#### SolO/EUI/FSI 304 Å

# Eruptions observed by EUI/FSI instrument onboard Solar Orbiter Marilena Mierla<sup>1,2</sup> and the EUI team 1. Royal Observatory of Belgium 2. Institute of Geodynamics of the Romanian Academy

2022-02-15 22:14



### **Overview of the talk**

- 1. Introduction of the EUI instrument
- 2. Data products
- 3. Eruptions observed by EUI/FSI
- 4. Conclusions



### Full Sun Imager (17.4/30.4nm

High Res Imager

30mm

a Fi

### High Res Imager

140 400 States

47.4mm

EUI: Extreme Ultraviolet Imager

0

2.75mm edge

			First Light (2020 May 12 - @0.66 AU)
@ 1 AU	high resolution HRIEUV HRILYA	full sun <b>FSI</b>	FSI 304 FSI 174
FOV	1 Rs	14 Rs	Ship Li _eut -ts104-1ssp. 202091709882299, 10,115   Li
plate-scale	360km	3300km	CONTREST LONGING PRED: 1   CONTREST (D) (D) (CONSIDE 000) PRED: 1   CONSIDE 000000000000000000000000000000000000
@ 0.28 AU	high resolution HRIEUV HRILYA	full sun <b>FSI</b>	
FOV	0.28 Rs	4 Rs	Volo Li, euc. Introductiong, 2000012112255992, Vol. 131   I.   2000 Li, euc. Introductiong, 2000012112255992, Vol. 131     Null 2000 Science   Null 2000 Science   2000 Science   2000 Science     Volo Li, euc. Introductiong, 2000012112255992, Vol. 131   Null 2000 Science   2000 Science     Volo Science   Volo Science   2000 Science   2000 Science     Vol
plate-scale	100km	920km	Line FAT   Month   Section   Section <th< th=""></th<>

#### https://www.sidc.be/EUI/intro

## **Recent HRIEUV Data**



## Data Products



Full disk and high resolution images



FSI occulted images

# Eruptions Observed by EUI/FSI

All eruptions from May 2020 to present: https://www.sidc.be/EUI/solar-eruptions

Large eruptions: <a href="https://www.sidc.be/EUI/data/movie/largeEruptions/">https://www.sidc.be/EUI/data/movie/largeEruptions/</a>

Daily movies: https://www.sidc.be/EUI/data/movie/dailySynoptics



https://www.aanda.org

Letter to the Editor

# Prominence eruption observed in He II 304 Å up to >6 $R_{\odot}$ by EUI/FSI aboard Solar Orbiter\*

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## **Observations**



## Observations











#### https://solar-mach.github.io/

## Selected features





# **Kinematics**



# Signal vs Background





# **Radiative Properties**

The lower part of the prominence in FSI304 and EUVI304 is much brighter than the underlying disk => it is unlikely that the He II emission there is produced by the resonant scattering of the disk radiation.

At the observed speeds of around 500 km/s the Doppler dimming effect in the 304 Å line will make the resonantly scattered emission negligible (Labrosse & McGlinchey 2012).



The excitation of the He II 304 Å line is probably dominated by collisions rather than by resonant scattering.

# **Conclusions - Huge Eruption**

- The prominence could be tracked in FSI 304 up to a projected height of 6.64 Rs (3D height of 6.97 Rs).
  - The presence of the He II 304 Å emission at heights above 6 Rs indicates that this part of the prominence was not heated to the fully ionised state during its propagation.
- This is the first time that a prominence is observed at such a large height in the FOV of an EUV imager.
- The excitation of the He II 304 Å line is probably dominated by collisions rather than by resonant scattering.
- The brightness of the trailing feature of the prominence at some point starts to increase with distance.
  - The temperature increases (thus producing more He+ ions) or
  - The prominence column density increases due to geometrical rearrangement

RESEARCH



#### Three Eruptions Observed by Remote Sensing Instruments Onboard Solar Orbiter

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## **Spacecraft Positions**



**Eruption2 and Eruption3** 

**Eruption1** 

# Eruption1 on February 21, FSI 304



# Eruption2 and Eruption3 on March 21, FSI 304



# **Observations of Three Prominence Eruptions**



# Observations of the Corresponding CMEs



#### Observations of the Corresponding CMEs -**Metis** 21-Feb-2021 11:10:15



-2 -4















-2 -4

6 4 2 . 0 -2 -4

-2 0

21-Mar-2021 21:36:15

.2 .



-4 -2 0 2 4 4







-4 -2 2 4





0



2 4





Q -4 -2 2 4







-6

6 ' 4 2 0 -2 -4 -6

Y / solar radii



# Conclusions – Three Eruptions

- The visual aspect of the three prominence eruptions is very different in EUV images taken from different perspectives.
- The values derived from the GCS reconstruction, higher in the corona compared with the ones from triangulation, lower in the corona show that:
  - Eruption 1 was deflected towards the equator by  $25^{\circ}$
  - Eruption 2 was deflected towards the equator by 15°
  - Eruption 3 only shows a slight deflection towards the equator and a stronger deflection towards the central meridian.
- The deflection of the eruptions could have been influenced by the nearby polar coronal holes.

### The eruption of 22 April 2021



#### Rodriguez et al., SolPhys

## Eruption 24-25 December 2021



#### Sasso et al., in preparation

### Eruptions at the First Perihelion: 2 March – 6 April 2022



# Eruptions at the First Perihelion: 16 March 2022



# Eruptions at the First Perihelion: 21 March 2022



# Eruptions at the First Perihelion: 28 March 2022



# **Questions to Answer**

What radiative processes are dominating in prominences at higher heights?

What is the morphology of the erupting prominences?

The large FOV of FSI, plus the observations taken from different latitudes and together with radiative transfer calculation and modelling will help answering these questions.

## Future Work

"A statistical study of the prominences seen far in the FOV of FSI", work led by Elke D'Huys.

"Radiative processes of prominences at higher heights", work led by Petr Heinzel and Susanna Parenti.





# **EUI Open Data Policy**

https://www.jhelioviewer.org (Datasets/ROB/SOLO) https://sidc.be/EUI/data (L1, L2 and L3 data)

Contact: eui@sidc.be

# Thank you!