


P2SC-ROB-WR-412 - 20180212 Weekly report #412	P2SC Weekly report	
Period covered: Date: Written by: Approved by:	Mon Feb 12 to Sun Feb 18, 2018 20 Feb 2018 Laurence Wauters Matthew West	Royal Observatory of Belgium - PROBA2 Science Center
To:	LYRA PI, marie.dominique@sidc.be SWAP PI, david.berghmans@sidc.be	http://proba2.sidc.be ++ 32 (0) 2 3730559
cc:	ROB DIR, ronald@oma.be ESA Redu, Etienne.Tilmans@esa.int ESA D/SRE, Joe.Zender@esa.int ESA D/TEC, Juha-Pekka.Luntama@esa.int	

1. Science

Solar & Space weather events

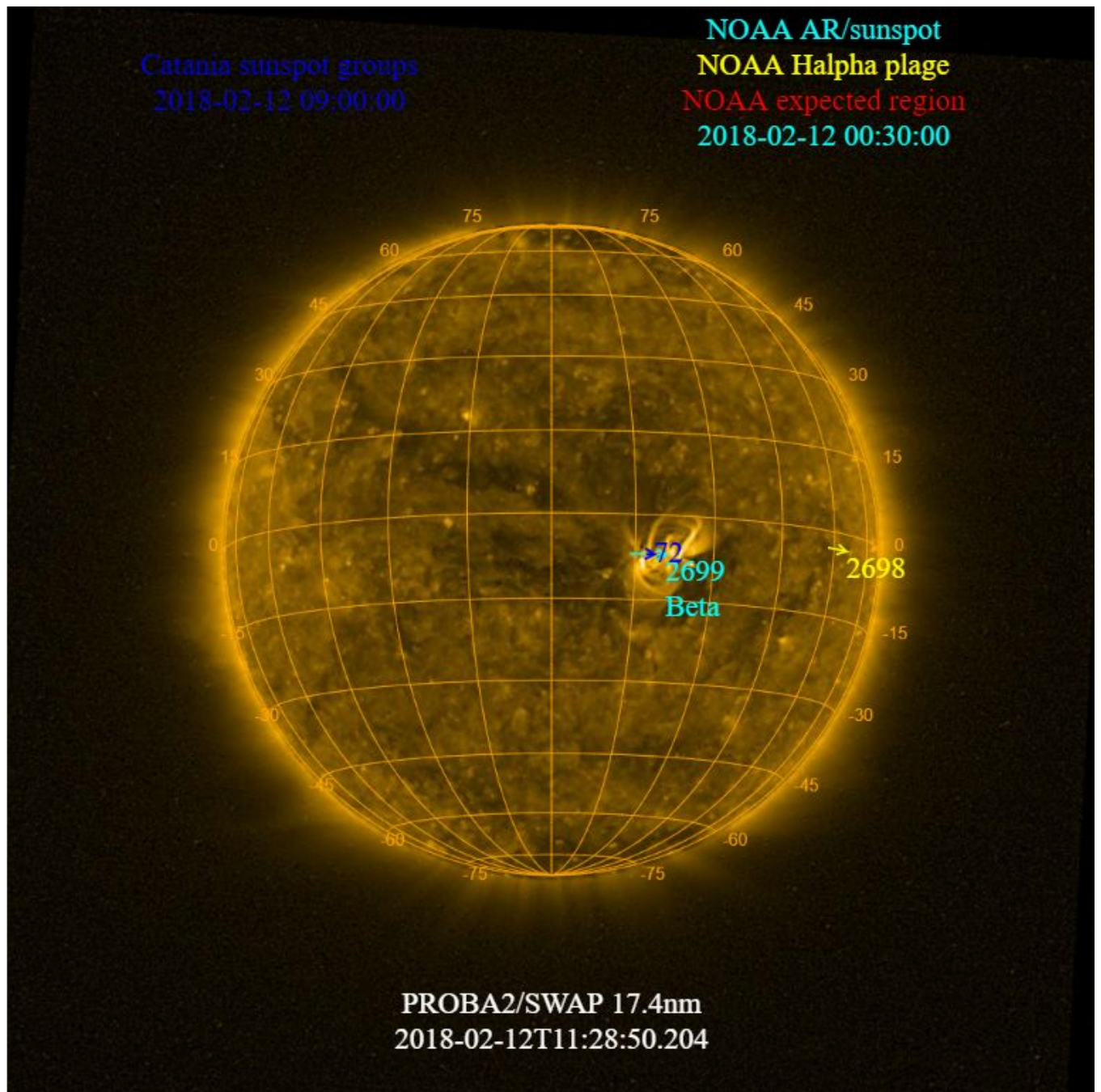
The level of solar activity¹ fluctuated between **very low and low** this week.

Only M- and X-flares are mentioned, the most energetic one(s) per day are presented in **bold**:

	Monday 12 Feb	Tuesday 13 Feb	Wednesday 14 Feb	Thursday 15 Feb	Friday 16 Feb	Saturday 17 Feb	Sunday 18 Feb
Activity	low	very low	very low	very low	very low	very low	very low
Flares	-	-	-	-	-	-	-

¹ See appendix. All timings are given in UT.

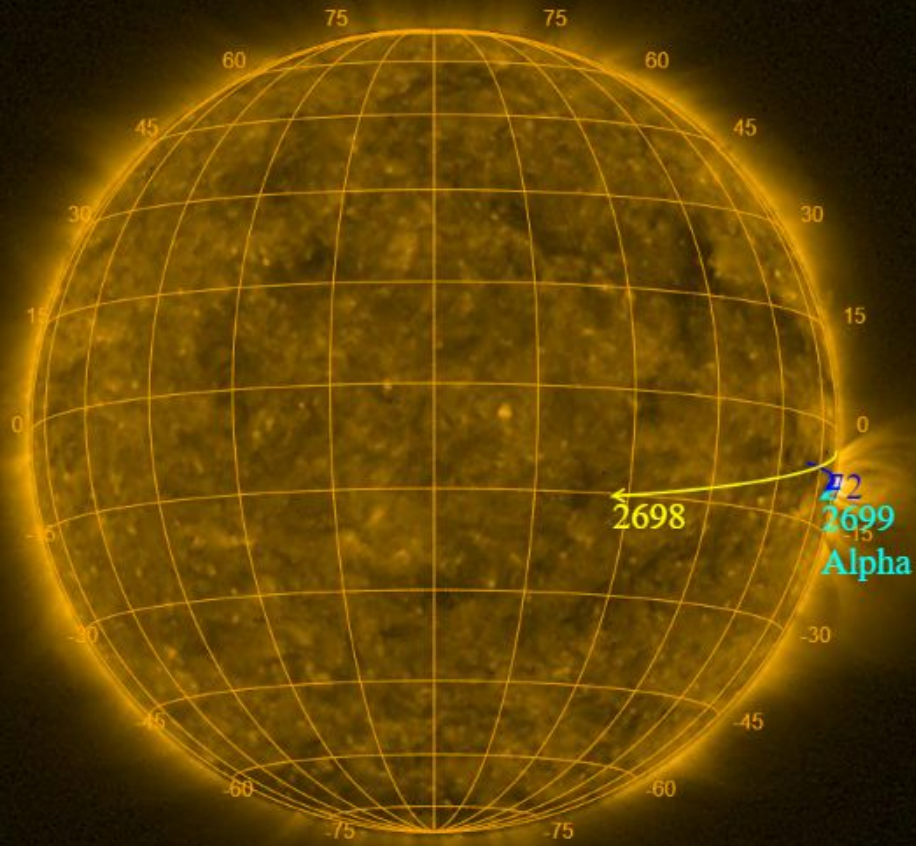
The SWAP images of Feb 12 and Feb 18 are shown below, with annotated active regions.



<http://sidc.be/soteria/soteria.php>

Catania sunspot groups
2018-02-16 07:36:00

NOAA AR/sunspot
NOAA Halpha plage
NOAA expected region
2018-02-17 00:30:00



PROBA2/SWAP 17.4nm
2018-02-18T11:28:18.525

Solar Activity

Solar flare activity fluctuated between very low and low during the week.

In order to view the activity of this week in more detail, we suggest to go to the following website from which all the daily (normal and difference) movies can be accessed: <http://proba2.oma.be/ssa>

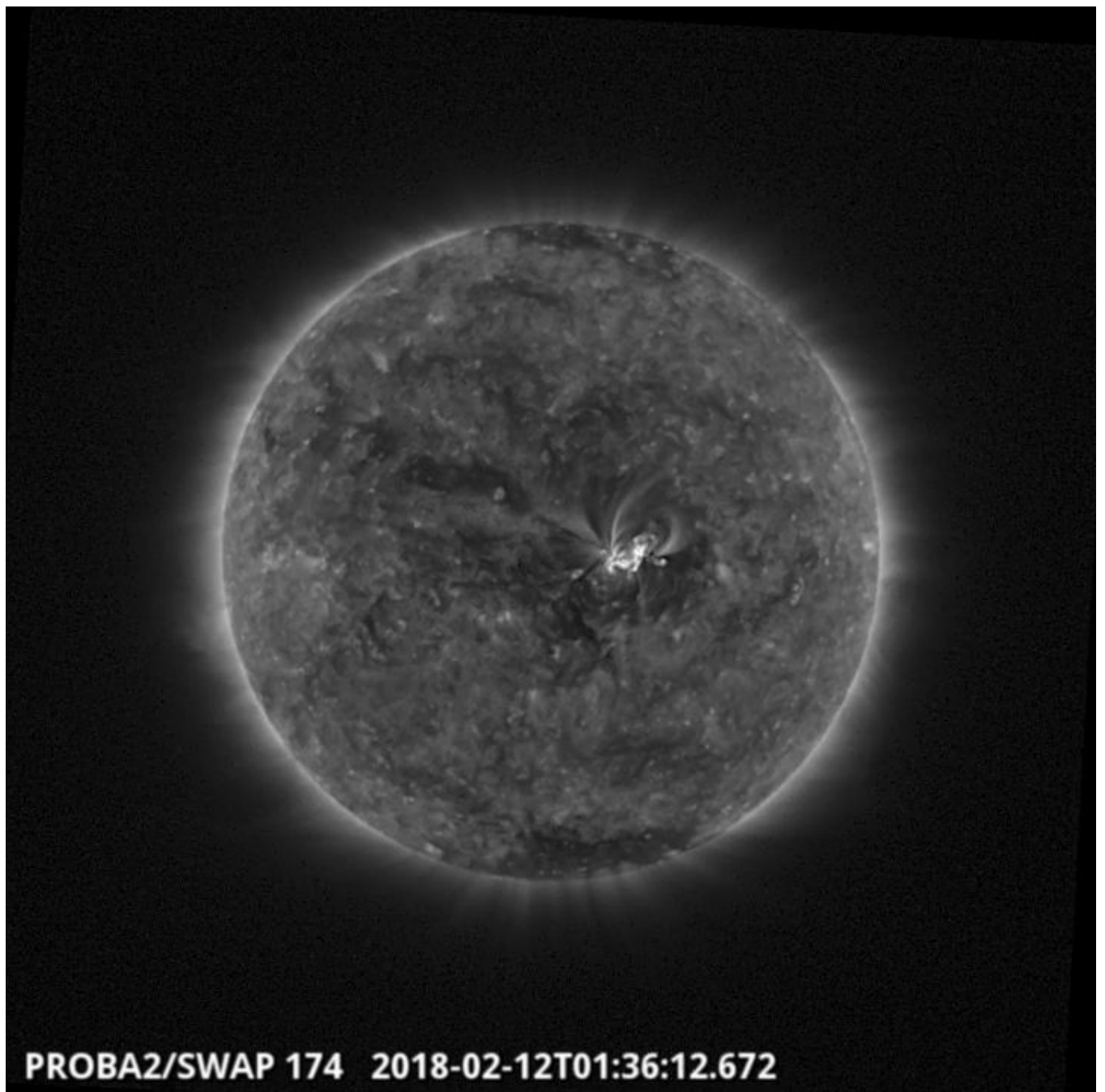
This page also lists the recorded flaring events.

A weekly overview movie can be found [here](#) (SWAP week 412).

Details about some of this week's events, can be found further below.

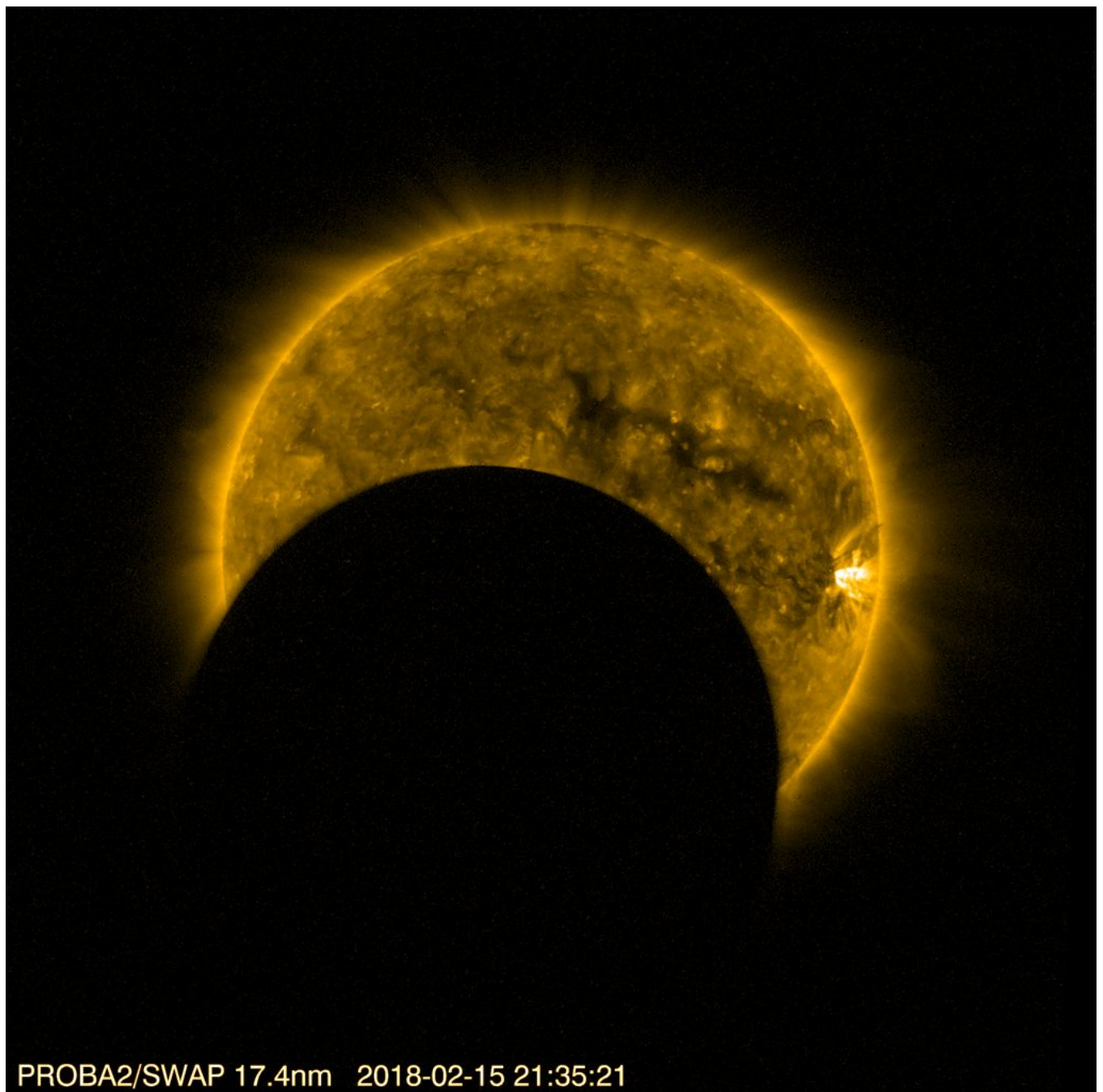
If any of the linked movies are unavailable they can be found in the P2SC movie repository [here](#)

Monday Feb 12

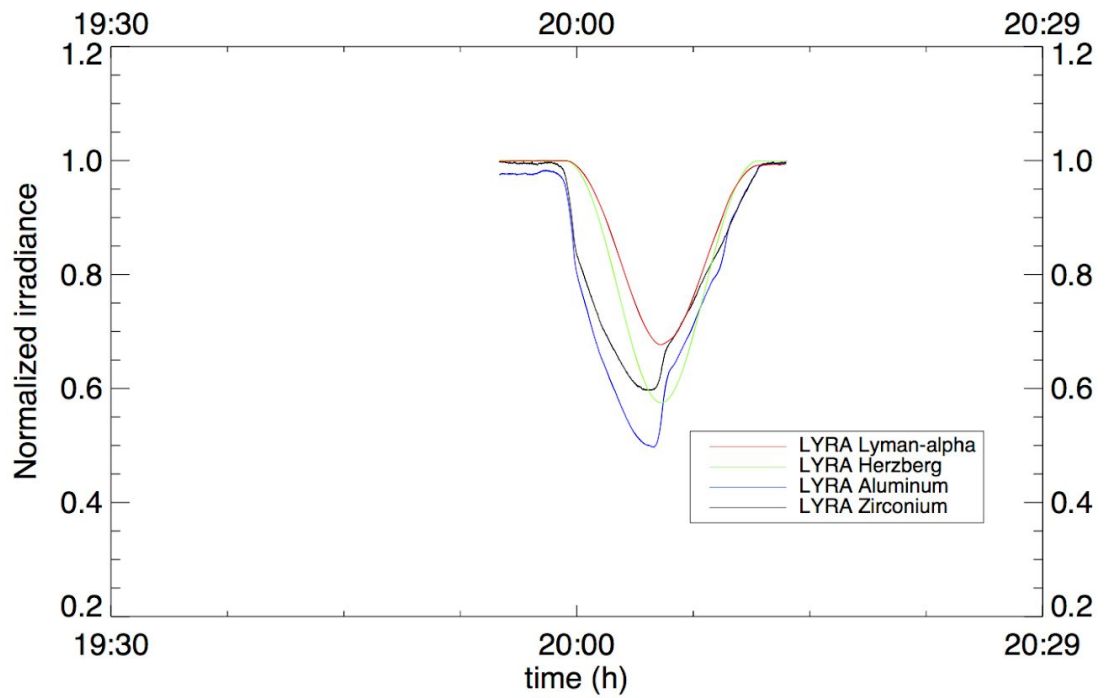


A C-class (C1.5) flare, associated with NOAA AR 2699, was observed by SWAP on 2018-Feb-12. The flare is visible near the solar disk center in the SWAP image above at 01:36 UT. This flare was followed by several B-class flares throughout the week.
Find a movie of the events [here](#) (SWAP movie)

Thursday Feb 15



On February 15, two eclipses occurred (between 19:59 and 20:11 UT, and between 21:28 and 21:41 UT respectively). The SWAP image above was taken during the second one. Additionally, the Moon appeared two more times in the SWAP and LYRA field of view, but without obscuring the solar disk.
Find a movie of the events [here](#) (SWAP movie)

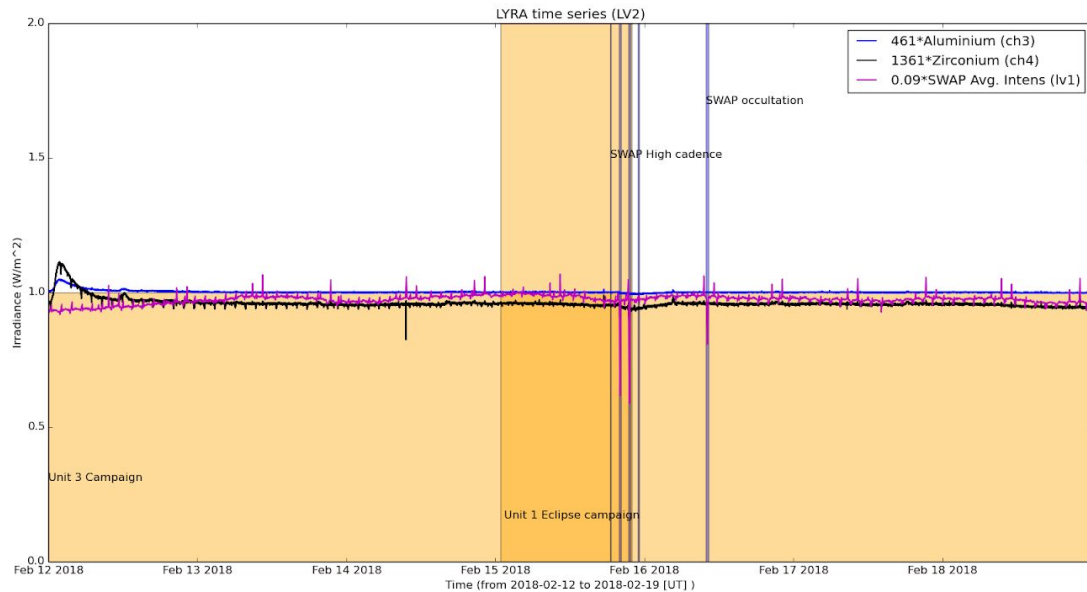


On February 15, the first partial eclipse (between 19:59 and 20:11 UT) was observed by LYRA, the above image shows the irradiance curves from LYRA throughout the event. Find LYRA fits files for this event [here](#).

An overview of the weekly LYRA & SWAP data is provided below:

The following curves are visible:

- black: Zirconium Channel LYRA Unit 2
- blue: Aluminium Channel of LYRA Unit 2
- purple: SWAVINT (SWAP Average Intensity; integrated solar intensity per SWAP image pixel)



The blue shaded periods related to SWAP, correspond to, from left to right:

- Eclipse high cadence campaign, 2018-Feb-15 (between 18:28 UT and 18:38 UT, between 19:56 and 20:16 UT, between 21:23 UT and 21:44 UT and between 23:00 UT and 23:12 UT respectively)
- Parallel occultation campaign with LYRA, 2018-Feb-16

The orange shaded periods related to LYRA correspond to, from left to right:

- Continuous Unit 3 campaign, from 2018-Feb-12 to 2018-Feb-15 00:40 and from 2018-Feb-15 22:15 to 2018-Feb-18
- LYRA (Unit1) eclipse campaign, 2018-Feb-15 from 00:53 UT to 22:00 UT

The red shaded periods related to other issues corresponds to:

- None

Outreach, papers, presentations, etc.

Please consult <http://proba2.oma.be/science/publications> for a list of interesting articles using SWAP & LYRA data, as well as a link to the complete article list.

The science section of this weekly report is also published in the weekly STCE newsletter (<http://www.stce.be/newsletter/newsletter.php>).

"The detection of ultra-relativistic electrons in low Earth orbit" by Katsiyannis et al. In this paper the authors looked at relativistic electrons with an energy range of 2 to 8 MeV present at high latitudes in the Earth atmosphere. The particles were indirectly detected by LYRA as a background signal. Combining LYRA observations with energetic particle telescope (EPT) observations the authors showed that the observed events are strongly correlated to geomagnetic activity and appear even during modest disturbances.

"On the Performance of Multi-Instrument Solar Flare Observations During Solar Cycle 24" by Milligan and Ireland. In this paper the authors describe a technique that combines observations from various solar missions instruments. As part of the dataset, SWAP's large field of view was used to produce the context image to show the location of a flare detected by all instruments and to emphasize the importance of large FOVs in such observations.

"Vertical Thermospheric Density Profiles From EUV Solar Occultations Made by PROBA2 LYRA for Solar Cycle 24" by Thiemann et al. In this paper the authors develop a new data set of summed neutral nitrogen and oxygen number density profiles of the Earth's atmosphere, spanning altitudes between 150 and 400 km. The neutral density profiles are derived from solar occultation measurements made by the Zirconium channel on LYRA. The observations are compared and match well with model made predictions. The density profiles are used to characterize the response of thermospheric density to solar EUV irradiance variability. LYRA is used through out the paper, making use of occultation observations. When PROBA2 passes behind the Earth in its orbit, LYRA is used to look at how the EUV emission of the Sun is extinguished. Note this paper was published in 2017, but was only listed on NASA ADS in the last weeks.

"Modelling Quasi-Periodic Pulsations in Solar and Stellar Flares" by McLaughlin et al was published in Space Science Reviews. This paper focuses on the radiation generated in solar and stellar flares, which show a pronounced oscillatory pattern, with characteristic periods ranging from a fraction of a second to several minutes. LYRA's high cadence observations are at the forefront of QPP observations due to LYRA's high cadence observations, and are discussed throughout this paper. An example is given in Figure 1 for the X4.9 flare of 25 February 2014. QPP oscillations with a period of ~35 s are clearly visible as an oscillatory train in all displayed time series.

Guest Investigator Program

- Ed Thiemann from LASP, Boulder, Colorado is visiting the P2SC for the week between Feb-08 and Feb-15 to begin his collaboration on the project "Comparing the response of the thermospheres of Earth and Mars to solar forcing with contemporaneous solar EUV occultations." During his visit he also gave a STCE seminar entitled "Mars Thermospheric Variability Revealed by MAVEN EUVM Solar Occultations".

2. LYRA instrument status

Calibration

No calibration campaign on this week.

IOS & operations

Monday 12 Feb	Tuesday 13 Feb	Wednesday 14 Feb	Thursday 15 Feb	Friday 16 Feb	Saturday 17 Feb	Sunday 18 Feb
Nominal acquisition + U3	Nominal acquisition + U3	Nominal acquisition + U3	Nominal acquisition + U3	Nominal acquisition + U3+ U1 eclipse campaign	Nominal acquisition + U3	Nominal acquisition + U3
LYIOS00674	LYIOS00674	LYIOS00675	LYIOS00675	LYIOS00676	LYIOS00676	LYIOS00676

The following science campaigns were performed by LYRA:

- Continuous Unit 3 campaign

On 2018-Feb-15:

- LYRA (Unit1) eclipse campaign

LYRA detector temperature

LYRA detector 2 temperature globally varied between 53.33 and 55.35 °C.

3. SWAP instrument status

Calibration

No Calibration campaign on this week.

MCPM errors

The number of MCPM recoverable errors increased from 1638 to 1951.

The number of MCPM unrecoverable errors remained at 0.

IOS & operations

Monday 12 Feb	Tuesday 13 Feb	Wednesday 14 Feb	Thursday 15 Feb	Friday 16 Feb	Saturday 17 Feb	Sunday 18 Feb
Nominal acquisition	Nominal acquisition + calibration	Nominal acquisition	Nominal acquisition	Nominal acquisition	Nominal acquisition	Nominal acquisition
IOS00761 609 images	IOS00761 728 images	IOS00762 586 images	IOS00762 889 images	IOS00762 775 images	IOS00763 680 images	IOS00763 597 images

Special operations for SWAP, this week:

On 2018-Feb-15:

- Eclipse high cadence campaign

On 2018-Feb-16:

- Occultation campaign

SWAP detector temperature

The SWAP Cold Finger Temperature globally varied between 2.07 and 3.91 °C.

4. PROBA2 Science Center Status

The main operator is Laurence Wauters.

The following changes were made to the P2SC:

- None.

5. Data reception & discussions with MOC

Passes

The delivery of the passes for this week (passes 26601 to 26668) was nominal, except for:

- None.

Data coverage HK

All HK data files (LYRA_AD) have been received, except:

- None.

Data coverage SWAP

All SWAP Science data files (BINSWAP) have been received, except:

- None.

Total number of images between 2018 Feb 12 00:00 UT and 2018 Feb 19 00:00 UT: 4925

Highest cadence in this period: 0 seconds

Average cadence in this period: 122.79 seconds

Number of image gaps larger than 300 seconds: 126

Largest data gap: 18.33 minutes

Data coverage LYRA

All LYRA Science data files (BINLYRA) have been received, except:

- None

6. APPENDIX: Frequently used acronyms

ADPMS	Advanced Data and Power Management System
AOCS	Attitude and Orbit Control System
APS	Active Pixel image Sensor
ASIC	Application Specific Integrated Circuit
BBE	Base Band Equipment
CME	Coronal Mass Ejection
COGEX	Cool Gas Generator Experiment
CRC	Cyclic Redundancy Check
DAC	Data Acquisition Controller
DBR	Deployment, backup & recovery
DDA	Decommutated data archive
ESP	Experimental Solar Panel
FITS	Flexible Image Transport System
FOV	Field Of View FPA Focal Plane Assembly
FPGA	Field Programmable Gate Arrays
GPS	Global Positioning System
HK	Housekeeping
IOS	Instrument Operations Sheet
LED	Light Emitting Diode
LYRA	LYman alpha RAdiometer
LYTMR	LYRA Telemetry Reformatter (software module of P2SC)
LYEDG	LYRA Engineering Data Generator (software module of P2SC)
MCPM	Mass Memory, Compression and Packetisation Module
MOC	Mission Operation Center
NDR	Non Destructive Readout
OBSW	On board Software
PI	Principal Investigator
P2SC	PROBA2 Science Center
ROB	Royal Observatory of Belgium
SAA	South Atlantic Anomaly
SEU	Single Event Upset
SoFAST	Solar Feature Automated Search Tool
SWAP	Sun Watcher using APS detector and image Processing
SWAVINT	SWAP AVerage INTensity
SWBSDG	SWAP Base Science Data Generator
SWEDG	SWAP Engineering Data Generator (software module of P2SC)
SWTMR	SWAP Telemetry Reformatter (software module of P2SC)
TBC	To Be Confirmed
TBD	To Be Defined
TC	Telecommand
UTC	Coordinated Universal Time
UV	Ultraviolet
VFC	Voltage to Frequency Converter

7. APPENDIX Solar Activity Definitions

In the science section we use the following solar activity standards.

The standard scale for solar activity is:

- very low (almost no flares, only B)
- low (a few C flares)
- moderate (many C flares and at least an M flare)
- high (several M flares and an X flare)
- very high (continuous background of C flares, numerous M flares, more than one X flare)