PART 1

Comparison between LYRA and SWAP Average Intensity during the July 11th, 2010 Solar Eclipse

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SWAP Average Intensity: SWAVINT

- SWAVINT is the average intensity of a calibrated (except transformation) whole SWAP image normalized with its exposure time:

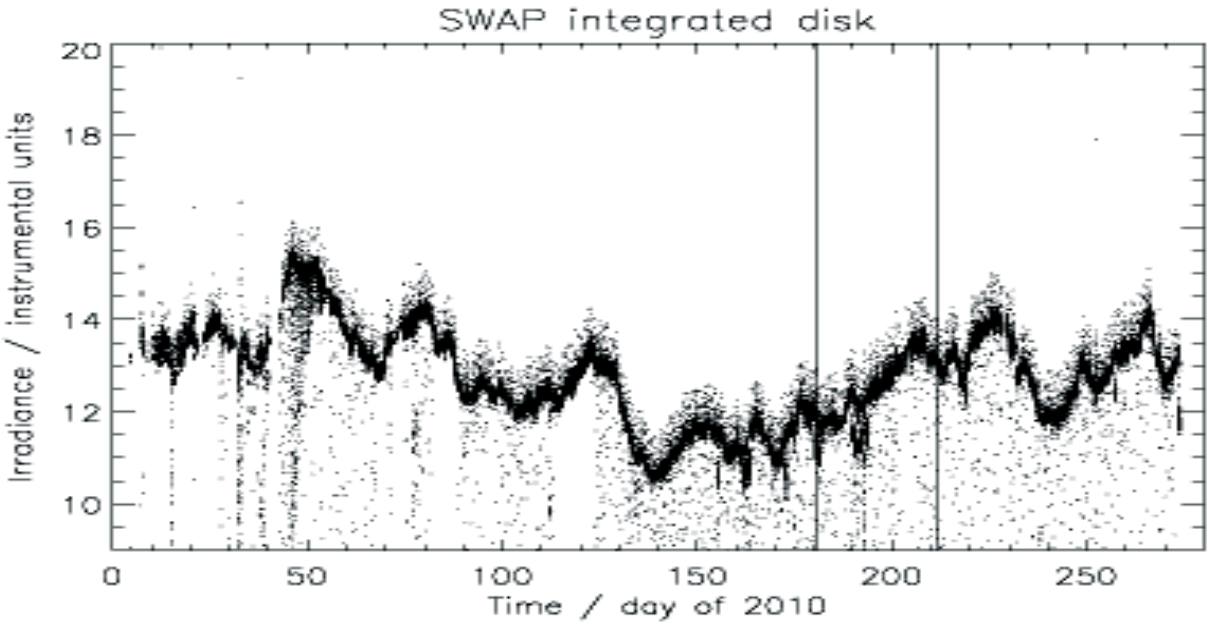
$$SWAVINT = \frac{1}{t_{\exp} \times P} \sum_{p=1}^{P} DN_p$$

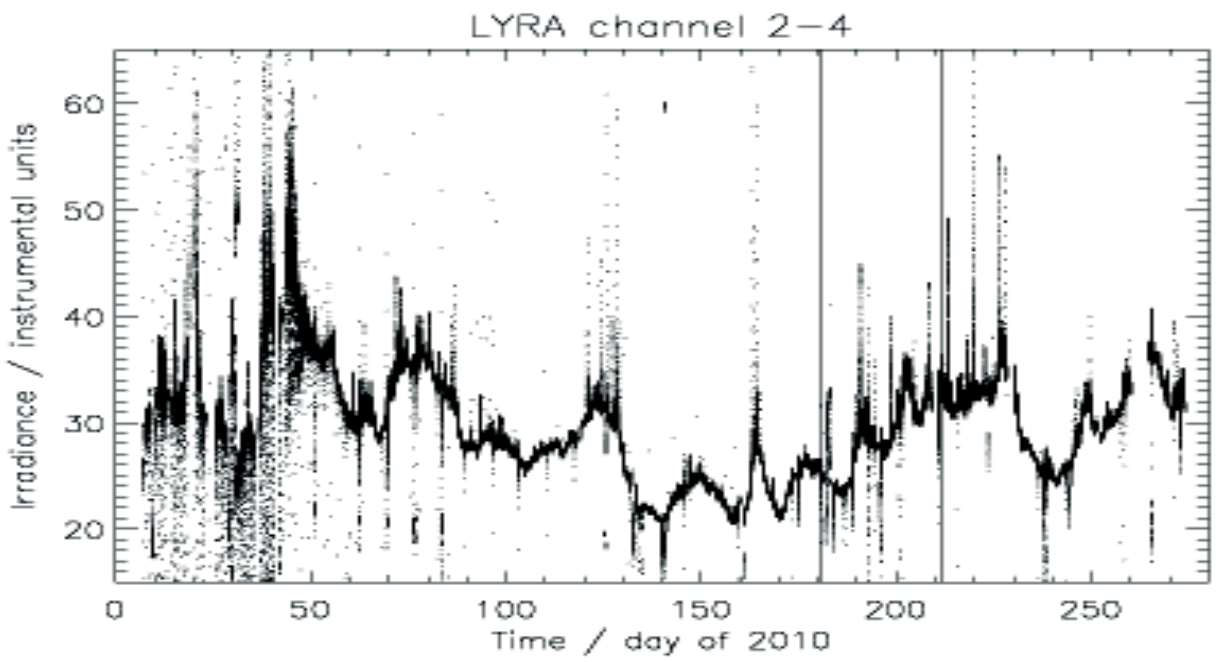
where t_{exp} is the exposure time, P is the number of pixels for the whole image, 1024x1024, and DN is the digital number in pixel p. The unit of SWAVINT is DN/s.

- It is a keyword in the calibrated (i.e. level-1) SWAP fits files.

- SWAVINT can be regarded as a solar EUV irradiance at the SWAP bandpass centered at 17.4 nm.

SWAVINT vs LYRA Channel 2-4 (Zirconium): Jan-Oct 2010 Period





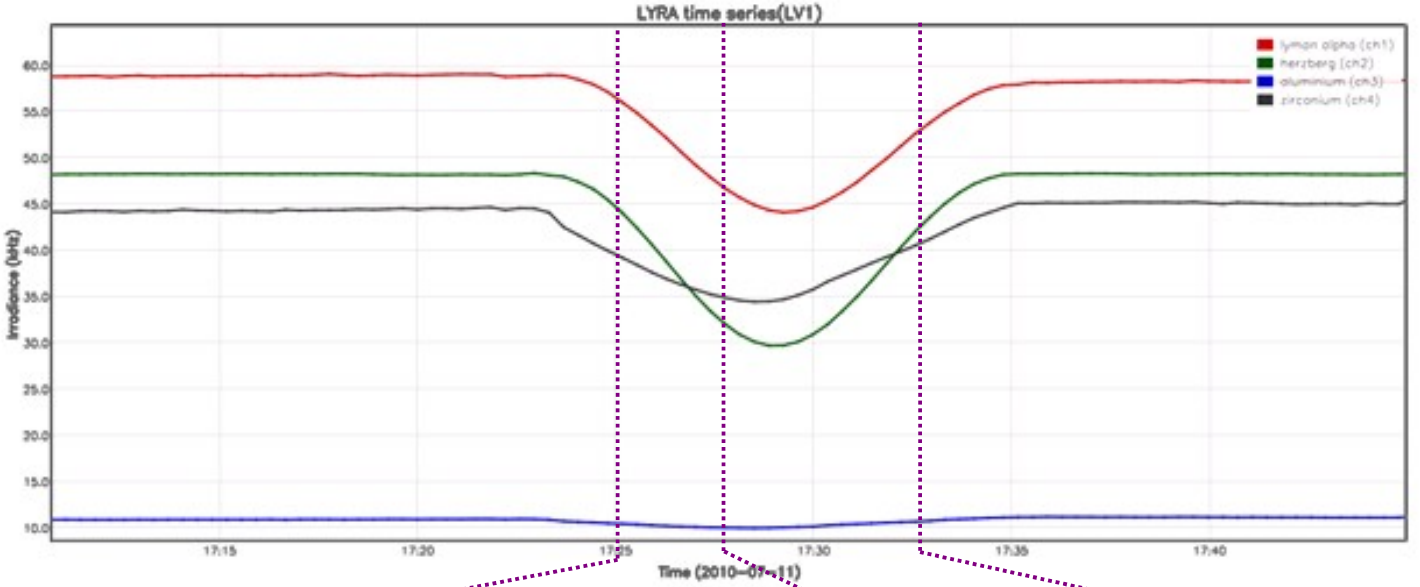
- The bandpass of LYRA zirconium channel is 6-20 nm + SXR below 2 nm.

- LYRA data consist of one-minute averages with a cadence varying between 10 ms and 1 s.

- Good correlation ! SWAP integrated flux can be considered as an additional radiometric channel.

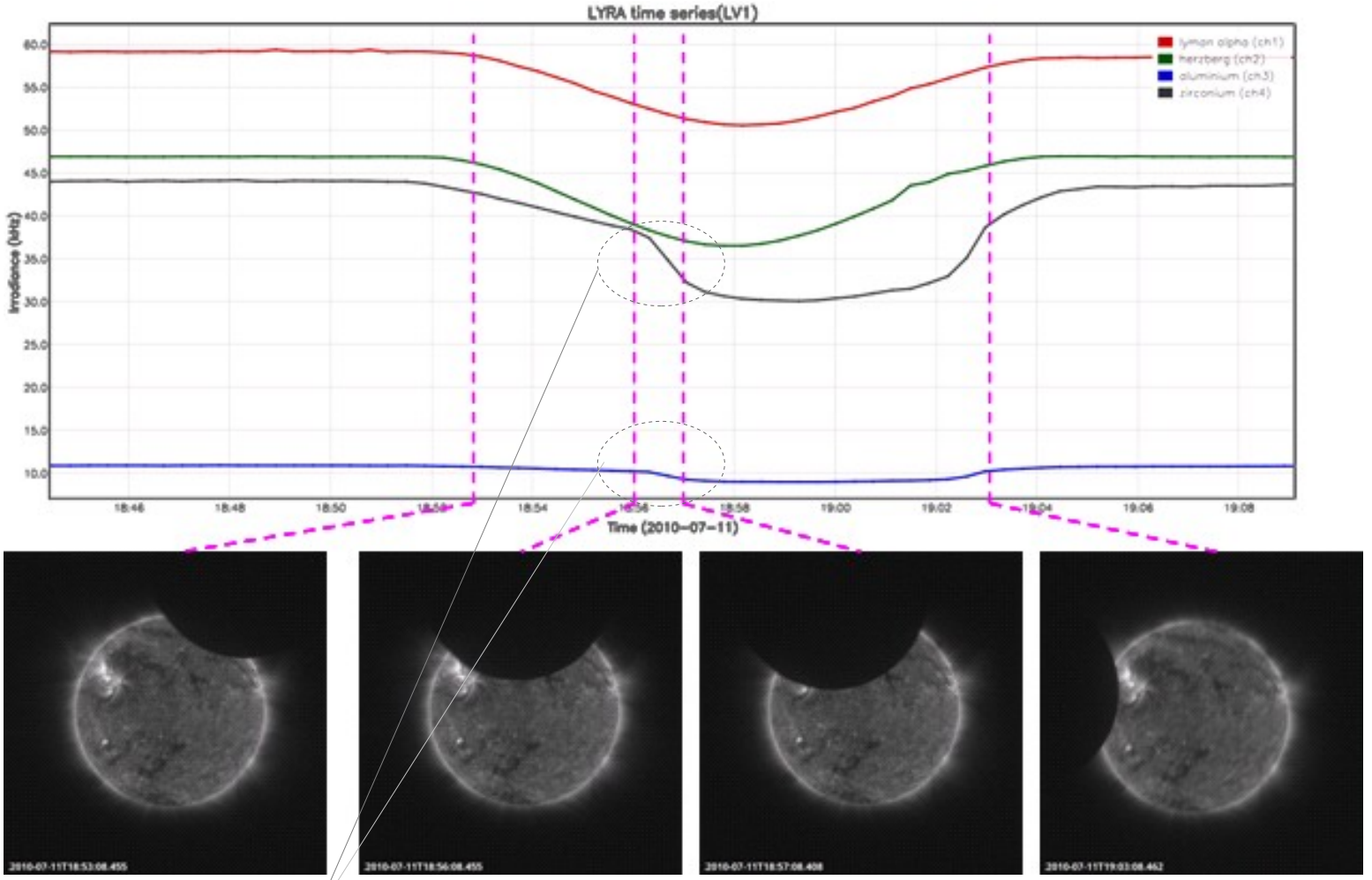
- On top of the EUV variation, flares associated with various active regions can be seen in the LYRA curve.

LYRA Channels: July 11th, 2010 Solar Eclipse – First Moon Transit



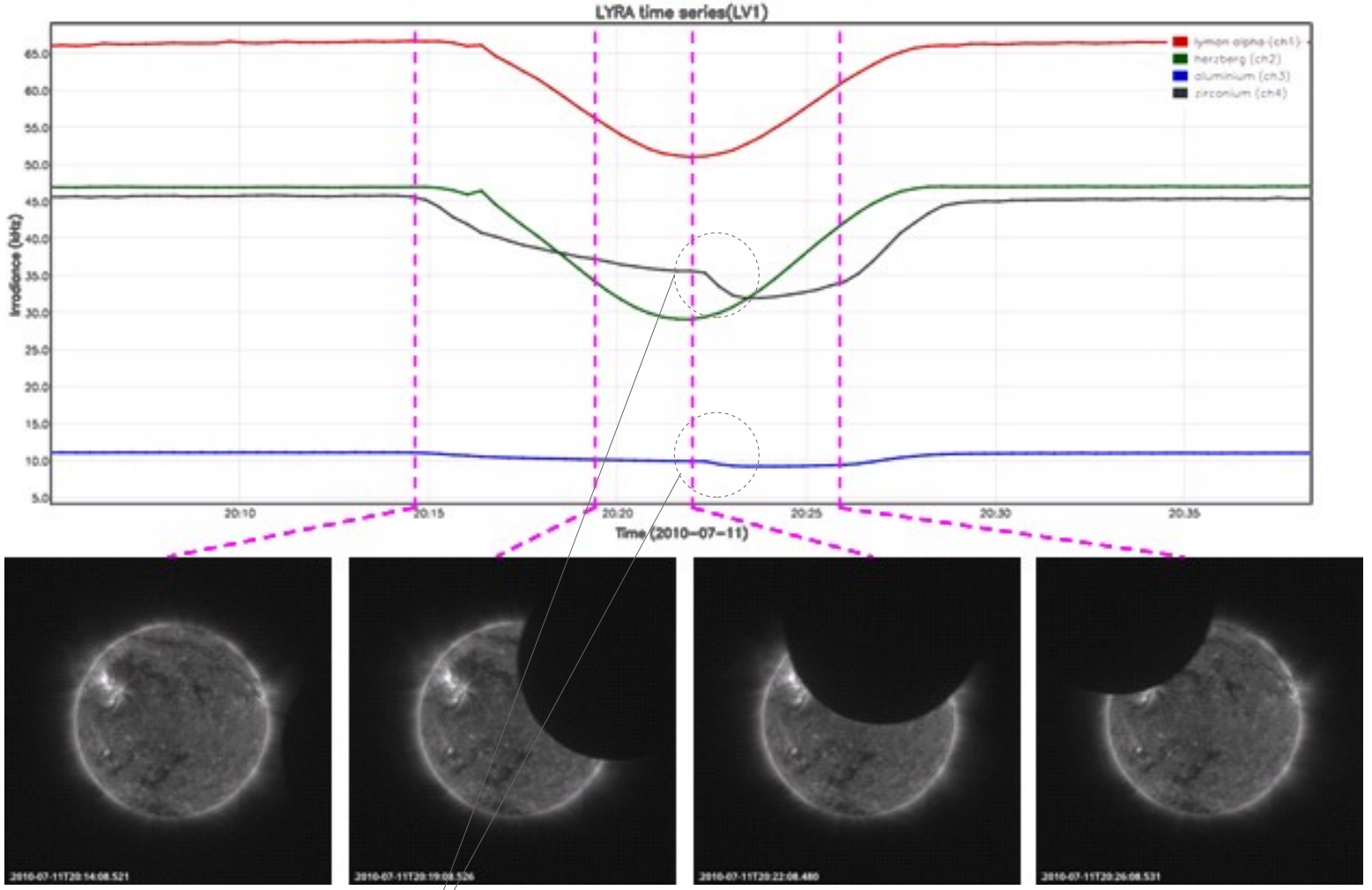
- LYRA data used here have a cadence of 50 ms without applying any averaging.
- All LYRA channels show a quite symmetric decrease in irradiance during the occultation.

LYRA Channels: July 11th, 2010 Solar Eclipse – Second Moon Transit



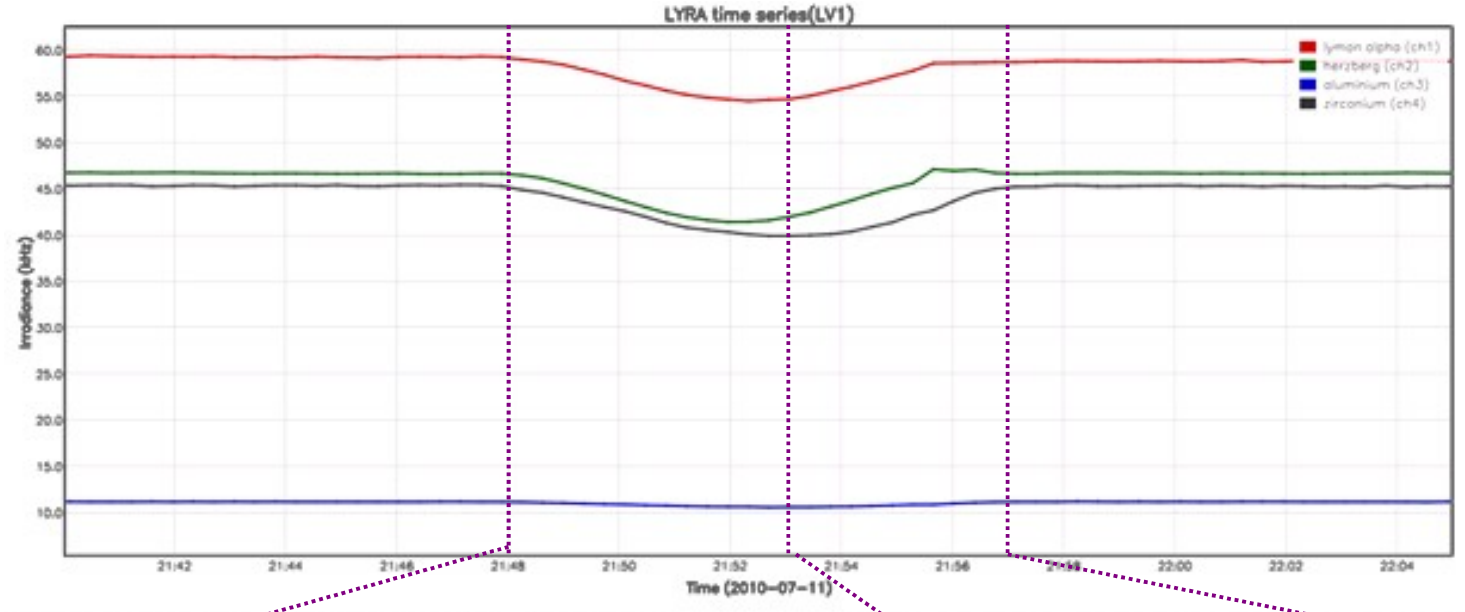
- Second dip in the LYRA short-wavelength channels (aluminum and zirconium) exists due to the blockage of the SXR component of the irradiance coming from the AR.

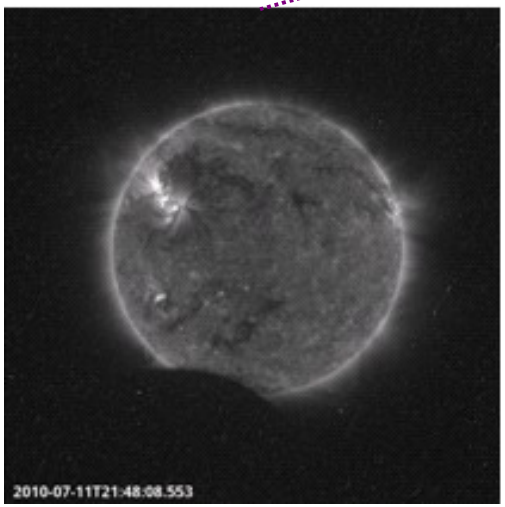
LYRA Channels: July 11th, 2010 Solar Eclipse – Third Moon Transit

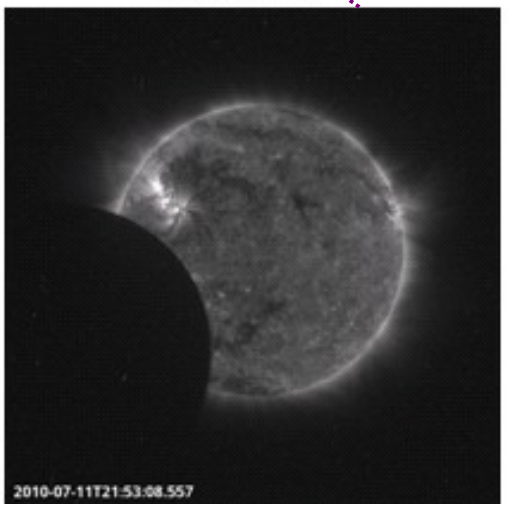


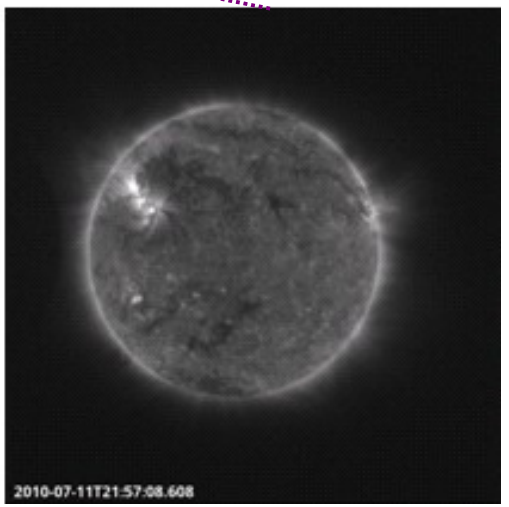
- Second dip in the LYRA short-wavelength channels (aluminum (17-80 nm + SXR below 5 nm) and zirconium) exists due to the blockage of the SXR component of the irradiance coming from the AR.

LYRA Channels: July 11th, 2010 Solar Eclipse – Fourth Moon Transit



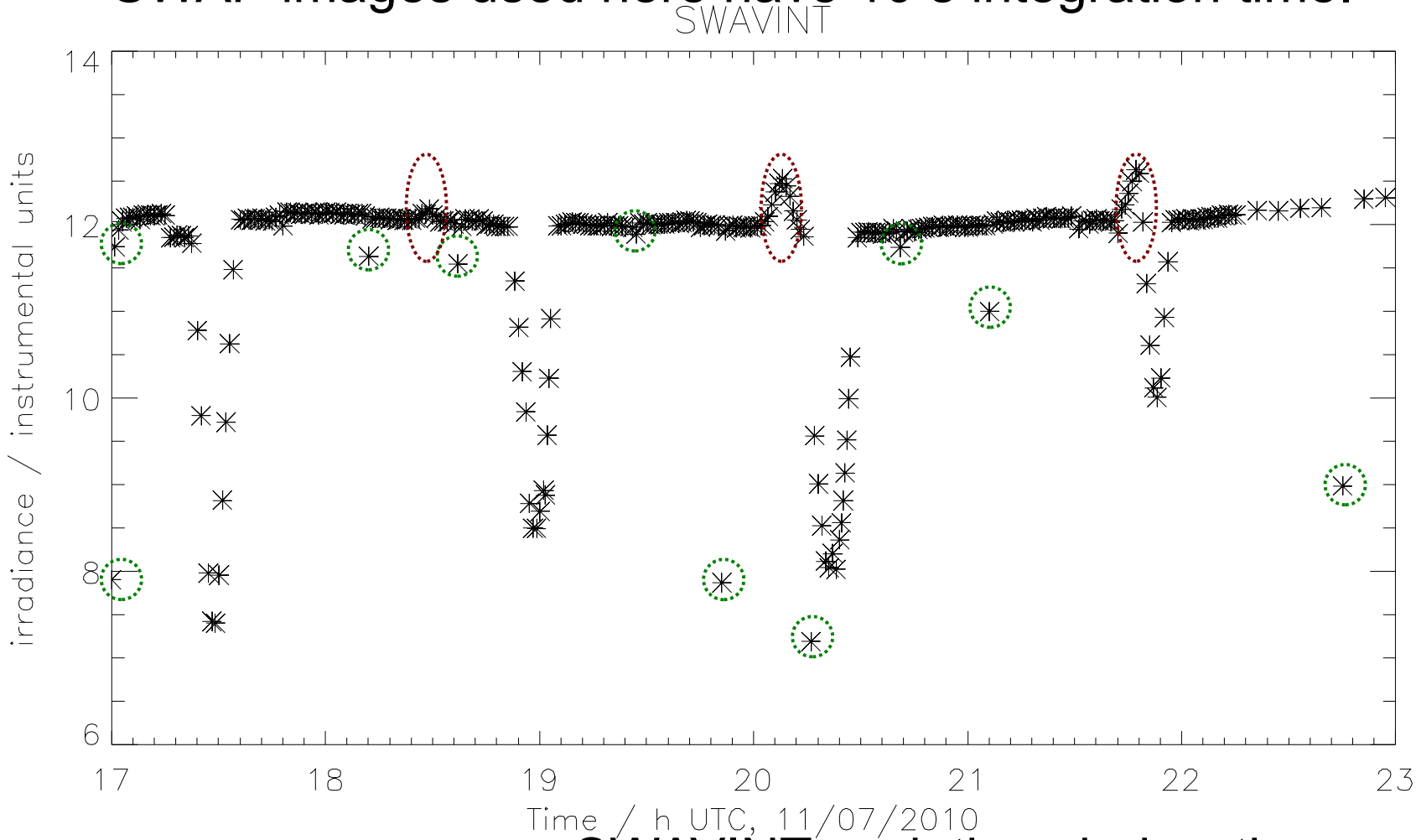






SWAVINT: July 11th, 2010 Solar Eclipse – All Four Moon Transits

- SWAP images used here have 10 s integration time.



Large angle rotation

South Atlantic Anomaly

- SWAVINT variation during the occultations is not as asymmetric and deep as the LYRA short-wavelength channels during the 2nd and 3rd transits as SWAP does not observe the AR in SXR.

PART 2

LYRA Imaging during the July 11th, 2010 Solar Eclipse

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LYRA Imaging: Main Idea

- The main idea is to obtain LYRA images of the solar corona corresponding to each of its four channels by assigning the differences in solar irradiance measured by each LYRA channel to the region(s) occulted and/or revealed on the solar disk during the transits of the Moon for the July 11th, 2010 solar eclipse.

LYRA Imaging: Different Cases

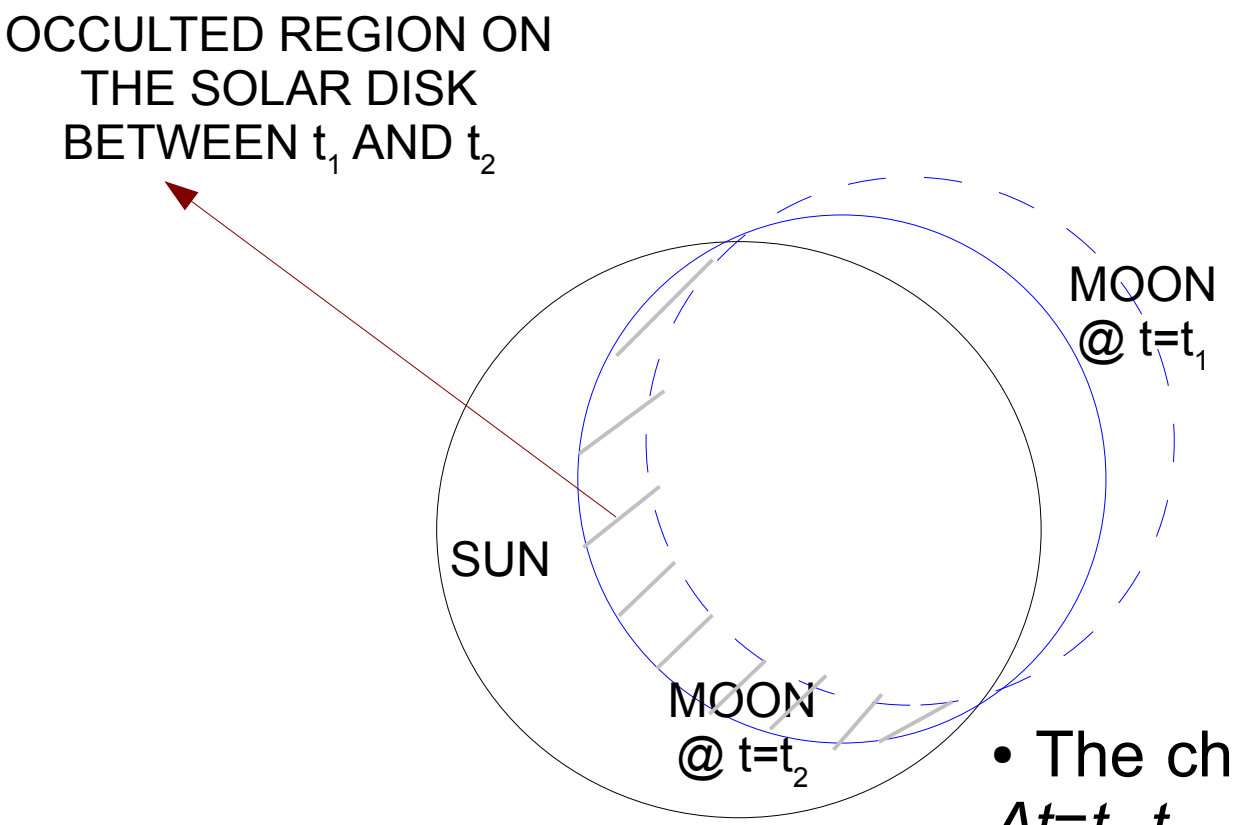
- The position of the Moon during the four transits is known (up to at each second) in a Cartesian coordinate system in terms of SWAP pixels thanks to the Pointing, Positioning and Time (PPT) Tool of P2SC.

- Therefore, the region(s) on the solar disk occulted and/or revealed by the motion of the Moon is/are filled with the amount of decrease/increase in solar irradiance (10 s running median of LYRA measurements) due to the motion of the Moon.

- Three different Occulted/Revealed Region configurations are foreseen during the motion of the Moon:

    1- Only occultation,
    2- Occultation and Revealing,
    3- Only revealing.

Only Occultation

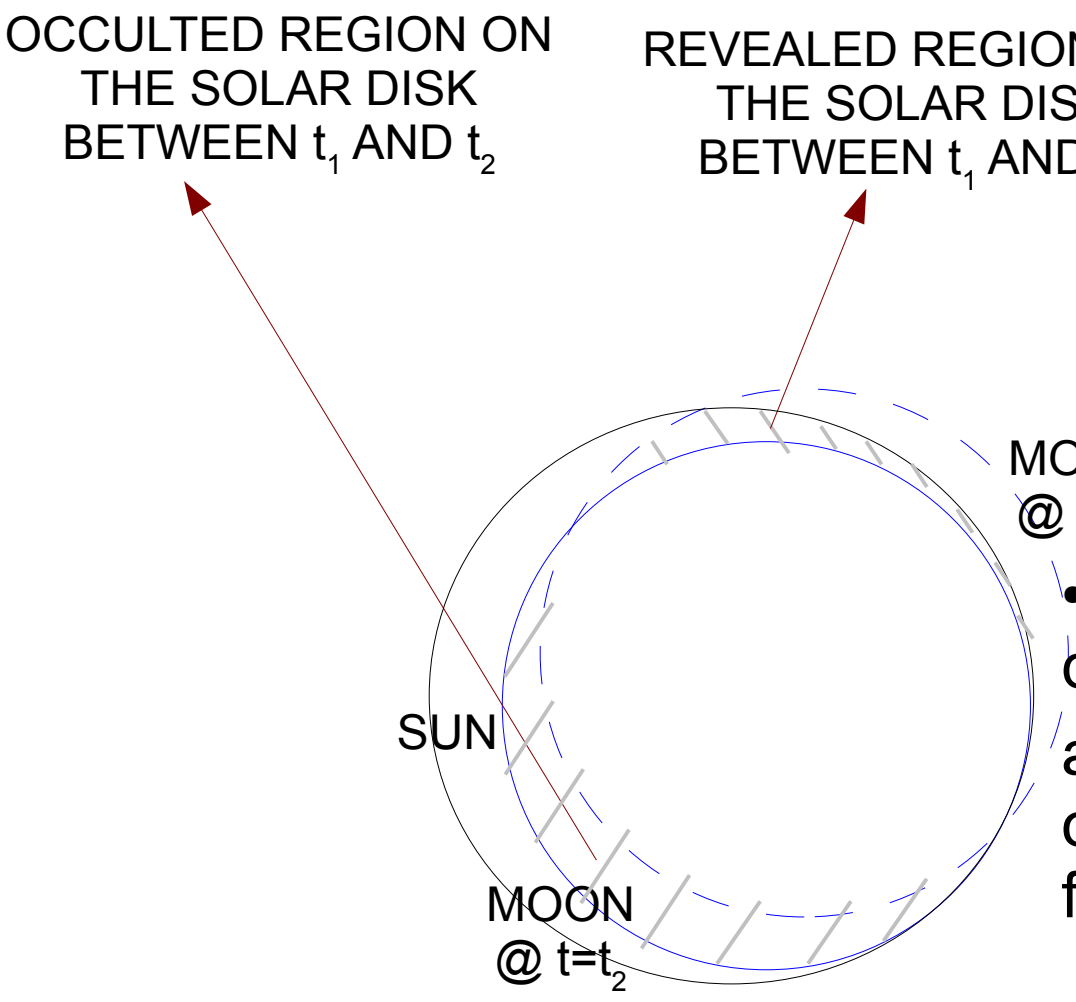


- The change in solar irradiance during $\Delta t=t_2-t_1$, ΔIRR_{LYRA}, is assigned to each pixel in the occulted region as follows:

$$IRR_{occ-pix}=\frac{|\Delta IRR_{LYRA}|}{P_{occ}}$$

where P_{occ} is the number of pixels in the occulted region.

Occultation and Revealing



- The change in solar irradiance during $\Delta t=t_2-t_1$, ΔIRR_{LYRA}, is assigned to each pixel in the occulted and revealed regions as follows:

$$IRR_{occ-rev-pixs} = \frac{\Delta IRR_{LYRA}}{P_{rev} - P_{occ}}$$

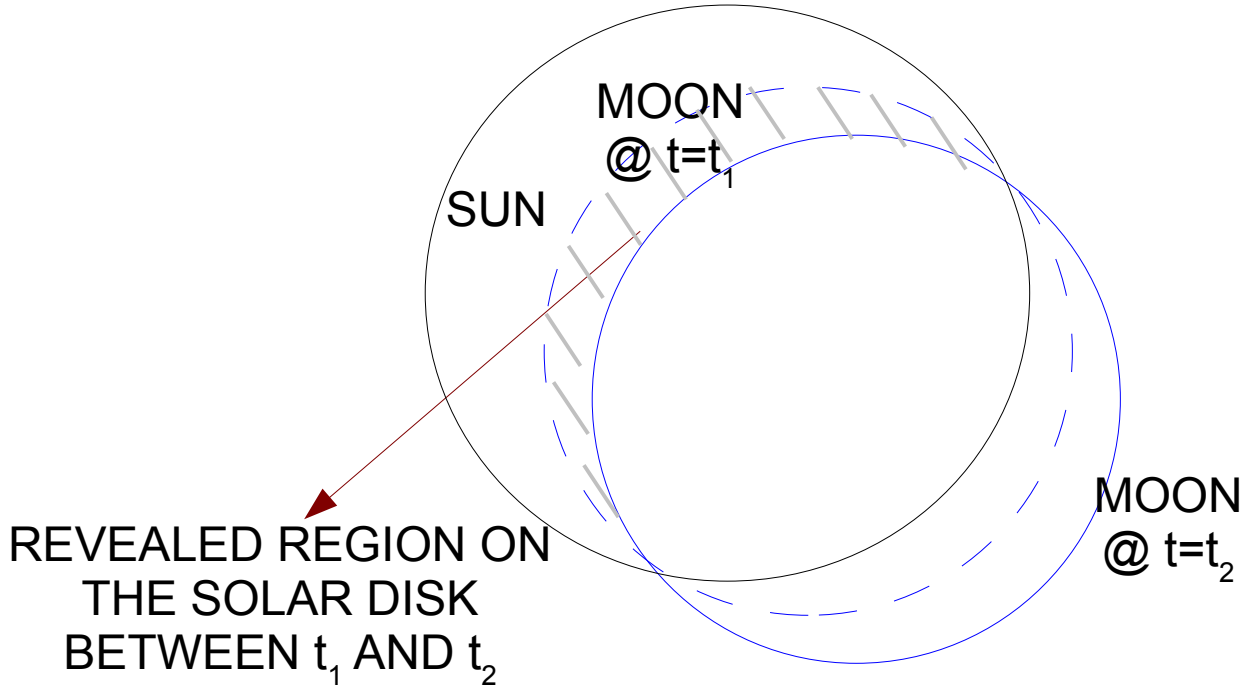
where P_{occ} and P_{rev} are the number of pixels in the occulted and revealed regions, respectively.

Only Revealing

• The change in solar irradiance during $\Delta t=t_2-t_1$, ΔIRR_{LYRA}, is assigned to each pixel in the revealed region as follows:

$$IRR_{rev-pix}=\frac{\Delta IRR_{LYRA}}{P_{rev}}$$

where P_{rev} is the number of pixels in the revealed region.

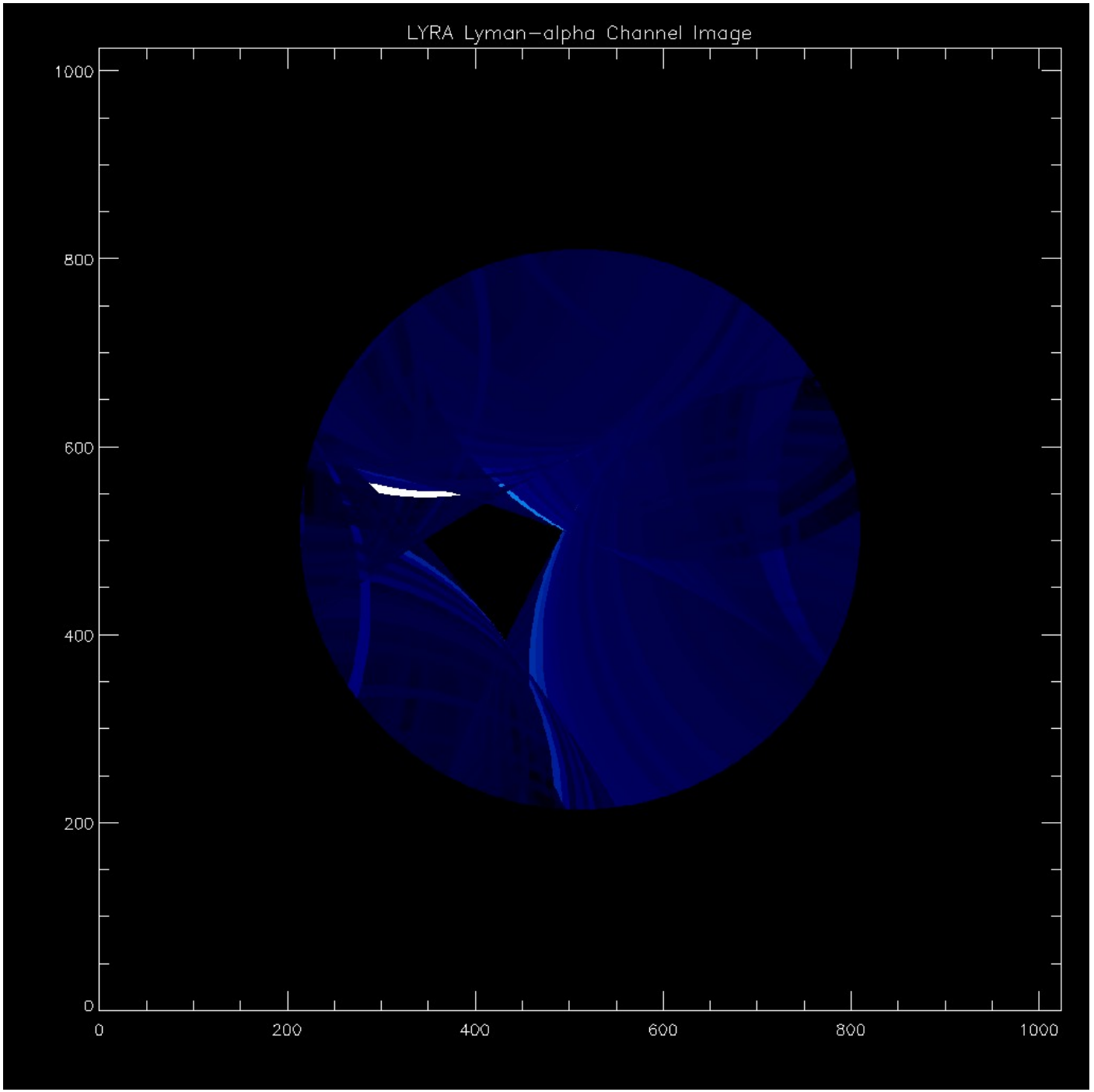


LYRA Imaging

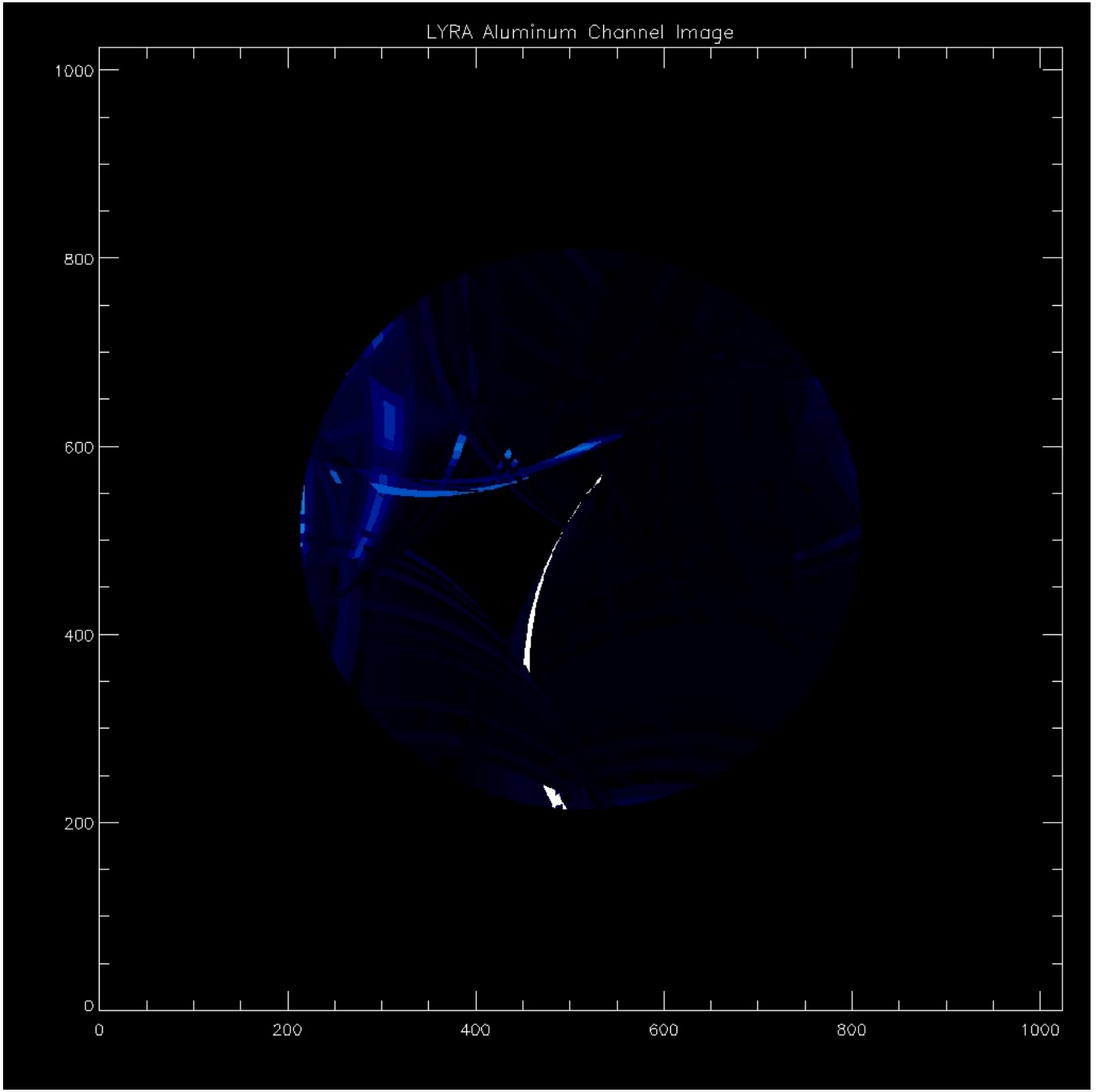
- Accordingly, a pixel will have as many different values as the number of occulted/revealed regions that contain that pixel after taking into account all four transits of the Moon.

- The median of those values is assigned to that pixel.

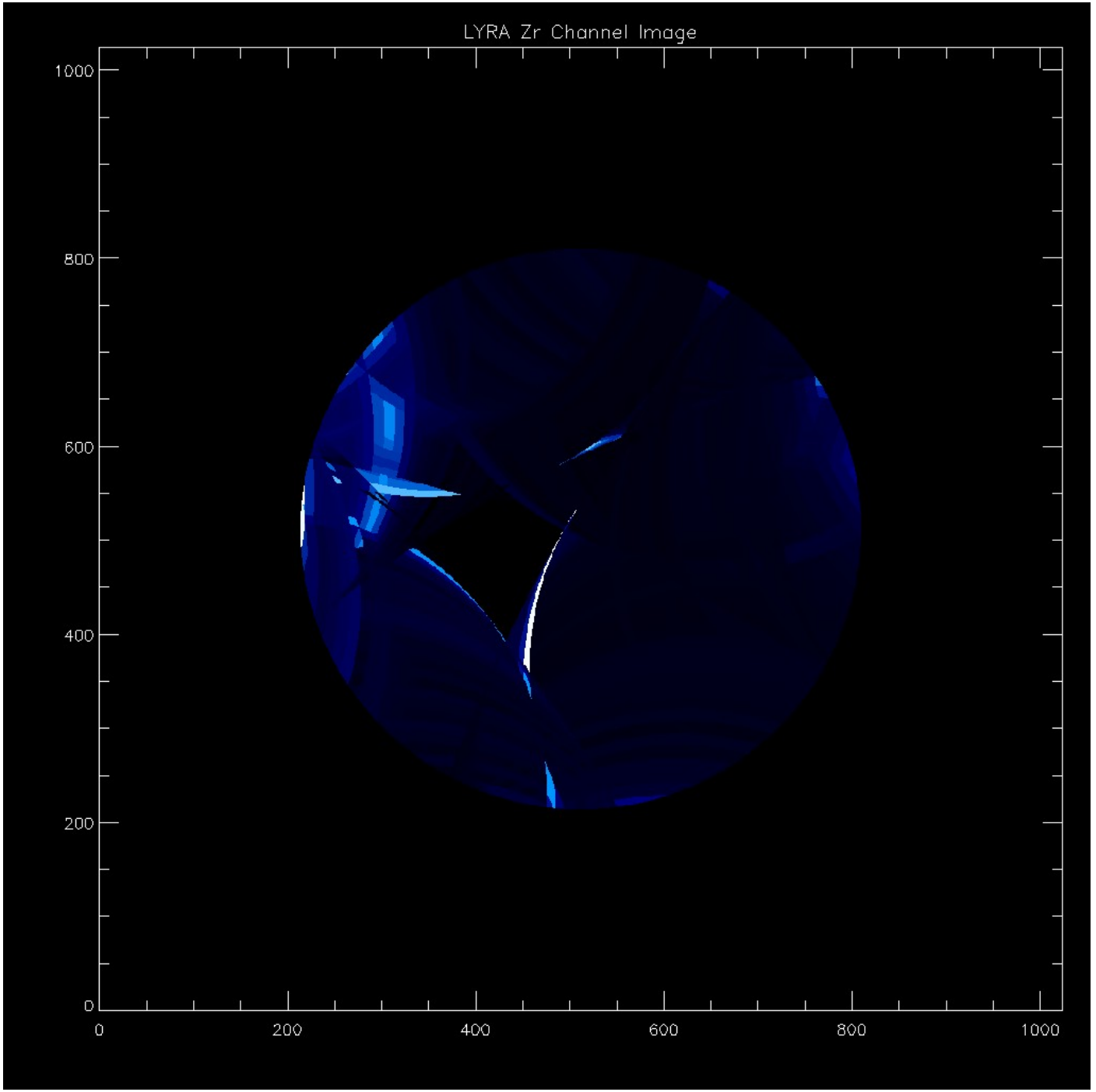
LYRA Imaging: Lyman-alpha Channel



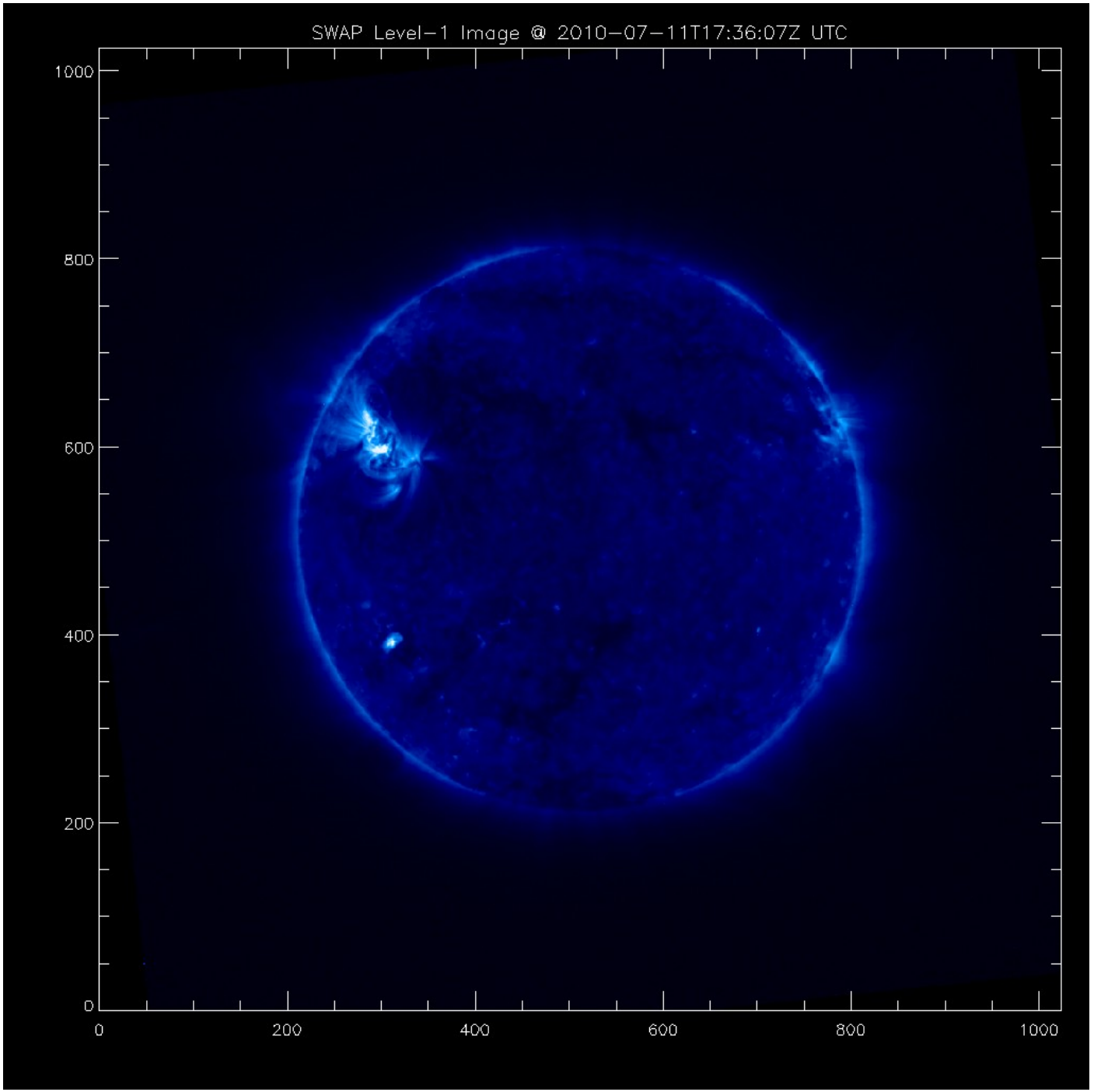
LYRA Imaging: Aluminum Channel



LYRA Imaging: Zirconium Channel



LYRA Imaging: A SWAP Image on 11/07/2010



Thank you !