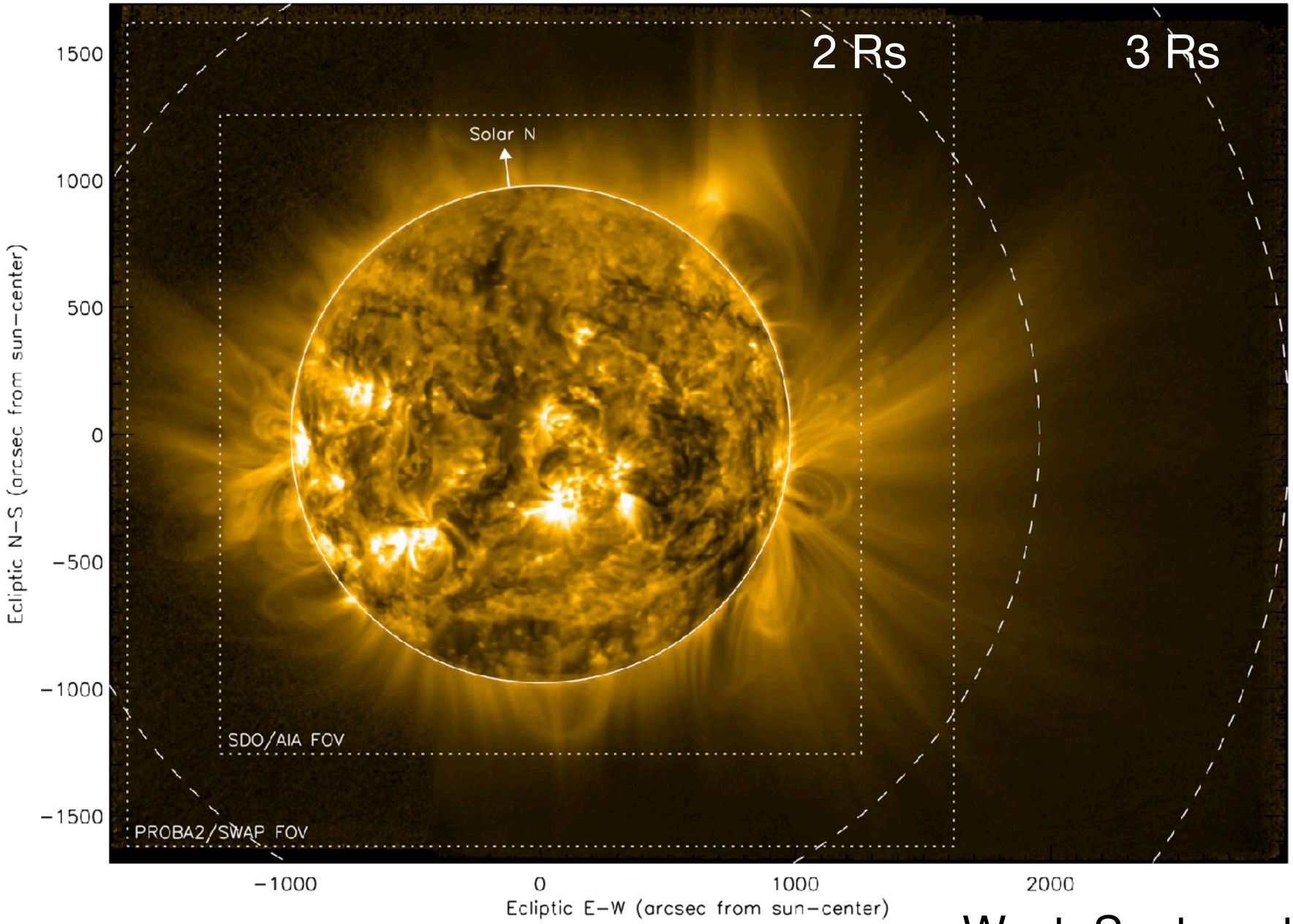
EUV coronagraphic observations of the Extreme Ultraviolet Imager on board Solar Orbiter

D. Berghmans & F. Auchère & EUI team

2023-11-28 ROB PROBA-3 SWT

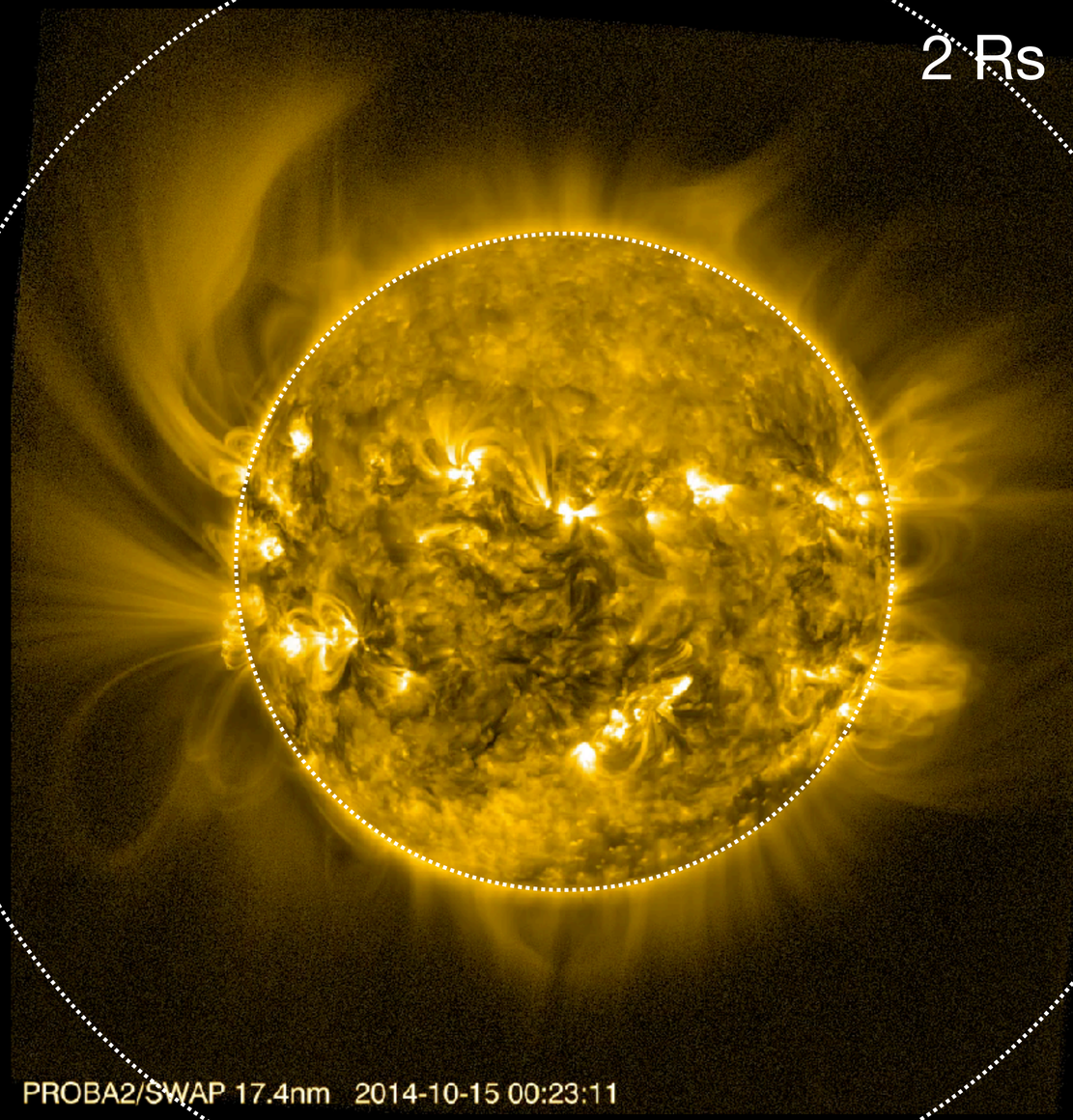
Auchère et al, 2023 Astron Astroph 674 A127

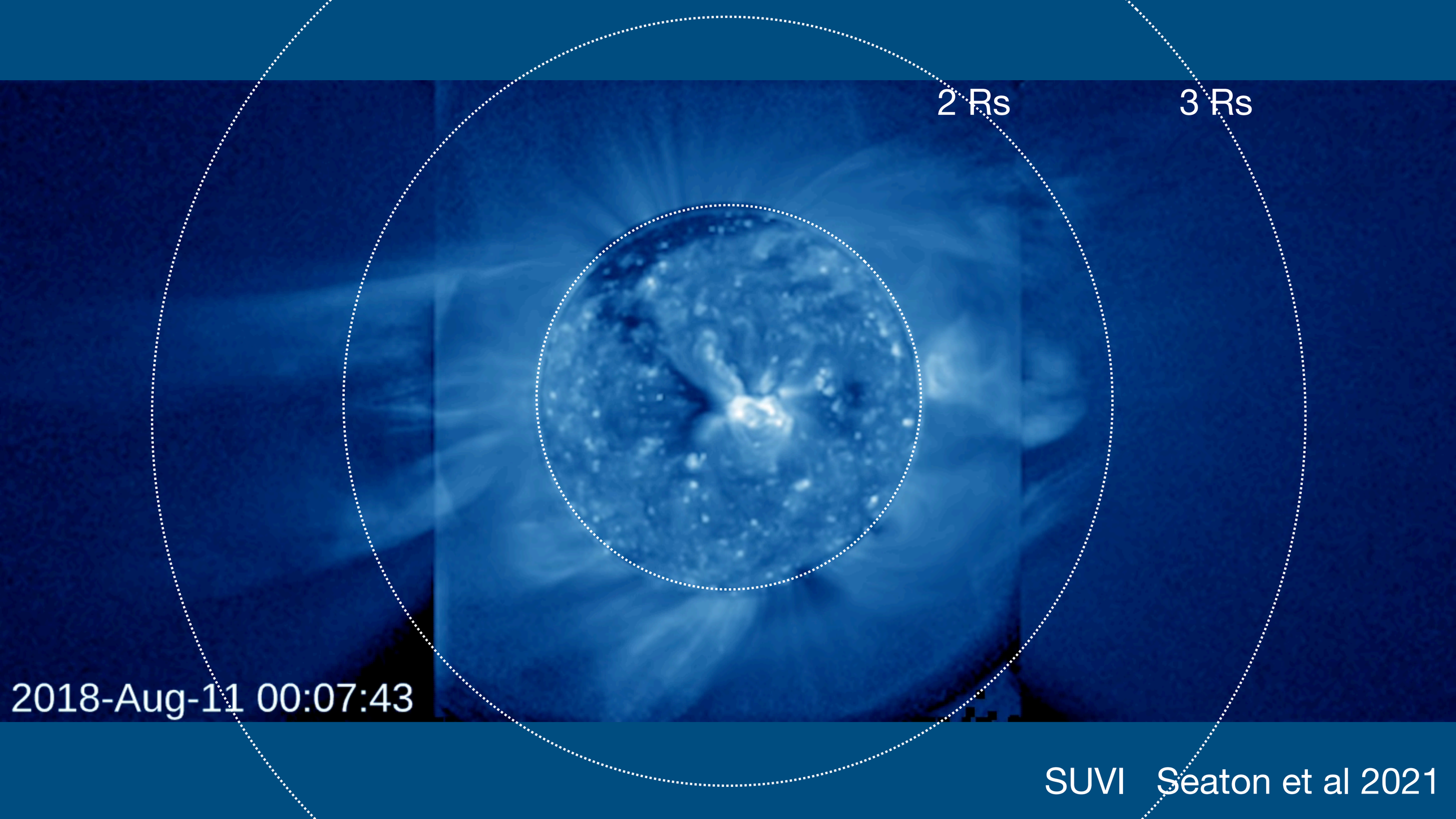
PROBA2 SWAP

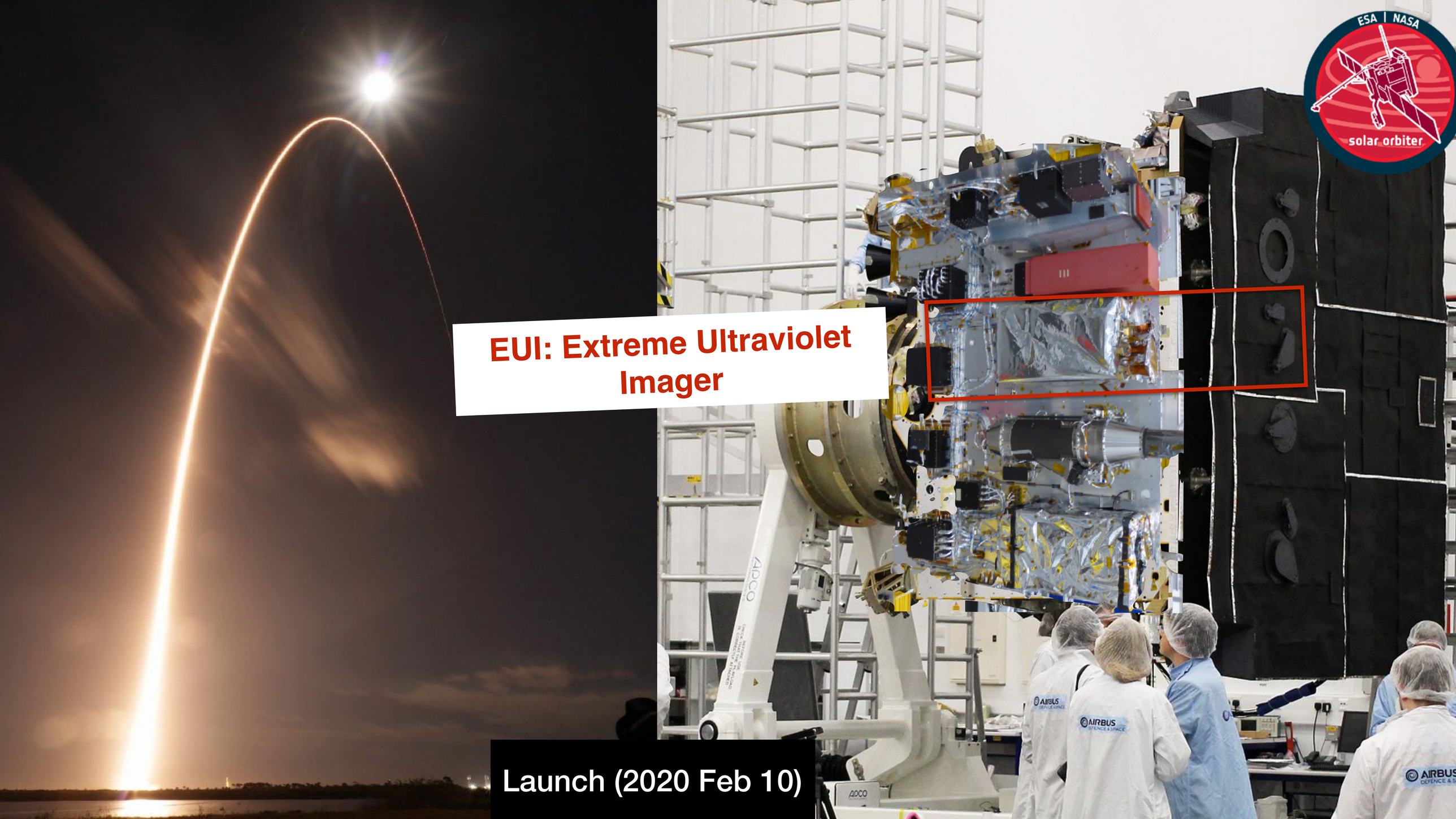


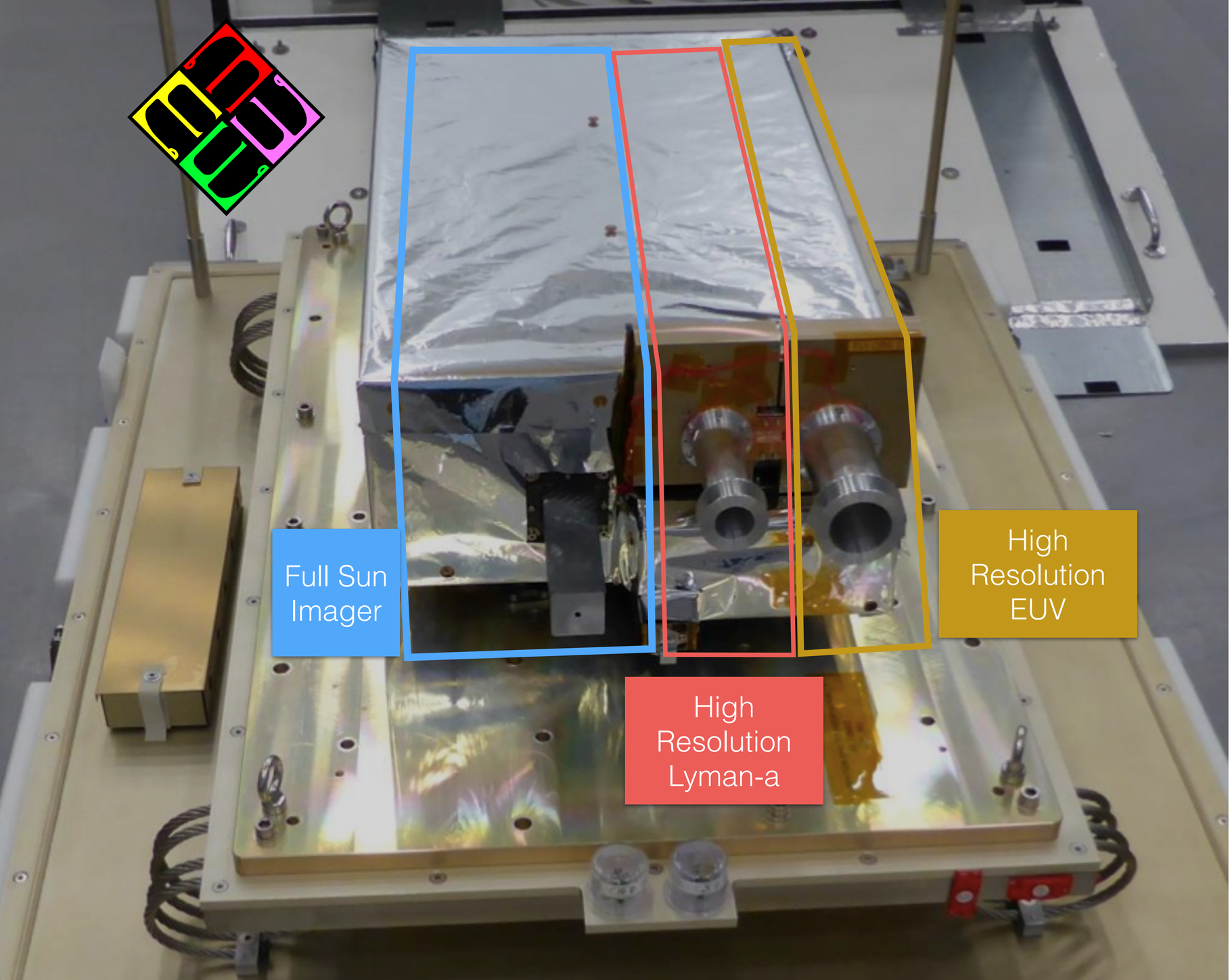
West, Seaton et al 2022

PROBA2 SWAP



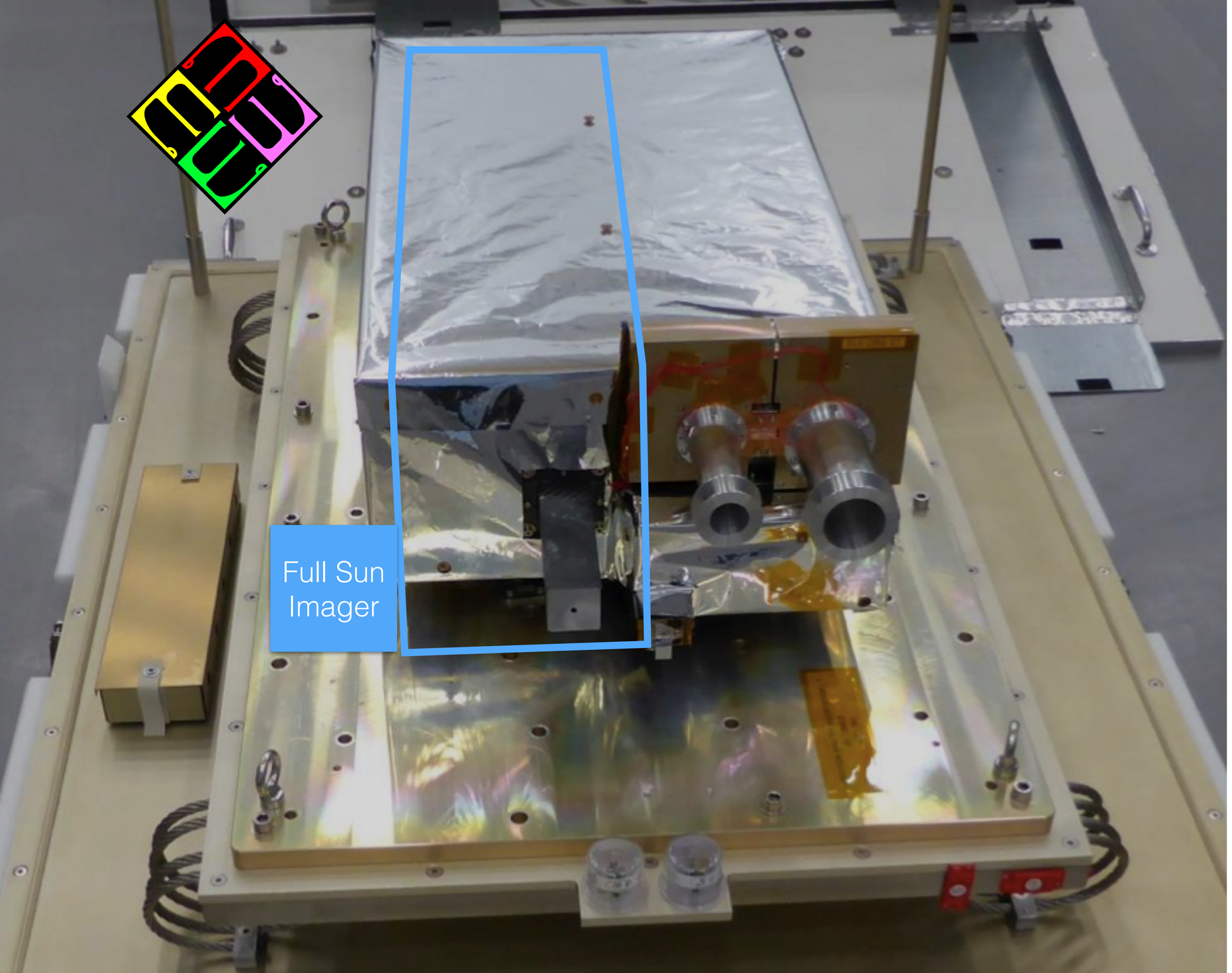

2 Rs
3 Rs
2018-Aug-11 00:07:43
SUVI Seaton et al 2021


ESA | NASA
solar orbiter
EUI: Extreme Ultraviolet Imager
Launch (2020 Feb 10)
AIRBUS
DEFENCE & SPACE



The “Extreme Ultraviolet Imager” (EUI) has been built by:

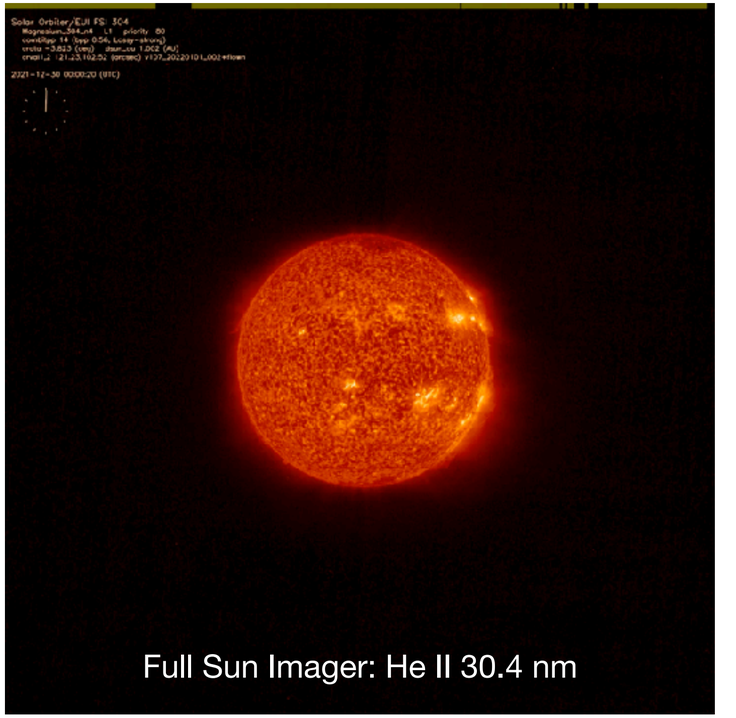
- Centre Spatial de Liège
- Institut d’Astrophysique Spatiale
- Laboratoire Charles Fabry, Institut d’Optique
- Max Planck Institute for Solar System Research
- Physikalisch-Meteorologisches Observatorium Davos
- UCL-Mullard Space Science Laboratory
- Royal Observatory of Belgium



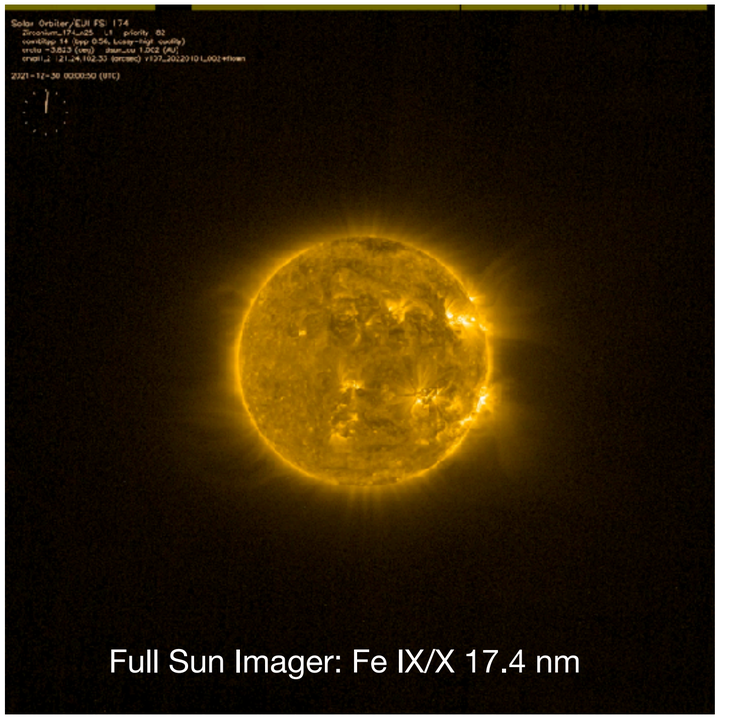
	FSI
FOV	3.8 deg ~ 4 Rs
pixel scale	~4.5 arcsec ~920km
time resolution	minuten

red: at perihelion, 0.29 au

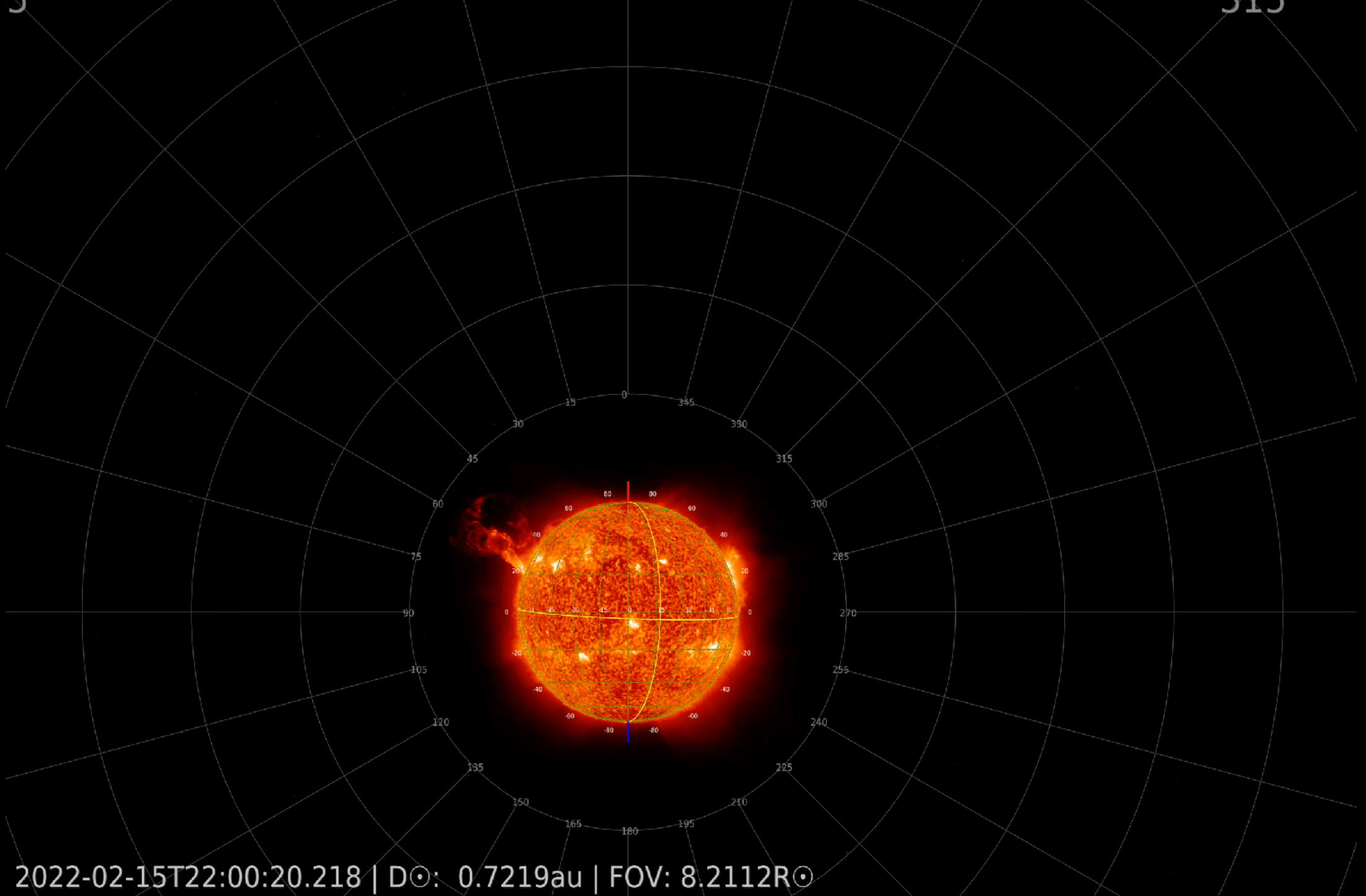
Full Sun Imager

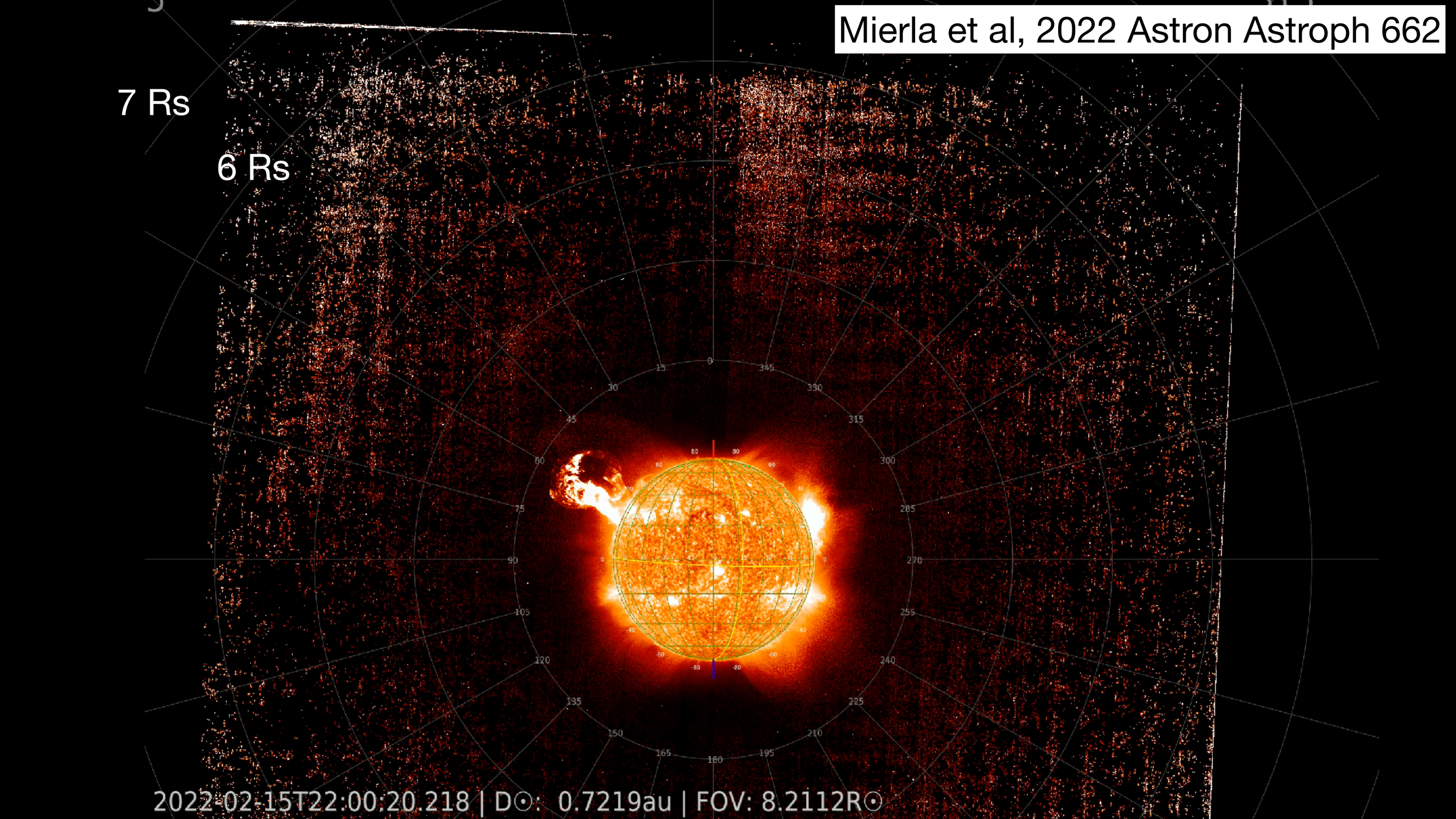


Full Sun Imager: He II 30.4 nm

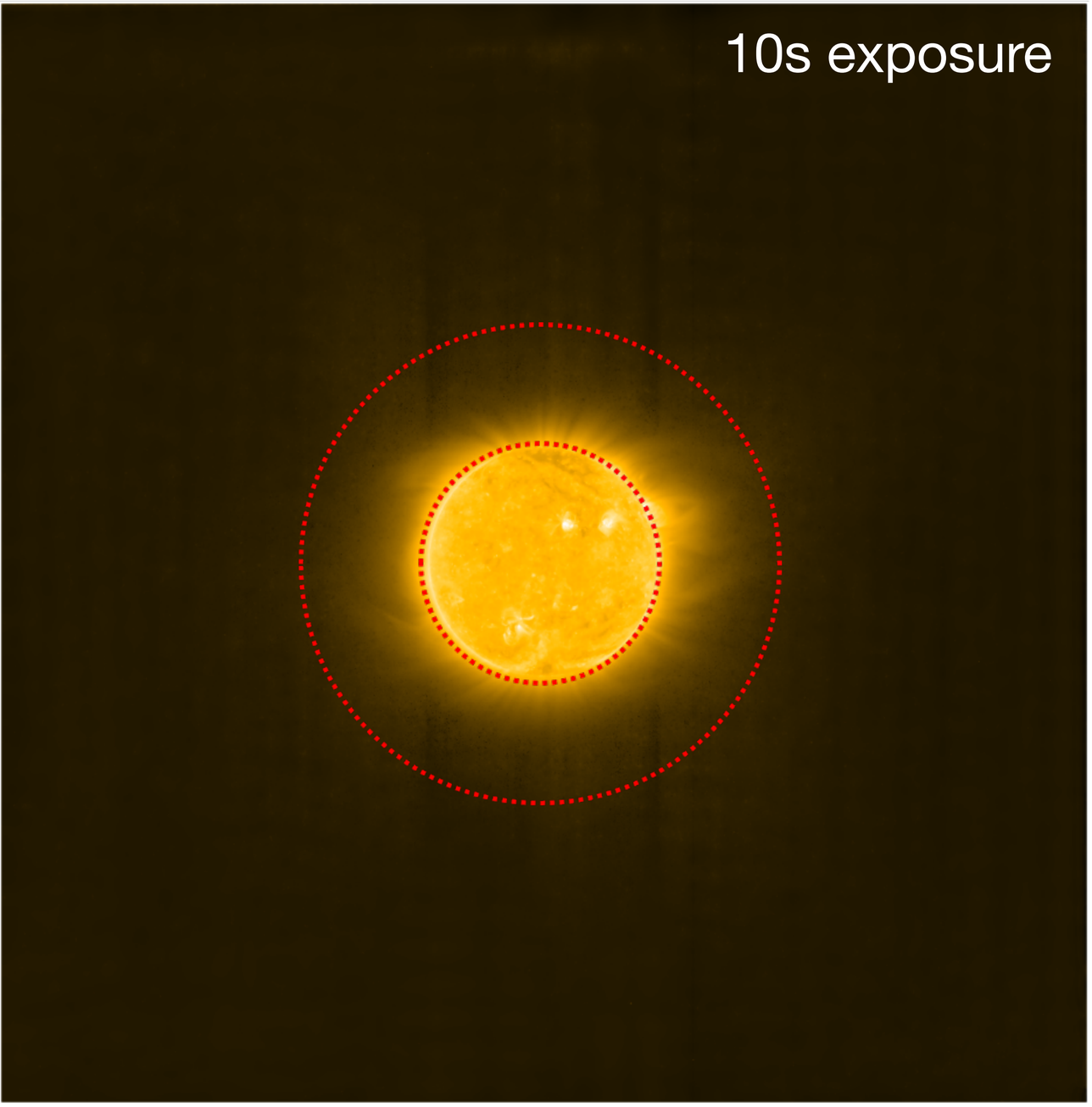


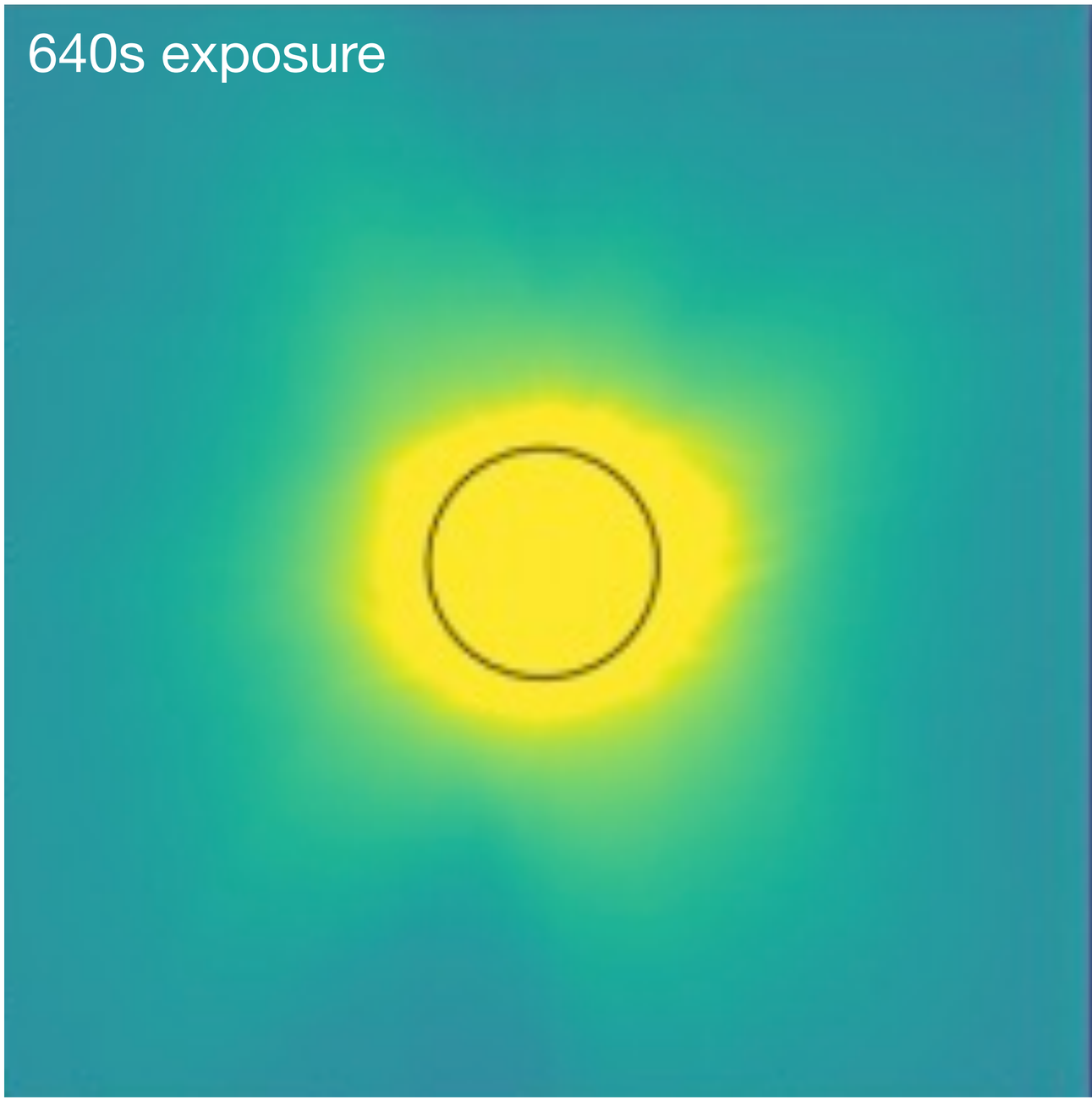
Full Sun Imager: Fe IX/X 17.4 nm


0
15
30
45
60
75
90
105
120
135
150
165
180
195
210
225
240
255
270
285
300
315
330
345
2022-02-15T22:00:20.218 | D⊙: 0.7219au | FOV: 8.2112R⊙


Mierla et al, 2022 Astron Astroph 662
7 Rs
6 Rs
2022-02-15T22:00:20.218 | D☉: 0.7219au | FOV: 8.2112R☉

FSI174 @ 0.68 au





www.esa.int/Science_Exploration/Spa

Toegang - Your Nature | EUI wiki | PromOptica - ...ures (Indico) | Honingbestell...oogle Sheets | https://www.a...41010-21.pdf

ESA - Camera 'hack' lets Solar Orbiter peer deeper into Sun's atmosphere

→ THE EUROPEAN SPACE AGENCY

esa

SCIENCE & EXPLORATION

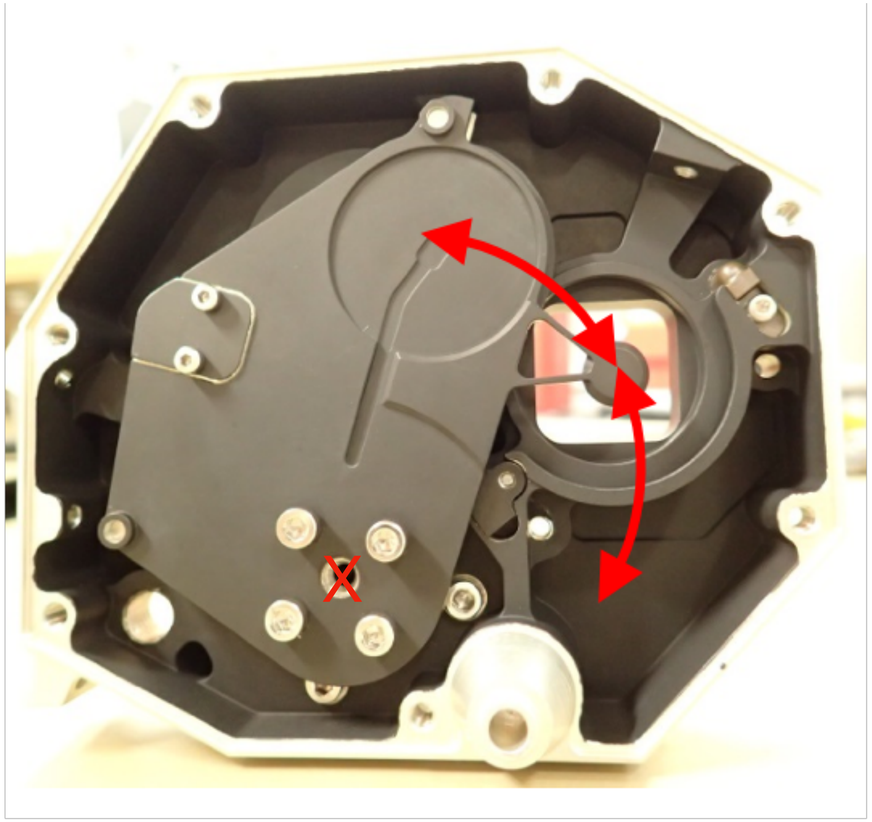
Camera 'hack' lets Solar Orbiter peer deeper into Sun's atmosphere

06/09/2023 10017 VIEWS 79 LIKES

ESA / Science & Exploration / Space Science / Solar Orbiter

"It was really a hack," says Frédéric Auchère, Institut d'Astrophysique Spatiale, Université Paris-Sud, and a member of the EUI team. "I had the idea to just do it and see if it would work. It is actually a very simple modification to the instrument."

It involved adding a small, protruding 'thumb', weighing a few grams, to the door of the instrument. As the door slides out of the way to let the light into

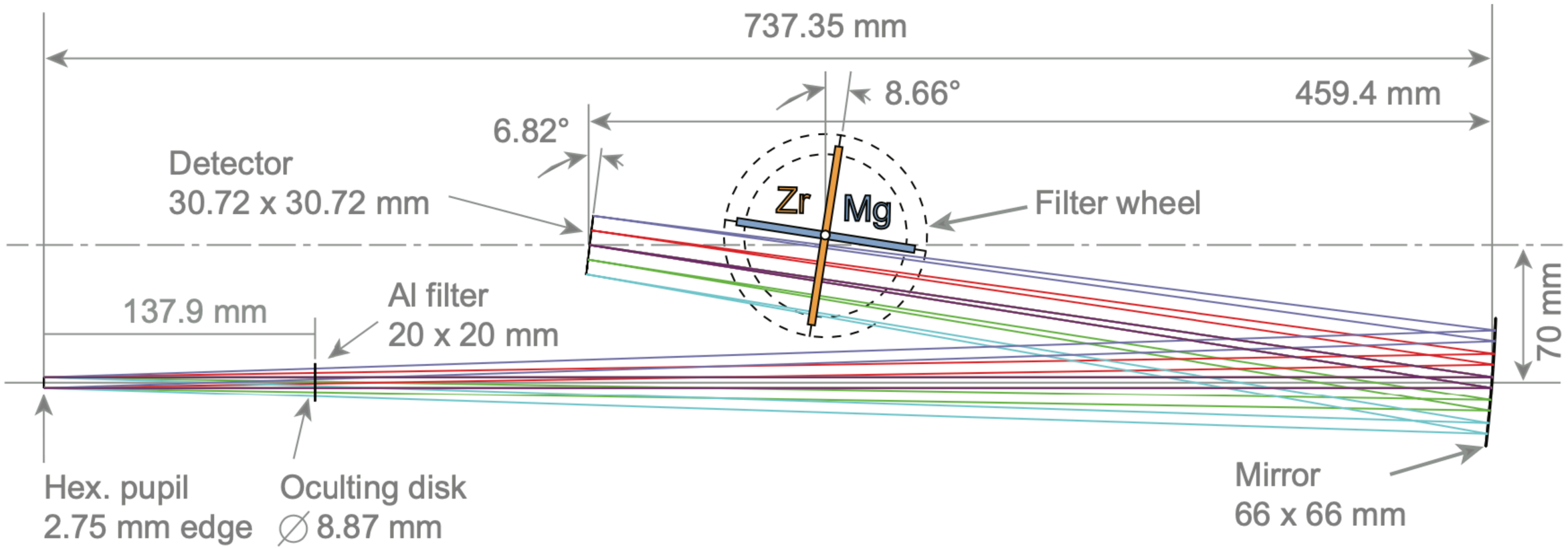


An occulting disk on the door

- Single disk solution OK @ 174 & 304

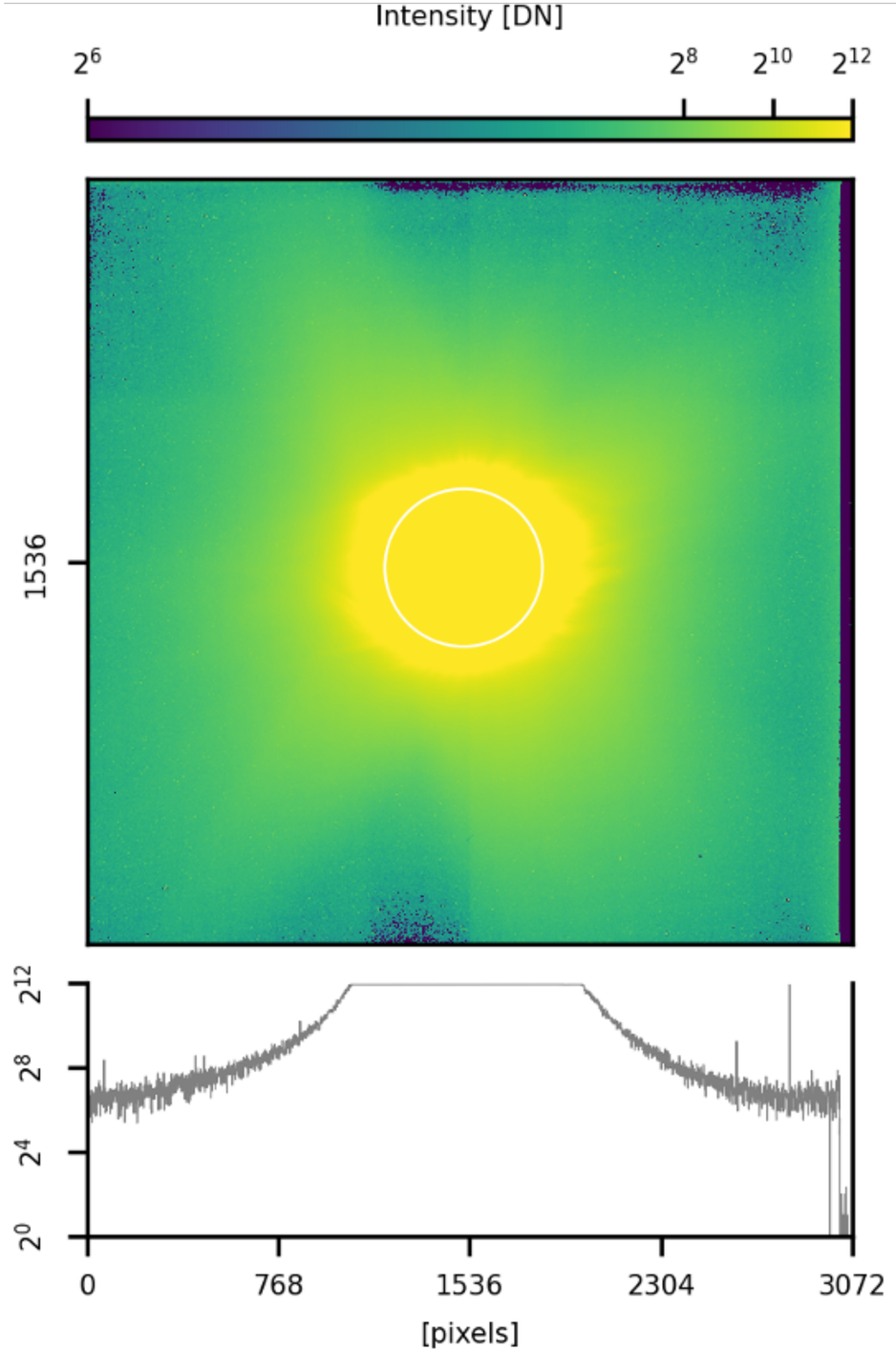
- Campaign mode

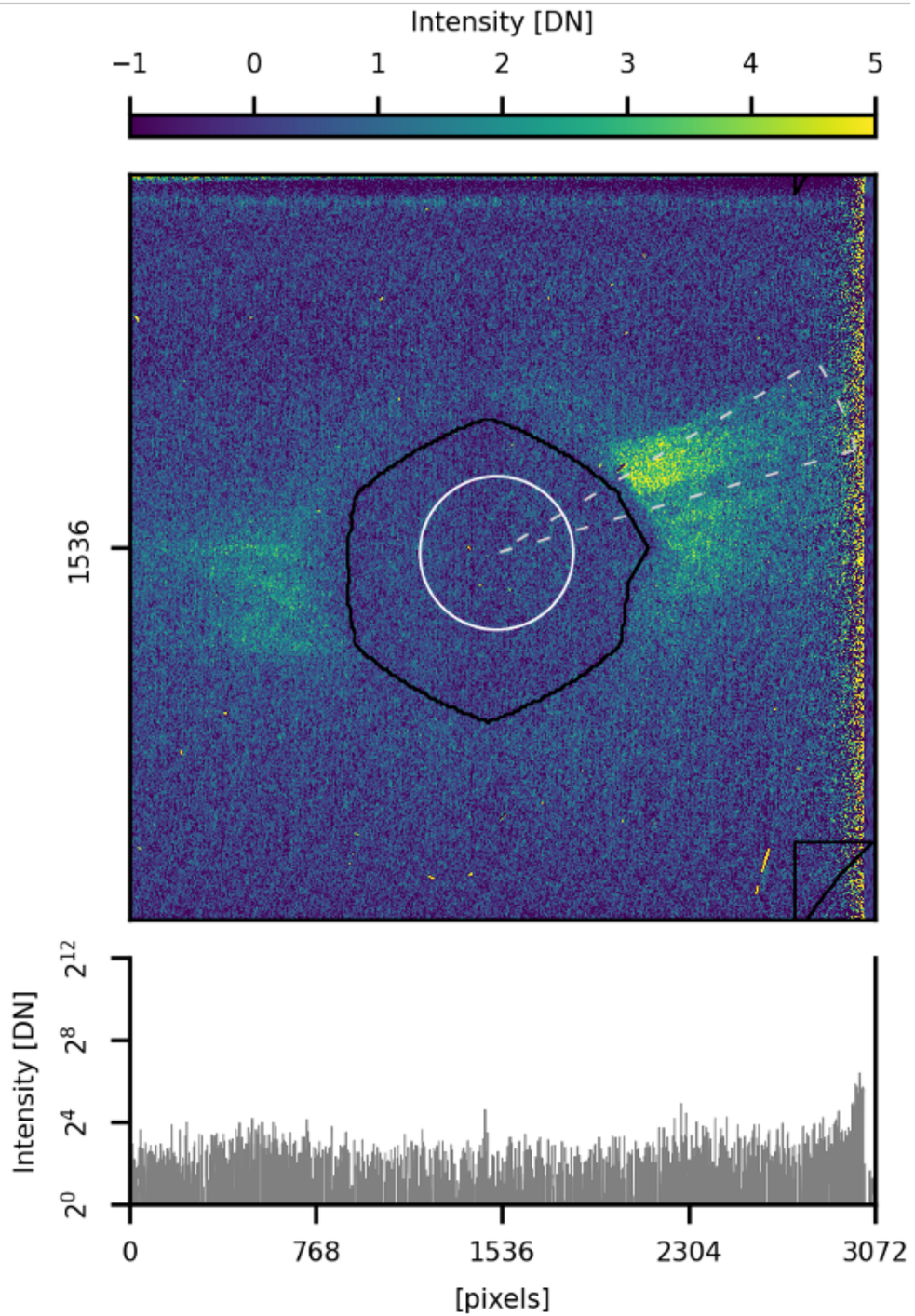
- When far from the Sun (>0.4UA)


737.35 mm
8.66°
459.4 mm
6.82°
Detector
30.72 x 30.72 mm
Zr
Mg
Filter wheel
70 mm
137.9 mm
Al filter
20 x 20 mm
Hex. pupil
2.75 mm edge
Oculting disk
∅ 8.87 mm
Mirror
66 x 66 mm

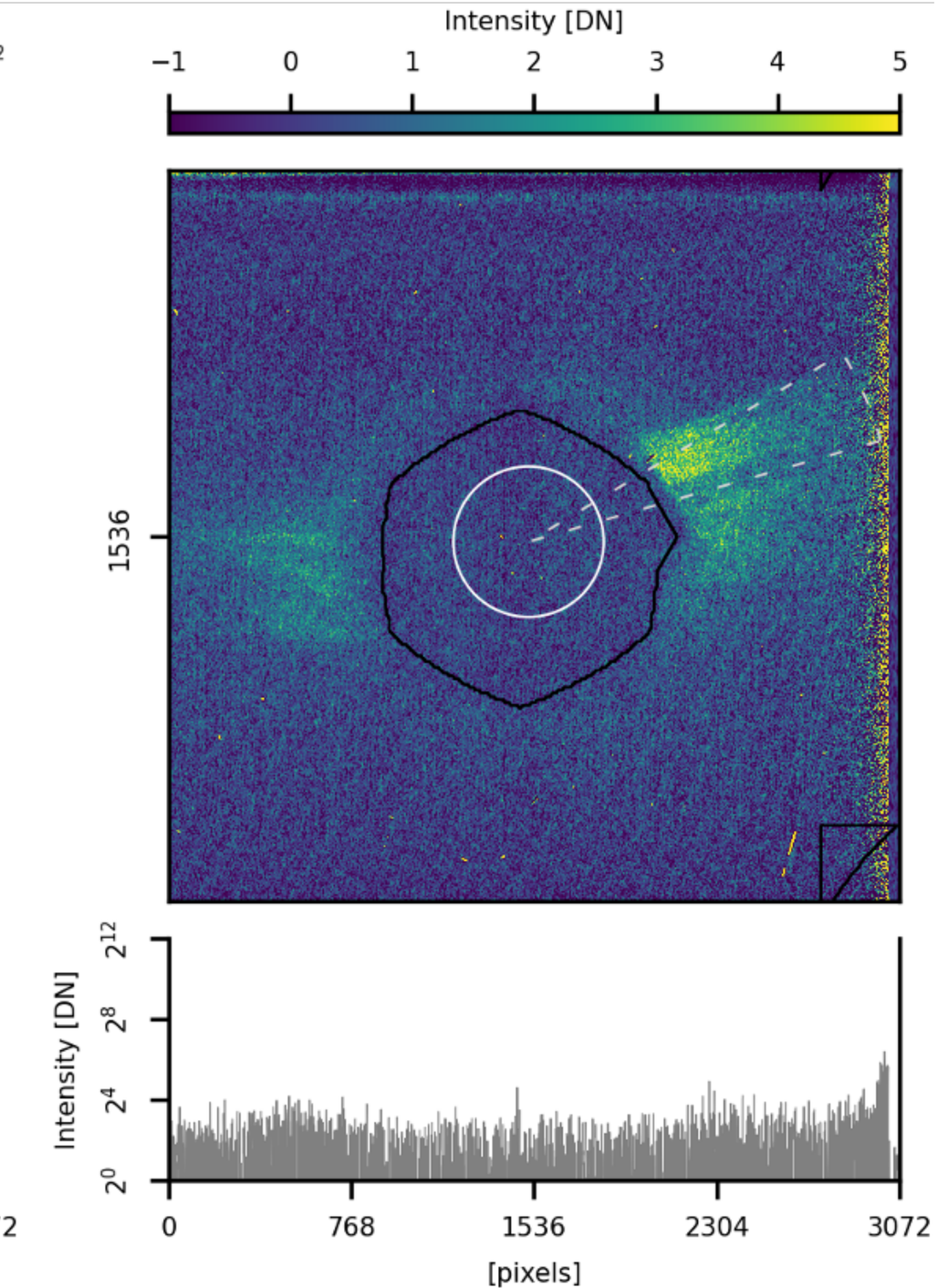
640s exposures

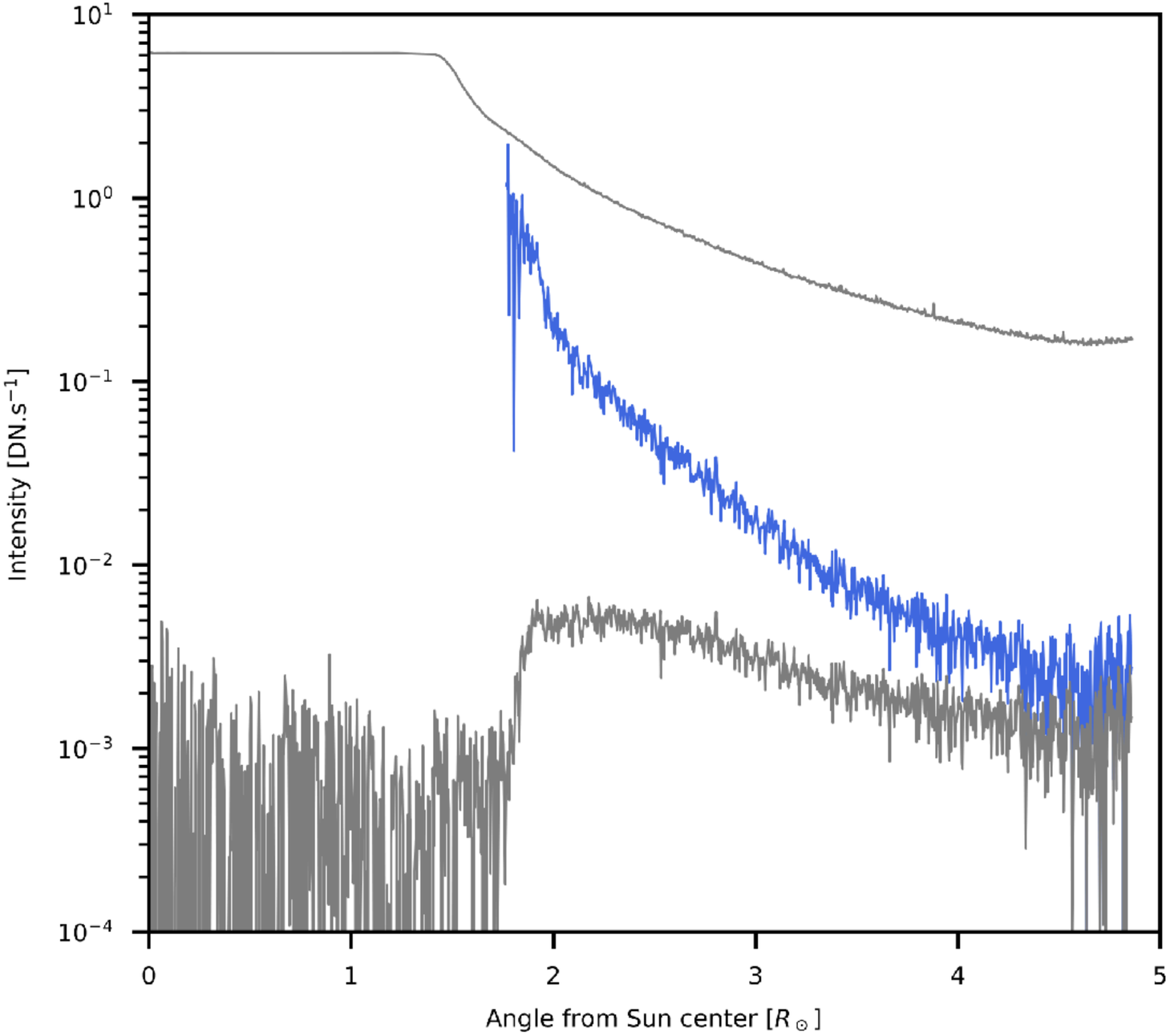
without occulting disk





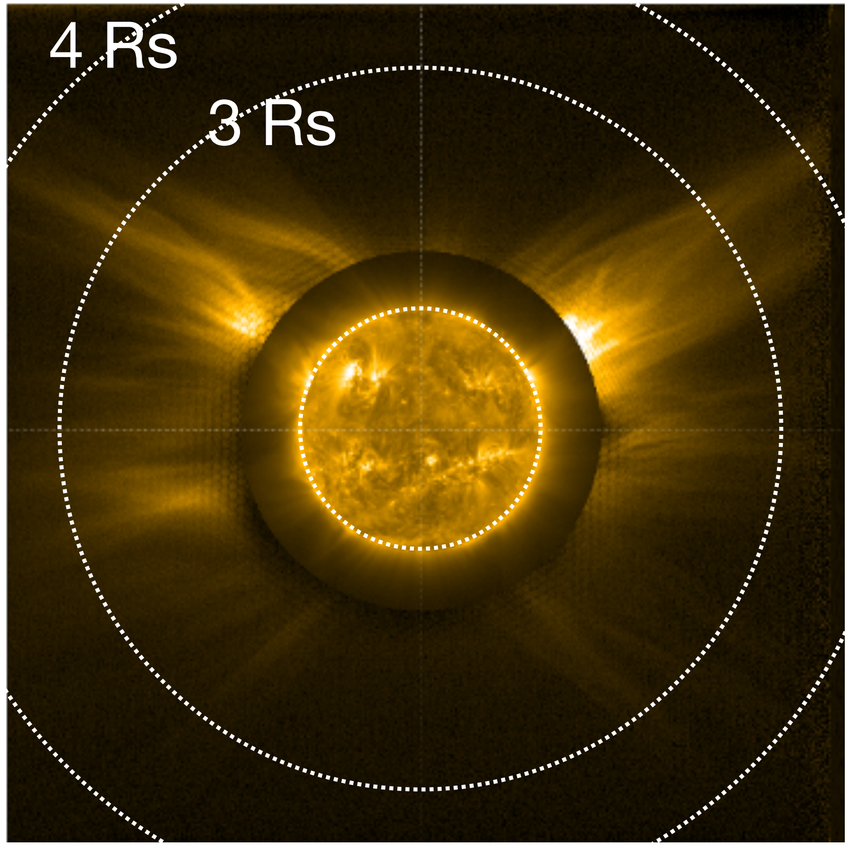
with occulting disk


Intensity [DN]
−1
0
1
2
3
4
5
1536
Intensity [DN]
2^{12}
2^{8}
2^{4}
2^{0}
0
768
1536
2304
3072
[pixels]

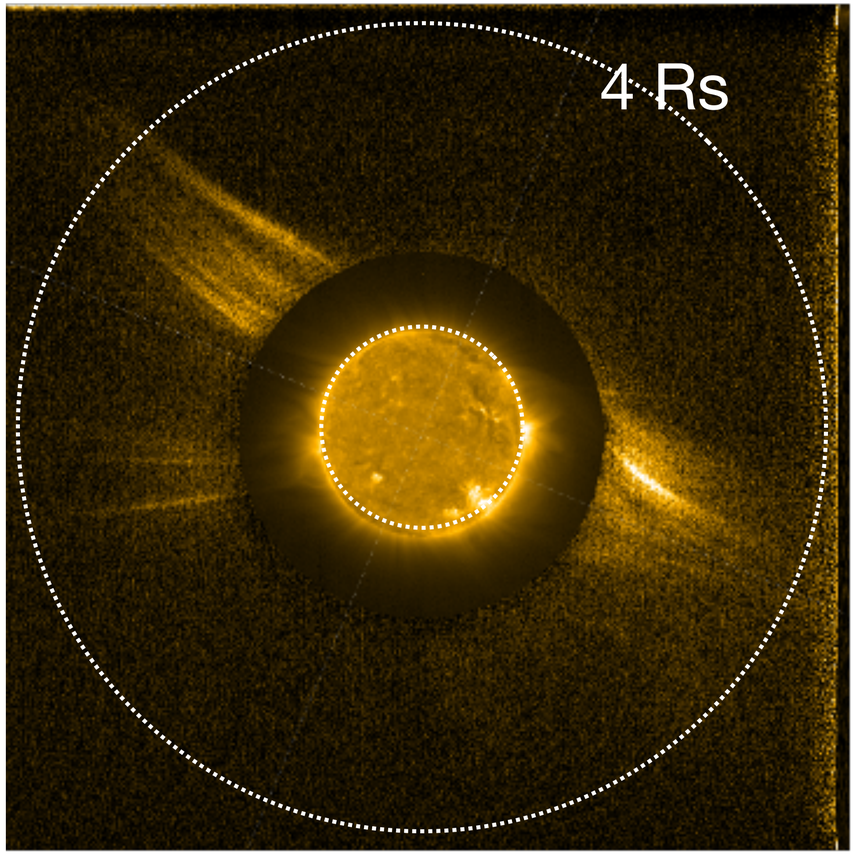

10^{1}
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
Intensity [DN.s^{-1}]
0
1
2
3
4
5
Angle from Sun center [$R_\odot$]

Start date (UT)		End date (UT)		Channel	Exposure	Cadence	Sun distance	Separation angle	
								Earth	STEREO A
2021 Sep. 9	00:42	2021 Sep. 9	09:30	17.4 nm	640 s	11 min	0.60 au	65°	24°
2021 Nov. 1	00:42	2021 Nov. 3	23:42	17.4 nm	1000 s	30 min	0.83 au	2°	36°
2021 Nov. 4	00:12	2021 Nov. 4	21:12	30.4 nm	1000 s	30 min	0.84 au	2°	36°
2022 Feb. 8	04:15	2022 Feb. 8	07:45	17.4 nm	1000 s	30 min	0.79 au	19°	16°
2022 Mar. 7	16:00	2022 Mar. 7	19:30	17.4 nm	1000 s	30 min	0.50 au	3°	33°
2022 Dec. 5	04:00	2023 Jan. 1	22:15	17.4 nm	1000 s	30 min	0.83 au–0.95 au	16°–22°	4°–9°

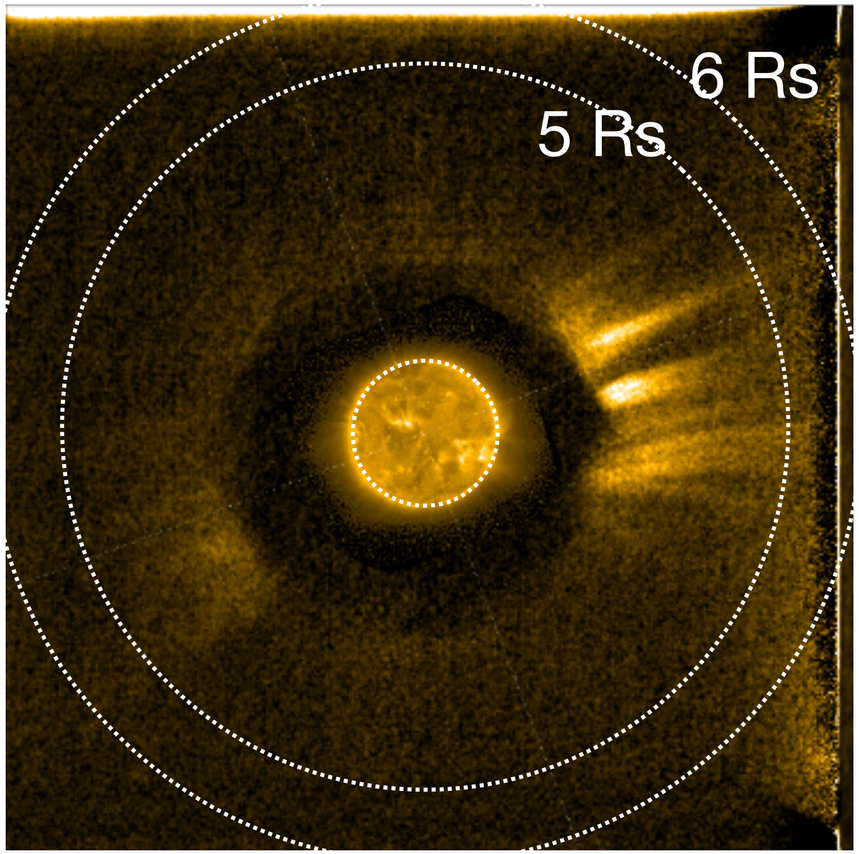
+ march 2023



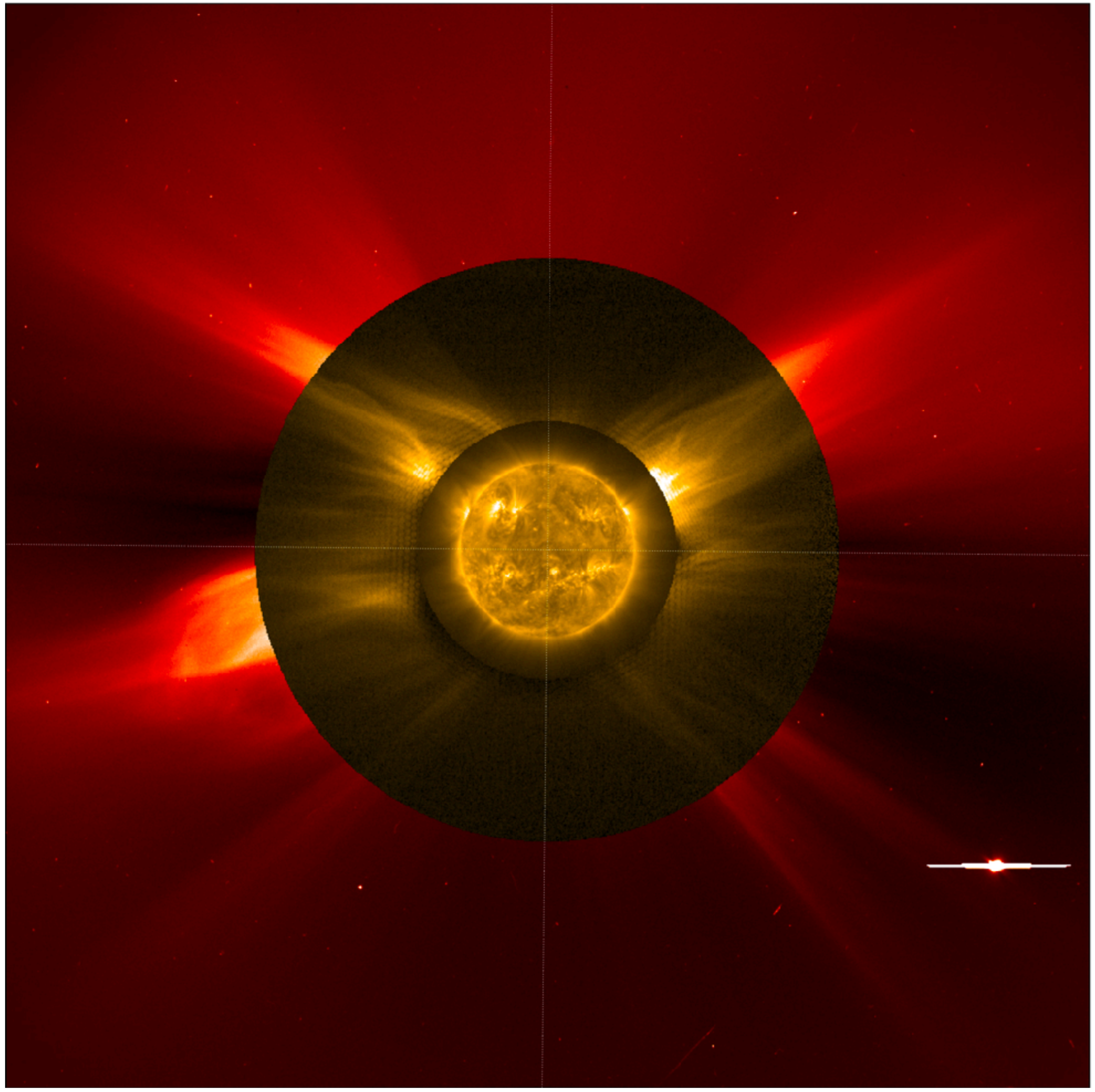
2022 March 7 (ext: FSI, int: FSI)

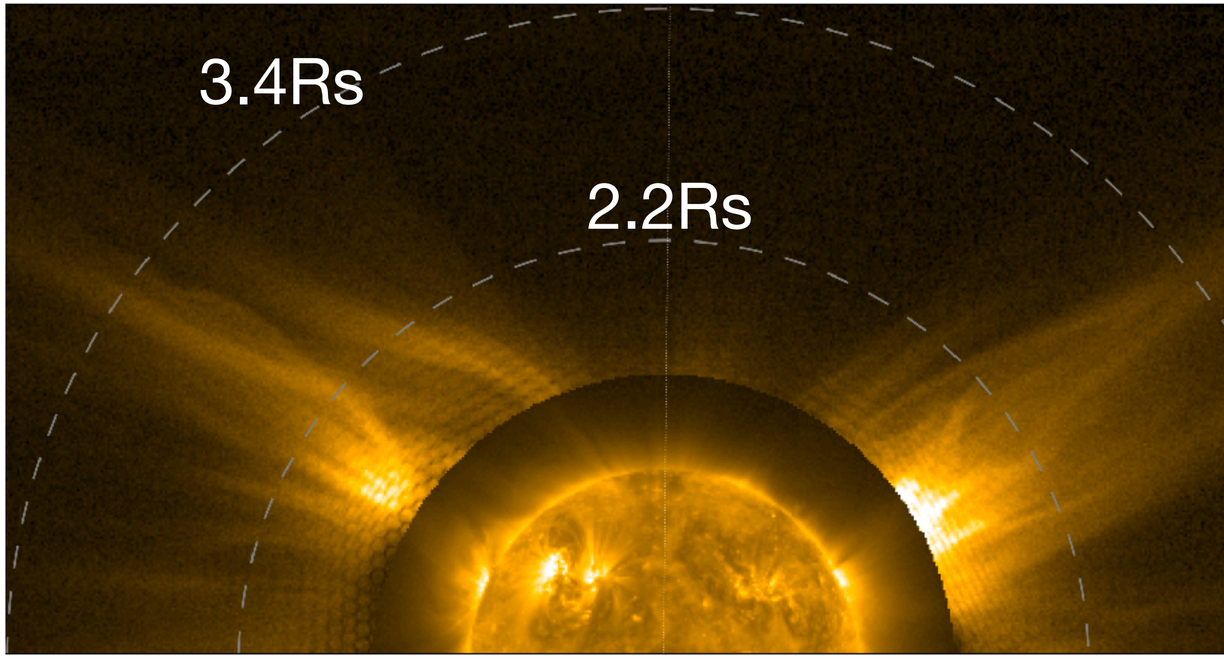


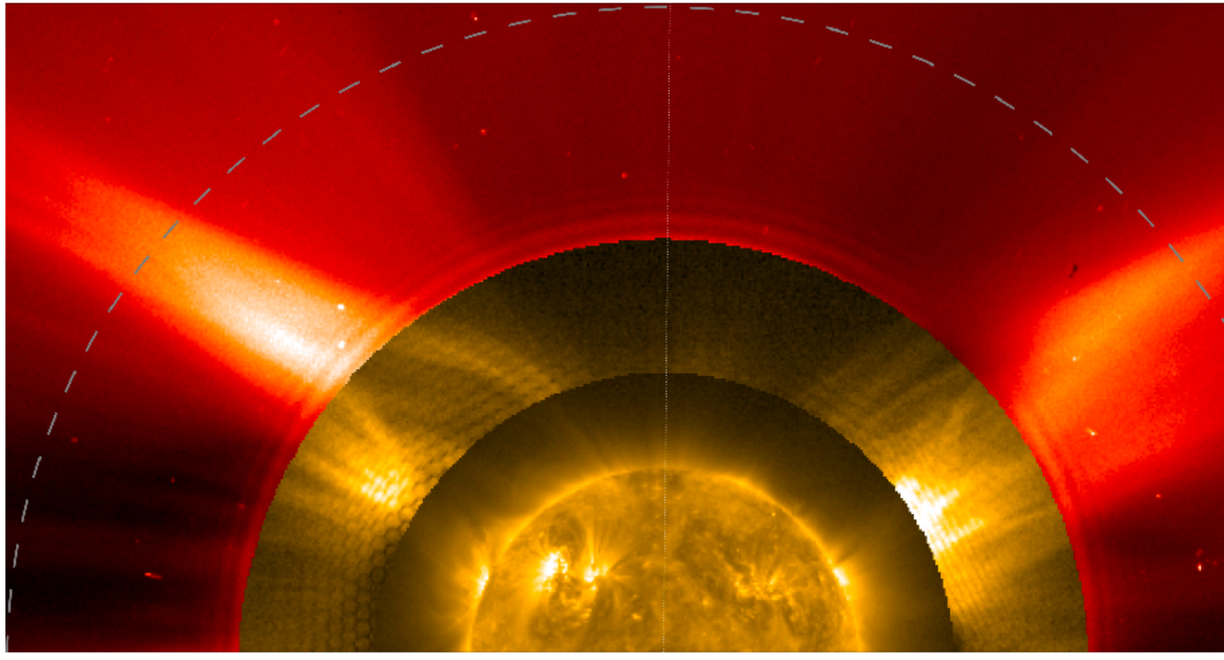
2021 Sept 9 (ext: FSI, int: FSI)

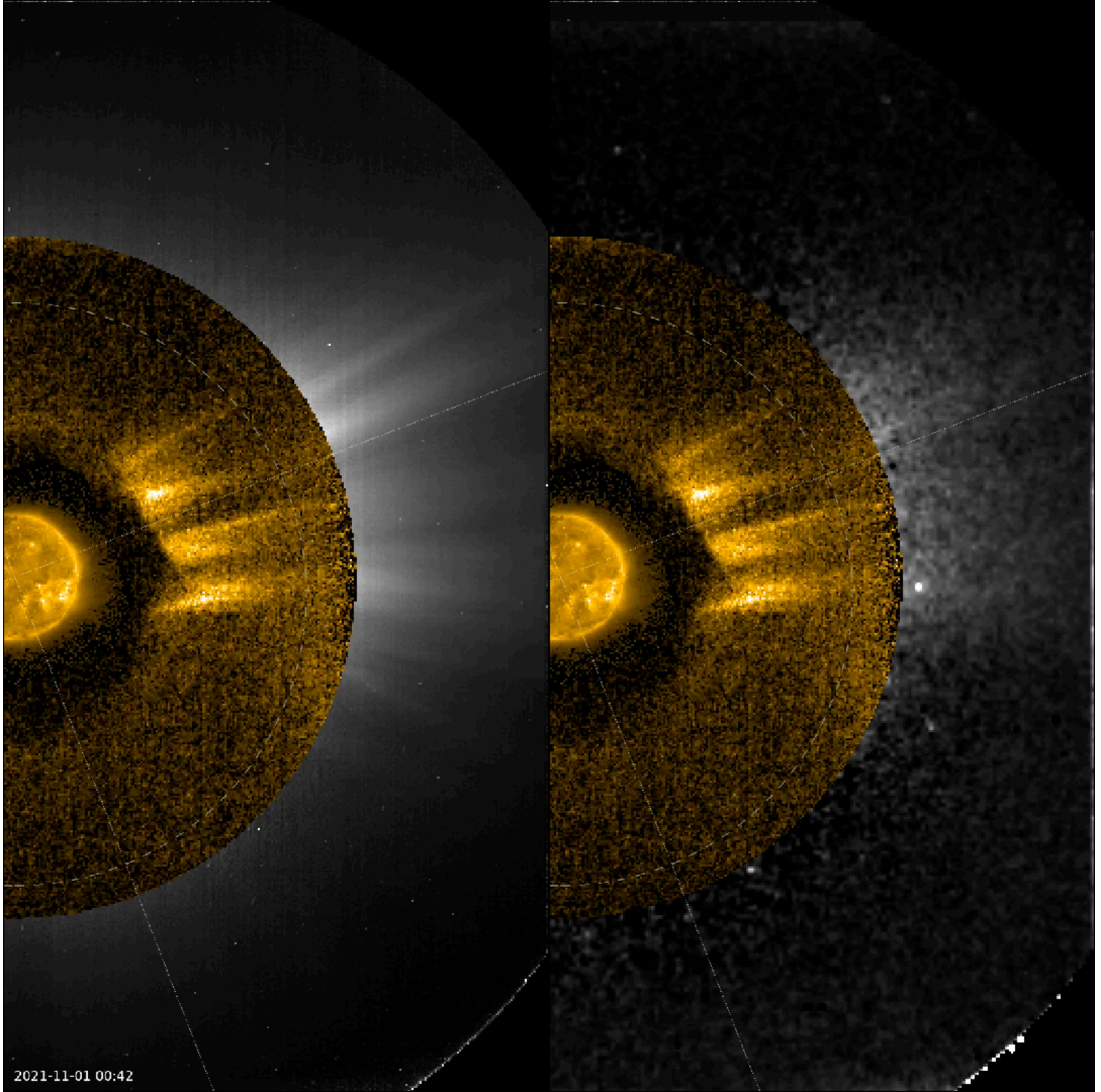


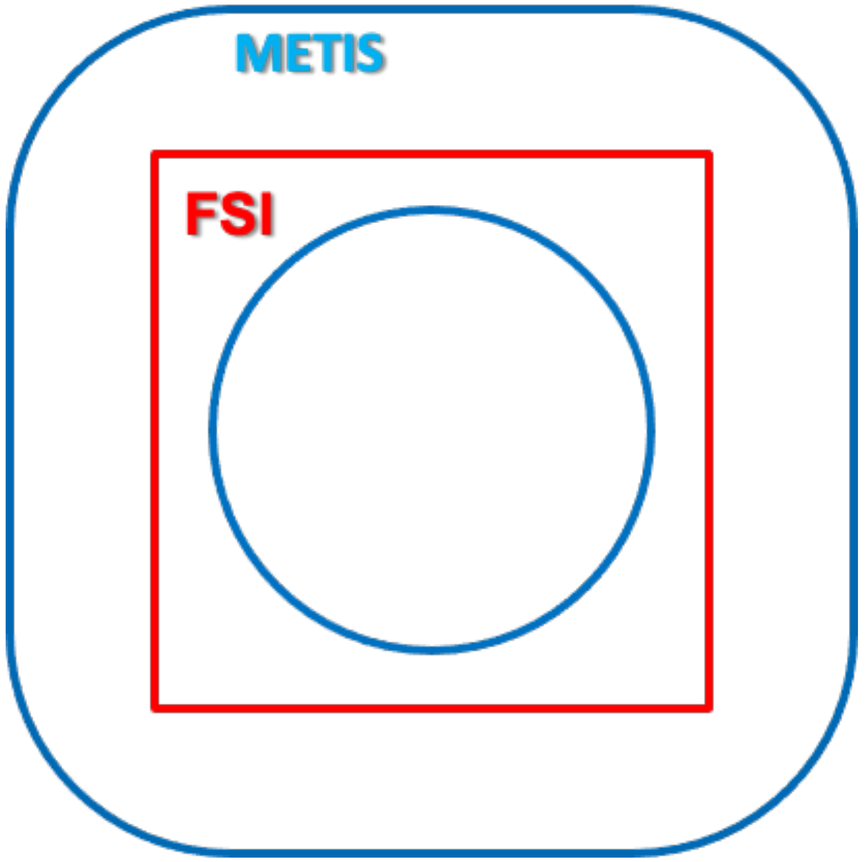
2021 Nov 1 (ext: FSI, int: SWAP)




3.4Rs
2.2Rs



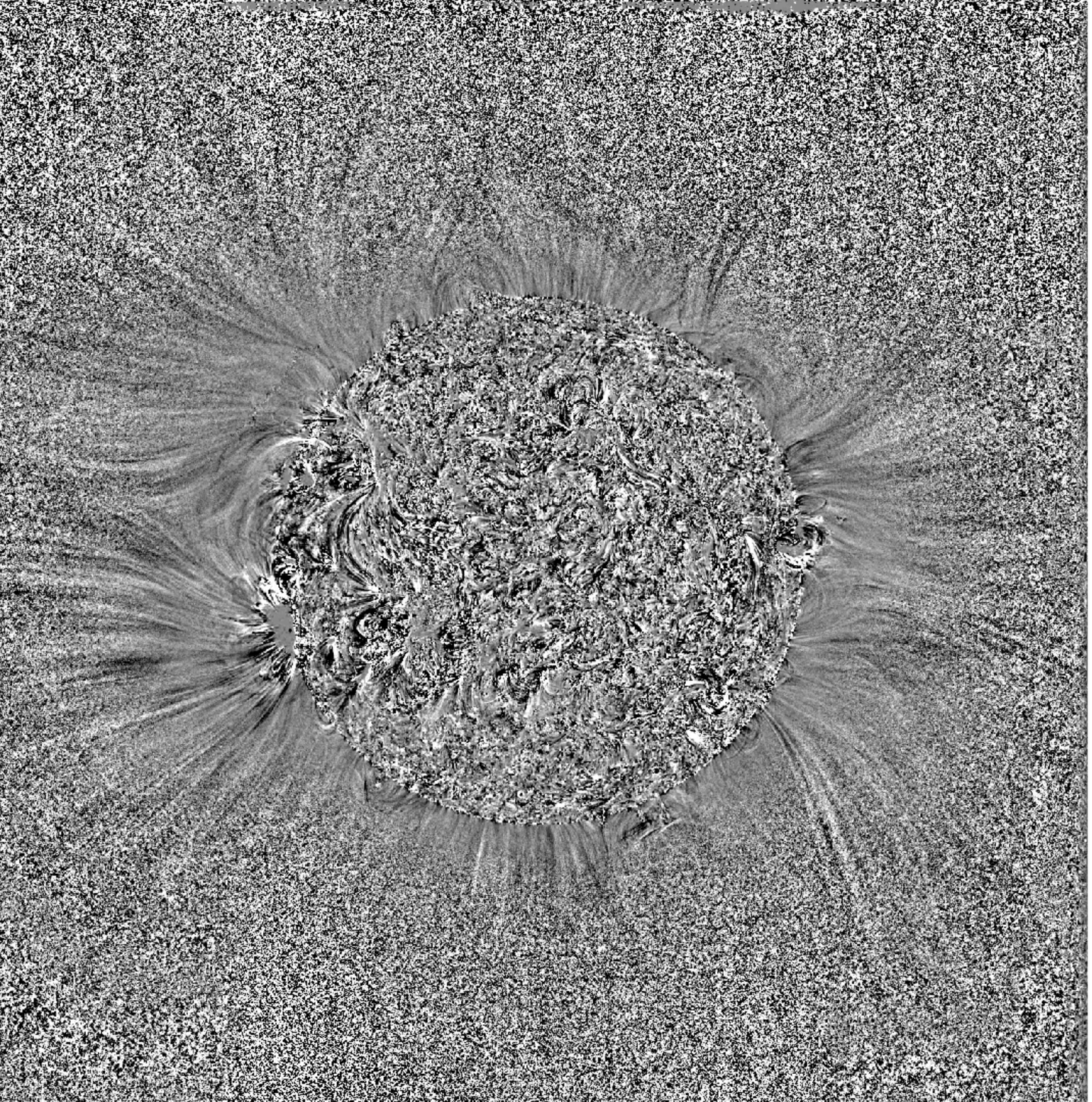




Abbo, 2023 submitted

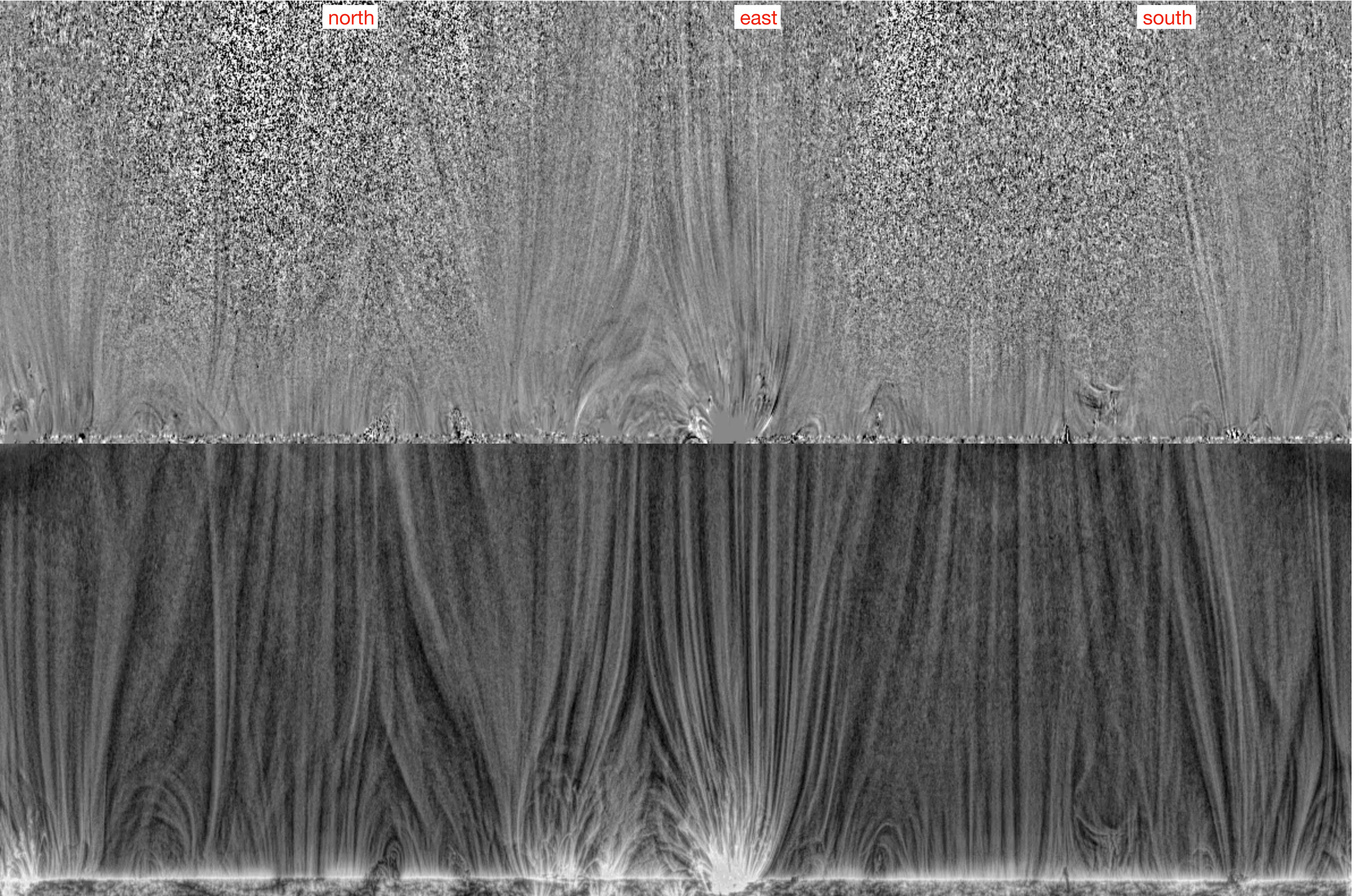
Conclusions

- 3.8 degree FOV of FSI is unprecedented
- occulting disc: signal in 17.4nm up to >5 Rsun
- no succes with 30.4nm so far due to light leak
- lots of interesting comparisons to make with Metis and ASPIICS



- recentering of images following L2 limb-fitting
- summed images per 5
  (20s exposure at 30s cadence -> 100s exposure at 2.5min cadence)
- take relative difference over 5 sums (so difference over 5x2.5min = 12.5min)
- threshold intensity range strongly

looping back and forth

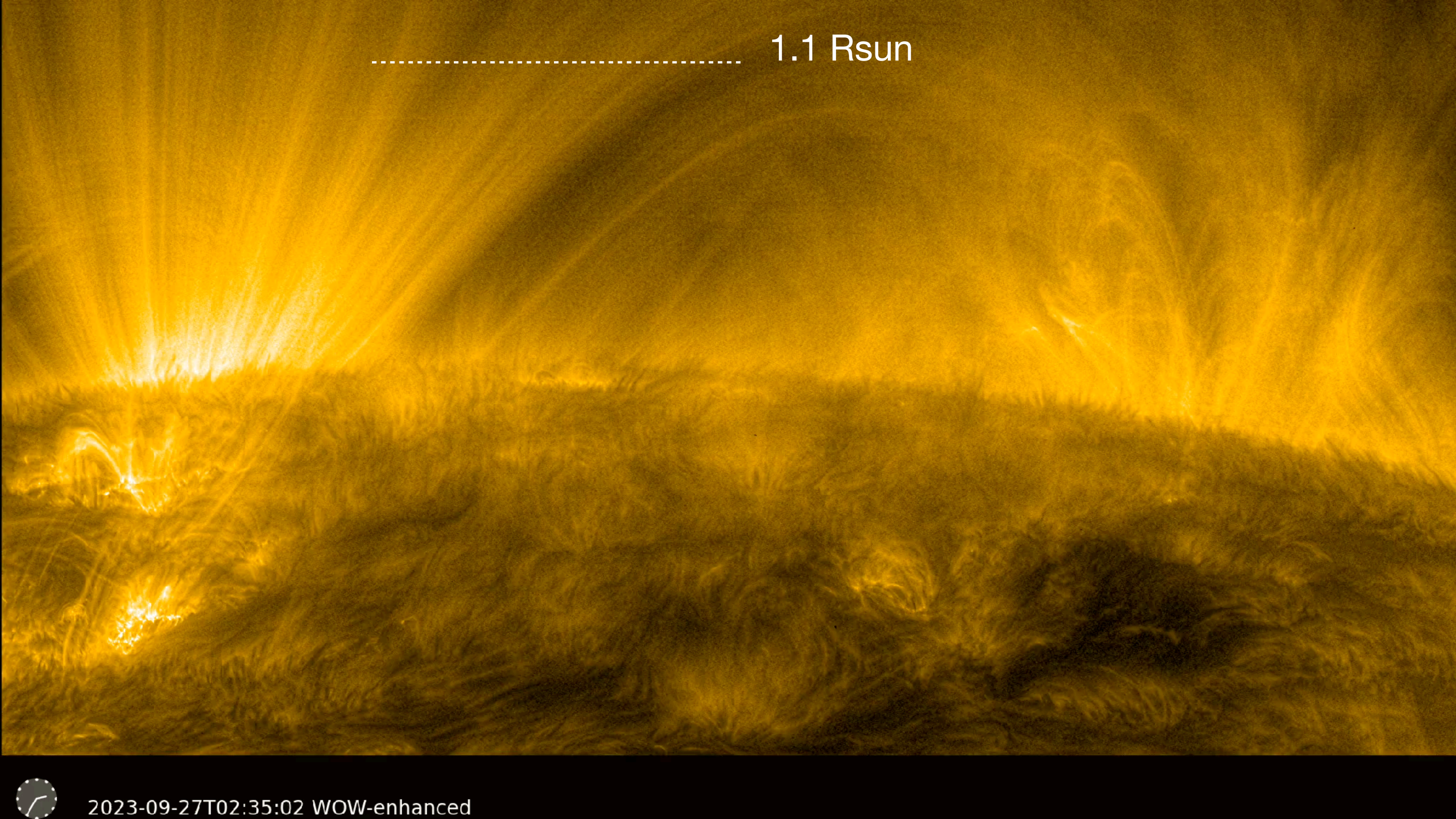


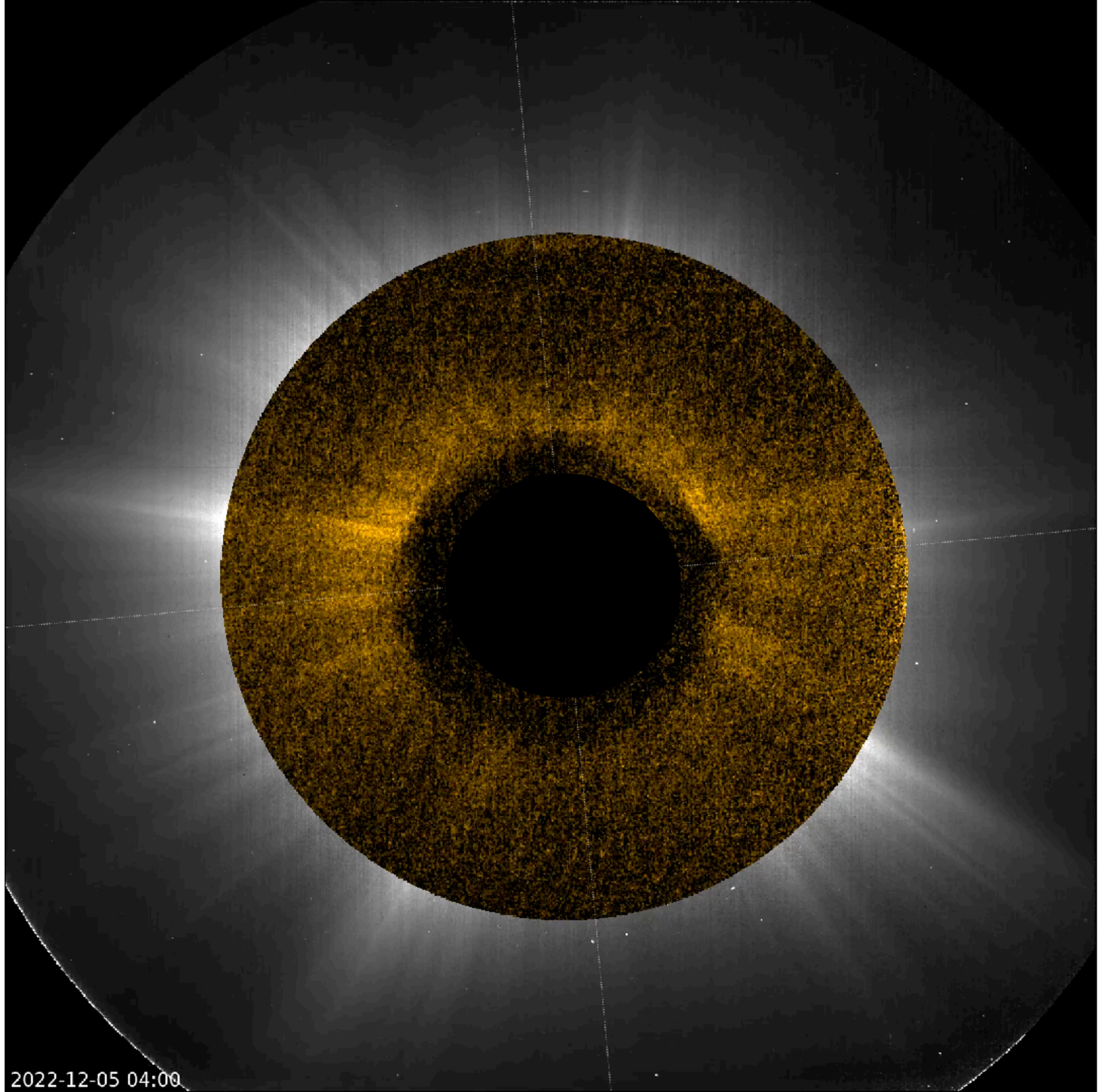
1Rsun

relative difference
over 5 sums
(ie 5x2.5 min)

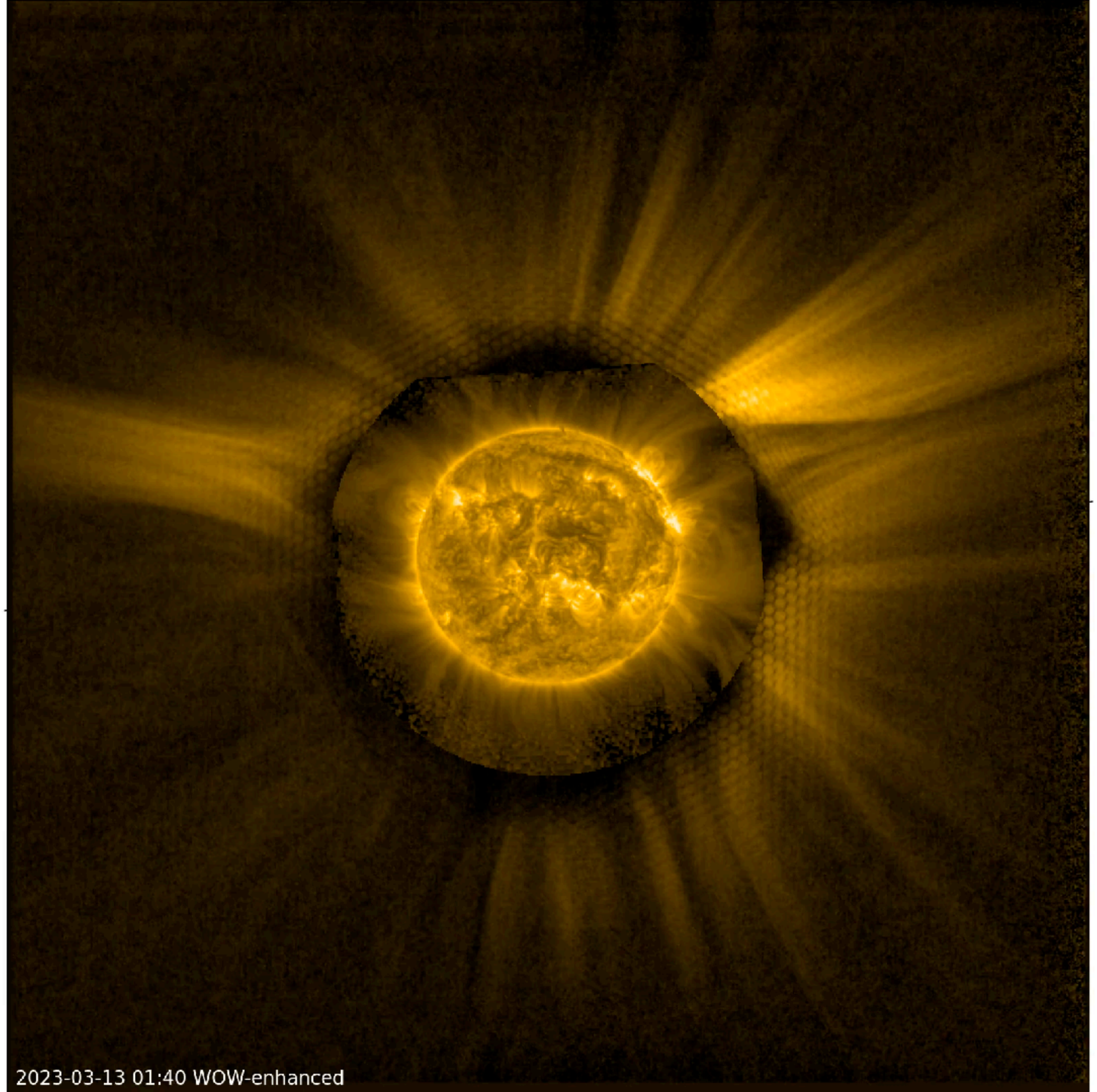
2 Pi

wow,
summed per 5 images


1.1 Rsun
2023-09-27T02:35:02 WOW-enhanced



FSI + Metis



FSI + SECCHI/EUVI