MONITORING SOLAR ACTIVITY WITH PROBA2

Dan Seaton & The PROBA2 Science Center Team
Royal Observatory of Belgium

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dseaton@oma.be
INTRODUCTION TO PROBA2
PROBA2 LAUNCH

November 2, 2009, 01:50:51 UTC • Plesetsk, Russia
SPACECRAFT SEPARATION

November 2, 2009, 04:50:06 UTC ☀ 725 km altitude
ESA’S PROBA2 PROGRAM

Project for On-Board Autonomy
ESA’S PROBA2 PROGRAM

4 science instruments: SWAP, LYRA, TPMU, DSLP
17 platform technology experiments
PROBA2 INSTRUMENTATION

Sun Watcher with Active Pixel System & Image Processing
PROBA2 INSTRUMENTATION

Large Yield Radiometer
PROBA2 INSTRUMENTATION

Thermal Plasma Measurement Unit
PROBA2 INSTRUMENTATION

Dual-Segmented Langmuir Probe
ORBIT

Polar Sun-Synchronous

725 km altitude
ORBIT

≈90 minute period

Large Angle Rotations every 20 minutes
Eclipse season:

- Visible: November-January
- EUV: Slightly longer
- Maximum duration 18 min per orbit
GROUND STATIONS

Redu (Belgium) & Svalbard (Norway)

≈ 8 data downlinks/day
PROBA2 SCIENCE CENTER

Data processed & stored at ROB
Available in real time +30 min
LYRA

PI: Jean-François Hochedez
INSTRUMENT OVERVIEW

Three detector heads

Four spectral channels per head
INSTRUMENT OVERVIEW

Diamond-Based Detectors:
Radiation & degradation resistant

LYRA in South Atlantic Anomaly
INSTRUMENT OVERVIEW

Diamond-Based Detectors:
High sensitivity & linear response
Diamond-Based Detectors:

Insensitive to visible light compared to Si detectors
INSTRUMENT OVERVIEW

Herzberg Continuum: 200-220 nm

Lyman-α: 120-123 nm

Aluminum Filter: 17-80 nm (includes He II at 30.4 nm)

Zirconium Filter: 1-20 nm

<table>
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<th>Unit</th>
<th>Ly</th>
<th>Hz</th>
<th>Al</th>
<th>Zr</th>
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<td>1</td>
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<td>PiN</td>
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<td>Si</td>
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<td>Si</td>
<td>PiN</td>
<td>Si</td>
<td>Si</td>
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INSTRUMENT OVERVIEW

High cadence observations
(up to 100 Hz)
LYRA DATA
LYRA DATA PRODUCTS

Daily Overview Light Curves

http://proba2.sidc.be/
M2.9 Flare, 6 February 2010
M2.9 Flare, 6 February 2010
M2.9 Flare, 6 February 2010
M2.9 Flare, 6 February 2010

EUV Eclipse

Channel 2–3 (Aluminium)

Channel 2–4 (Zirconium)
M2.0 Flare, 8 February 2010

LYRA Channel 2–1 (Lyman–alpha)
LYRA Channel 2–3 (Aluminium)
LYRA Channel 2–4 (Zirconium)
LYRA & GOES FLUX
Flares observed in 2010, LYRA Al Channel
LYRA & GOES FLUX

Flares observed in 2010, LYRA Zr Channel
SWAP

PI: David Berghmans
OPTICAL PATH

Off-Axis Ritchey-Chrétien Scheme
CMOS APS DETECTOR

1024×1024 Pixels
CMOS APS DETECTOR
Low power consumption
CMOS APS DETECTOR
P43 coating for EUV sensitivity
CMOS APS DETECTOR
First CMOS for solar physics in orbit
CMOS APS DETECTOR

No charge transfer as in CCD
No need for shutter
SWAP VS. EIT

**EIT:** 17.1, 19.5, 28.4, 30.4 nm
- Sun-centered FOV
- 45 arcmin FOV
- $\approx$ 12 minute cadence
- Located at L1-point

**SWAP:** 17.4 nm
- Flexible off-pointing
- 54 arcmin FOV
- $\approx$ 1 minute cadence
- Inside magnetosphere
SWAP VS. AIA ON SDO
SWAP VS. AIA ON SDO

54 arcmin
Automated CME Tracking

Up to 1 degree off-pointing

SWAP VS. AIA ON SDO
SPECTRAL RESPONSE
Measured with Synchrotron Beam at BESSY
SPECTRAL RESPONSE
Transmitted Lines at Selected Temperatures
SPECTRAL RESPONSE
Transmitted Lines at Selected Temperatures
SWAP DATA
ANNULAR SOLAR ECLIPSE

15 January 2010, 06:00 UTC
PROMINENCE ERUPTION

13 April 2010, 09:30 UTC

See attached movie
ERUPTION & FLARE

3 April 2010, 09:30 UTC ⭐ B7.4 Flare ⭐ Geoeffective CME

See attached movie
GETTING INVOLVED
OPEN DATA POLICY

Data will be freely available to all users from May 1 onwards

http://proba2.sidc.be/swap/data/
http://proba2.sidc.be/lyra/data/

All data ordered in year/month/day folders
Fancy data browser to come

Raw Engineering FITS: reformatted, decompressed, long header
Base Science Data FITS: (preliminary) calibrated, science header
PNG files: for quicklook purposes (available now)

SSW will have software trees SWAP & LYRA
HOW TO BE INVOLVED

Scientists are welcome to:
• use PROBA2 data
• propose special observation campaigns

**Guest Investigator Program** welcomes proposals for dedicated (joint) observations in the frame of a science project
• funds available for a stay at PROBA2 Science Center
• scientist can take part in the commanding of the instruments
• will gain expertise in the instrumental effects

• **Announcement:** May 3, 2010
• **GI proposal deadline:** June 1st (visits from Sep 2010 onwards)
• **First Science Working Team - GI selection:** June 14-16, Belgium
DATA & MORE INFORMATION

http://proba2.sidc.be/