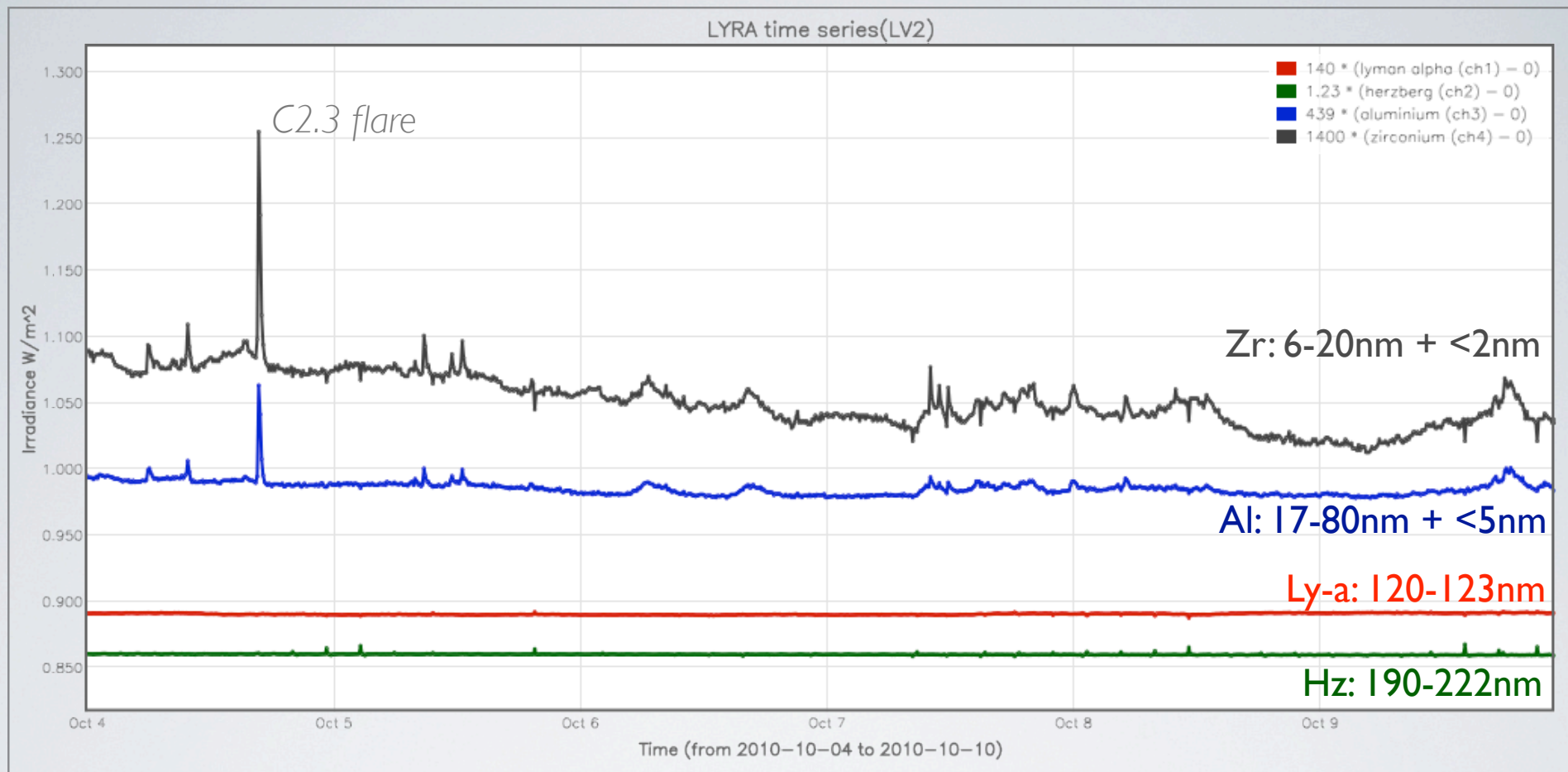






# SOLAR PHYSICS WITH SWAP

biggest opportunities when combined with other instruments

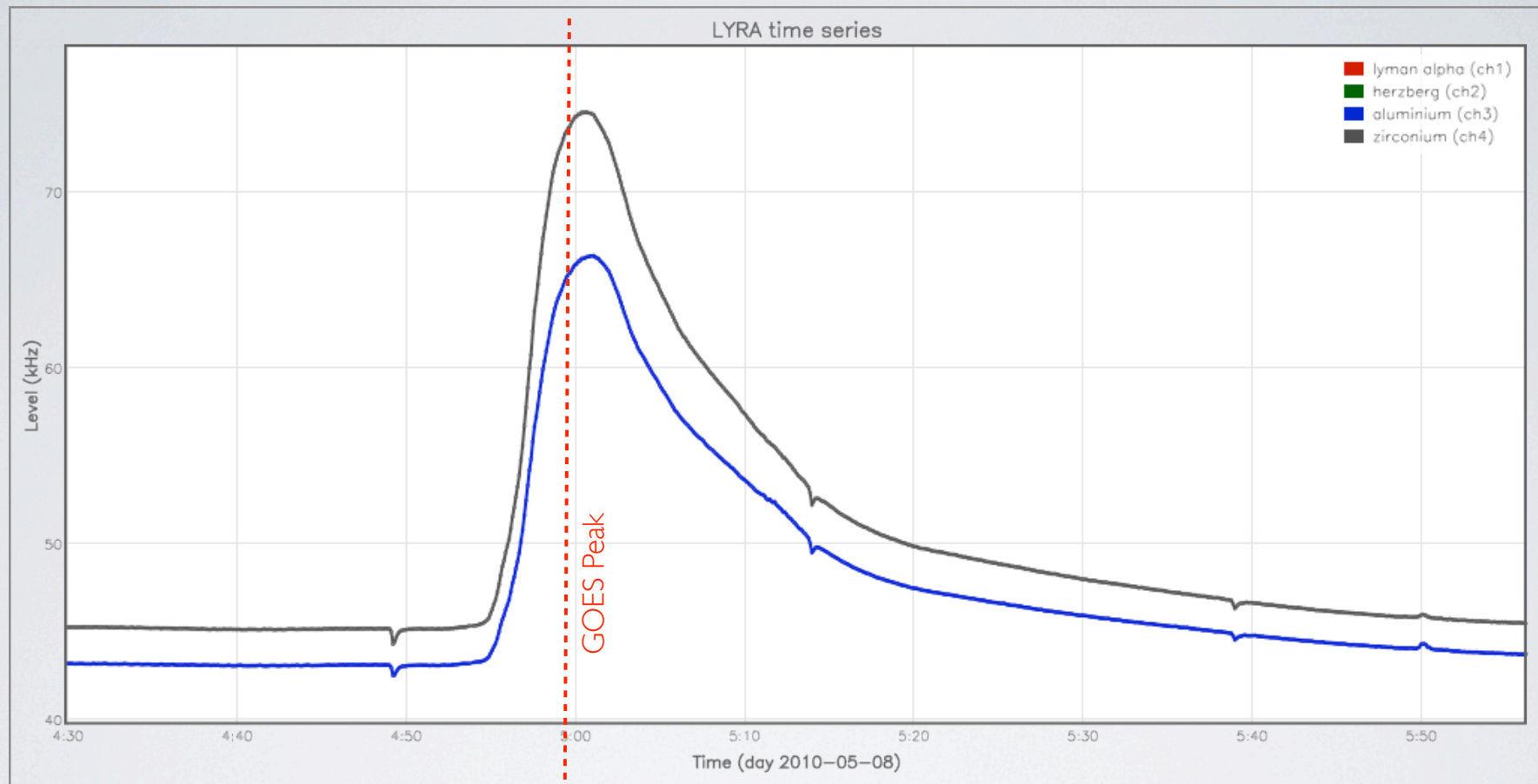


# LYRA RADIOMETER

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

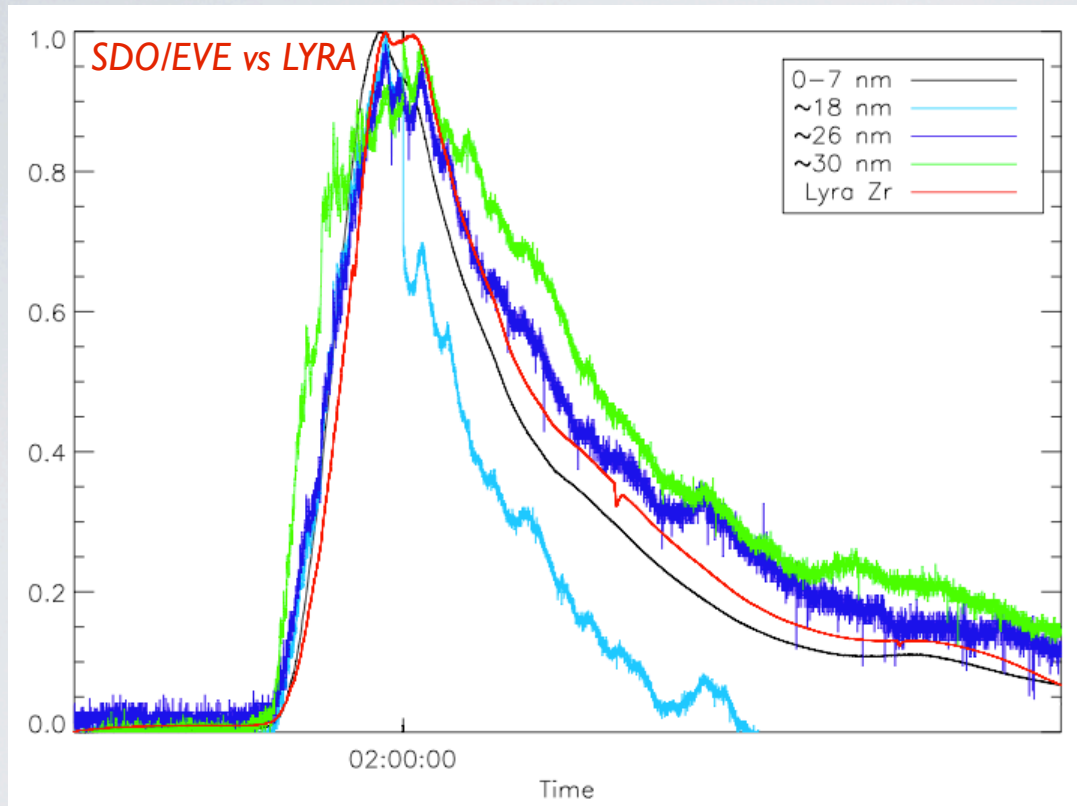


# SOLAR FLARES



LYRA senses all flares in Zr & Al at **50ms resolution** (upto 10ms)  
Good correlation to GOES flares with **better temporal resolution**  
Different onset & peak times in different pass bands  
Ly- $\alpha$  contribution for impulsive flares

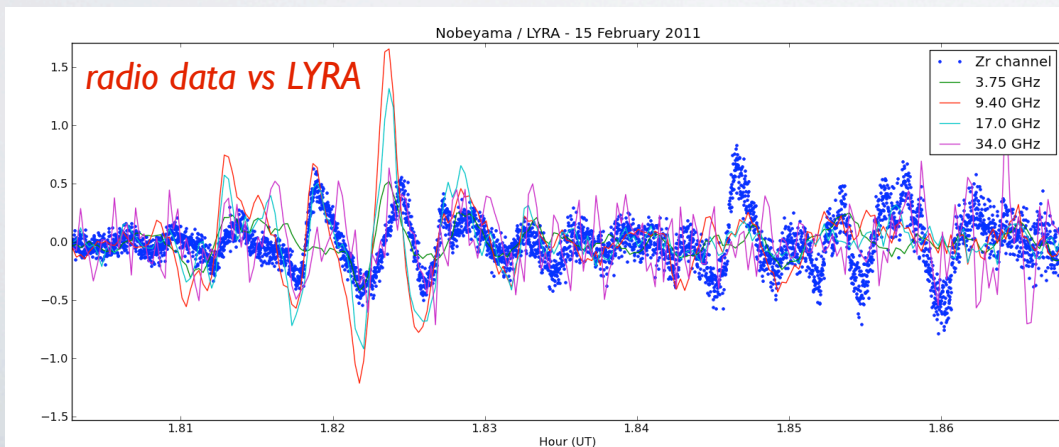
# FLARES: FIRST RESULTS



**Oscillations** during rising phase of all strong flares.

Show up in LYRA Al, Zr, Ly-a but also in SDO/EVE, GOES, and radio data

Comparisons & wave coherence studies reveal phase- and time shifts

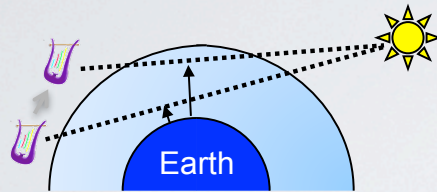


*Zender, Foing, Vagg et al, submitted  
Van Doorselaere et al, submitted in ApJ  
Dolla, Marqué et al., in preparation*



# LYRA DURING ECLIPSES

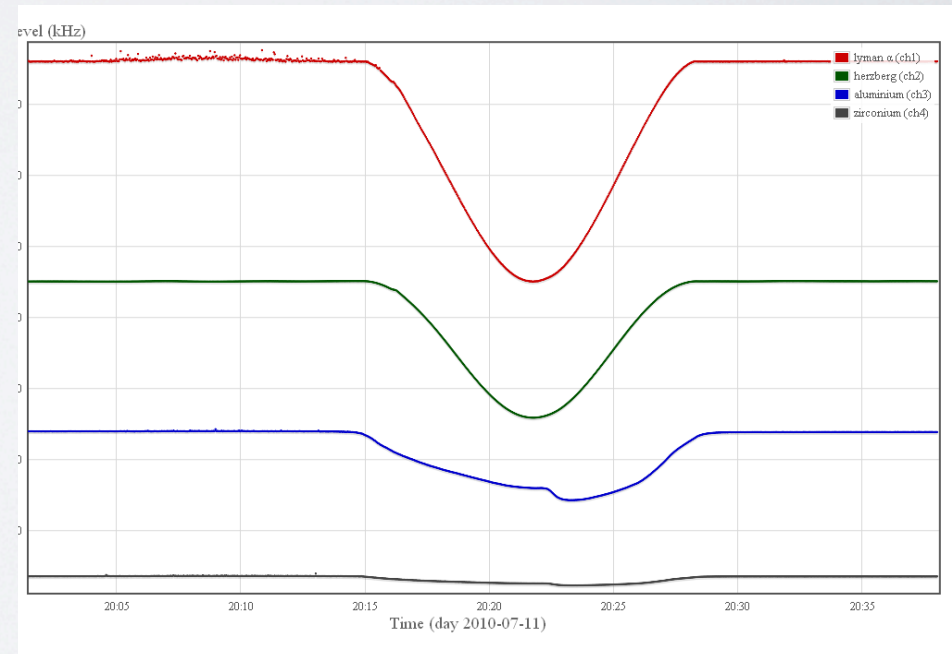
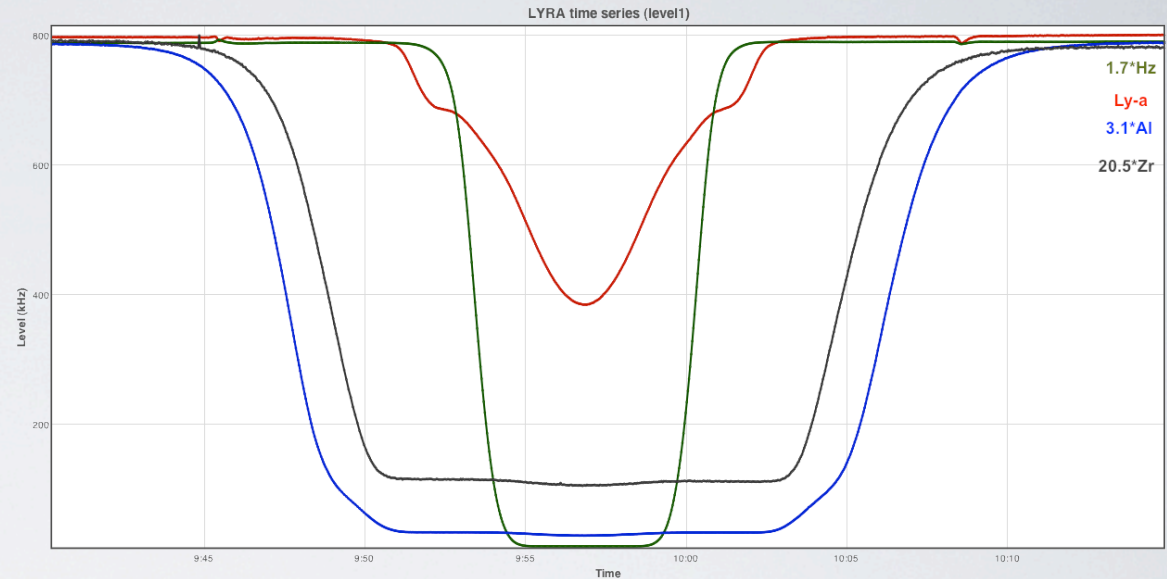
- > eclipse occultations by Earth's atmosphere
  - atmospheric layers are scanned



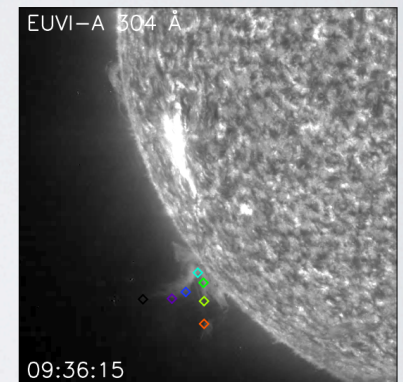
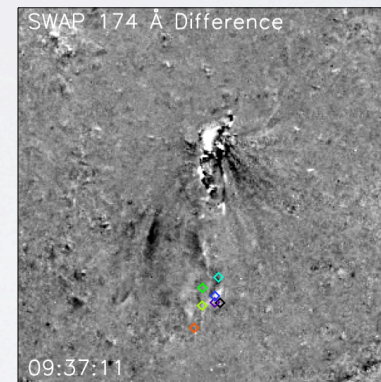
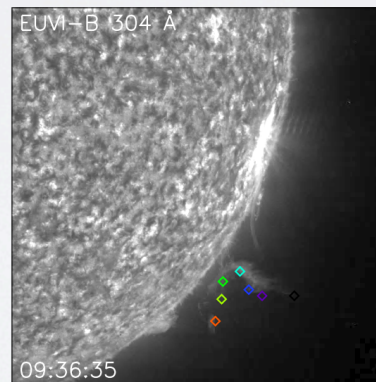
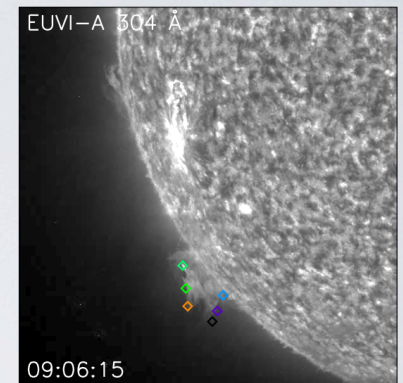
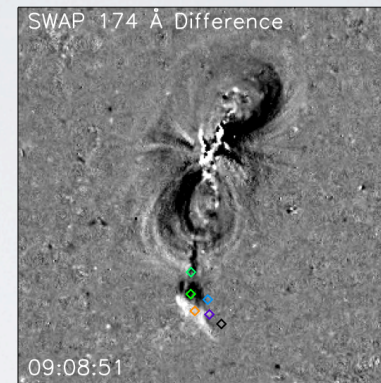
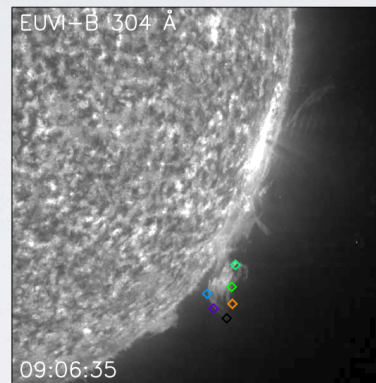
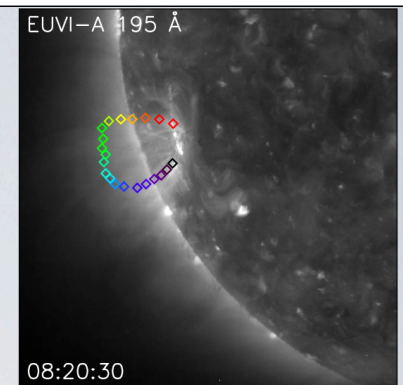
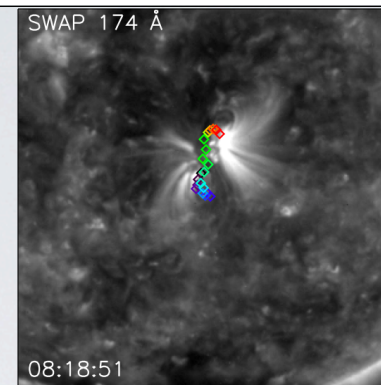
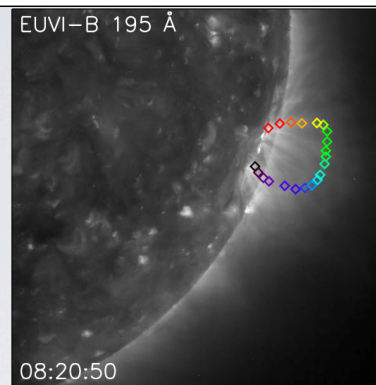
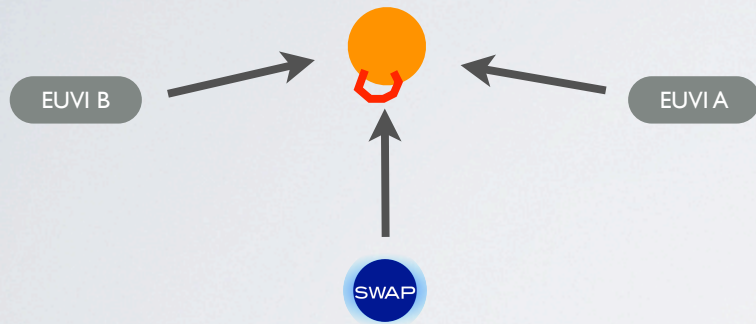
- > sun-moon eclipses
  - sources of irradiance



*Occultation paper in preparation  
Shapiro et al, in preparation*



3 april 2010:  
Earth-directed CME event  
seen in EUVI A, B and SWAP  
(*Seaton et al, 2011*)



# 3D CME RECONSTRUCTION

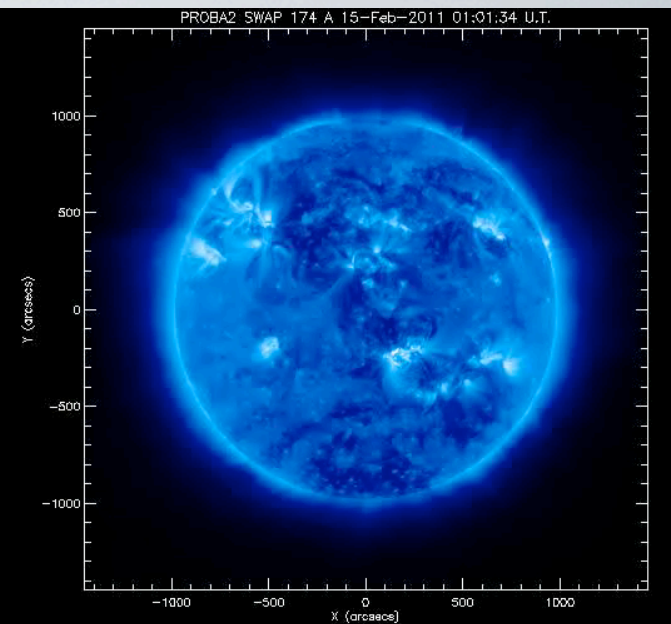
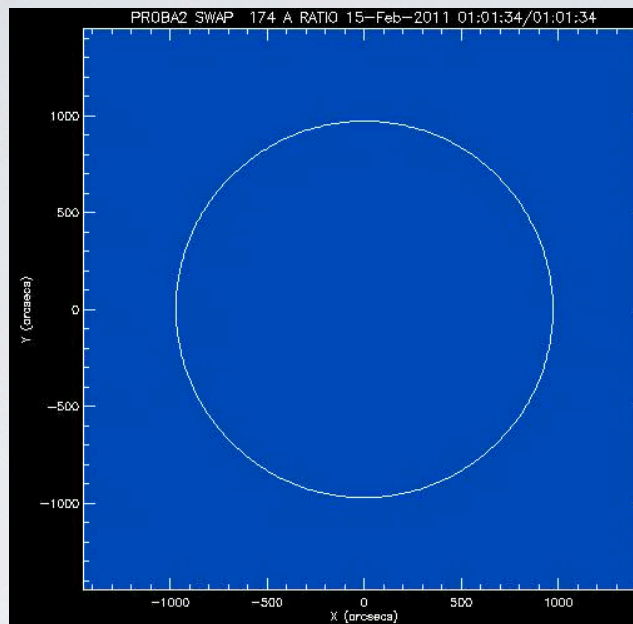
with STEREO/EUVI



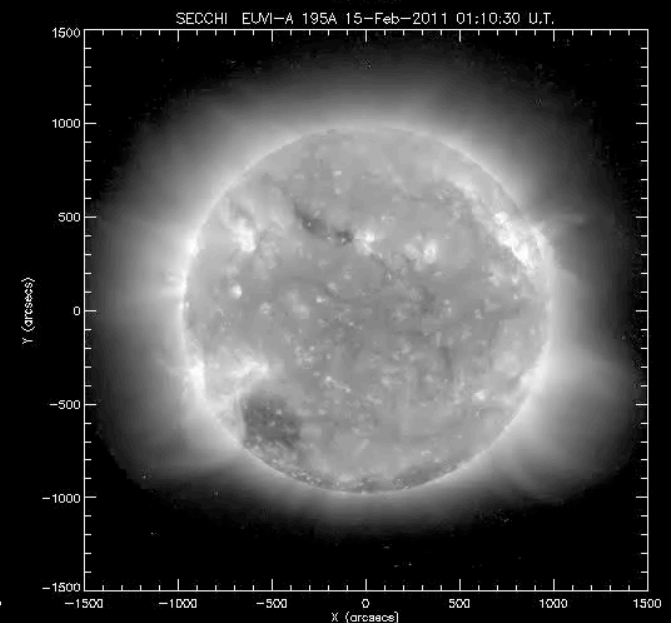
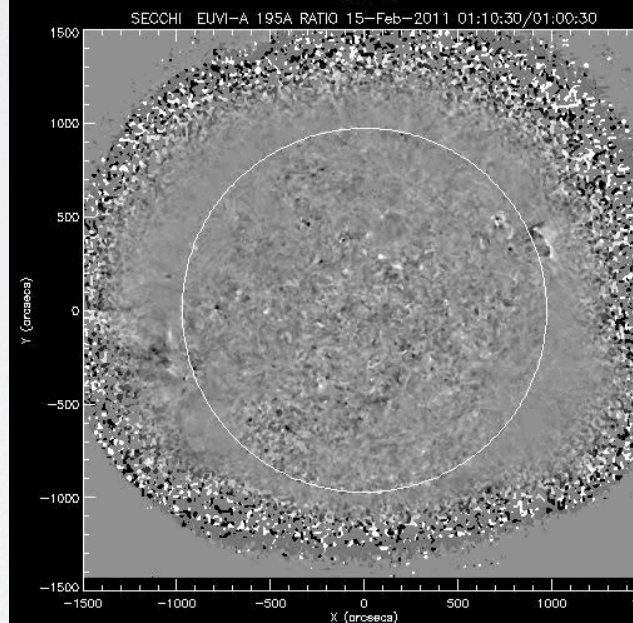
15 feb 2011:  
global coronal wave  
associated with X-flare  
in EUVI A, SDO/AIA  
and SWAP

*(work in progress by  
Kienreich et al., U. Graz)*

SWAP

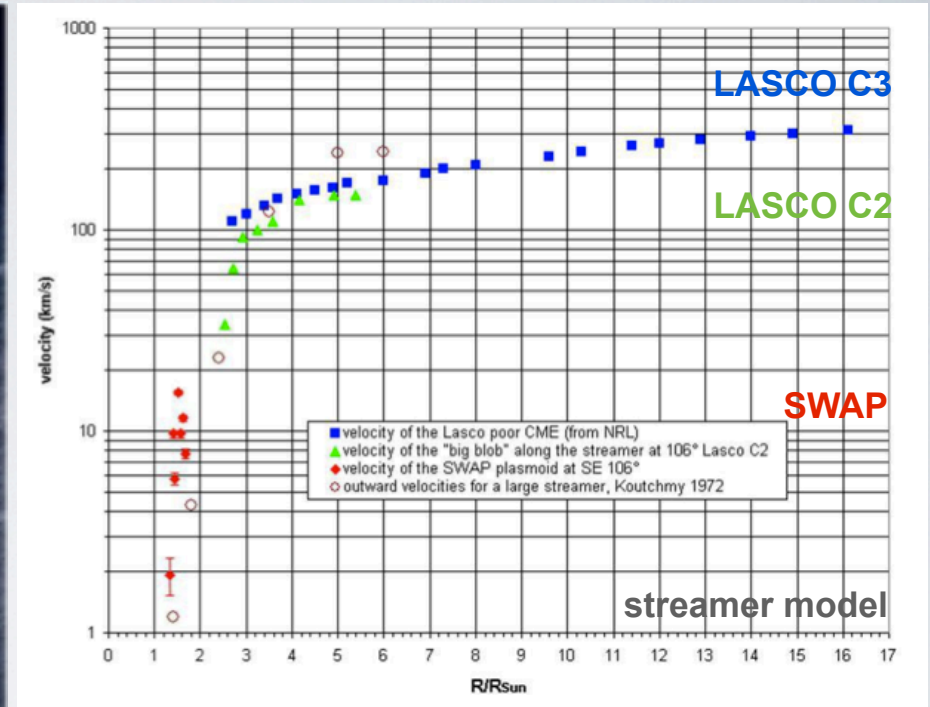
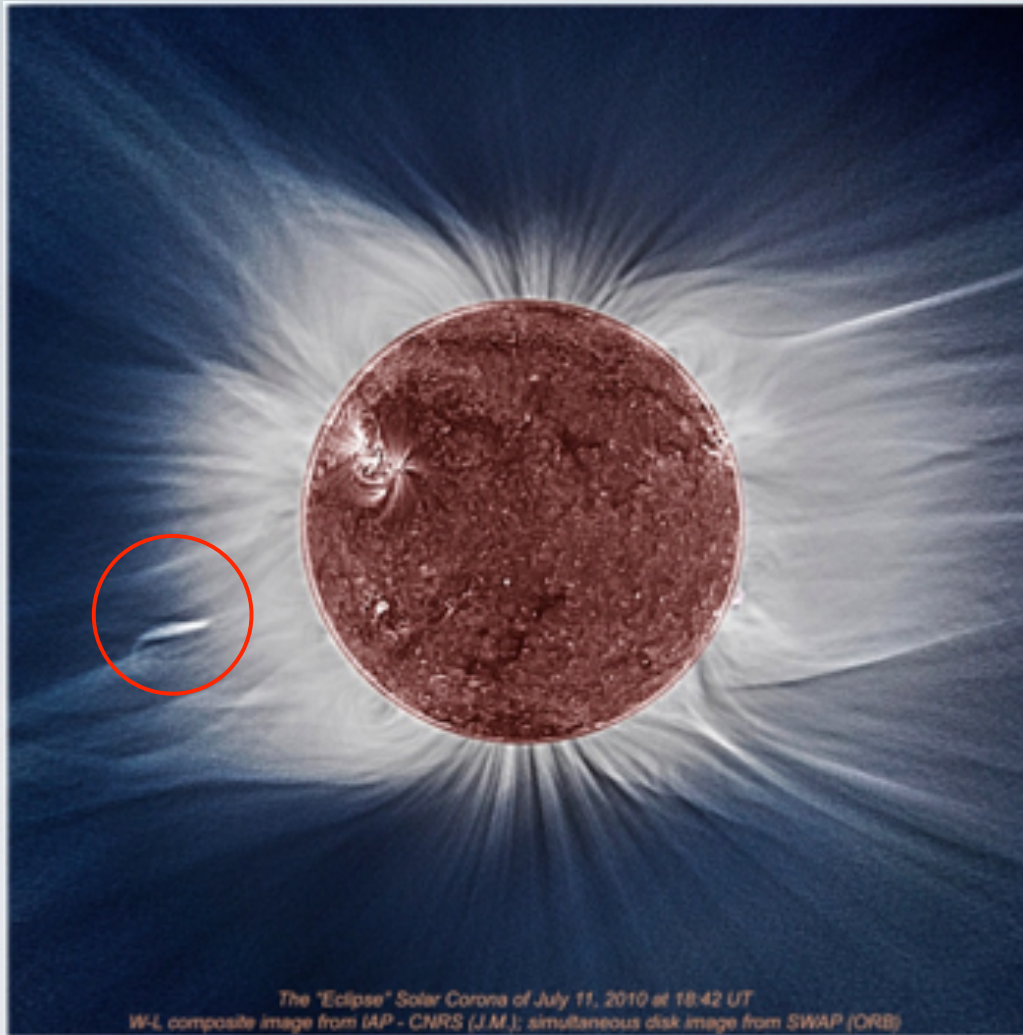


EUVI-A



# GLOBAL CORONAL WAVES

with STEREO/EUVI and SWAP in quadrature



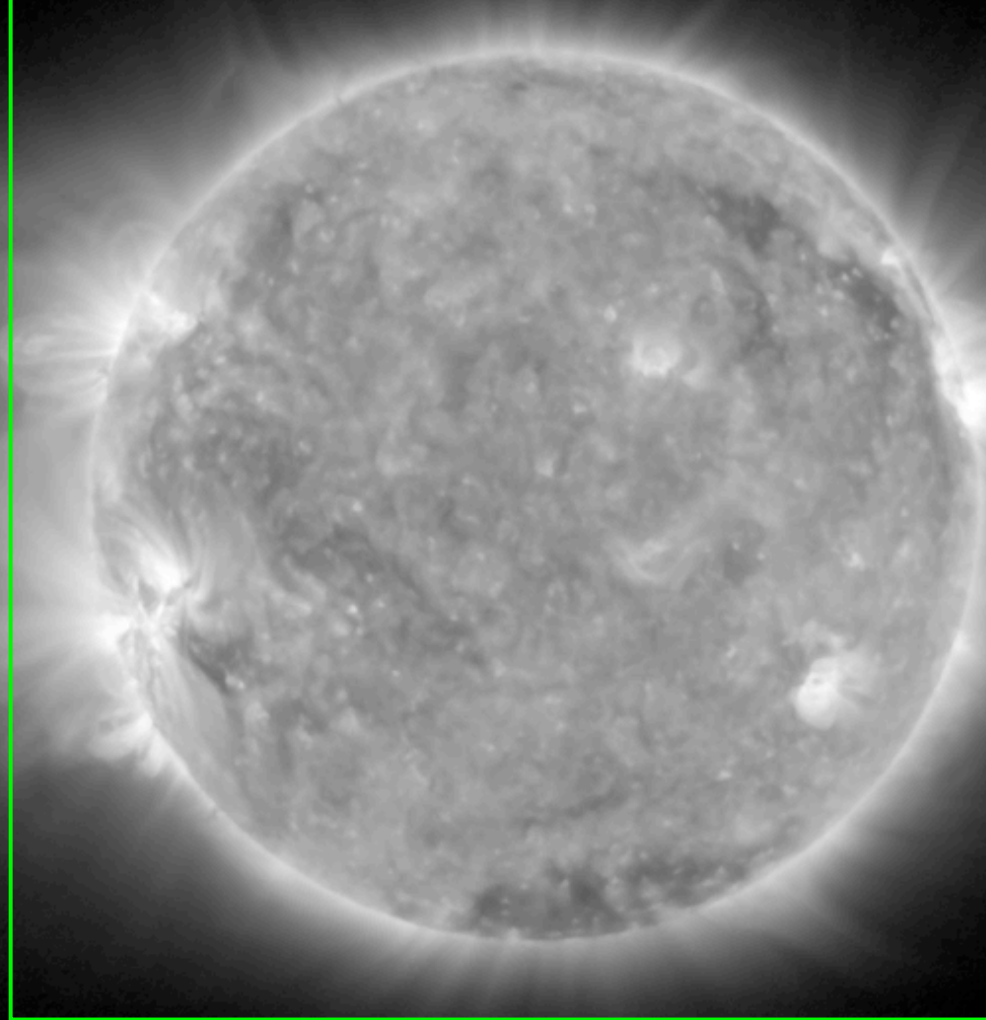
11 Jul 2010:

- coronal plasmoid in EUV and white light  
(*Koutchmy et al., paper in preparation*)
- comparison with flash spectra for TR and prominence analysis  
(*Bazin et al., paper in preparation*)

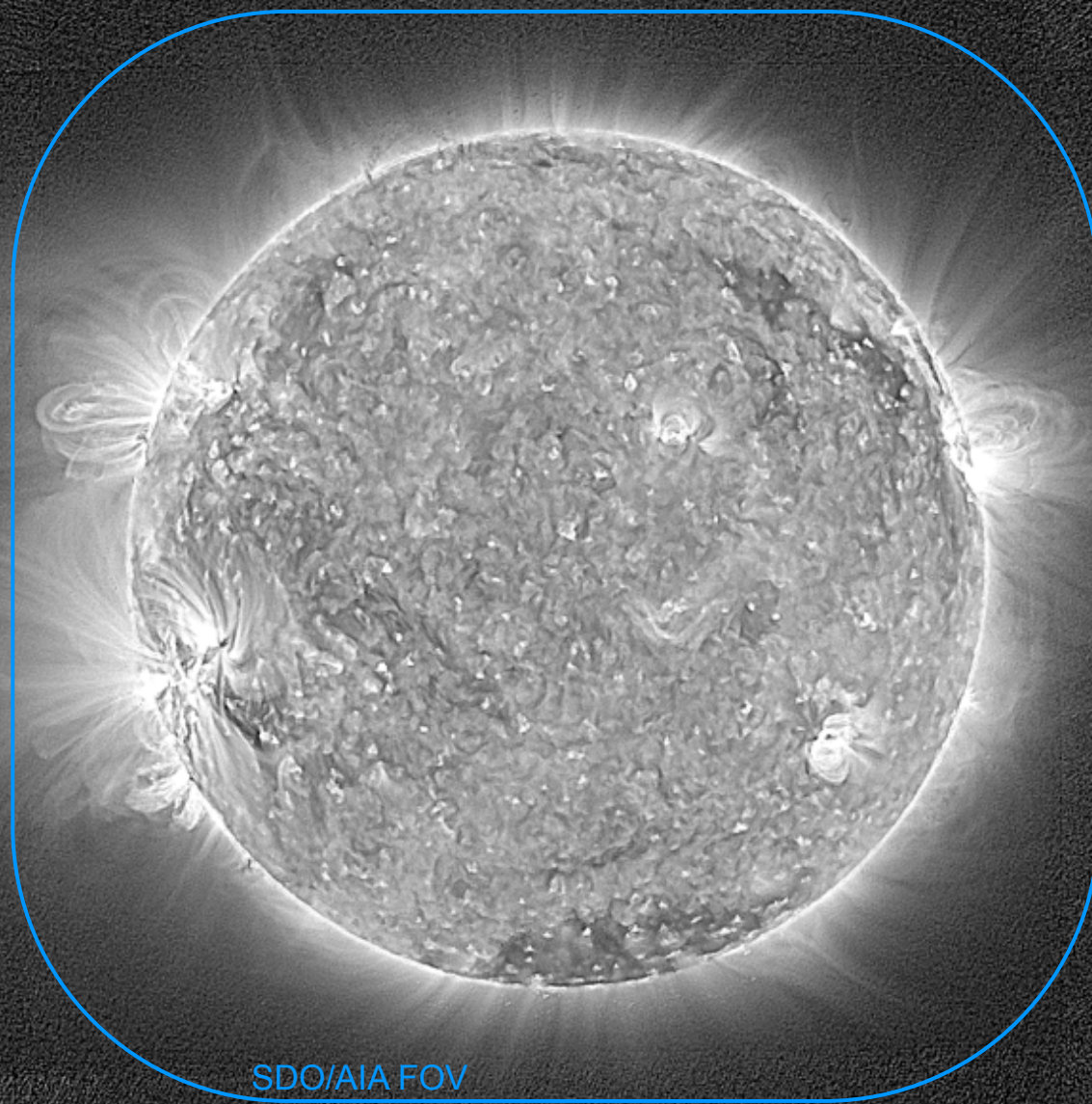
# ECLIPSE OBSERVATIONS

white light vs EUV 17.4nm





SWAP MOSAICS

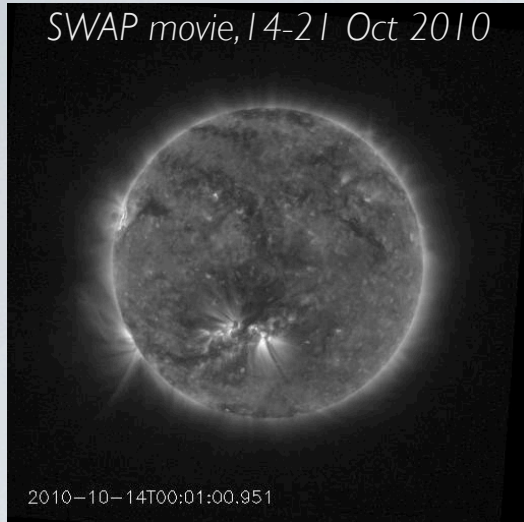


PROBA2/SWAP FOV

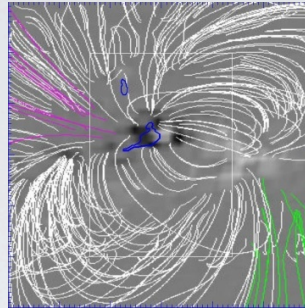
SWAP 2011-03-23



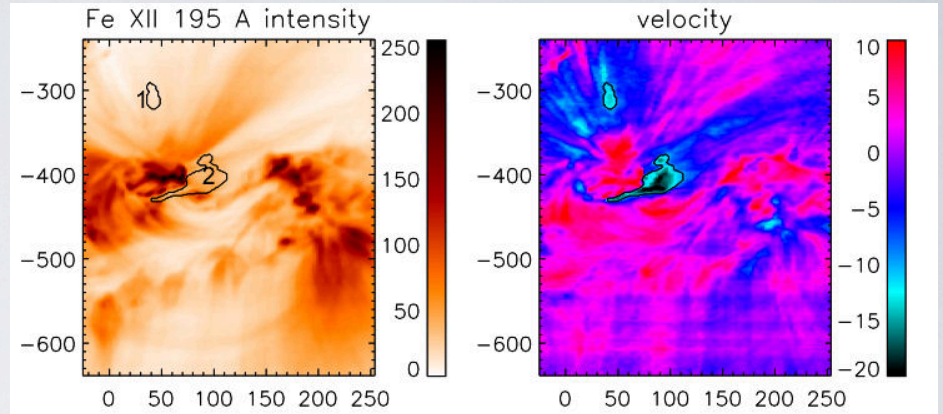
SWAP movie, 14-21 Oct 2010



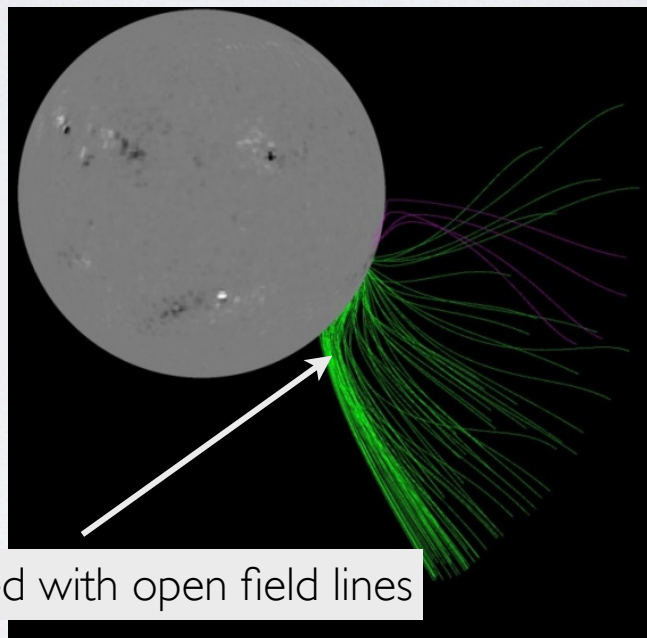
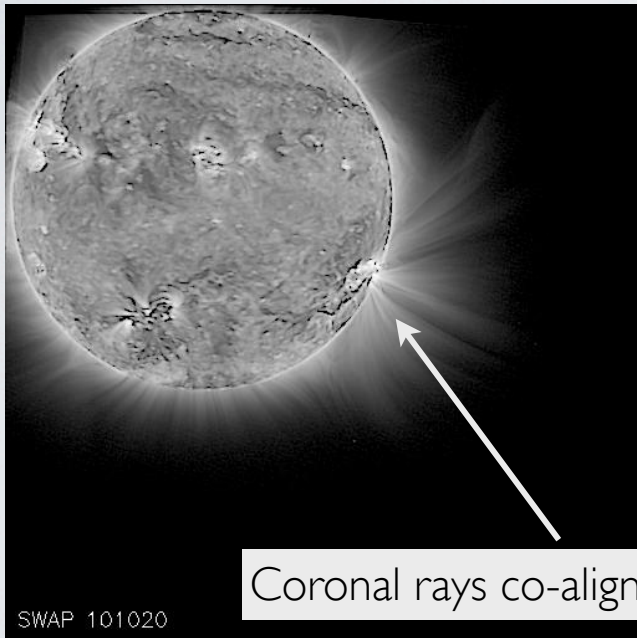
PFSS magnetic field



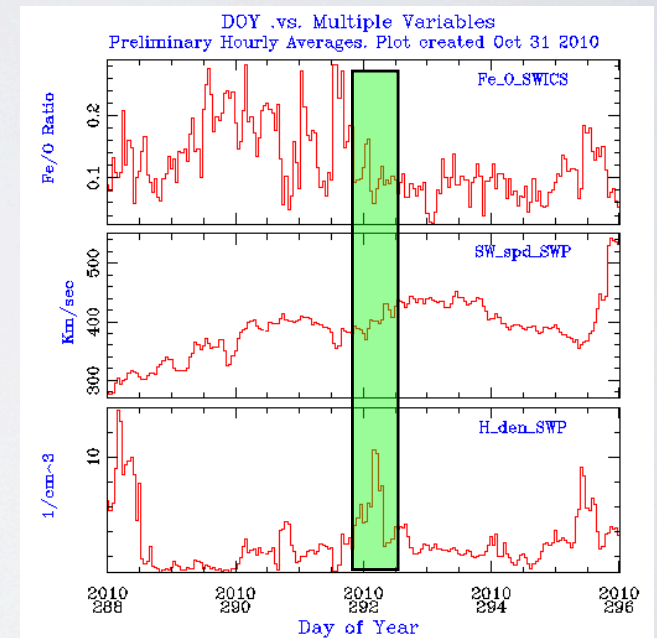
Outflows in AR 11112 detected by EIS 14/10/10



Impact of outflows on ACE solar wind data



Coronal rays co-aligned with open field lines

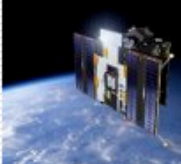


# SOLAR WIND SOURCES - SWAP/EIS

V. Slemzin, L. Harra, A. Urnov, S. Kuzin, F. Goryaev, D. Berghmans, A. De Groof, D. Seaton (EGU 2011)

# DATA AVAILABILITY

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



## PROBA2 SCIENCE CENTER

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Last update: 11th of May 2011

### Community

- Guest investigator program
  - First Guest Investigators are selected
  - Second Call for Ideas is open!
- + Science consortium for LYRA and SWAP
- + Calendar

Home page > Community > Guest investigator program

## Second Call for Ideas is open! **Deadline: 30 June 2011**

A Guest Investigator Program is available to promote the use of PROBA2 data. Selected proposers will be invited to spend one or a few months with the PI teams to obtain expert knowledge on the instruments and to participate in the daily commanding of SWAP and LYRA. Each guest investigator will be reimbursed for travel, accommodation and living expenses.

The second Call for Ideas for the PROBA2 Guest Investigator Program - for visits between September 2011 and June 2012 - is currently open. A third call will be made in spring 2012 covering the period July until December 2012.

We solicit research proposals based on SWAP and LYRA data analysis, by scientists outside the SWAP and LYRA PI-teams. We encourage in particular young post-docs and PhD students to apply, although more senior guest investigators proposals are welcome also.

Selected proposers will be invited to spend one or a few months with the PI teams to obtain expert knowledge on the instruments, to participate in the daily commanding of the SWAP and LYRA instruments according to the needs of their data analysis proposal, and to finalize their research. We encourage two separate visits to the Science Centre, so that the first visit can be devoted to the preparation of the research and the second one to the finalization of the work. The ultimate goal for every GI visit is to publish a paper in a peer-reviewed journal. Guest investigators may be reimbursed for travel, accommodation and living expenses up to a maximum of 5000 euro. Limited support to present the results at an international conference can also be considered.

Proposals should include

- a short CV of the candidate guest investigator.
- a max 2 page description of the proposed research including a description of the required SWAP and LYRA data. Information on the possibilities of the SWAP and LYRA instruments can be found on this website or by asking the PI teams.
- at least 1 publication authored by the candidate guest investigator related to the proposed research
- a short motivation for the requested support as well as a motivation& timeframe of an eventual visit to the SWAP and LYRA PI-teams.