De zon & PROBA2

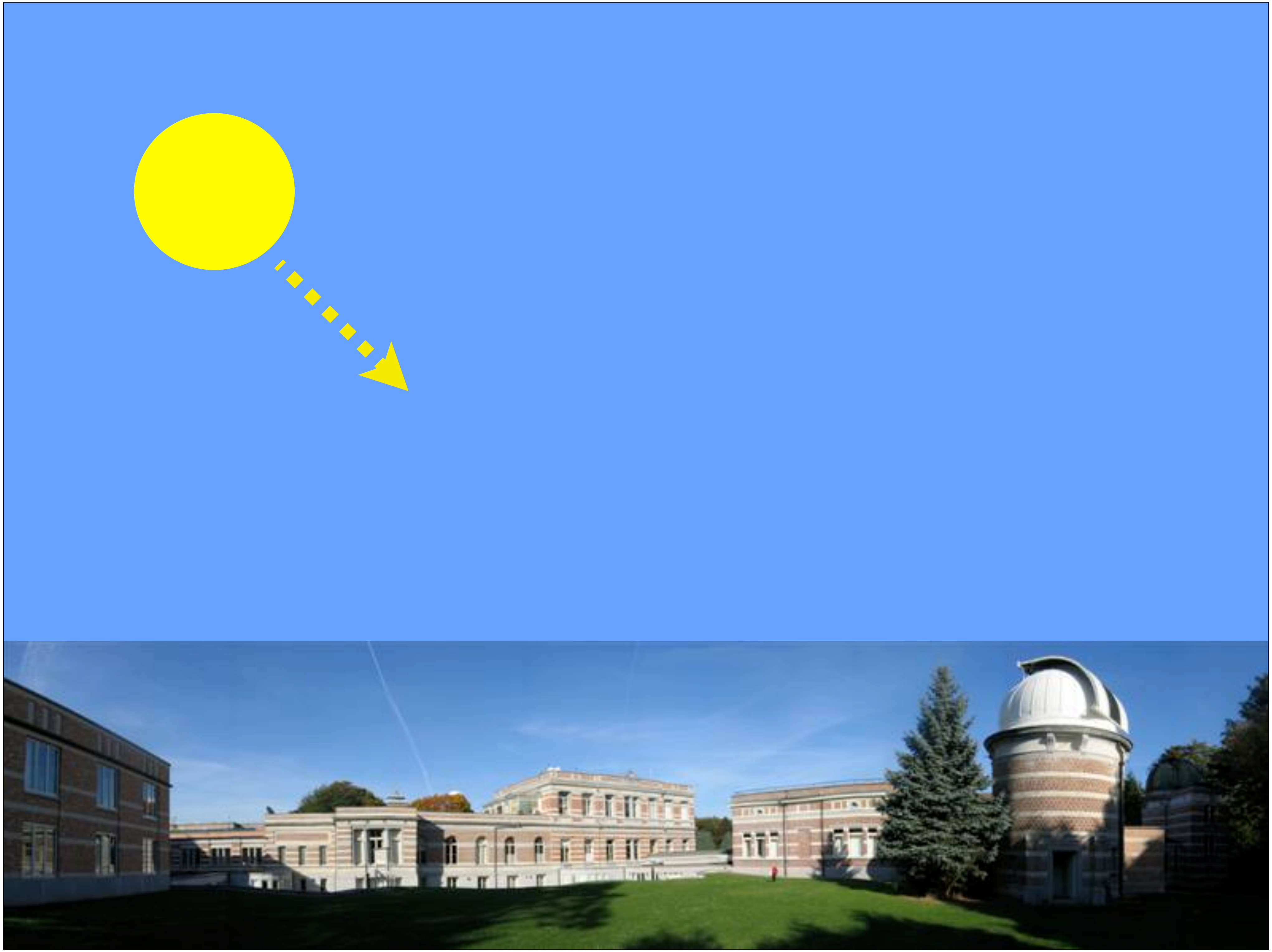
David Berghmans
Koninklijke Sterrenwacht van België

URANIA opendeur

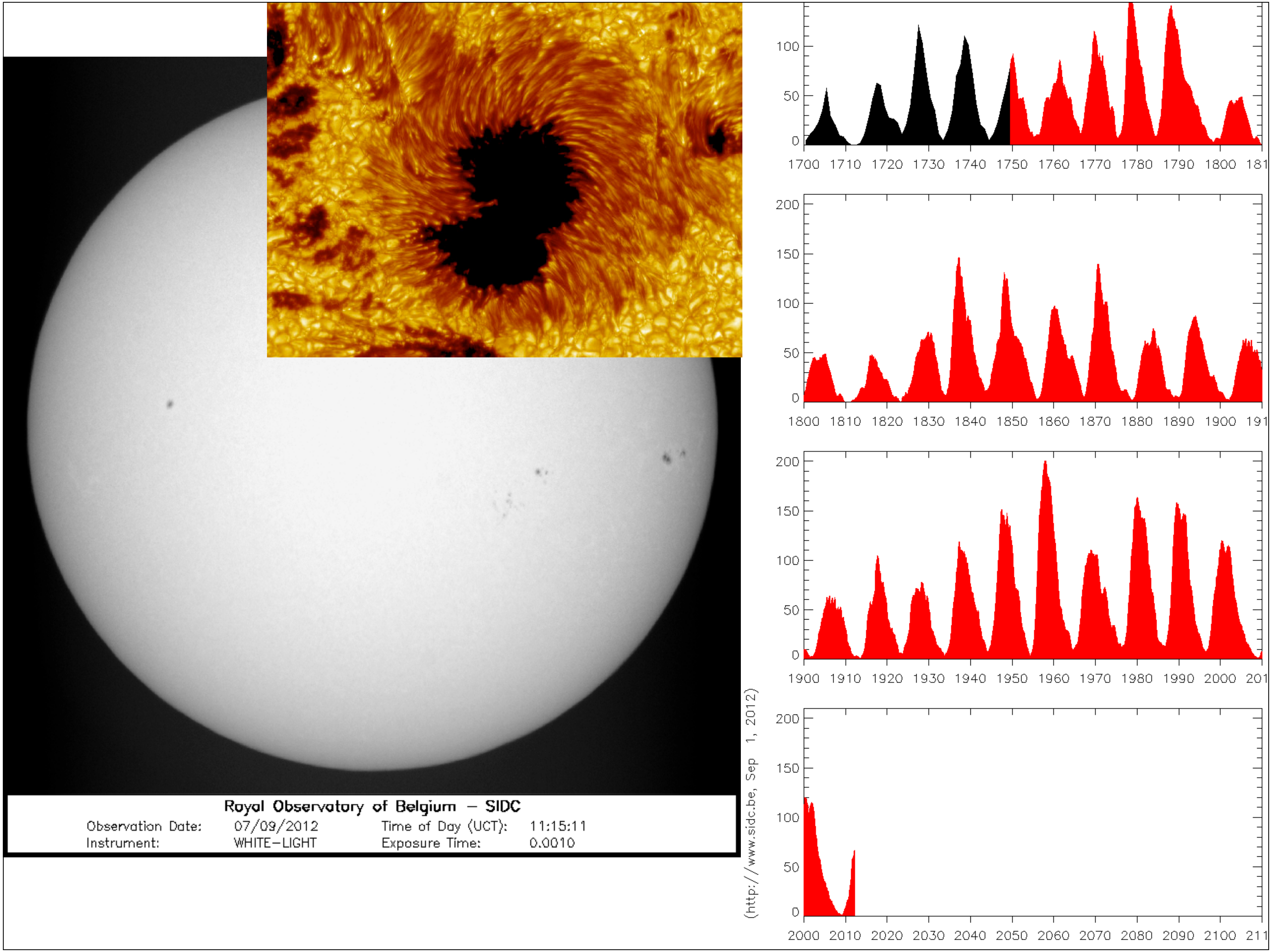
2012-09-07, Hove

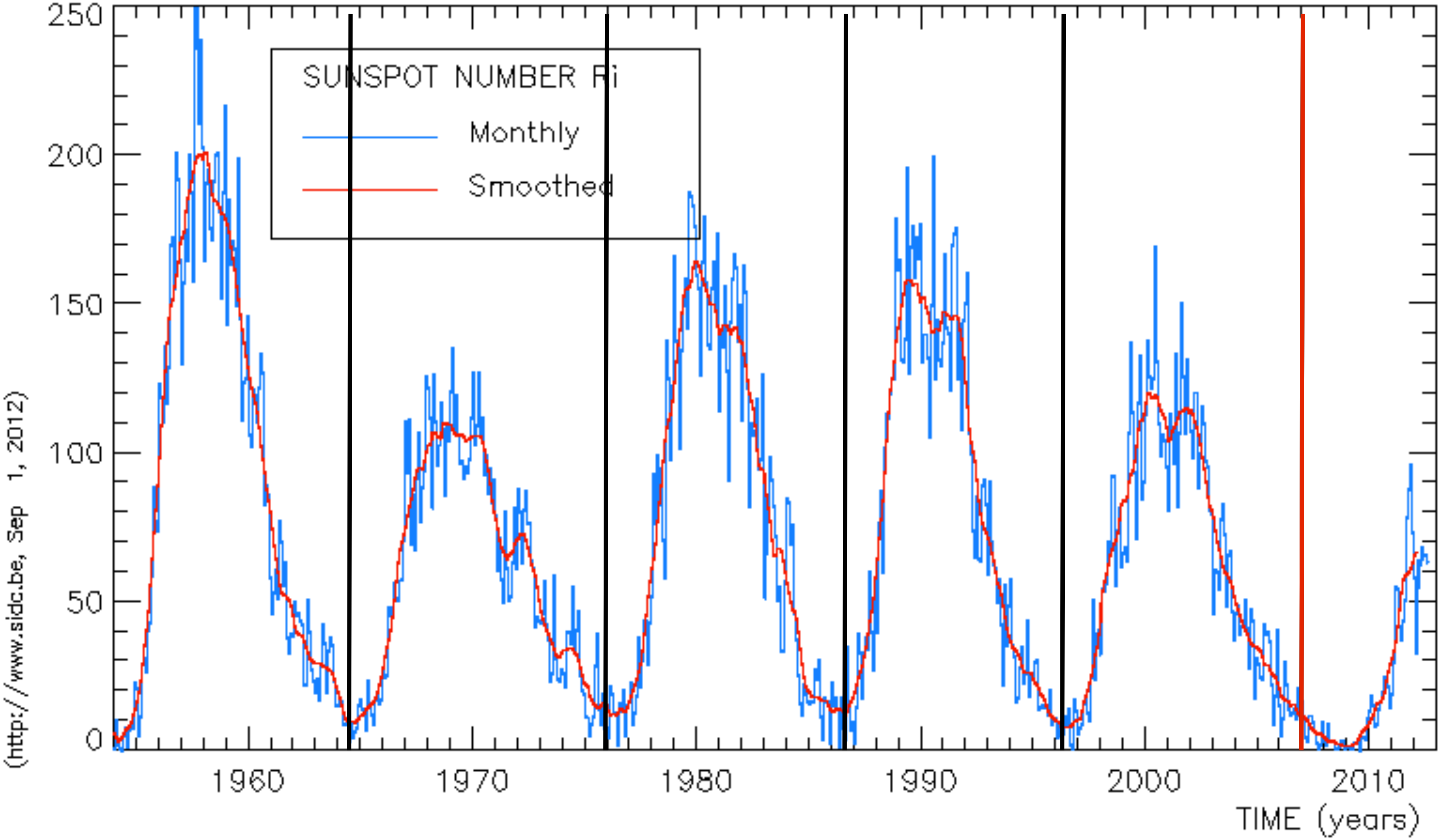
quiz

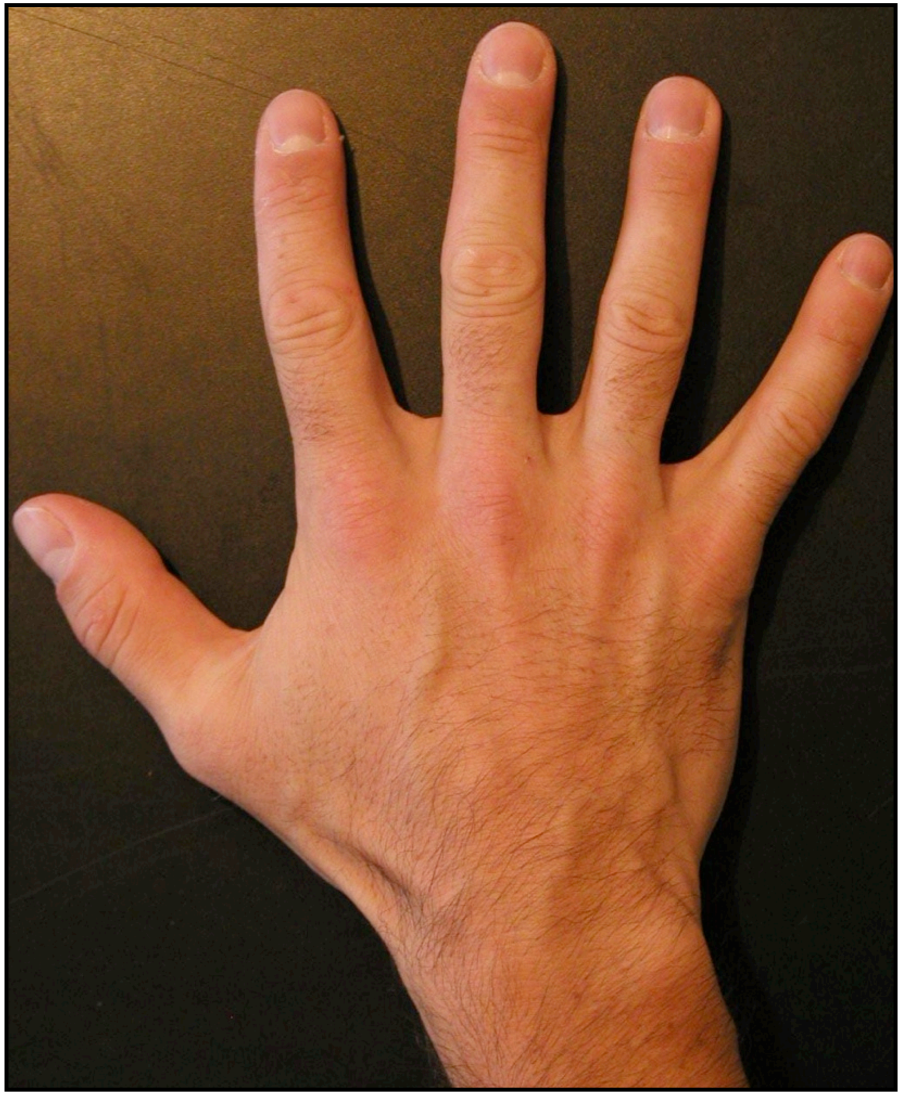
1. Is er leven in de zonneatmosfeer?
2. Is de ‘lege’ ruimte rond de aarde heet?
3. Kan je zonnebrand in een vliegtuig krijgen?
4. Kan de zon te laat zijn?




Je bent hier!
Vous êtes ici!


Royal Observatory of Belgium – SIDC
Observation Date: 07/09/2012
Time of Day (UCT): 11:15:11
Instrument: WHITE–LIGHT
Exposure Time: 0.0010
(http://www.sidc.be, Sep 1, 2012)
0 50 100
1700 1710 1720 1730 1740 1750 1760 1770 1780 1790 1800 181
0 50 100 150 200
1800 1810 1820 1830 1840 1850 1860 1870 1880 1890 1900 191
0 50 100 150 200
1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 201
0 50 100 150 200
2000 2010 2020 2030 2040 2050 2060 2070 2080 2090 2100 211


SUNSPOT NUMBER Ri
Monthly
Smoothed
250
200
150
100
50
0
1960
1970
1980
1990
2000
2010
TIME (years)
(http://www.sidc.be, Sep 1, 2012)

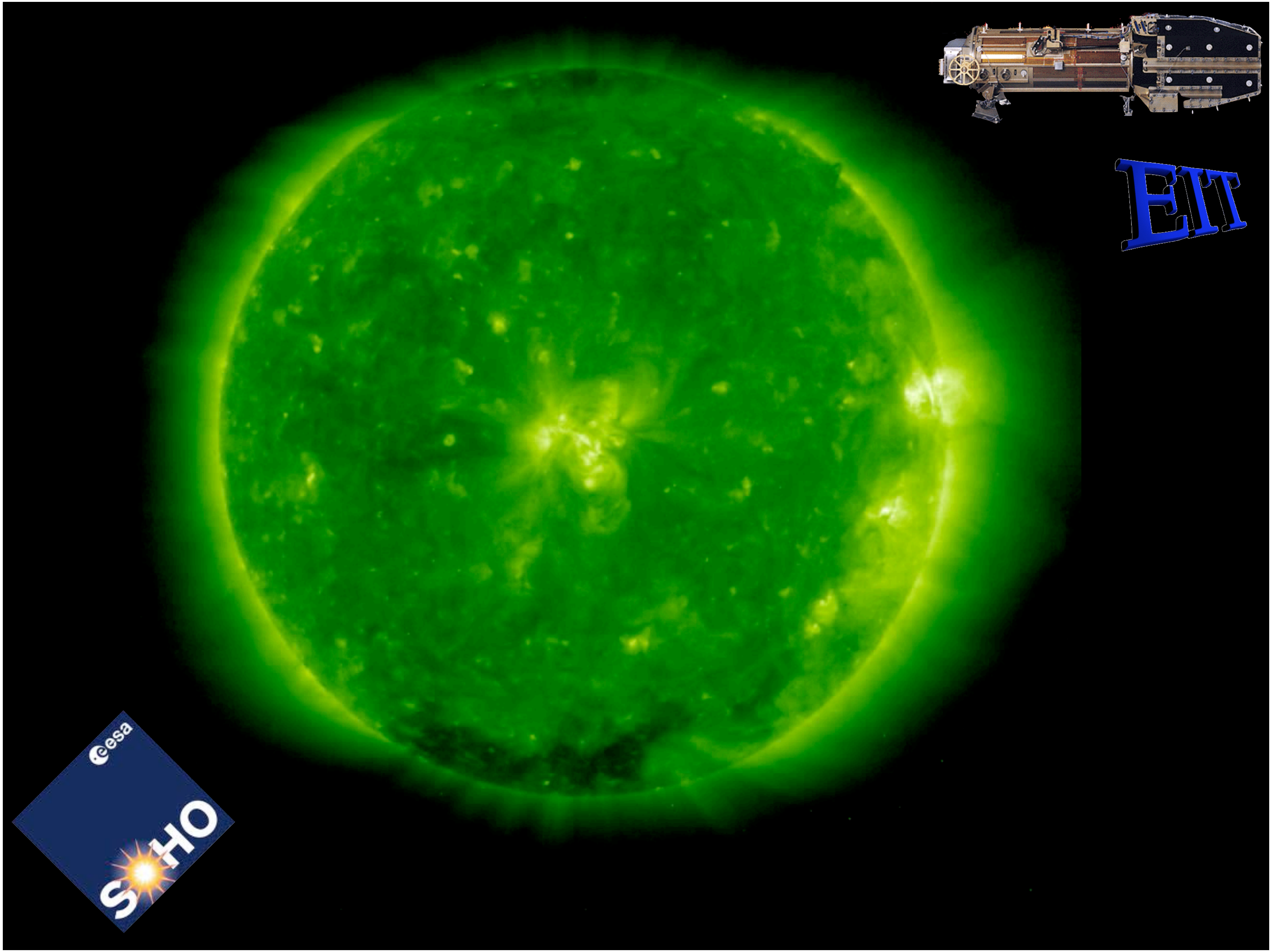


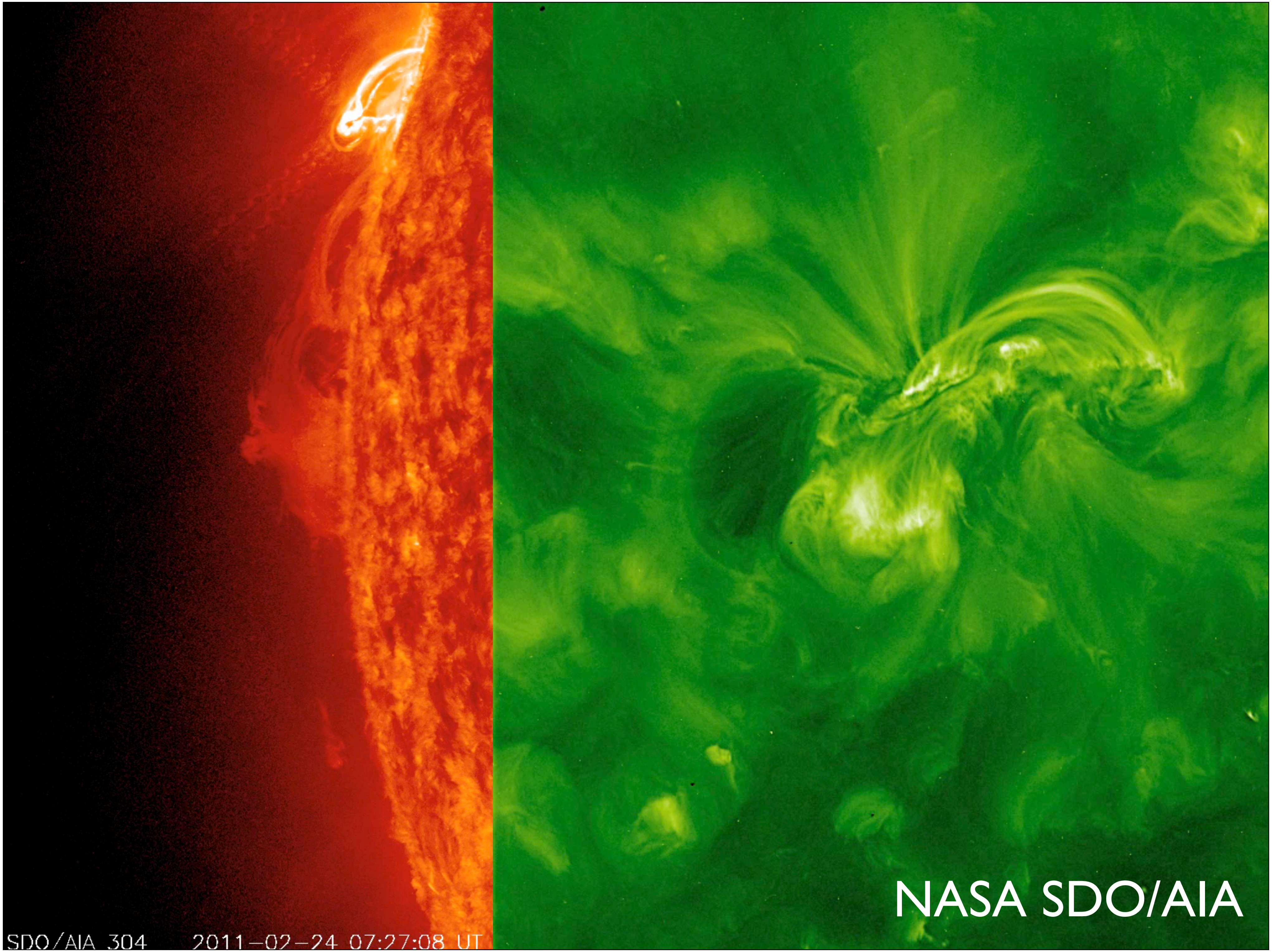
Zichtbaar licht

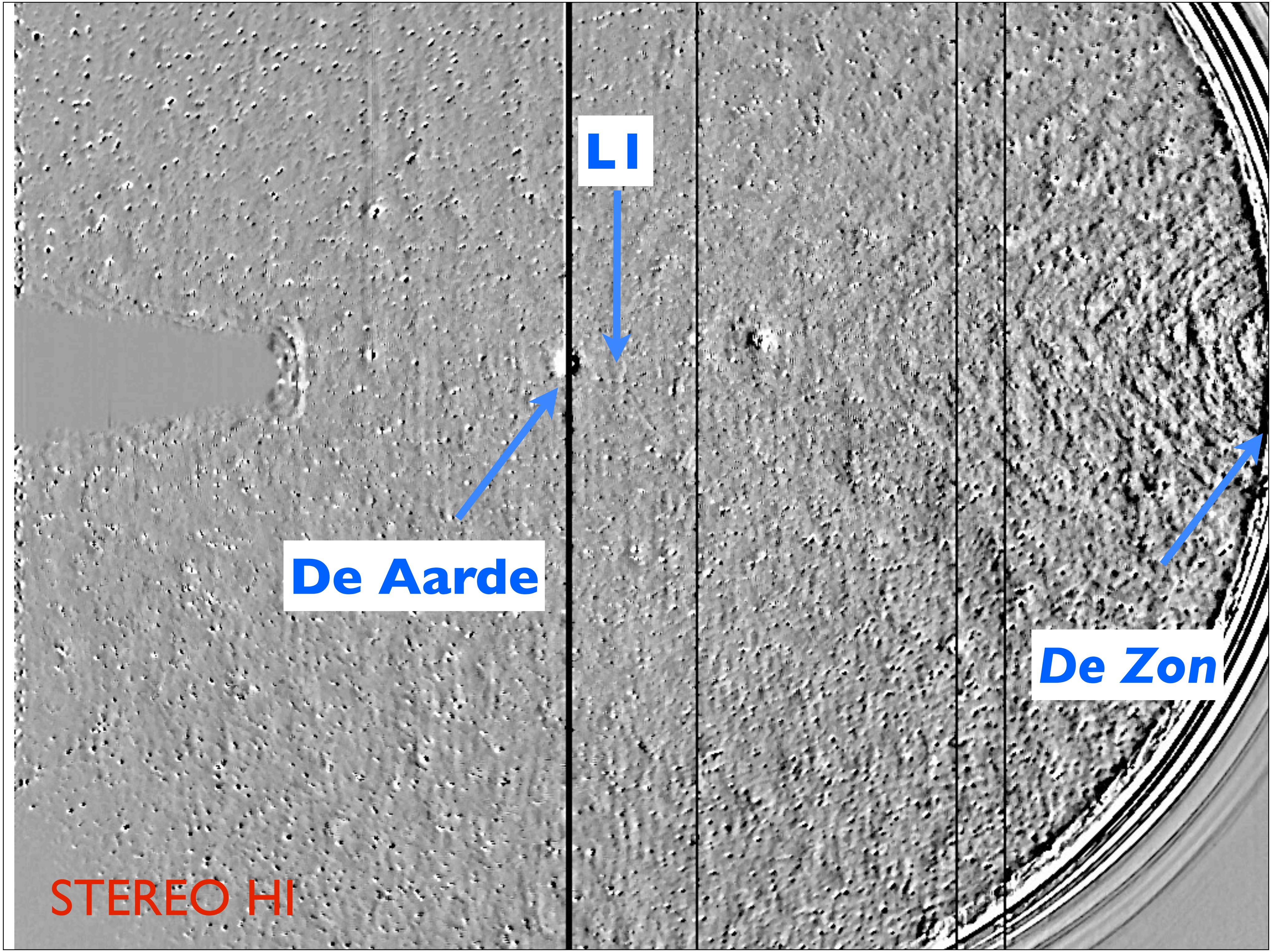
X-straling

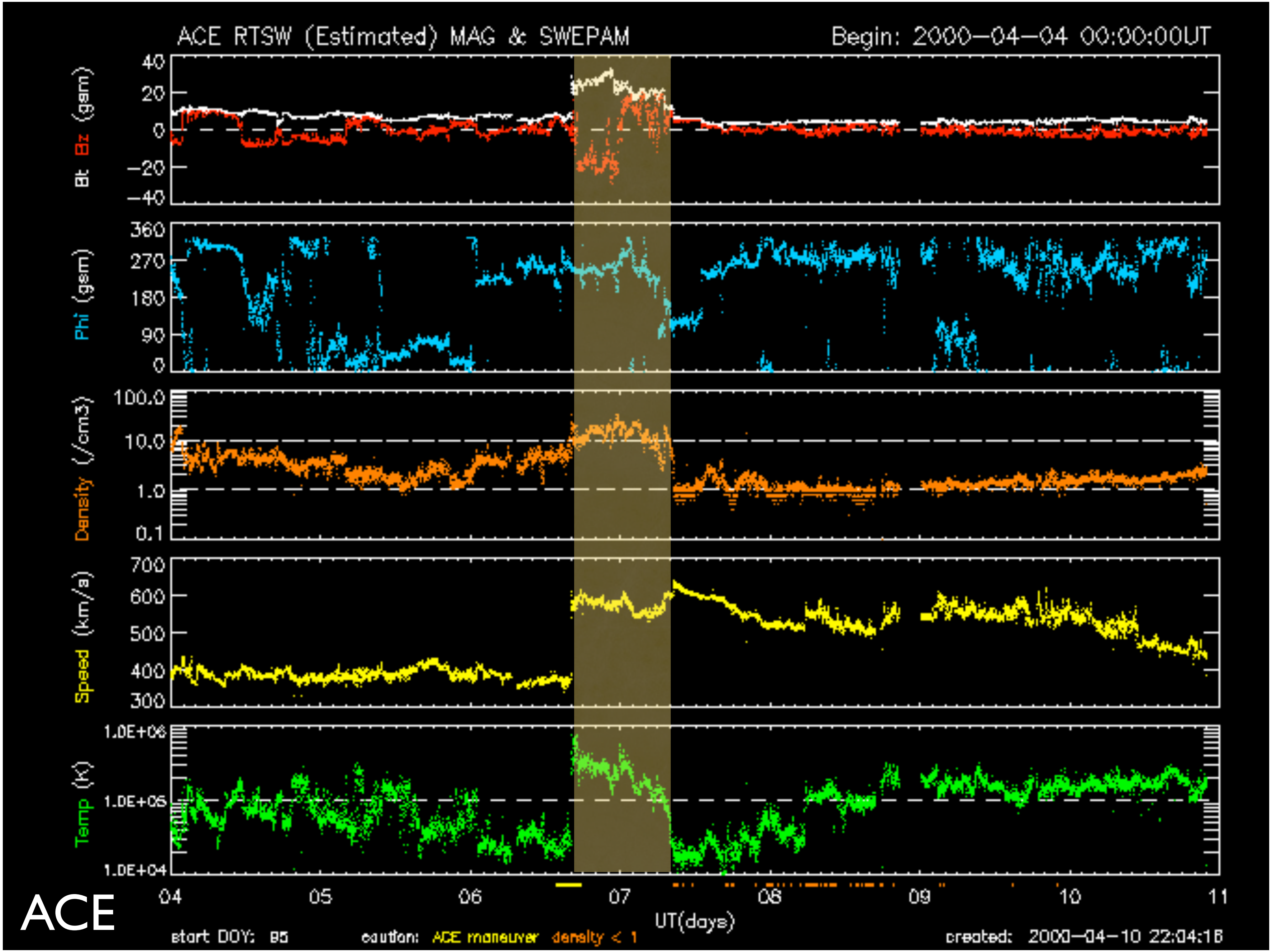
Zichtbaar licht

X-straling

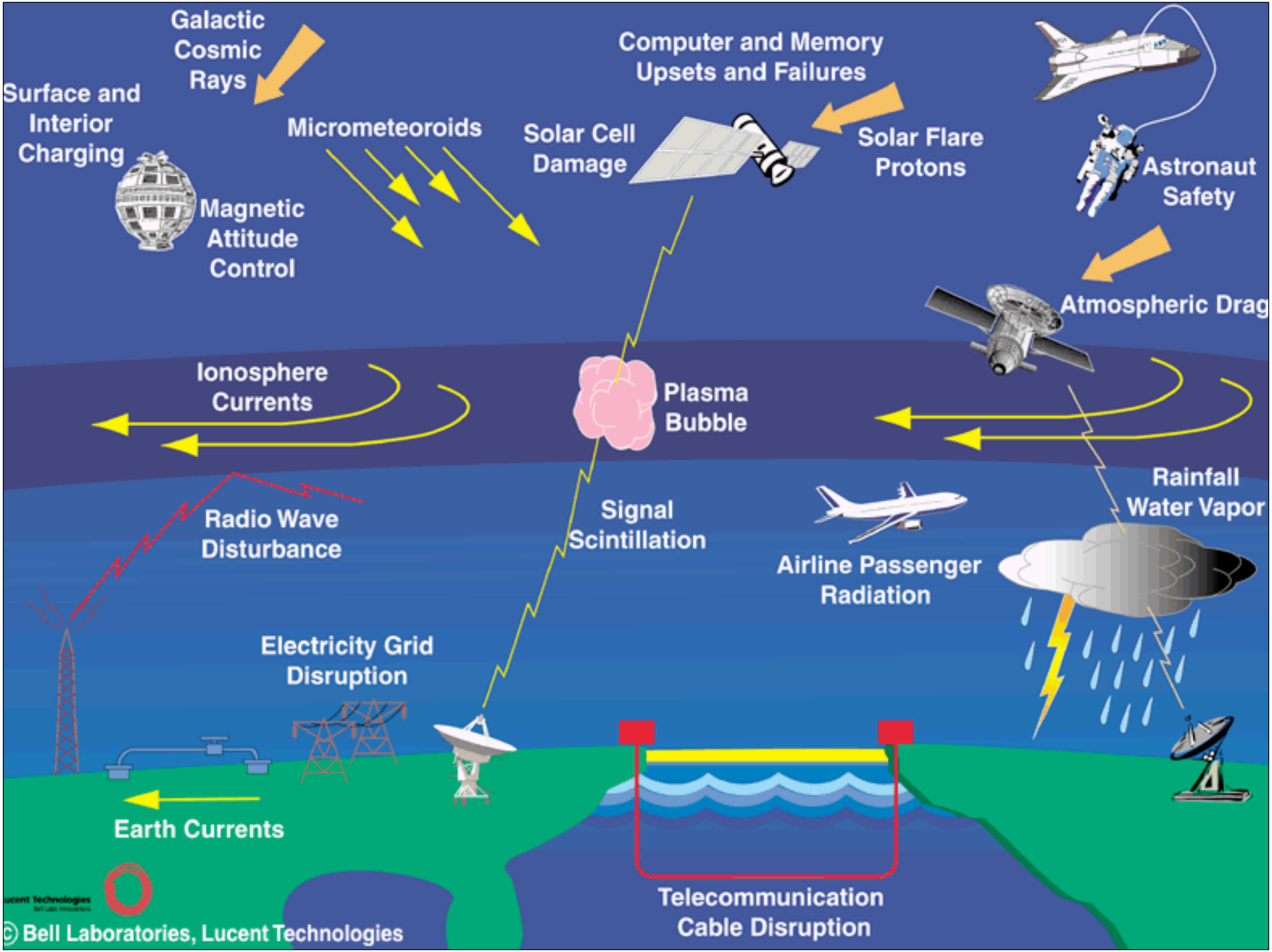

EIT
esa
SOHO


SDO/AIA 304 2011-02-24 07:27:08 UT
NASA SDO/AIA


L1
De Aarde
De Zon
STEREO HI



ACE RTSW (Estimated) MAG & SWEPAM
Begin: 2000-04-04 00:00:00UT
Bt Bz (gsm)
Phi (gsm)
Density (/cm3)
Speed (km/s)
Temp (K)
UT(days)
start DOY: 95
caution: ACE maneuver density < 1
created: 2000-04-10 22:04:16
ACE



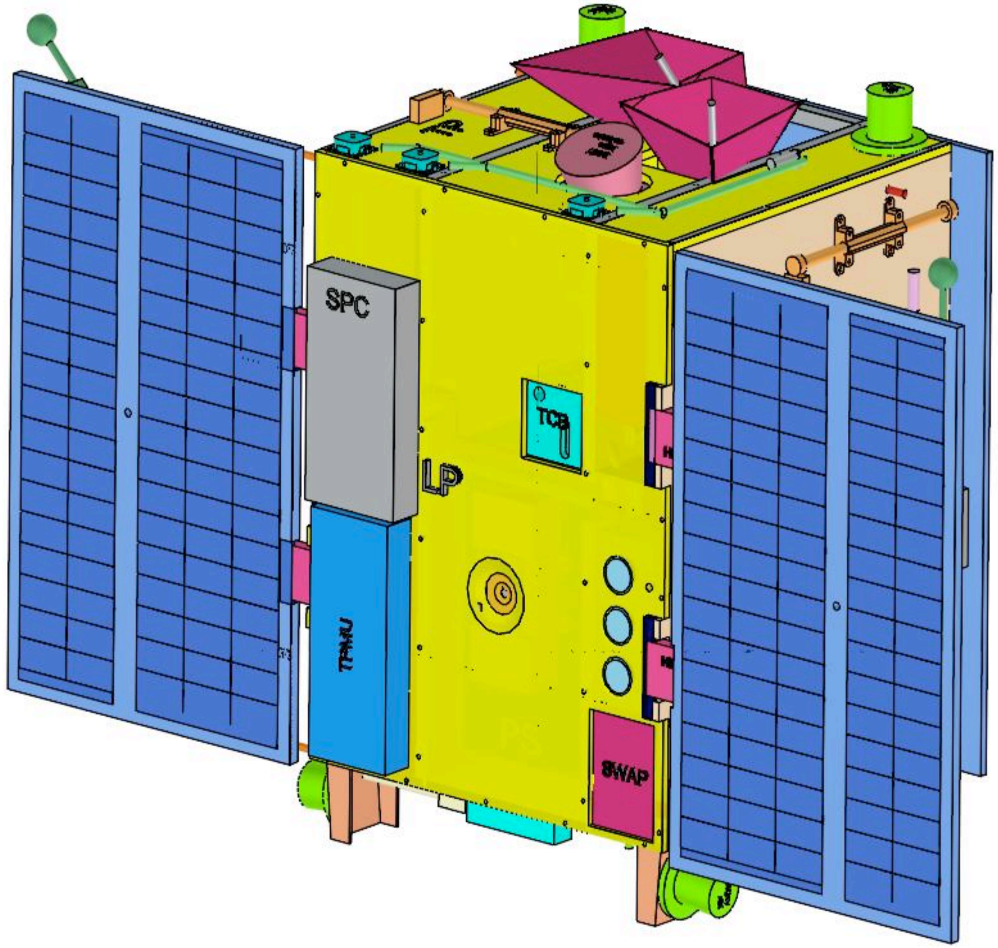
Galactic Cosmic Rays
Computer and Memory Upsets and Failures
Surface and Interior Charging
Micrometeoroids
Solar Cell Damage
Solar Flare Protons
Astronaut Safety
Magnetic Attitude Control
Atmospheric Drag
Ionosphere Currents
Plasma Bubble
Rainfall Water Vapor
Radio Wave Disturbance
Signal Scintillation
Airline Passenger Radiation
Electricity Grid Disruption
Earth Currents
Telecommunication Cable Disruption
Lucent Technologies

quiz

1. Is er leven in de zonneatmosfeer?
2. Is de ‘lege’ ruimte rond de aarde heet?
3. Kan je zonnebrand in een vliegtuig krijgen?
4. Kan de zon te laat zijn?

PROBA2

PROBA2, gebouwd in België
instrumentenbeheer vanuit Brussel

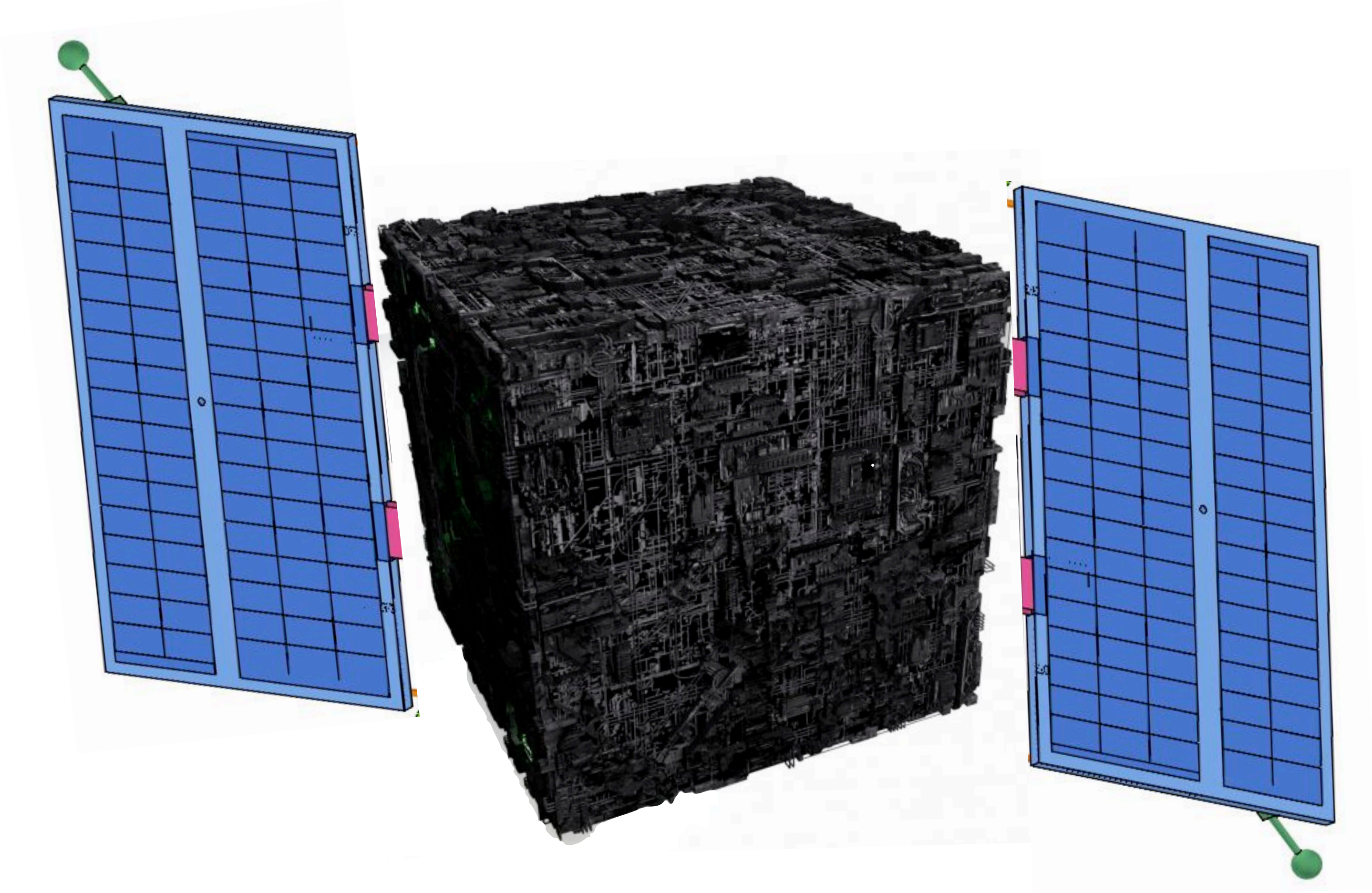


VERHAERT SPACE
A QinetiQ Company

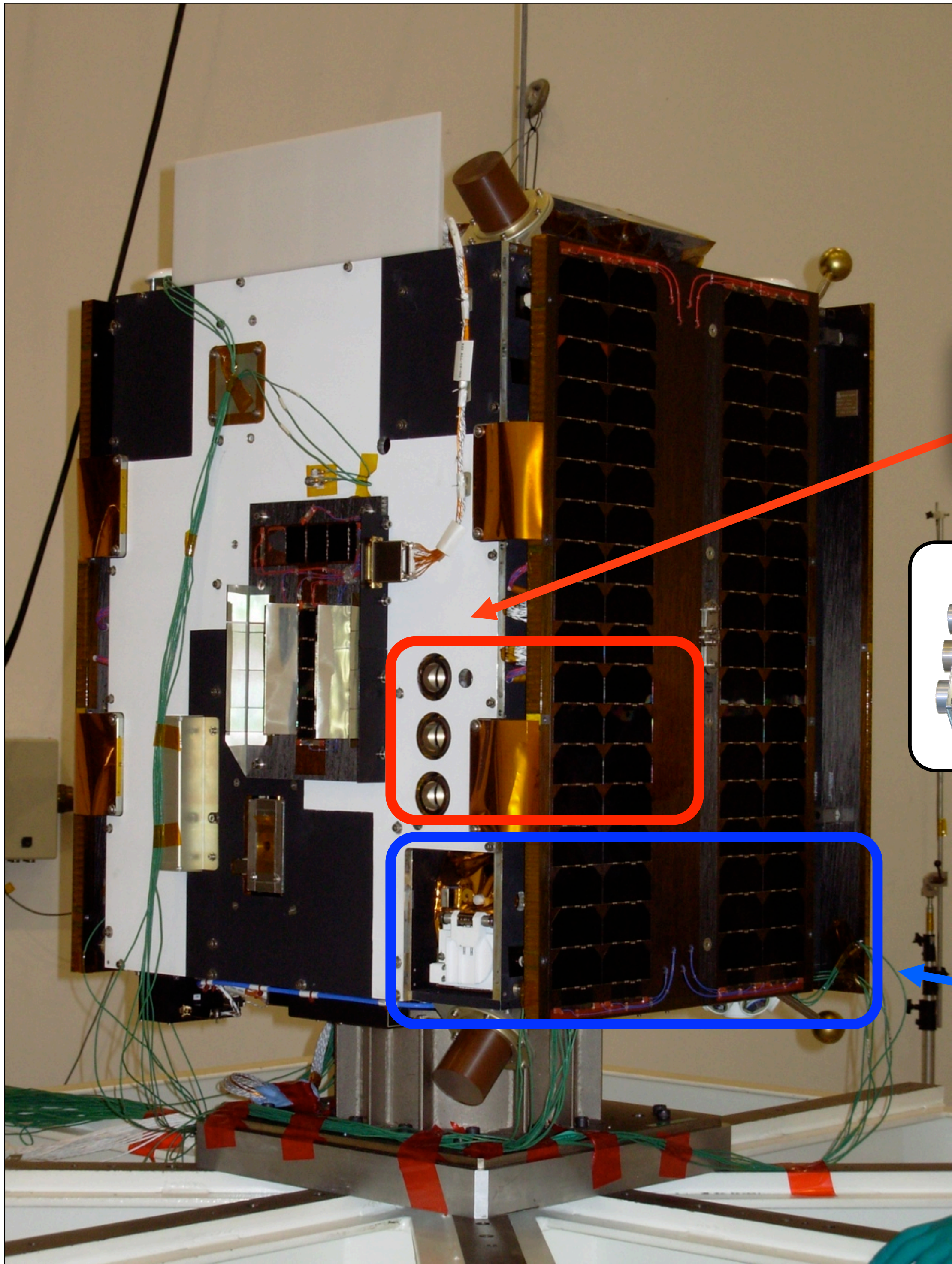
Small is beautiful

Miele

Built to last

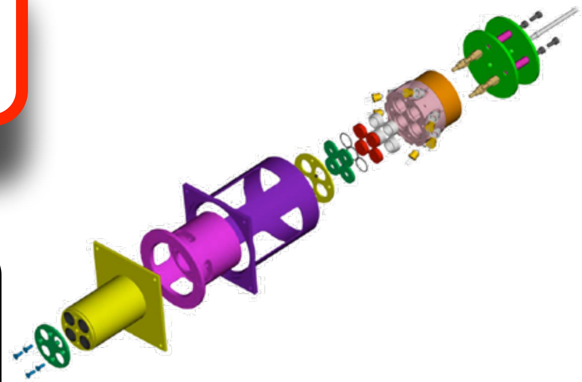


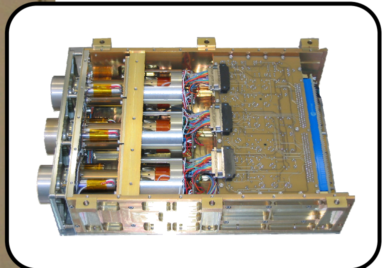
Resistance is futile



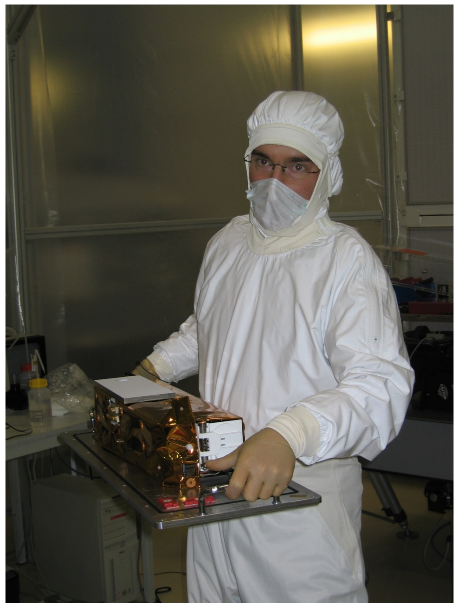
PR2BA

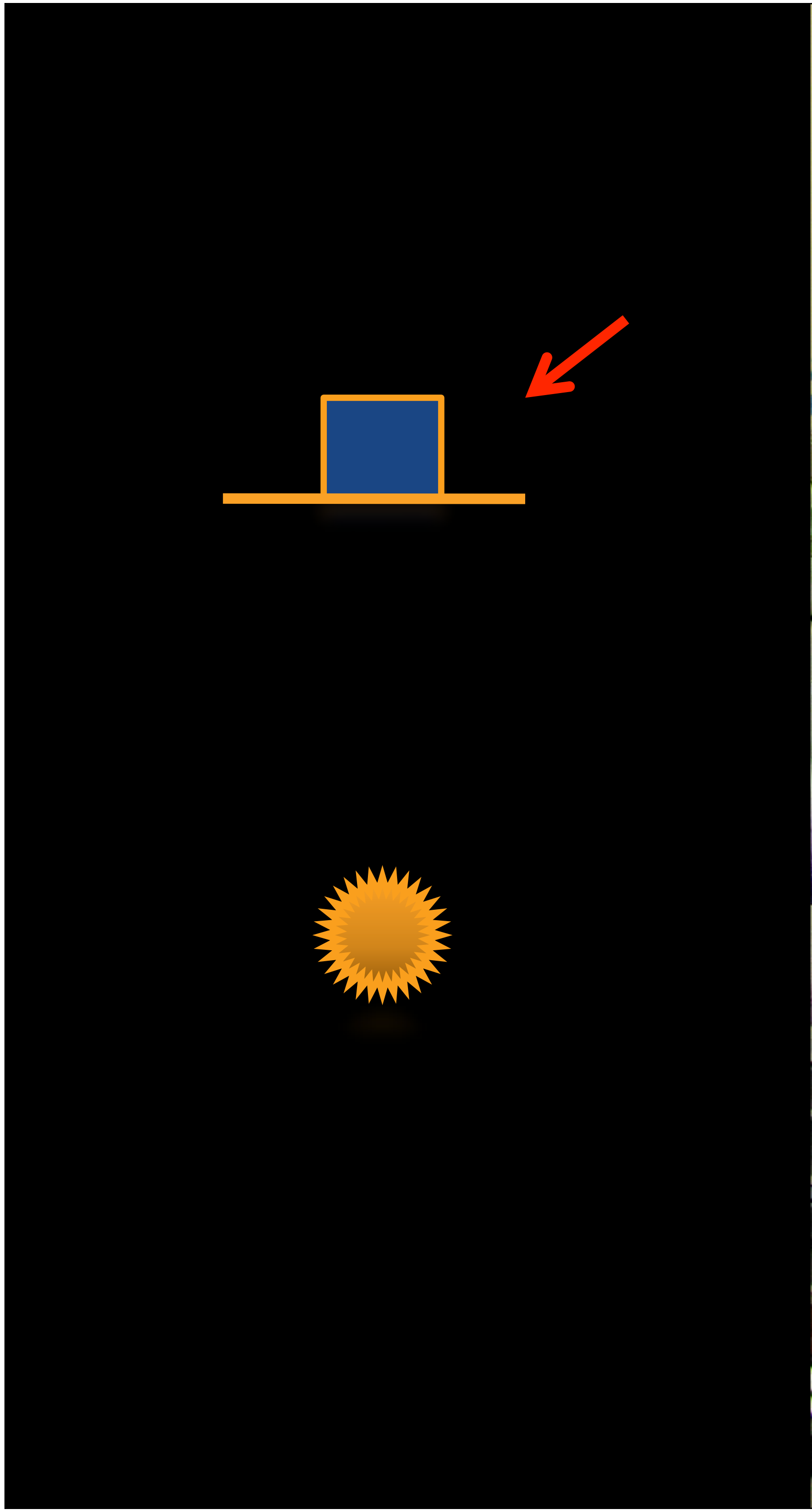
LYRA

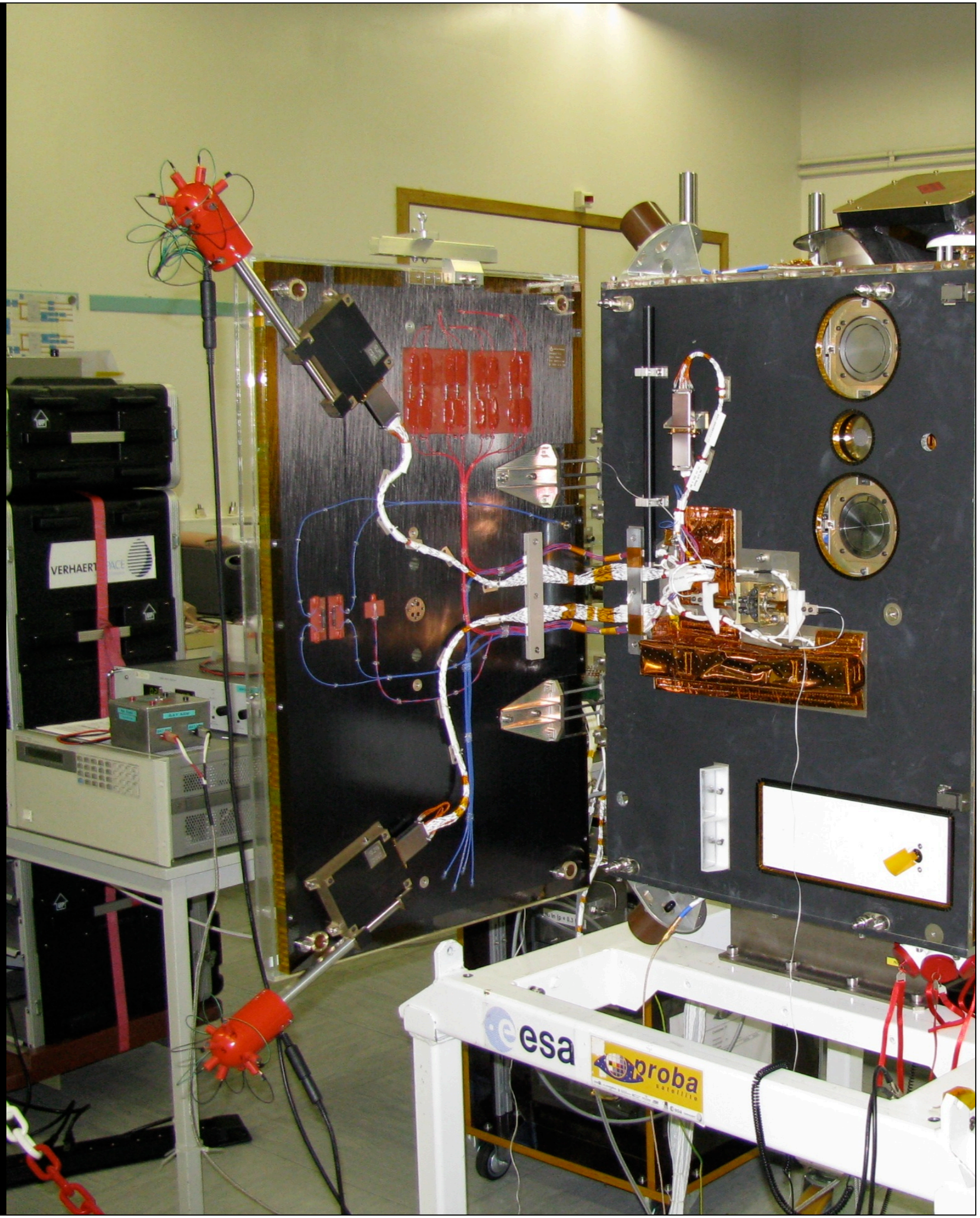


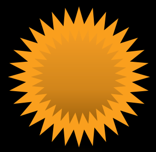


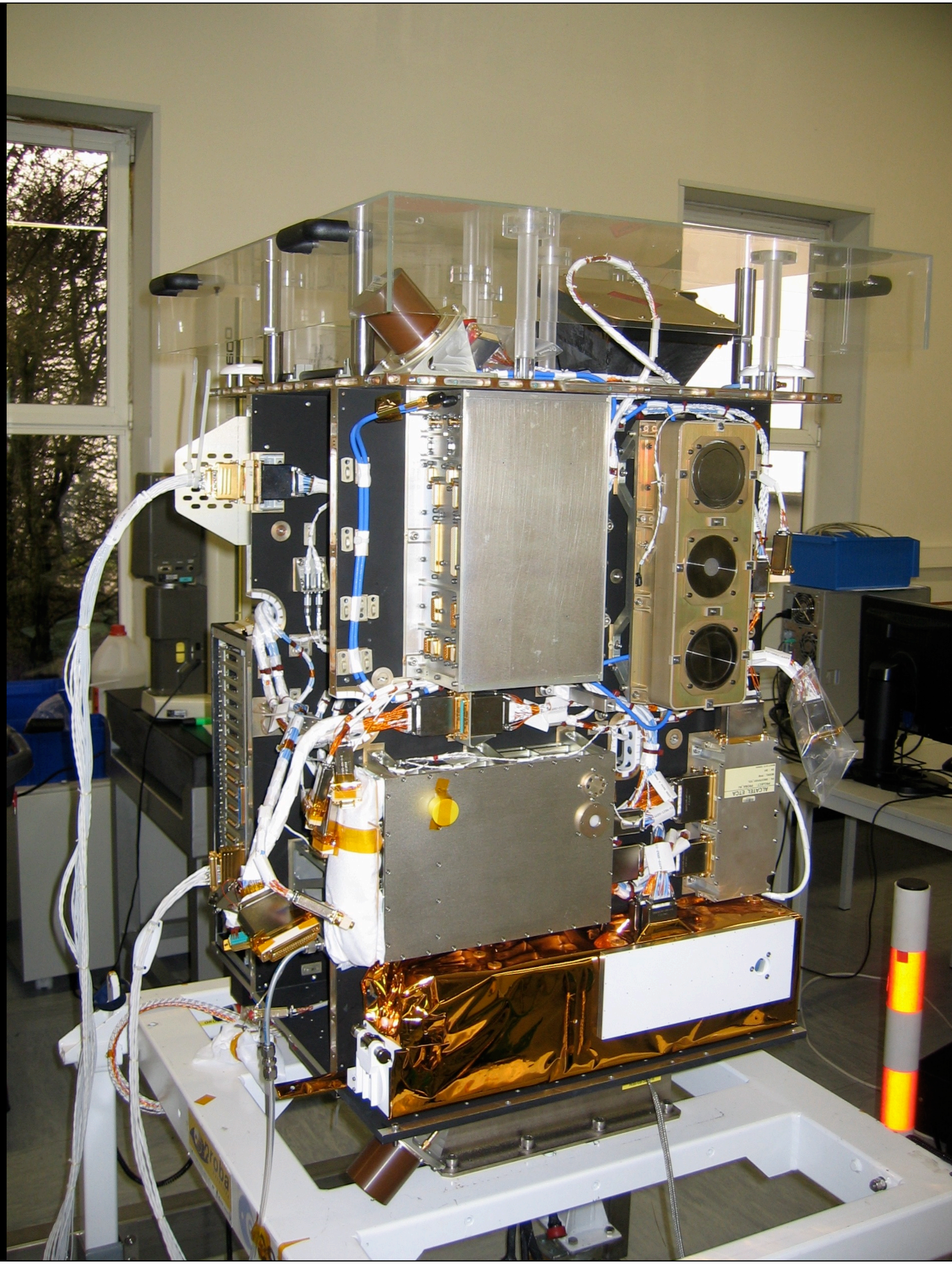
SWAP

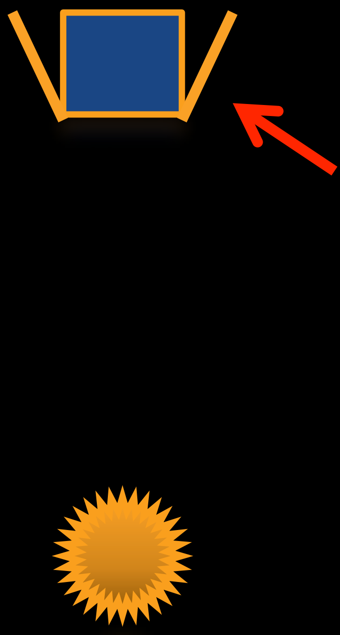




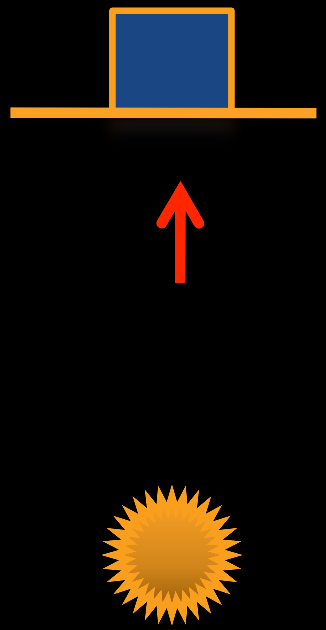

VERHAERT
esa
proba

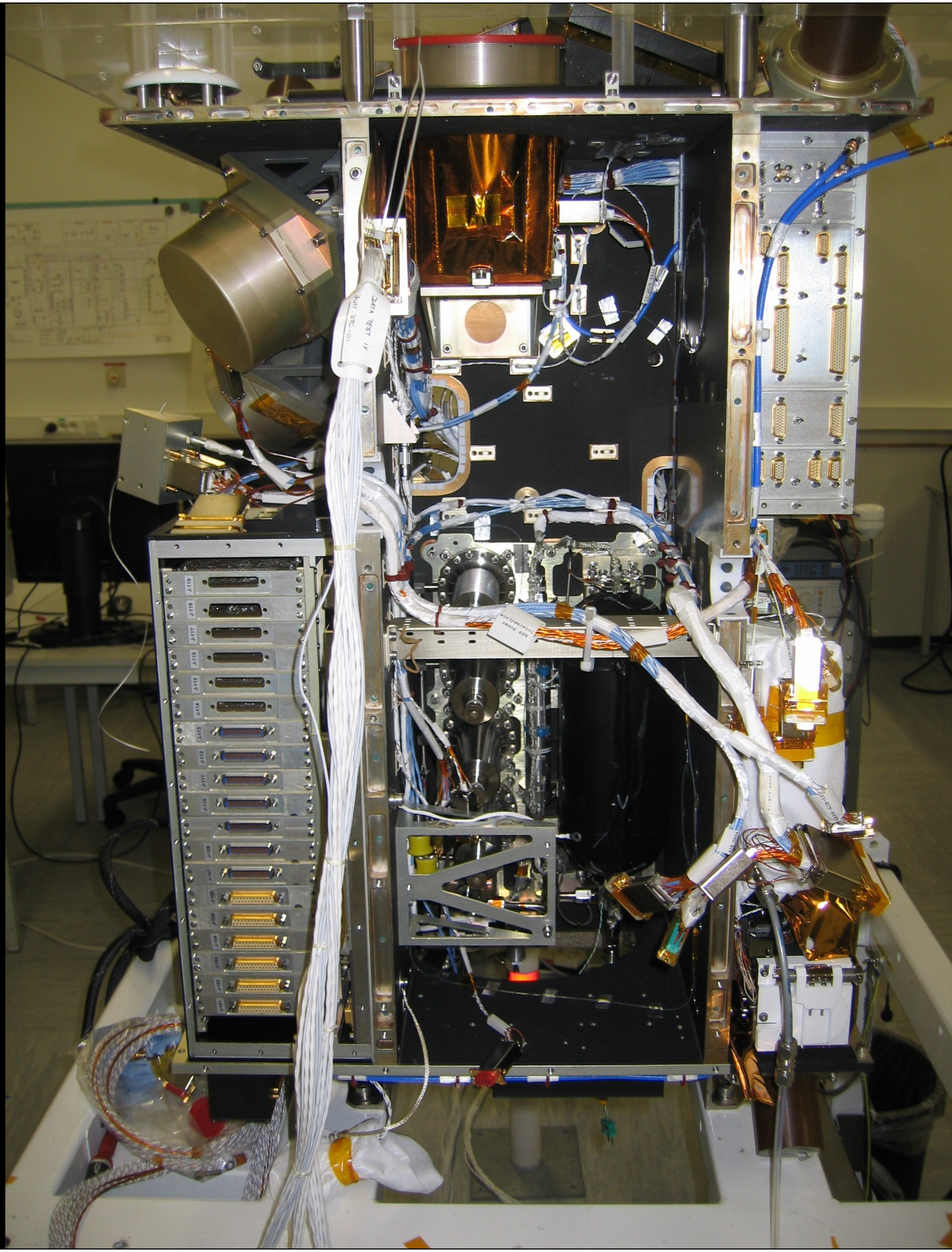


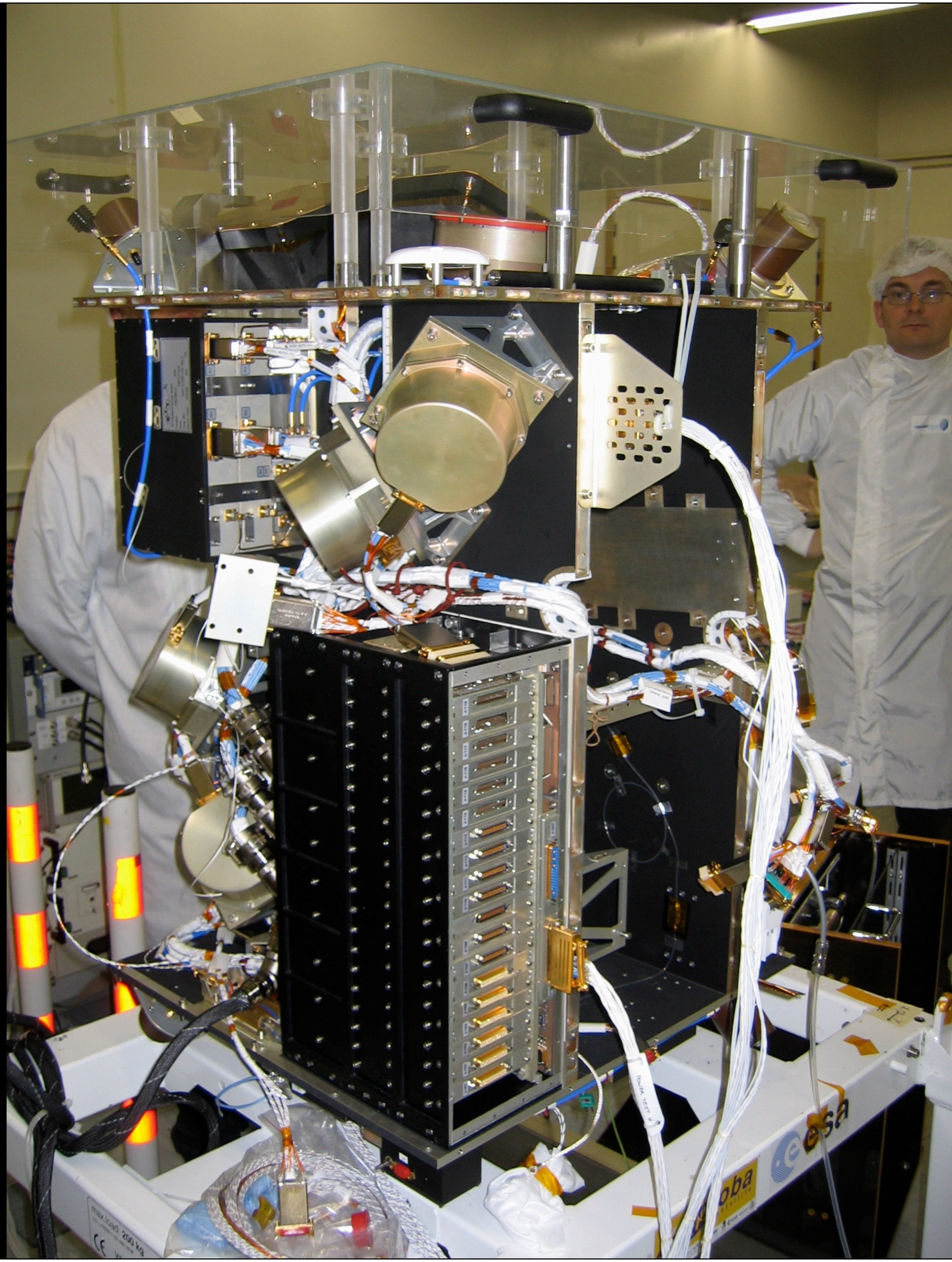


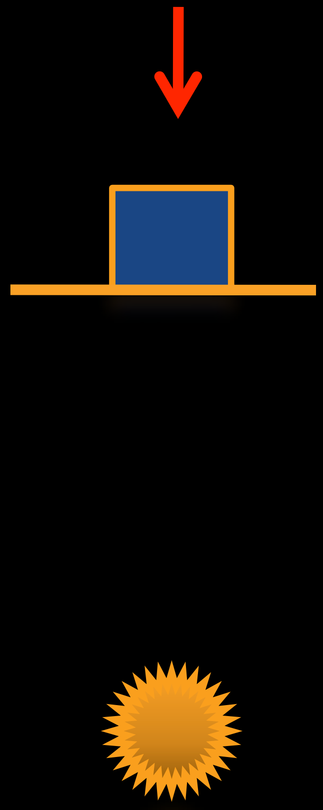


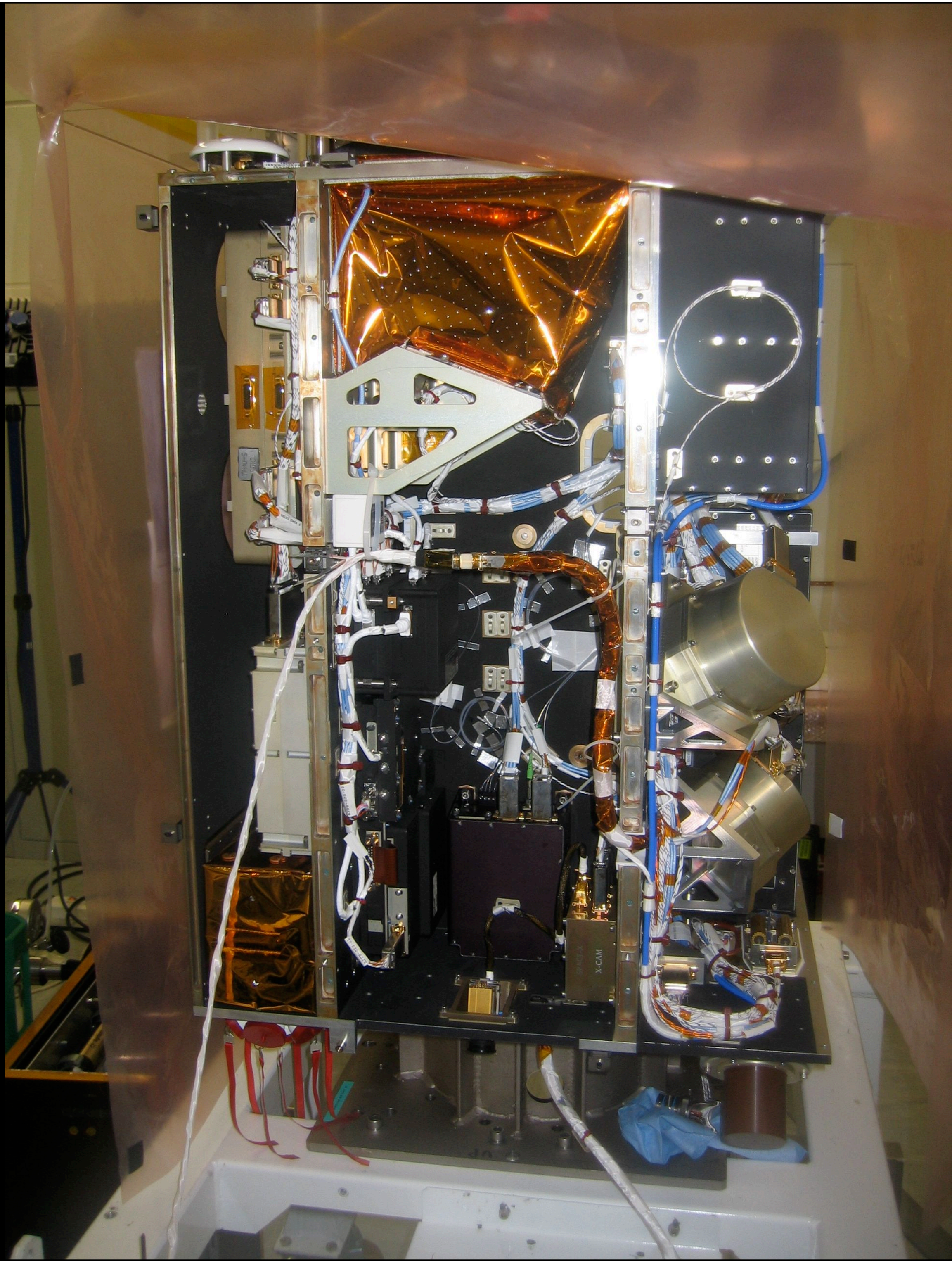

proba
esa
esa
proba

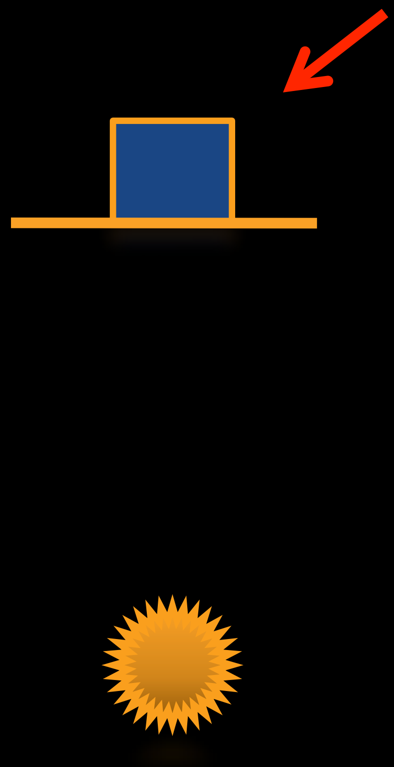


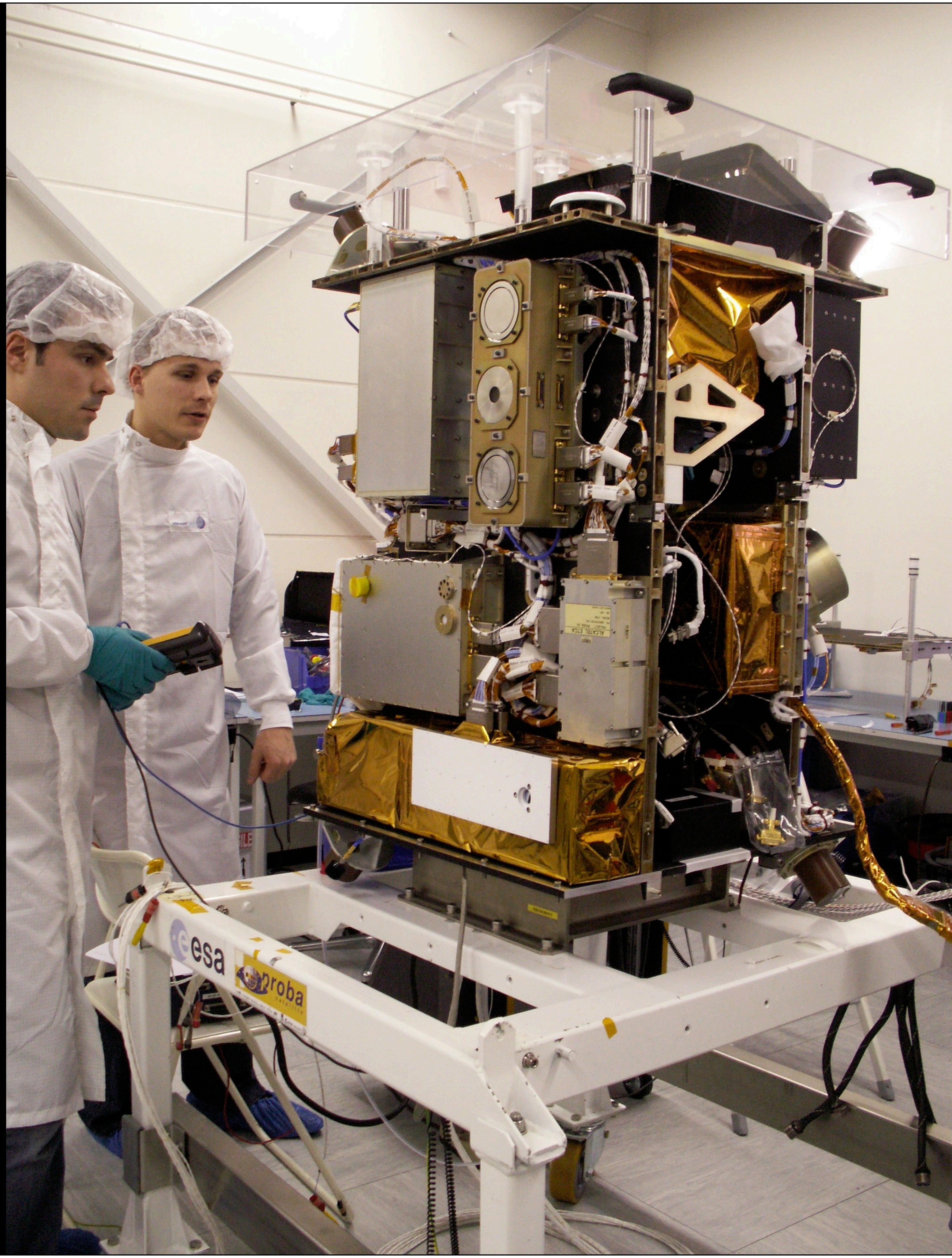






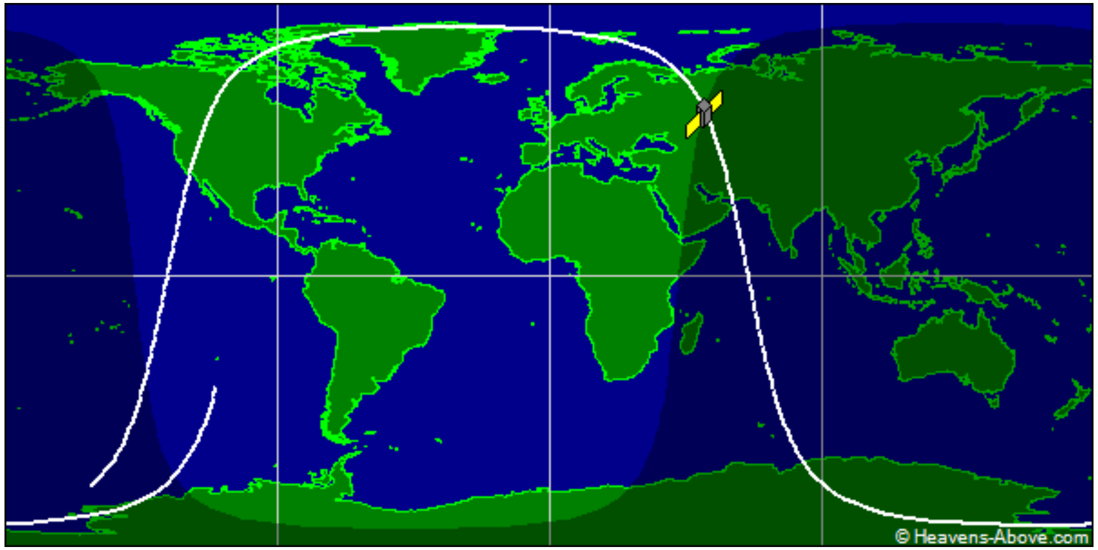





esa
proba

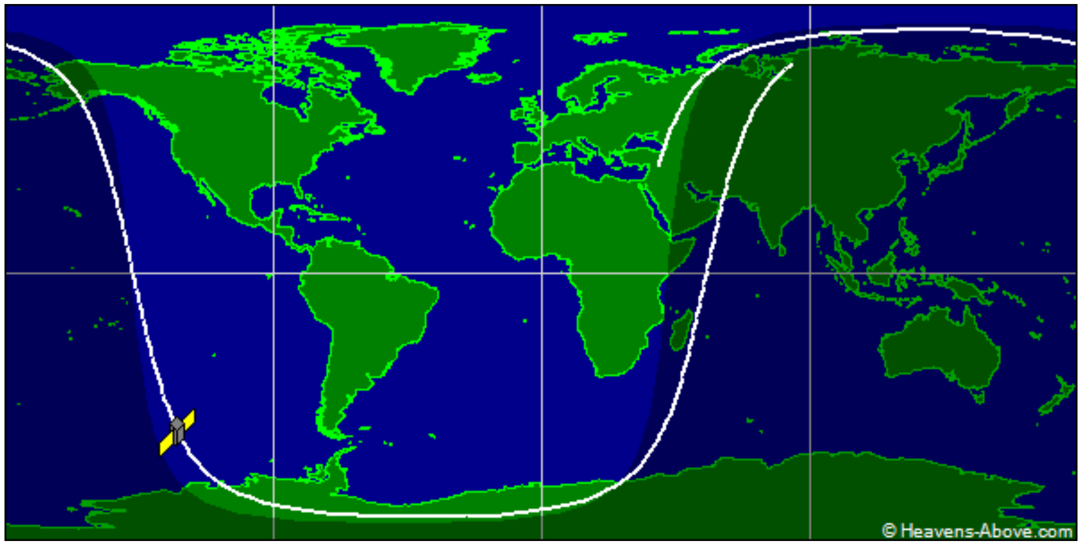
lancering

PROBA1: noon-midnight orbit



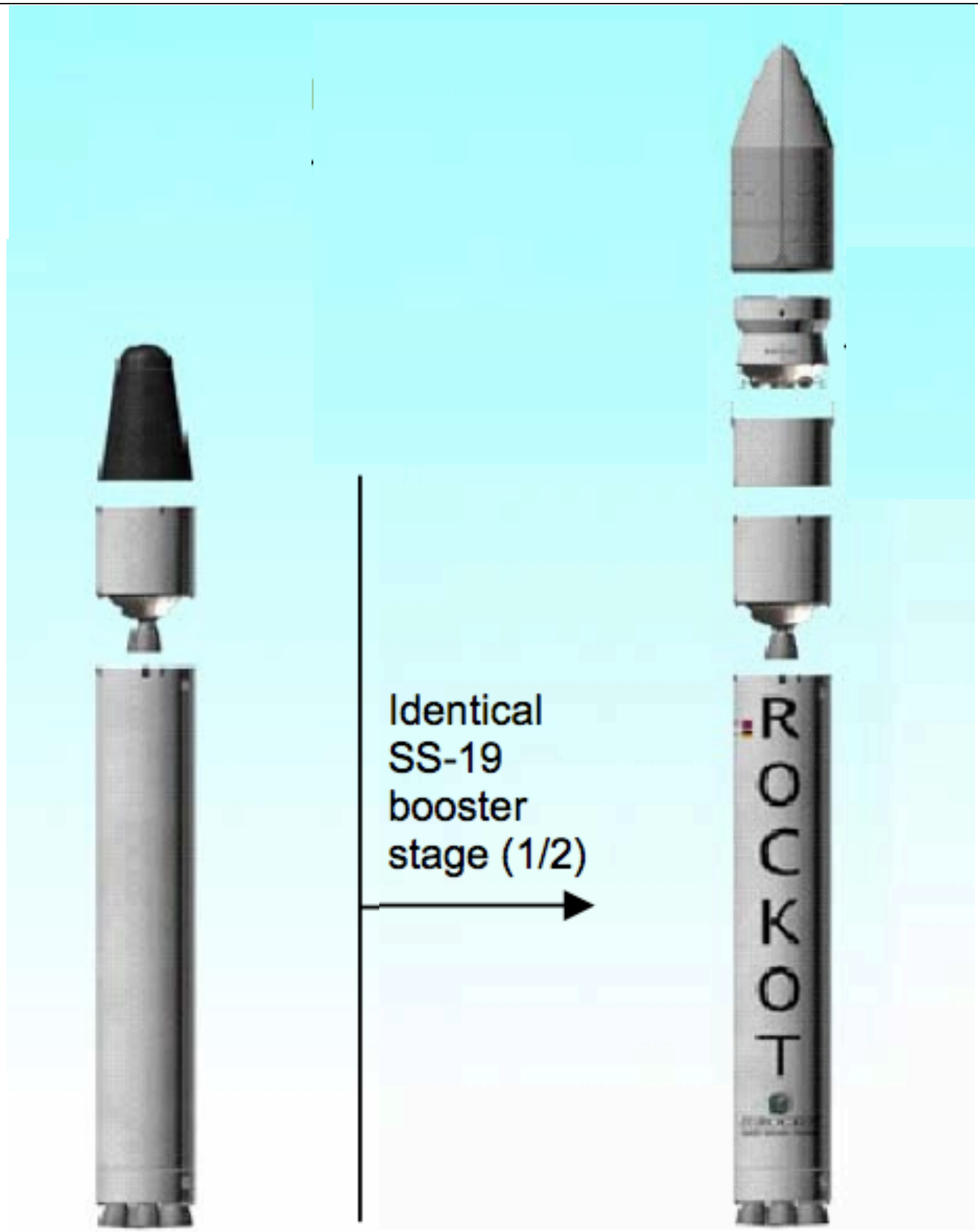
Earth observation:
Small shadows on Earth

PROBA2: dawn-dusk orbit



Solar observation:
'Permanent' Sun


SMOS
Soil Moisture and Ocean Salinity mission



SS-19 145/148

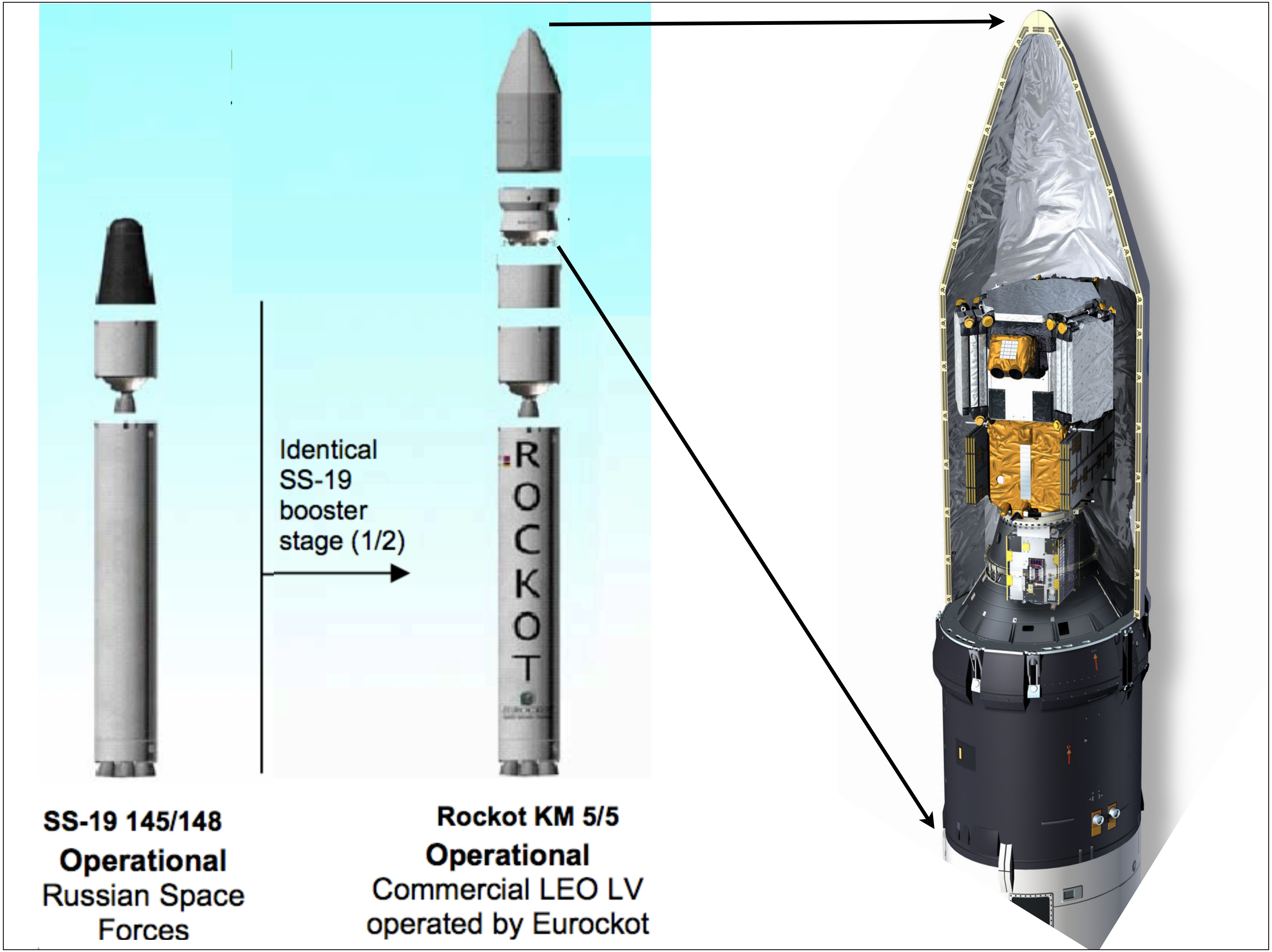
Operational

Russian Space Forces

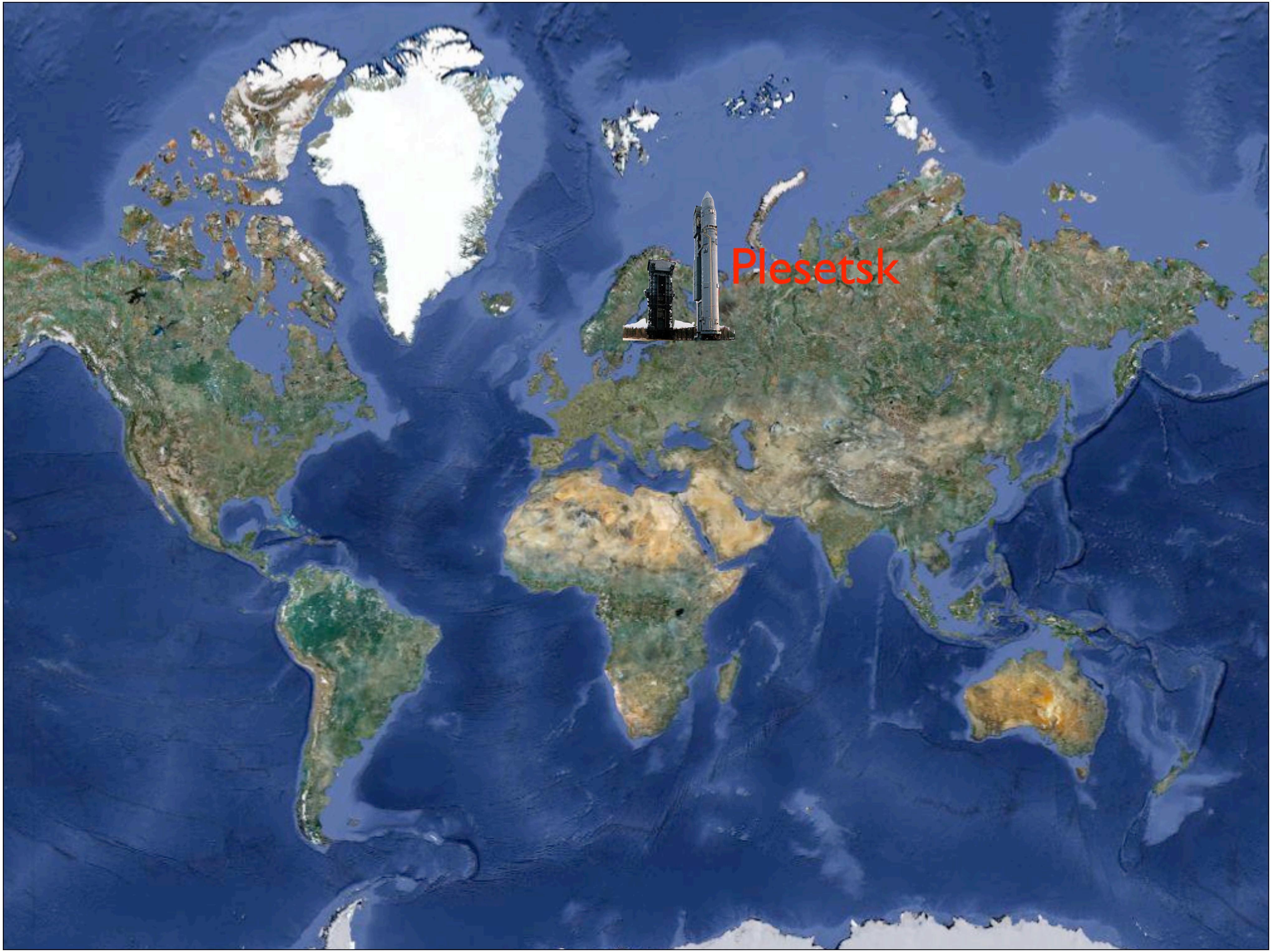
Rockot KM 5/5

Operational

Commercial LEO LV operated by Eurockot


Identical
SS-19
booster
stage (1/2)
ROCKOT
SS-19 145/148
Operational
Russian Space
Forces
Rockot KM 5/5
Operational
Commercial LEO LV
operated by Eurockot

Piggy-backing


Plesetsk

Arrival in nearby airport

Transport to Plesetsk

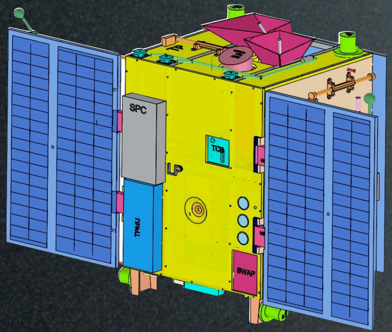

27 okt 2009

2 nov 2009


TMI reception
Animation,only
LV
Insertion Phase
Breeze M
US de-orbiting
maneuver
Vorkuta
S.Petersburg
Shchelkovo
2nd maneuver
by ICE
1st maneuver
by ICE
Adapter
separation
SC PROBA-2
separation
SC SMOS
separation
Breeze M
2nd burn
Mission time after Lift-Off
10660
2:57:40
UTC
4:48:31
Legal Moscow
7:48:31
Local time
7:48:31


BREEZE

Proba2 science center (PB2SC)



telemetry

science products

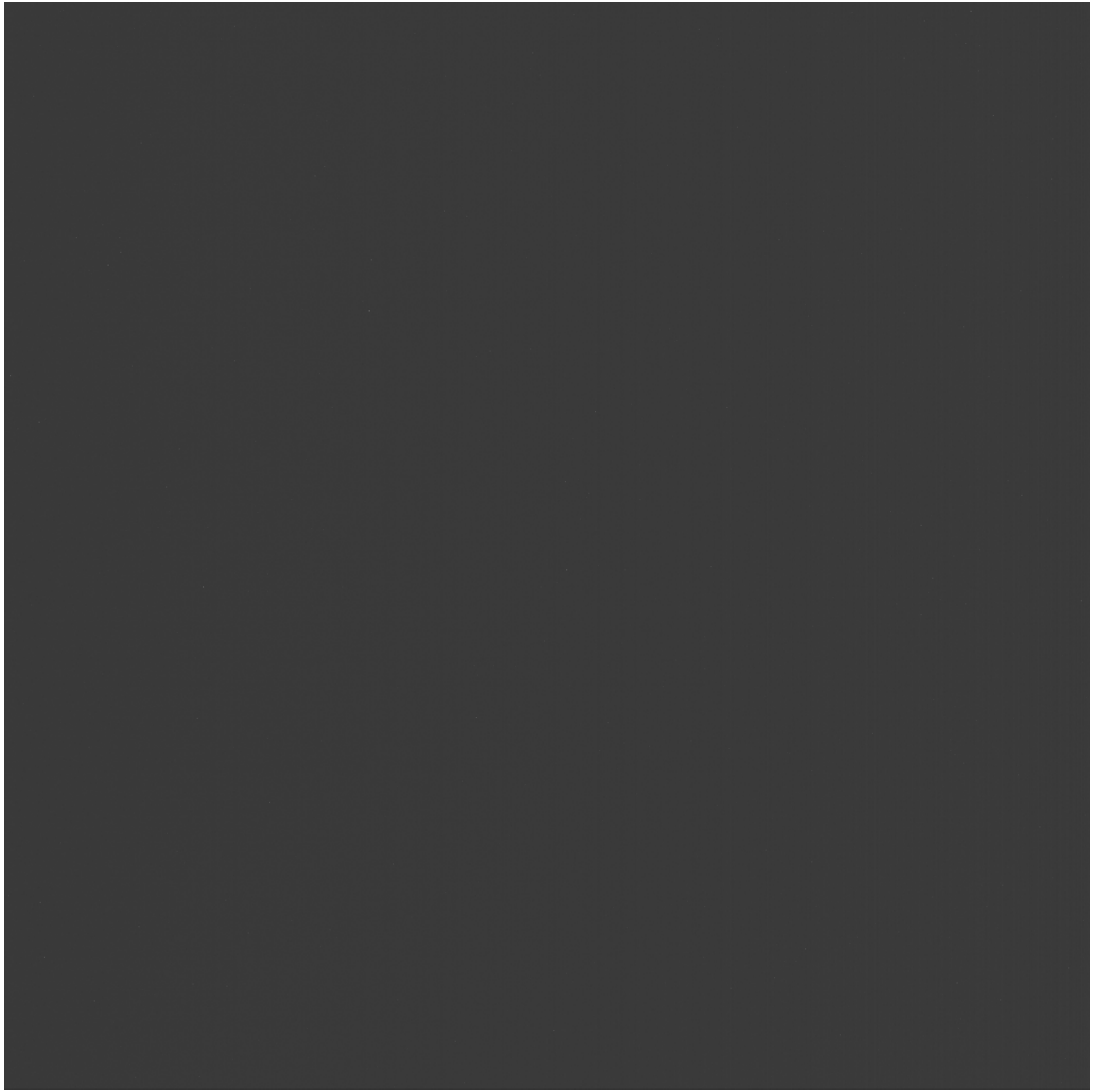
Redu

commanding

data

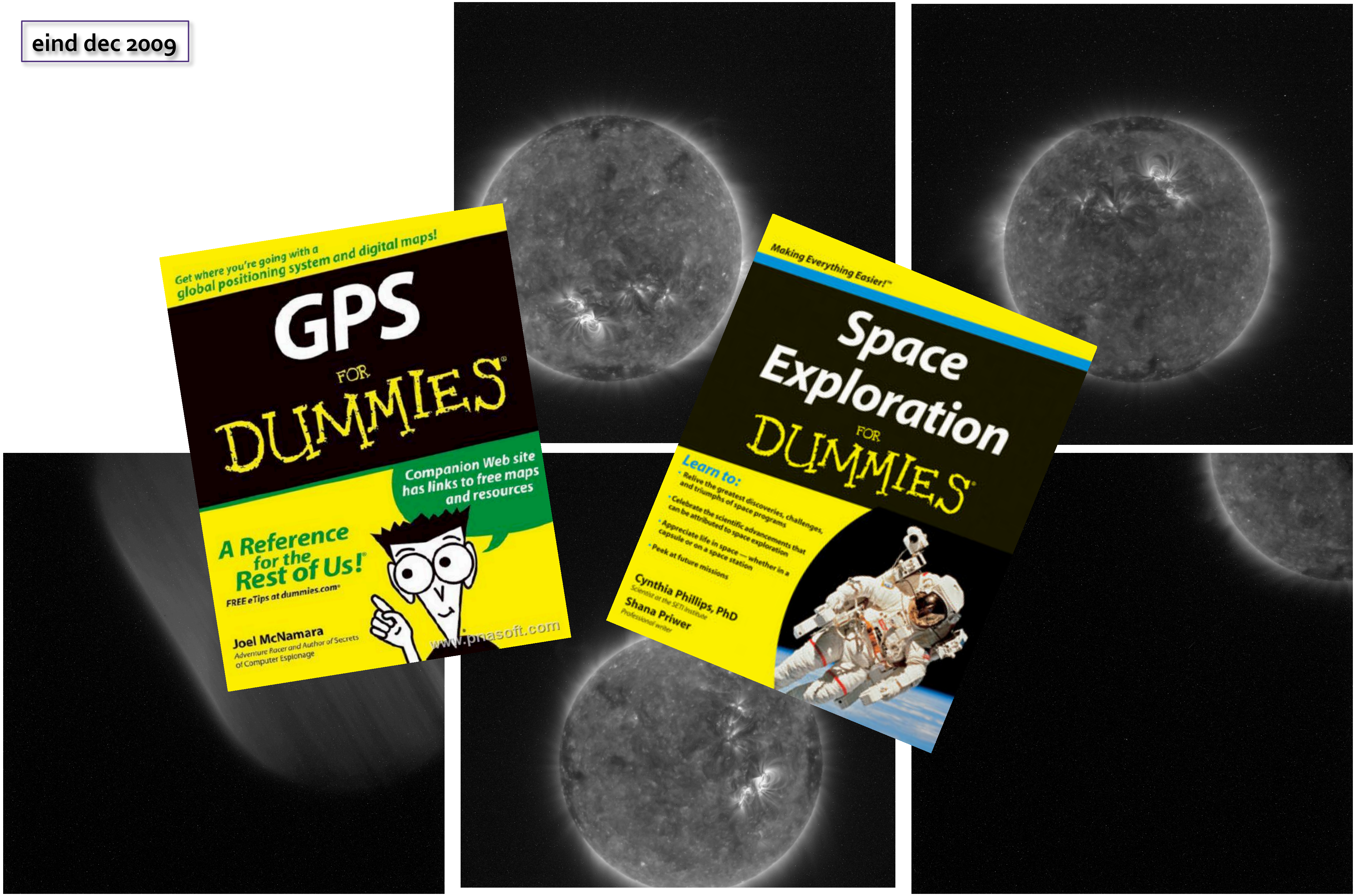
P2SC

20 nov 2009, t0+18d

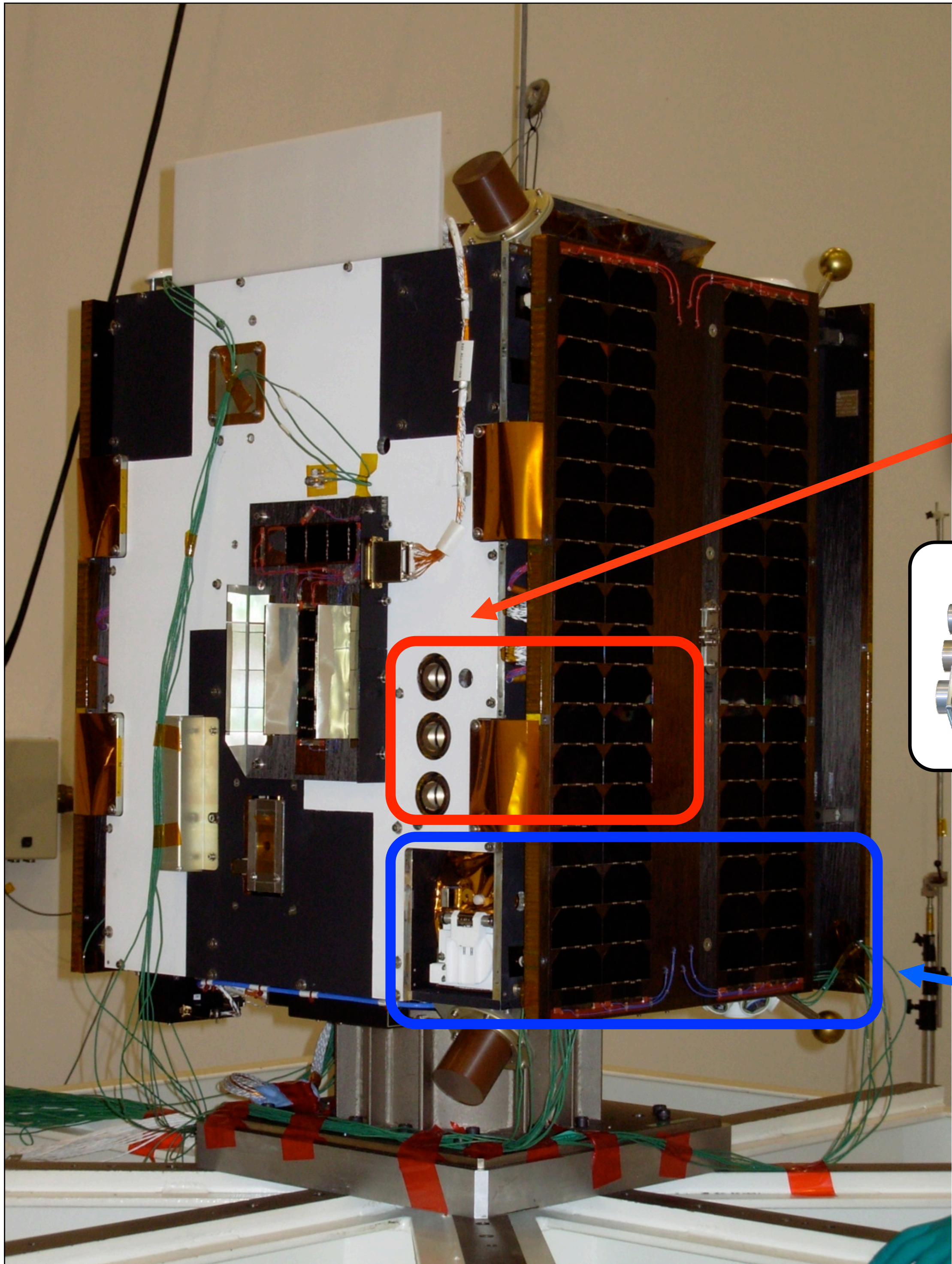


14 dec 2009, t0+42d

eind dec 2009

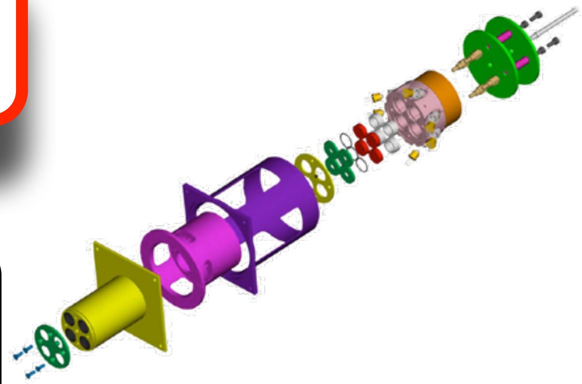


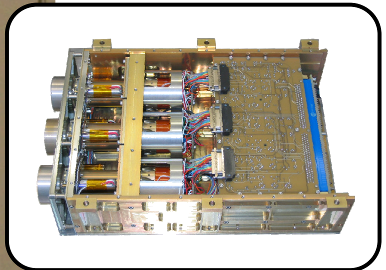
SWAP & LYRA



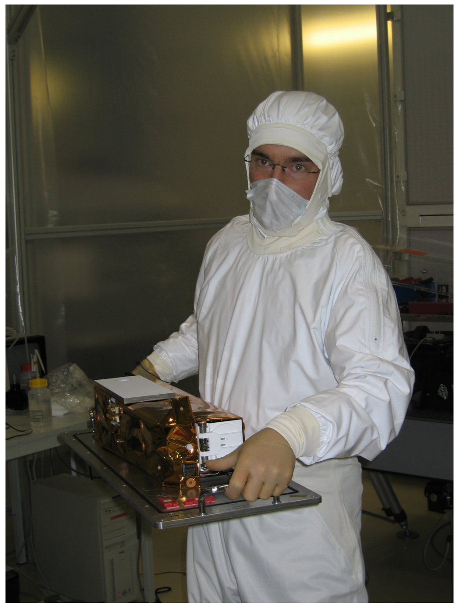
PROBA2

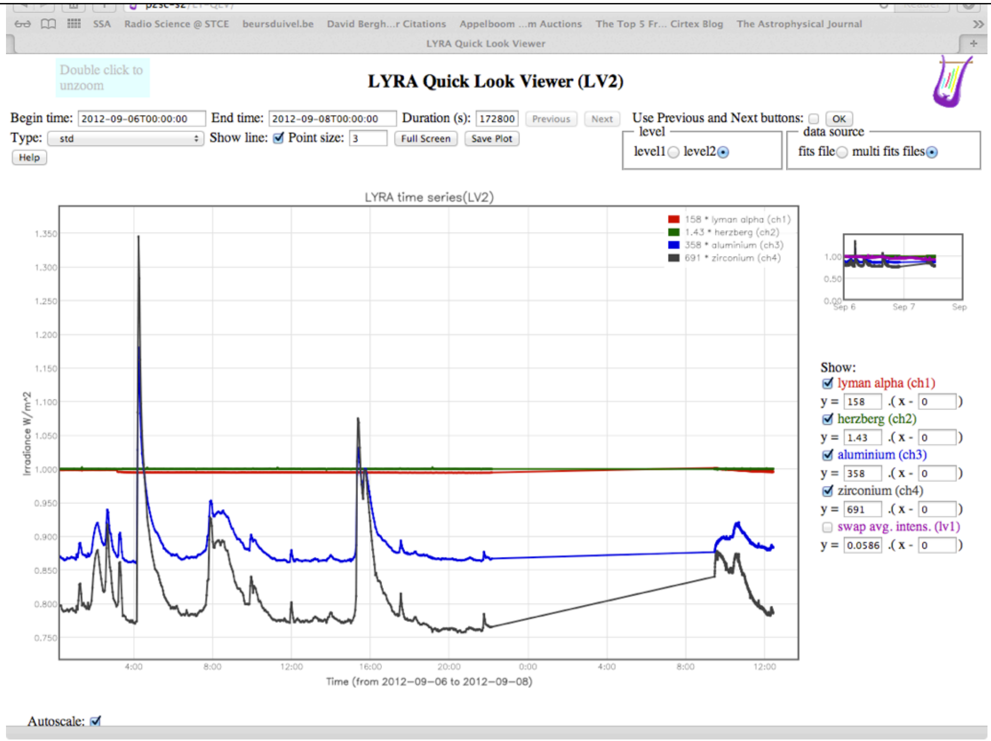
LYRA



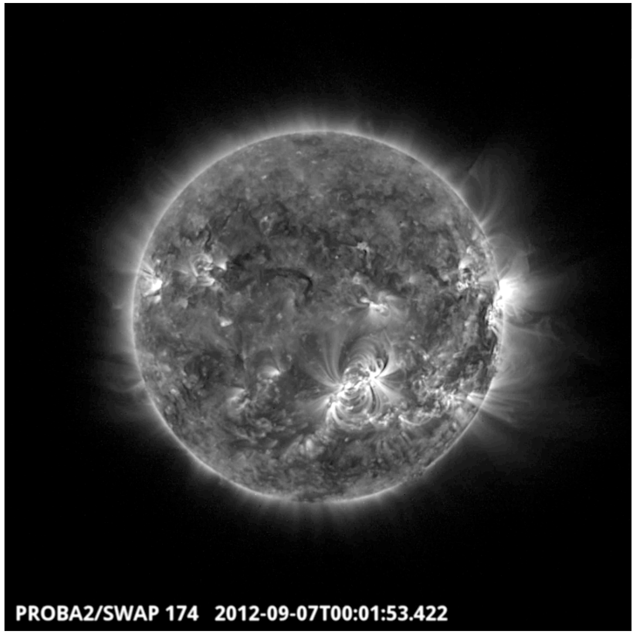


SWAP

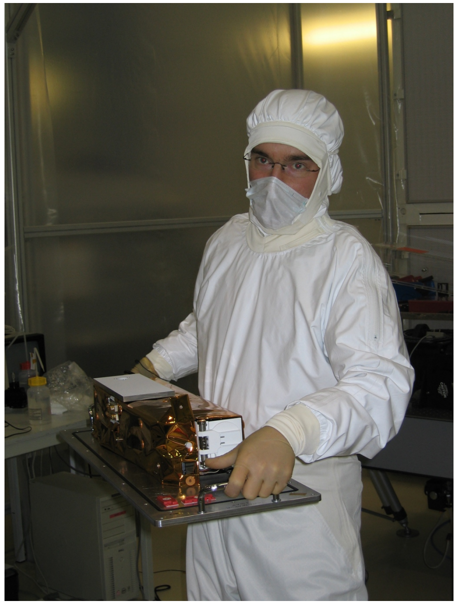


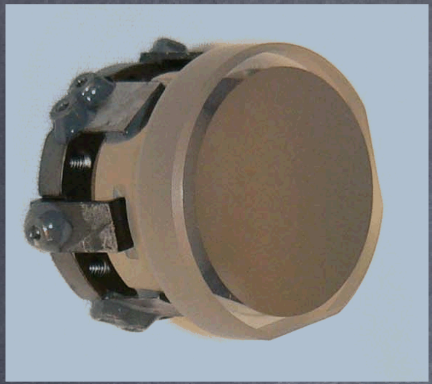
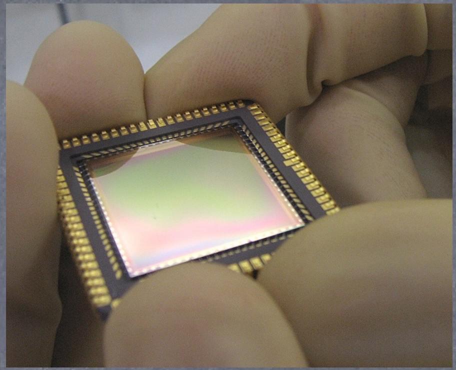
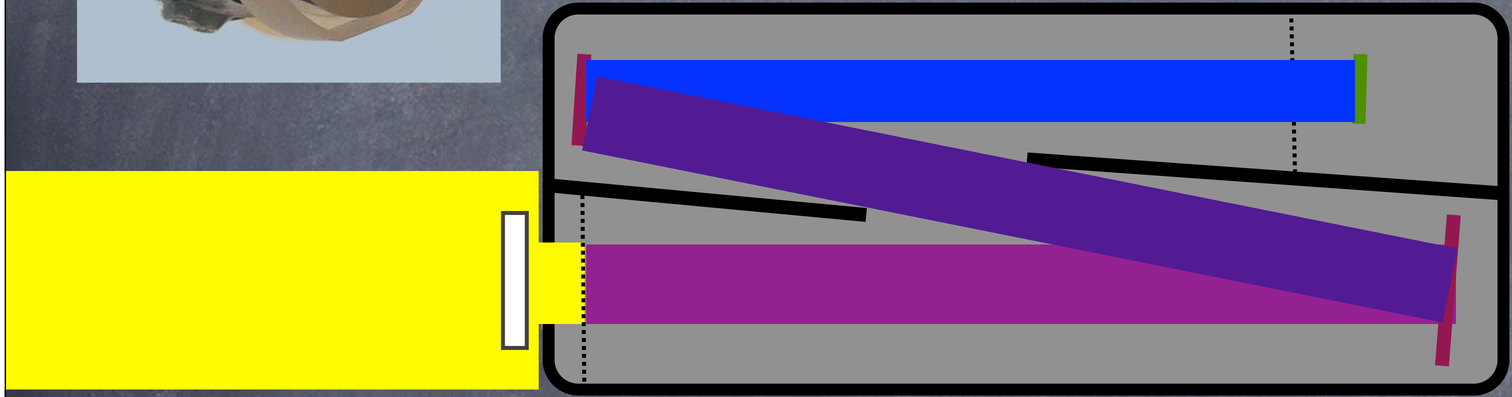
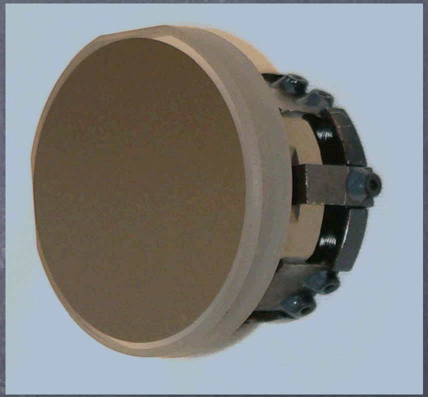
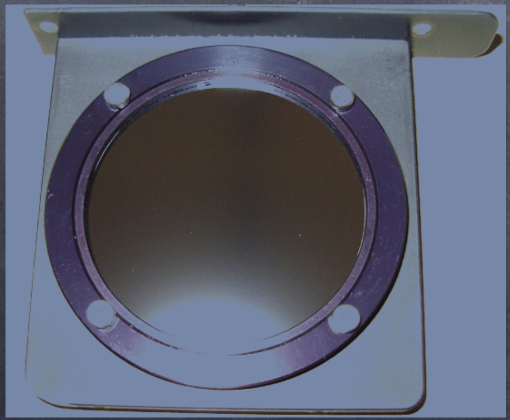
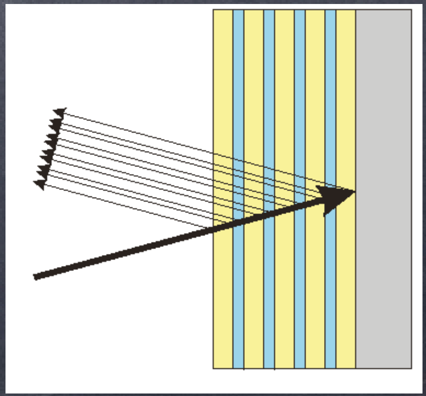

LYRA Quick Look Viewer (LV2)
Double click to unzoom
Begin time: 2012-09-06T00:00:00
End time: 2012-09-08T00:00:00
Duration (s): 172800
Previous
Next
Use Previous and Next buttons:
OK
Type: std
Show line:
Point size: 3
Full Screen
Save Plot
Help
level
level1
level2
data source
fits file
multi fits files
LYRA time series(LV2)
158 * lyman alpha (ch1)
1.43 * herzberg (ch2)
358 * aluminium (ch3)
691 * zirconium (ch4)
Irradiance W/m^2
Time (from 2012−09−06 to 2012−09−08)
Show:
lyman alpha (ch1)
herzberg (ch2)
aluminium (ch3)
zirconium (ch4)
swap avg. intens. (lv1)
Autoscale:

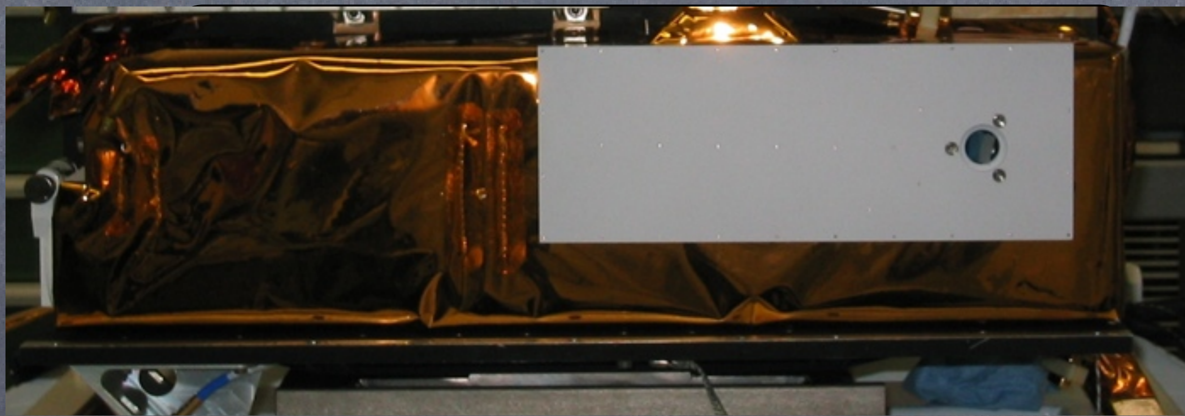
LYRA


PROBA2/SWAP 174 2012-09-07T00:01:53.422

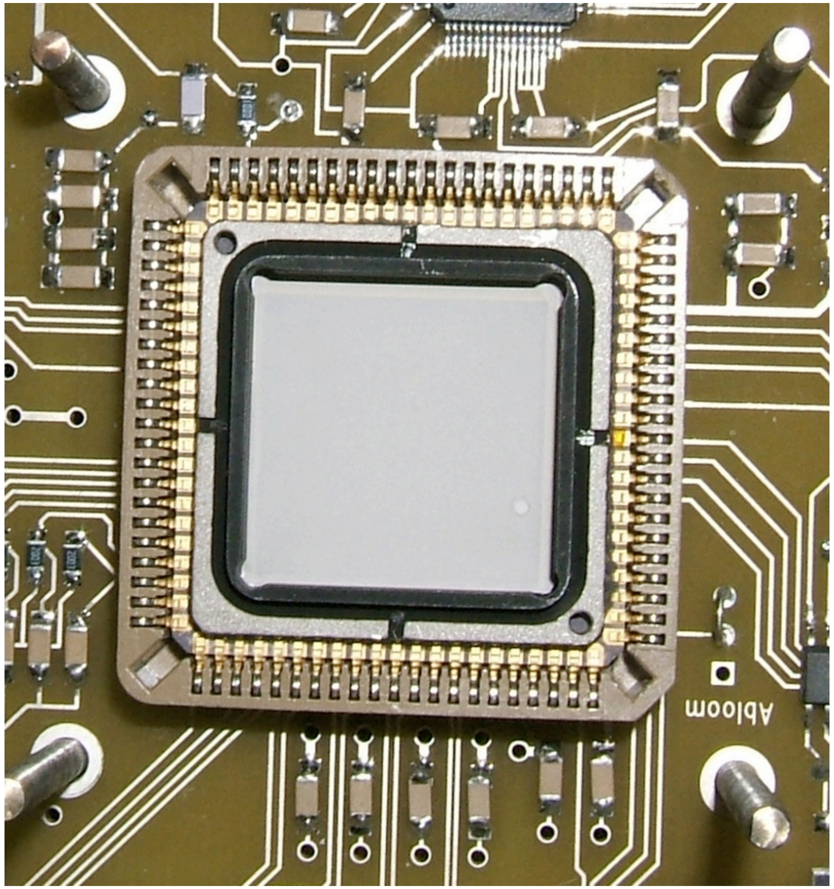
SWAP



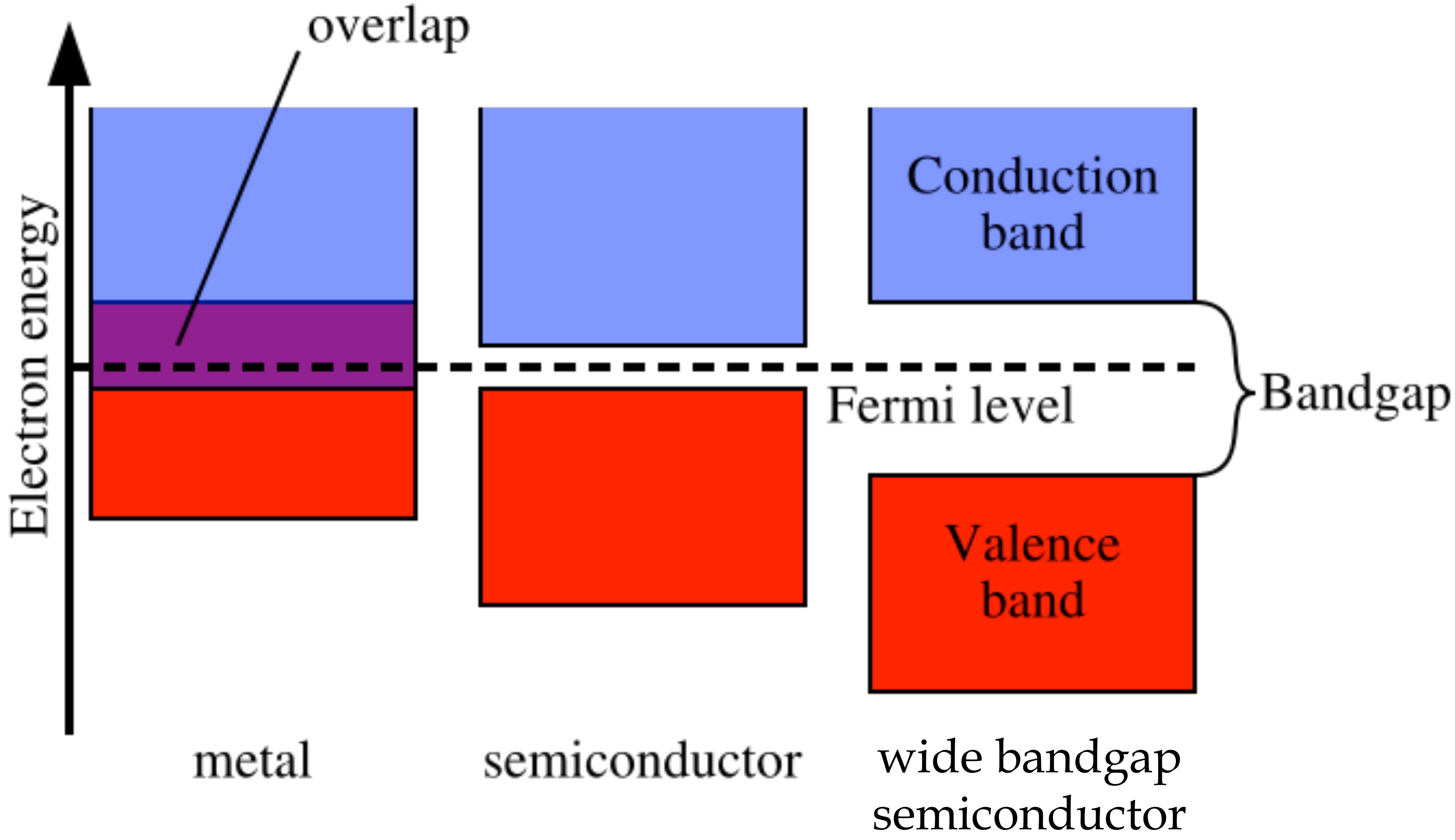


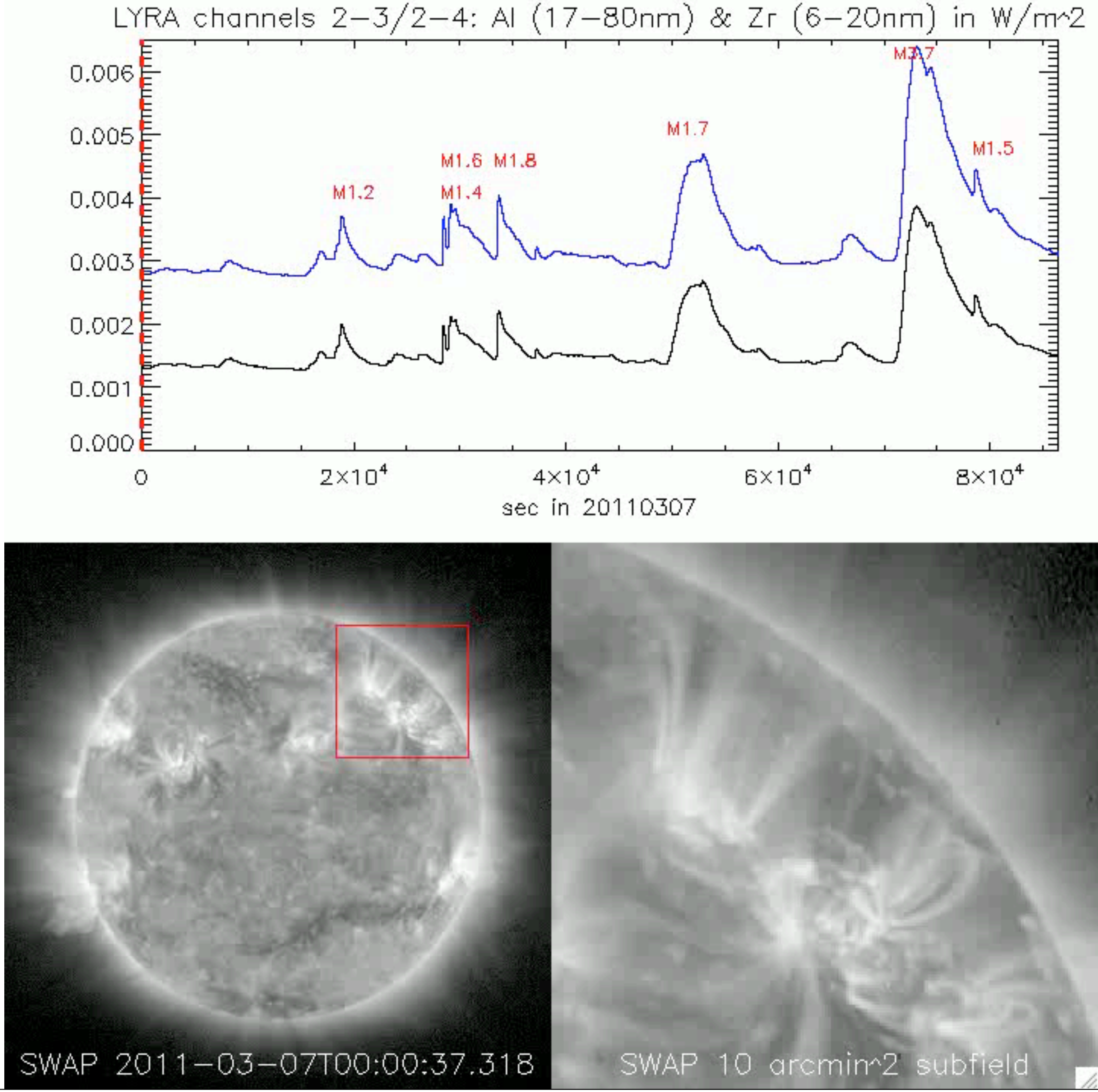
SWAP: CMOS APS detector



- “High Accuracy Star Tracker” by Fillfactory (Mechelen, B), now Cypress (US)
- 1024x1024 pixels
- low power consumption
- no charge transfer, non-destructive read-out

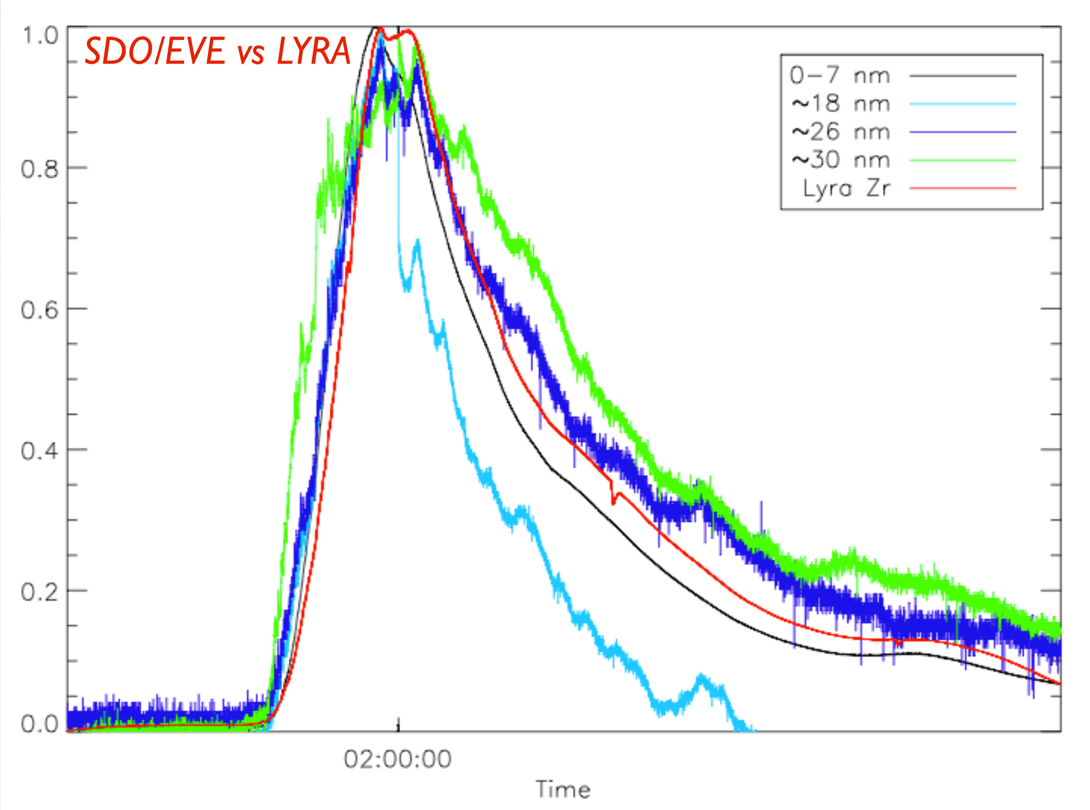
LYRA: diamond detectors

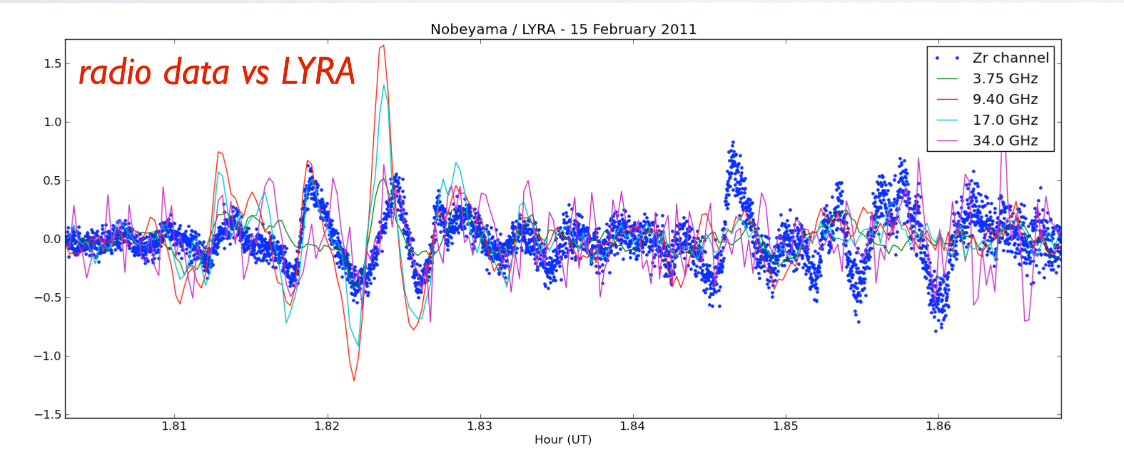




LYRA channels 2-3/2-4: Al (17-80nm) & Zr (6-20nm) in W/m^2
0.006
0.005
0.004
0.003
0.002
0.001
0.000
M1.2
M1.6 M1.8
M1.4
M1.7
M3.7
M1.5
0
2×10^4
4×10^4
6×10^4
8×10^4
sec in 20110307
SWAP 2011-03-07T00:00:37.318
SWAP 10 arcmin^2 subfield

FLARES: FIRST RESULTS





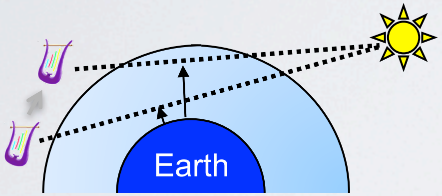
Oscillations during rising phase of all strong flares.
Show up in LYRA Al, Zr, Ly-a but also in SDO/EVE, GOES, and radio data

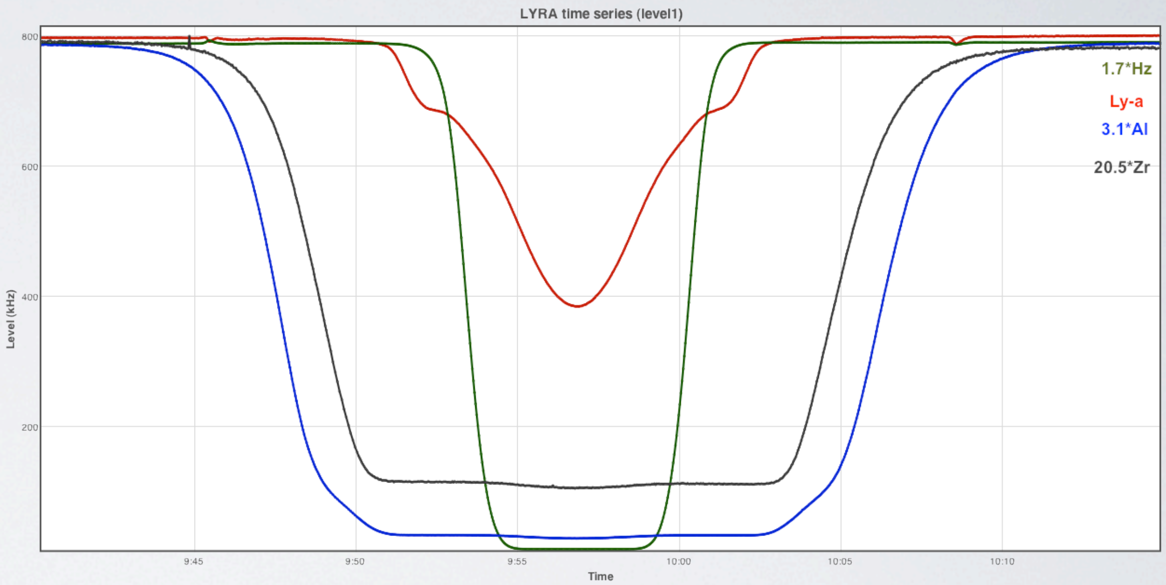
Comparisons & wave coherence studies reveal phase- and time shifts

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

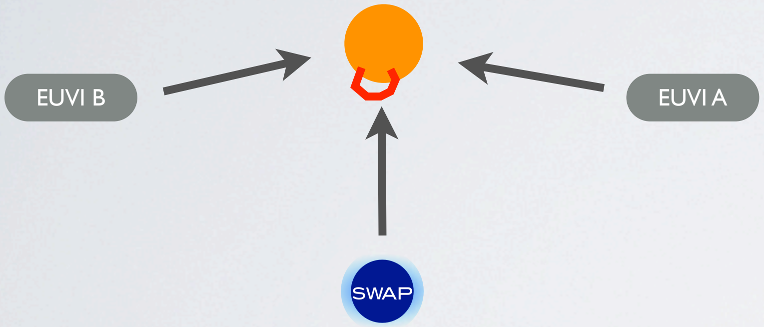
LYRA DURING ECLIPSES

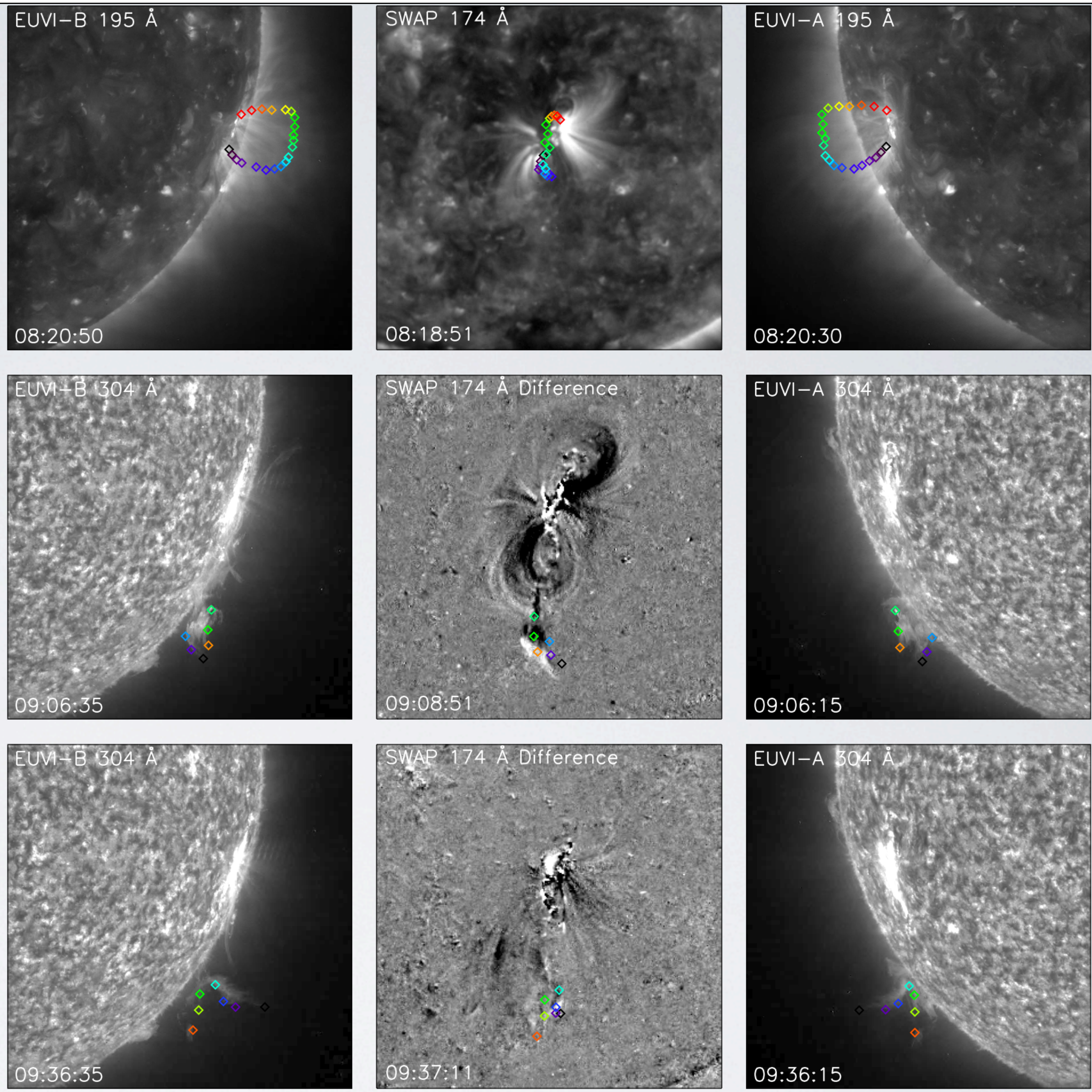
- eclipse occultations by Earth's atmosphere
  → atmospheric layers are scanned





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





3D CME RECONSTRUCTION

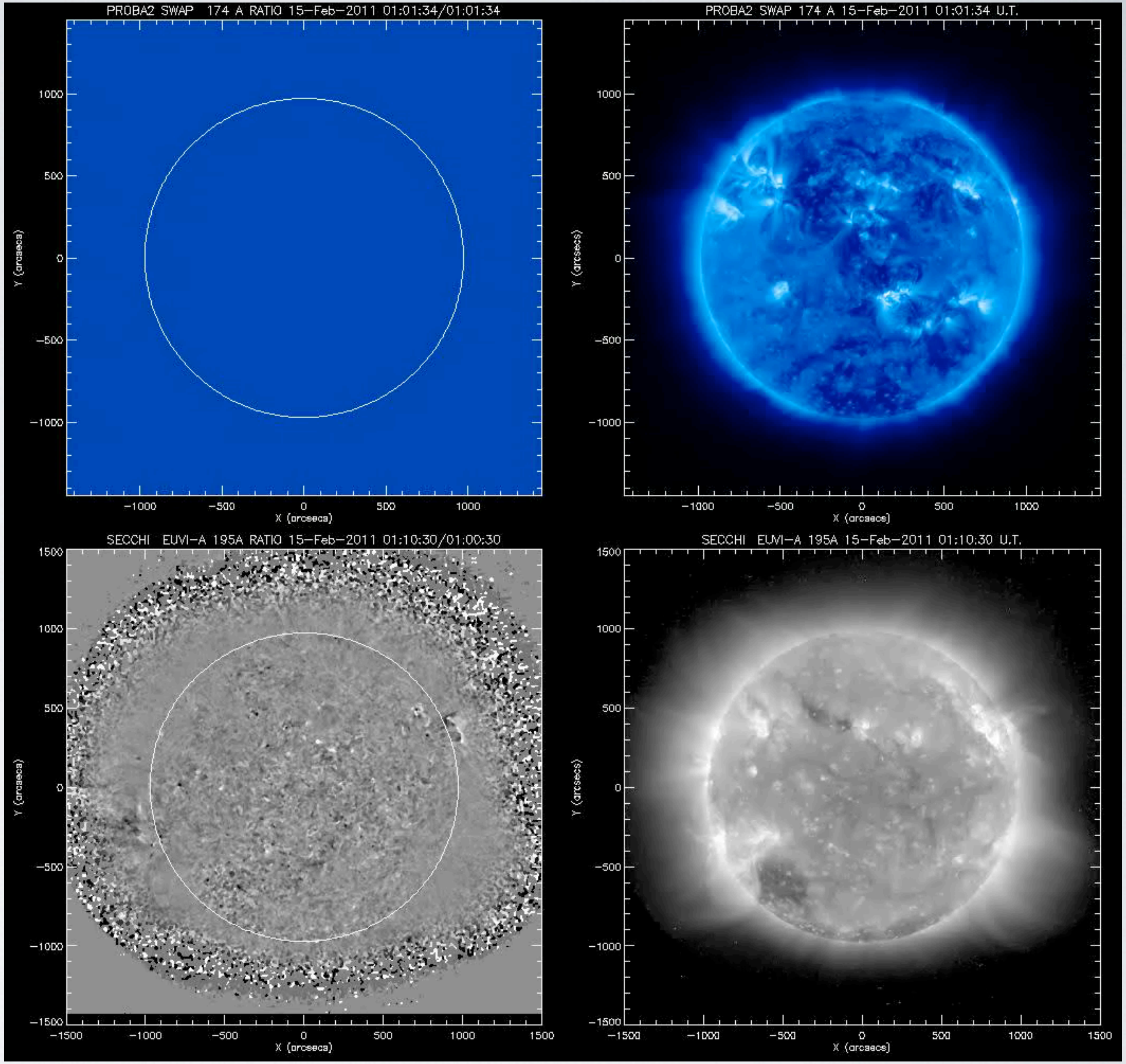
with STEREO/EUVI

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)

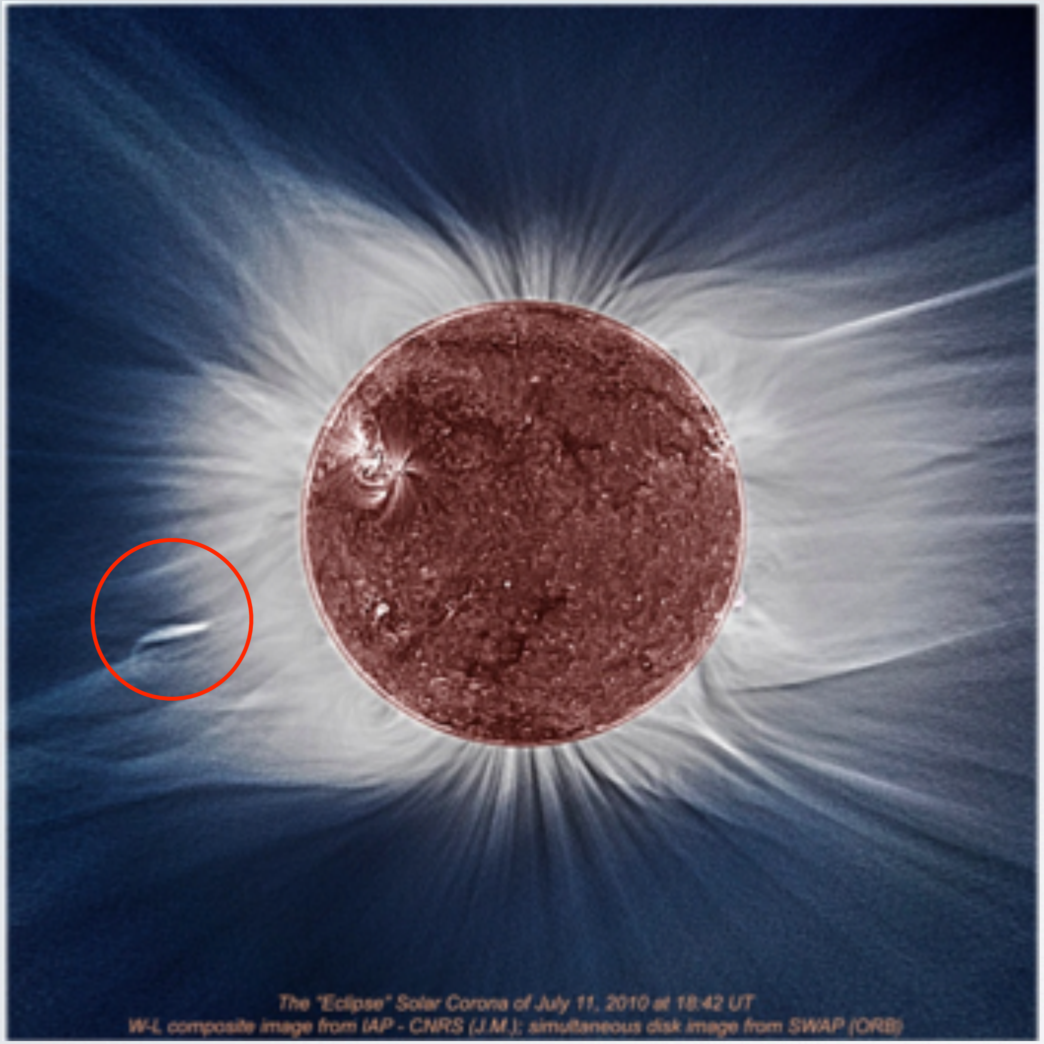
SWAP

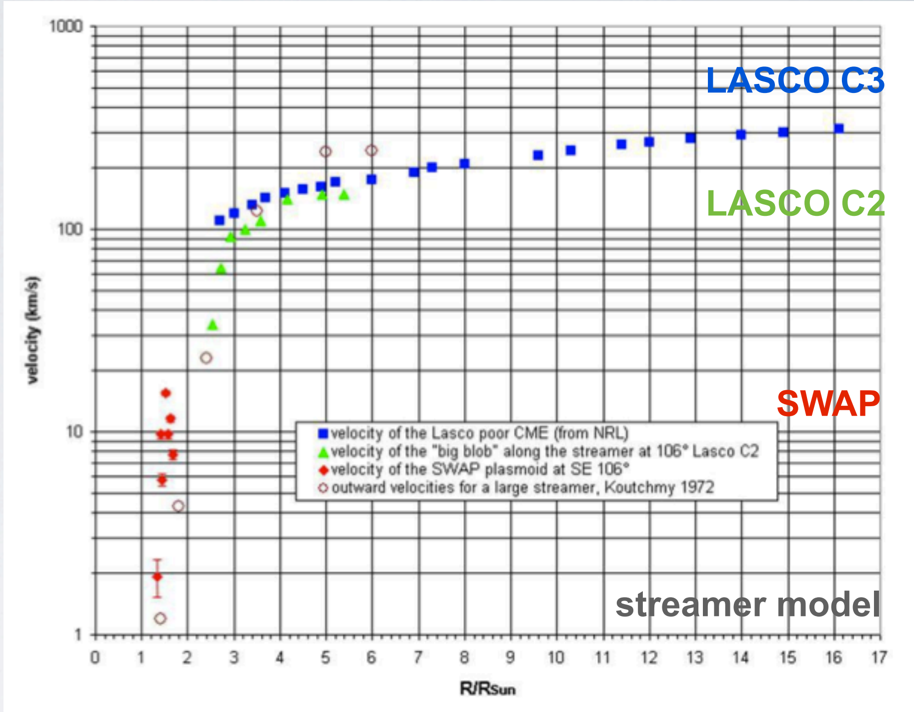
EUVI-A



GLOBAL CORONAL WAVES

with STEREO/EUVI and SWAP in quadrature





11 Jul 2010:

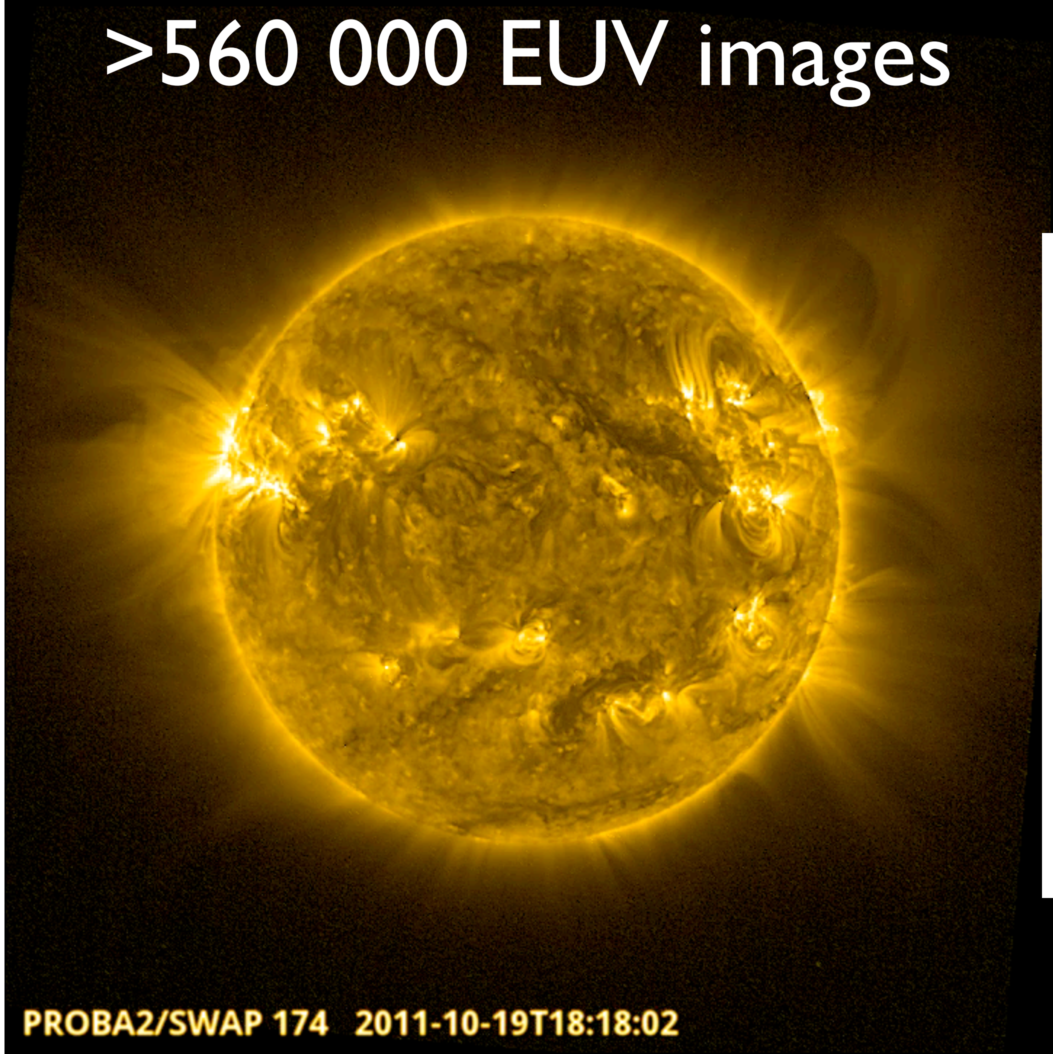
- coronal plasmoid in EUV and white light *(Koutchmy et al., paper in preparation)*
- comparison with flash spectra for TR and prominence analysis *(Bazin et al., paper in preparation)*

ECLIPSE OBSERVATIONS

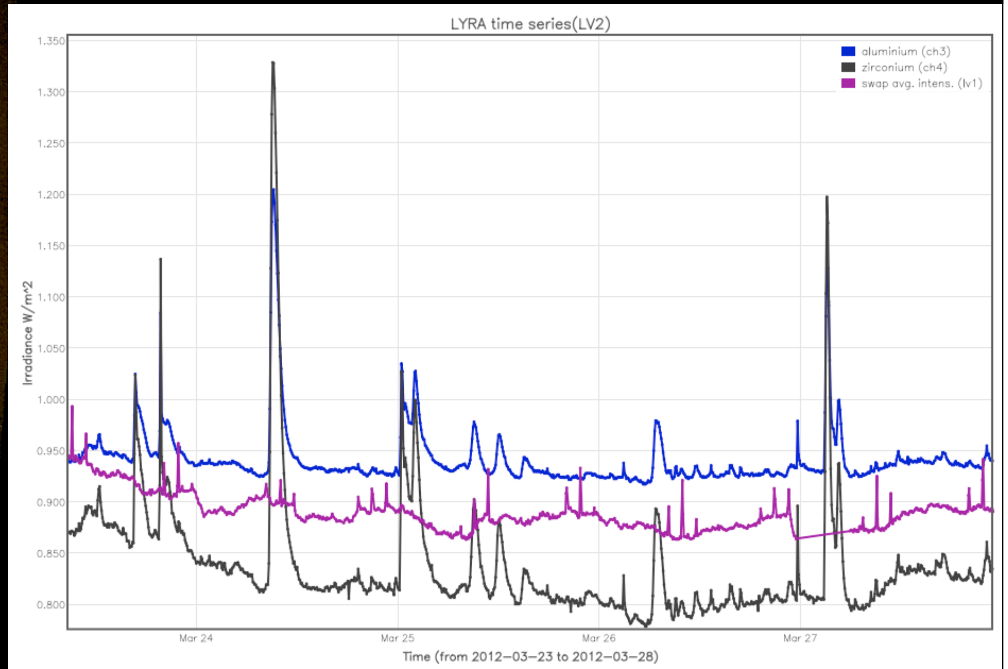
white light vs EUV 17.4nm

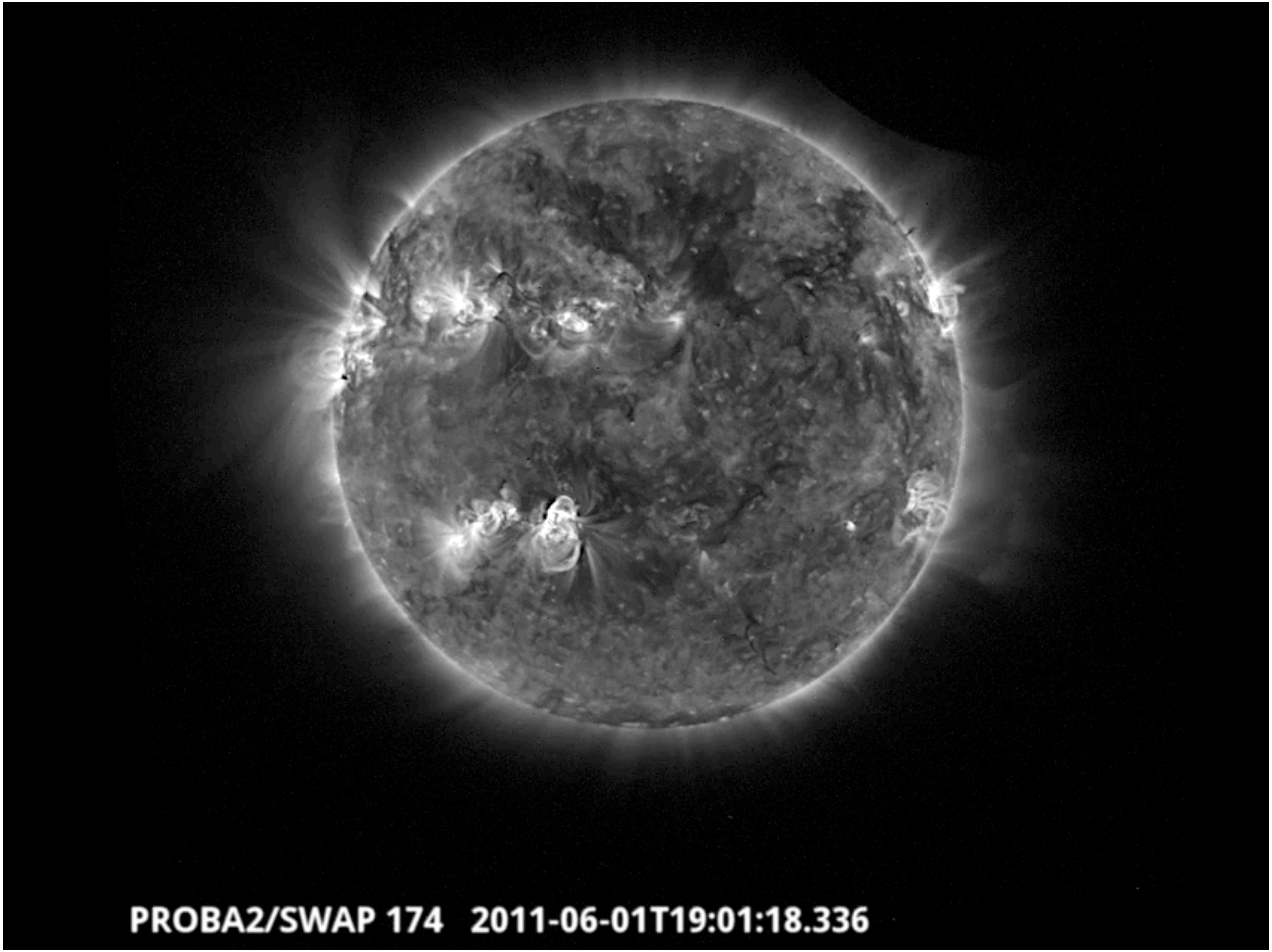
PROBA2 2.5 years

>560 000 EUV images



>320 Gbyte UV timelines

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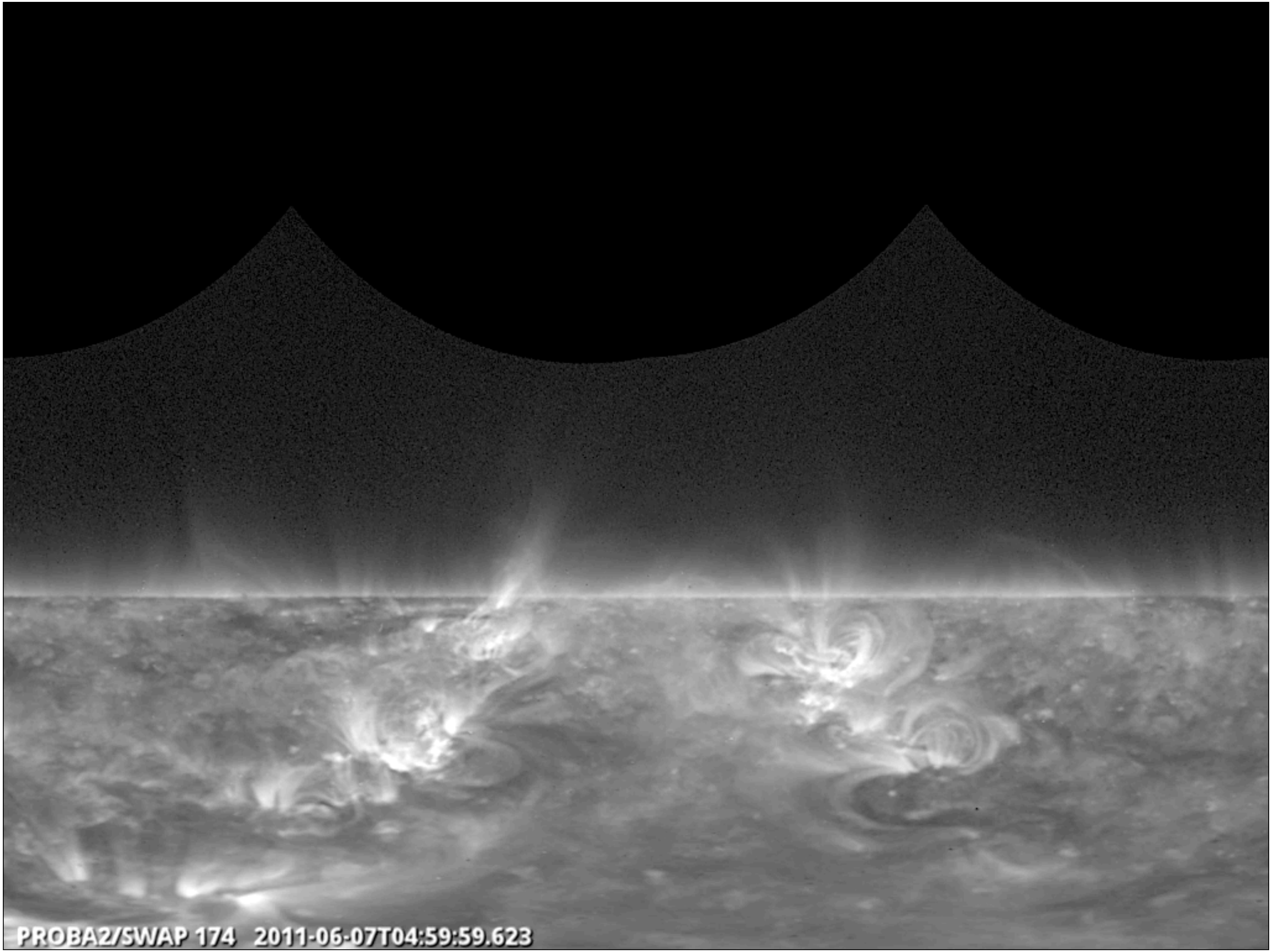
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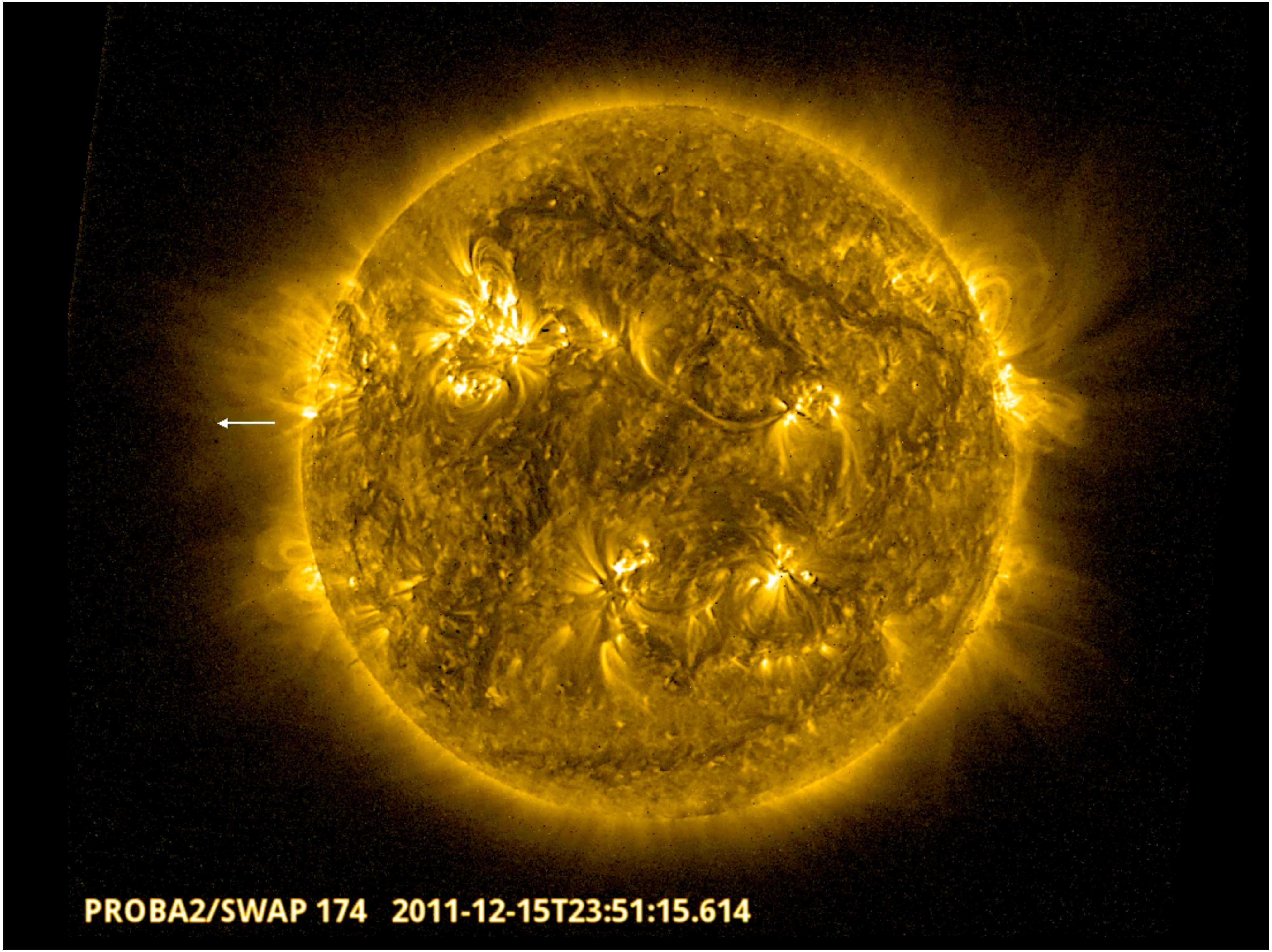
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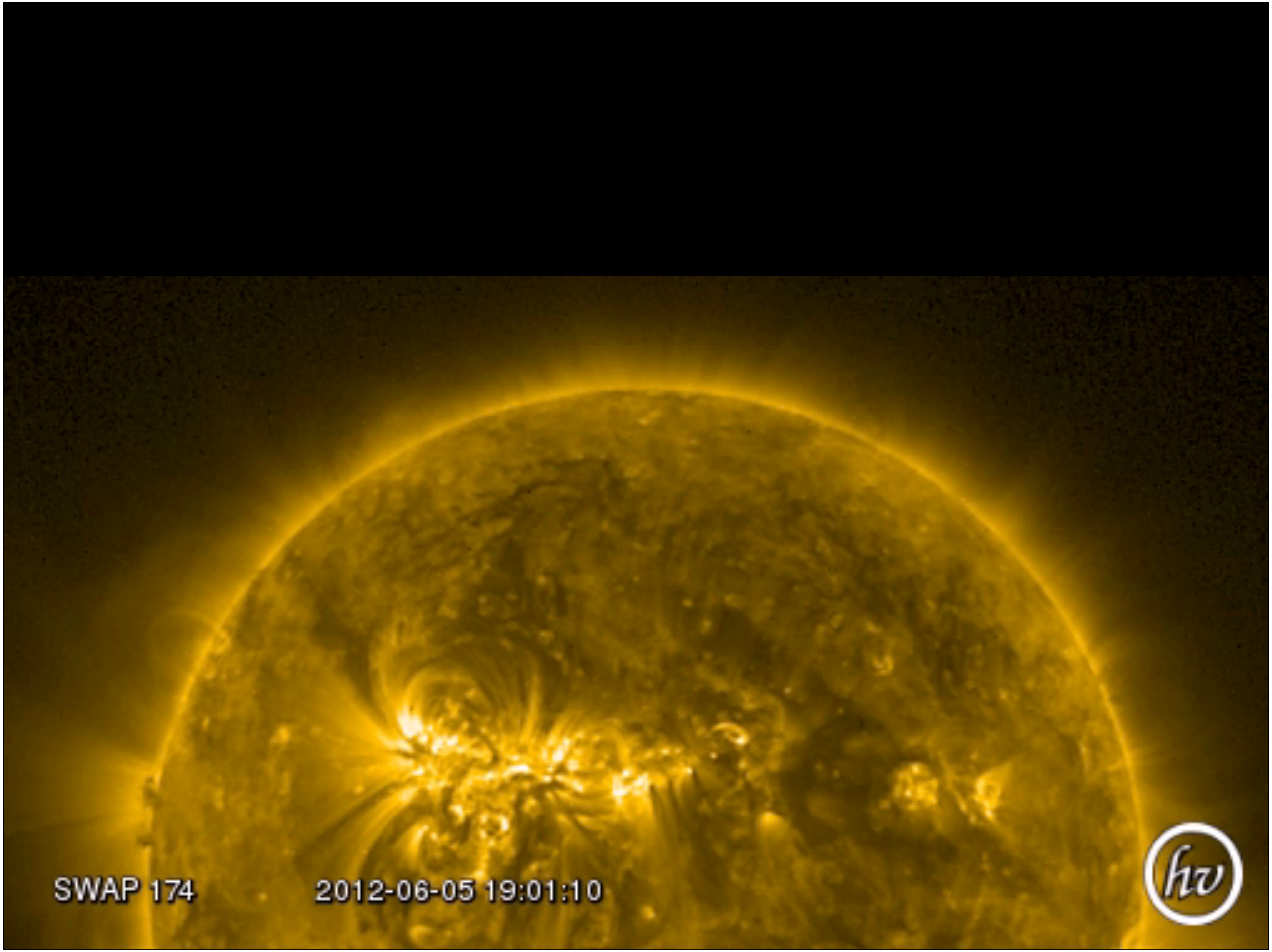
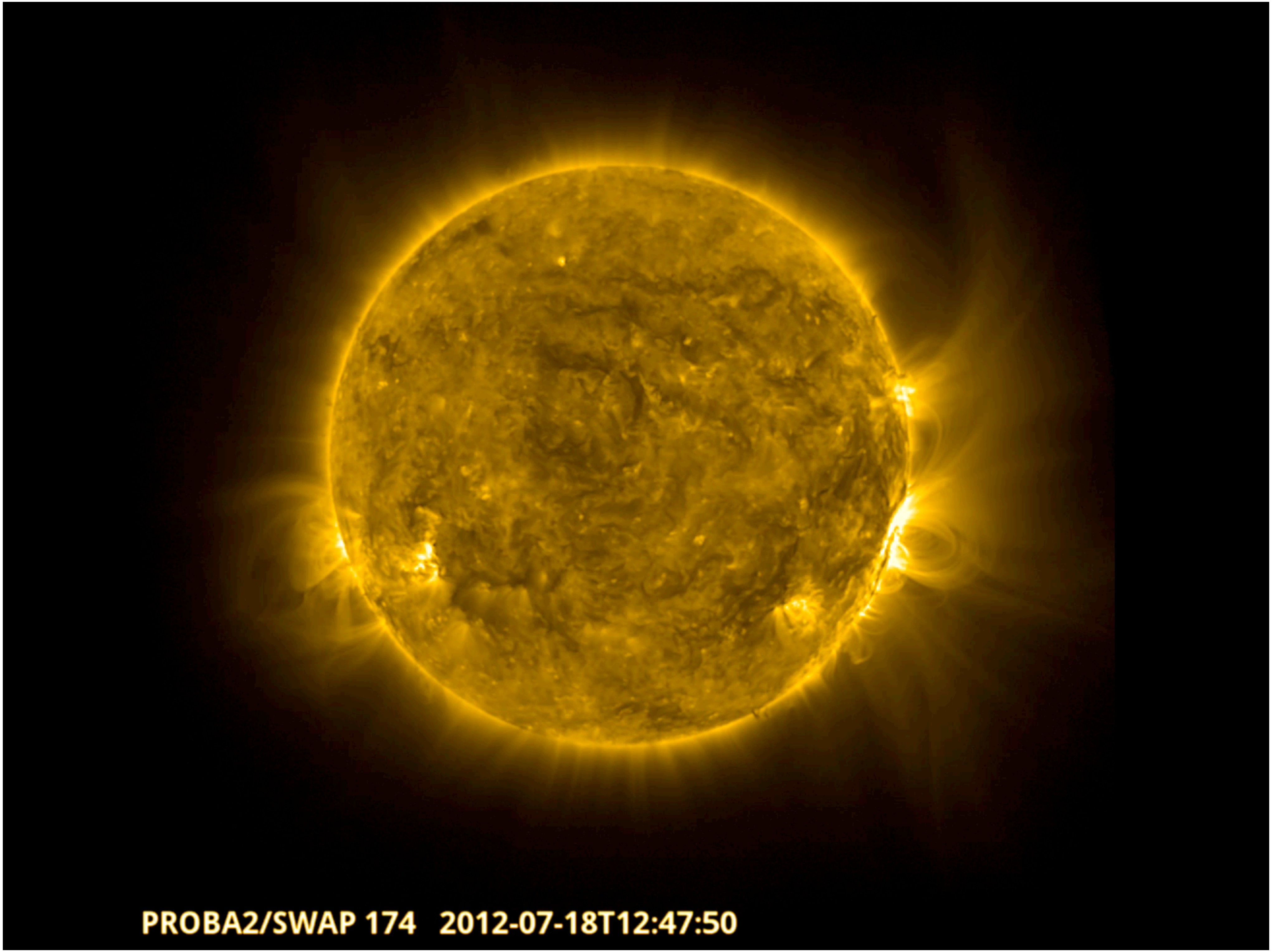

SWAP 174
2012-06-05 19:01:10
hv


PROBA2/SWAP 174 2012-07-18T12:47:50


EINDE