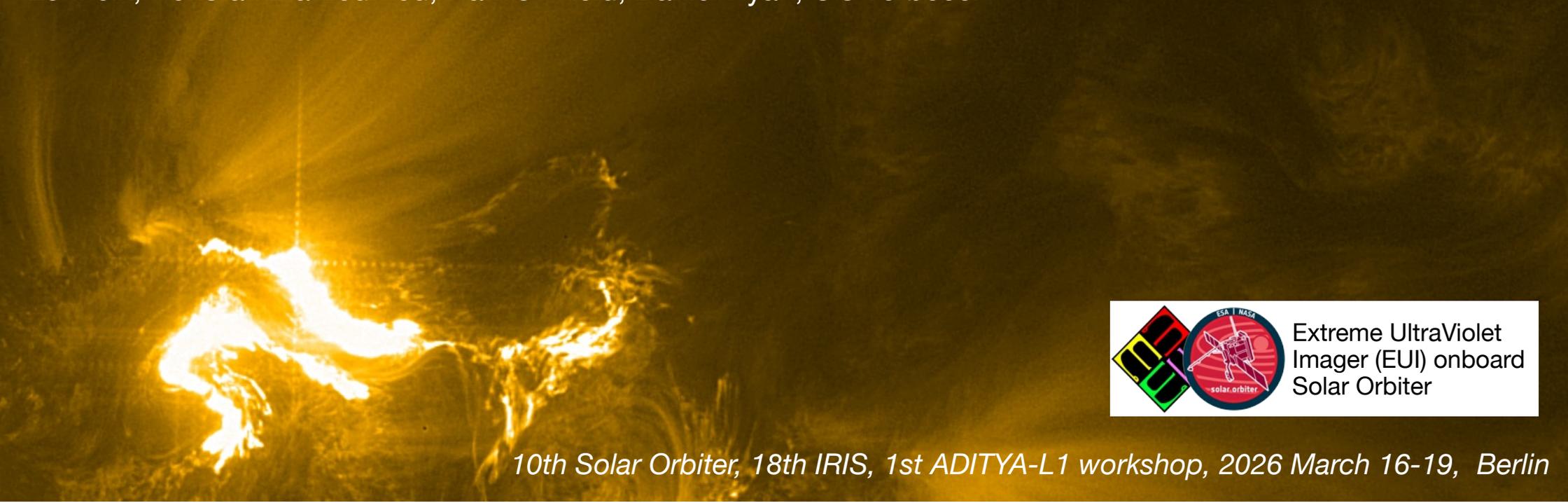


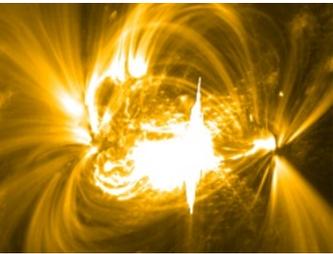
Unsaturated EUV imaging of solar flares at unprecedented temporal/spatial resolution

David Berghmans @ Royal Observatory of Belgium

Hannah Collier, Marie Dominique, Laua Hayes, Jana Kasparova, Emil Kraaikamp, Graham Kerr, Juraj Lorincik, Konstantina Loumou, Hamish Reid, Daniel Ryan, Cis Verbeeck



10th Solar Orbiter, 18th IRIS, 1st ADITYA-L1 workshop, 2026 March 16-19, Berlin



AIA on SDO

EUI/HRIEUV on Solar Orbiter

Flares

saturation Blooming

saturation ~~Blooming~~

Bright

Higher cadence

TM is available!

High cadence imaging

Fast dynamics

TM not available

High resolution

Small scales

Higher resolution

Lots of data
Lots of flares!

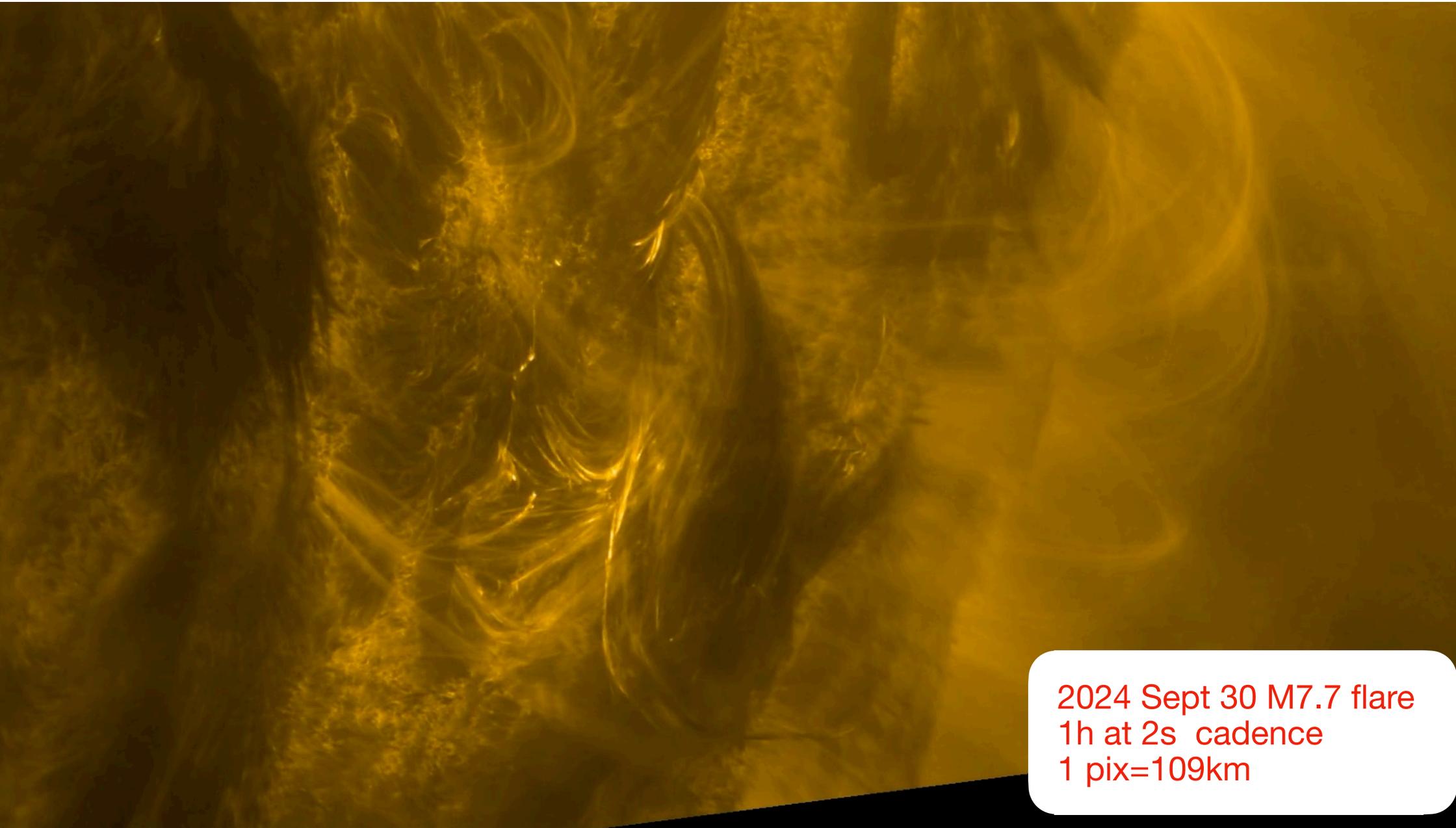
whole disk, non-stop

Seldom

Only subfields, from time to time

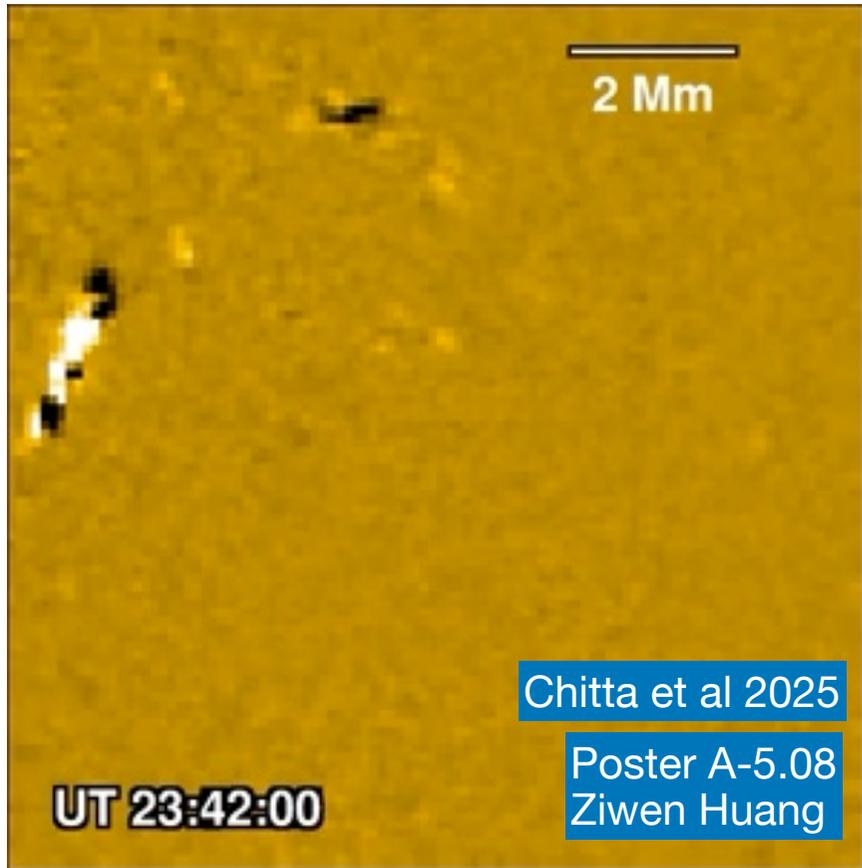
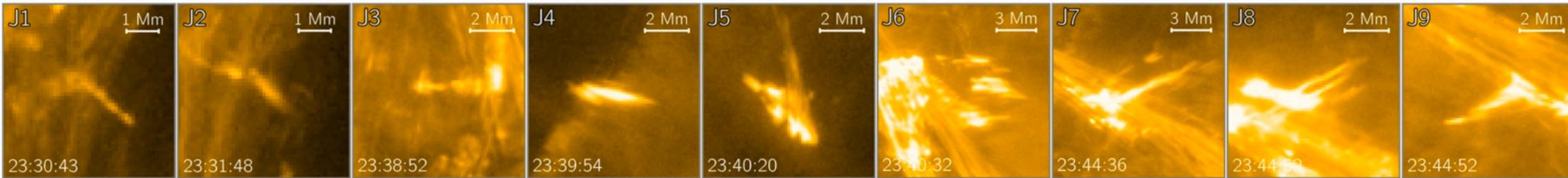
Little data
Few flares

How to catch a maximum of flares with HRIEUV and how to avoid saturation?

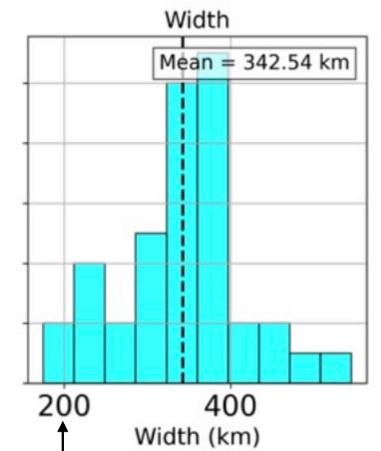
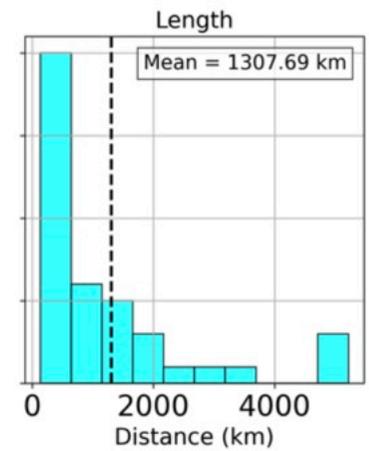
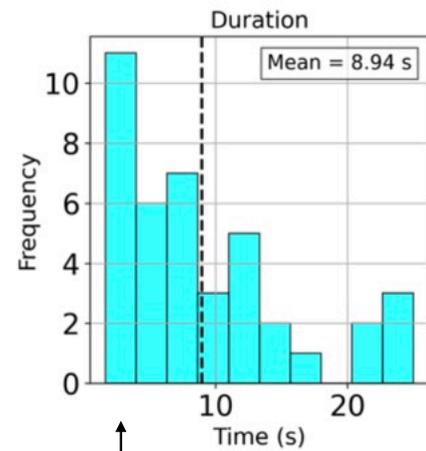


2024 Sept 30 M7.7 flare
1h at 2s cadence
1 pix=109km

Tan et al 2025

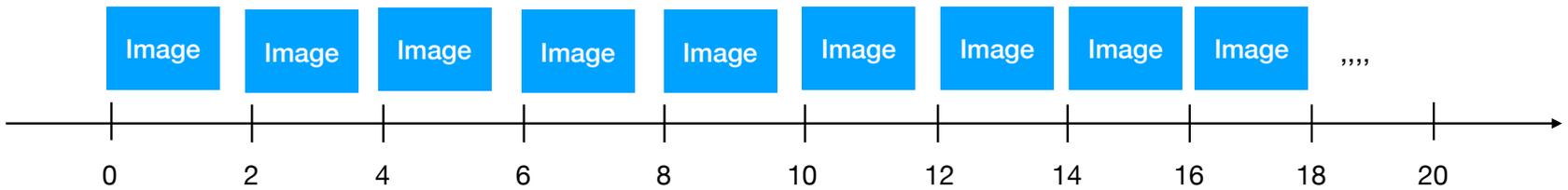


Wallace & Antolin, 2025

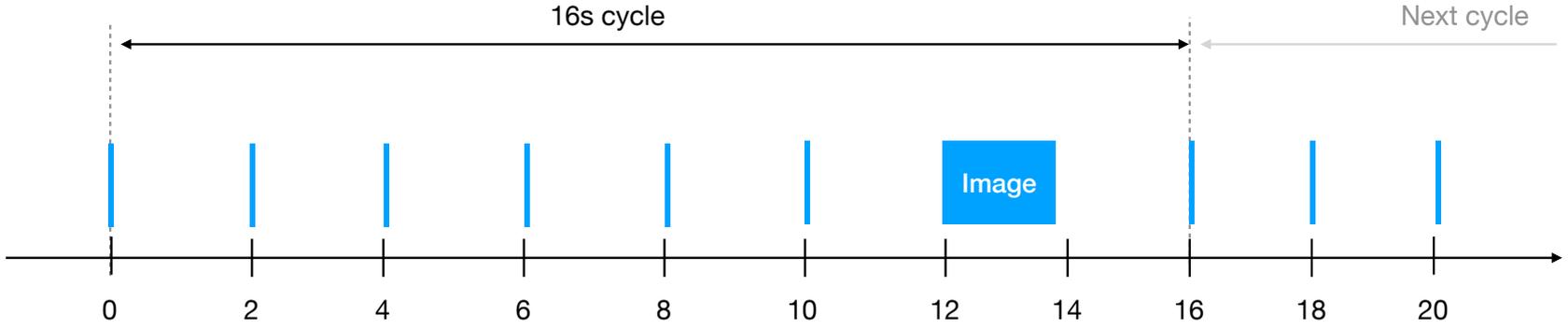


Temporal resolution

Spatial resolution



A regular image every 2s leads to saturation and can only be sustained for max 1h

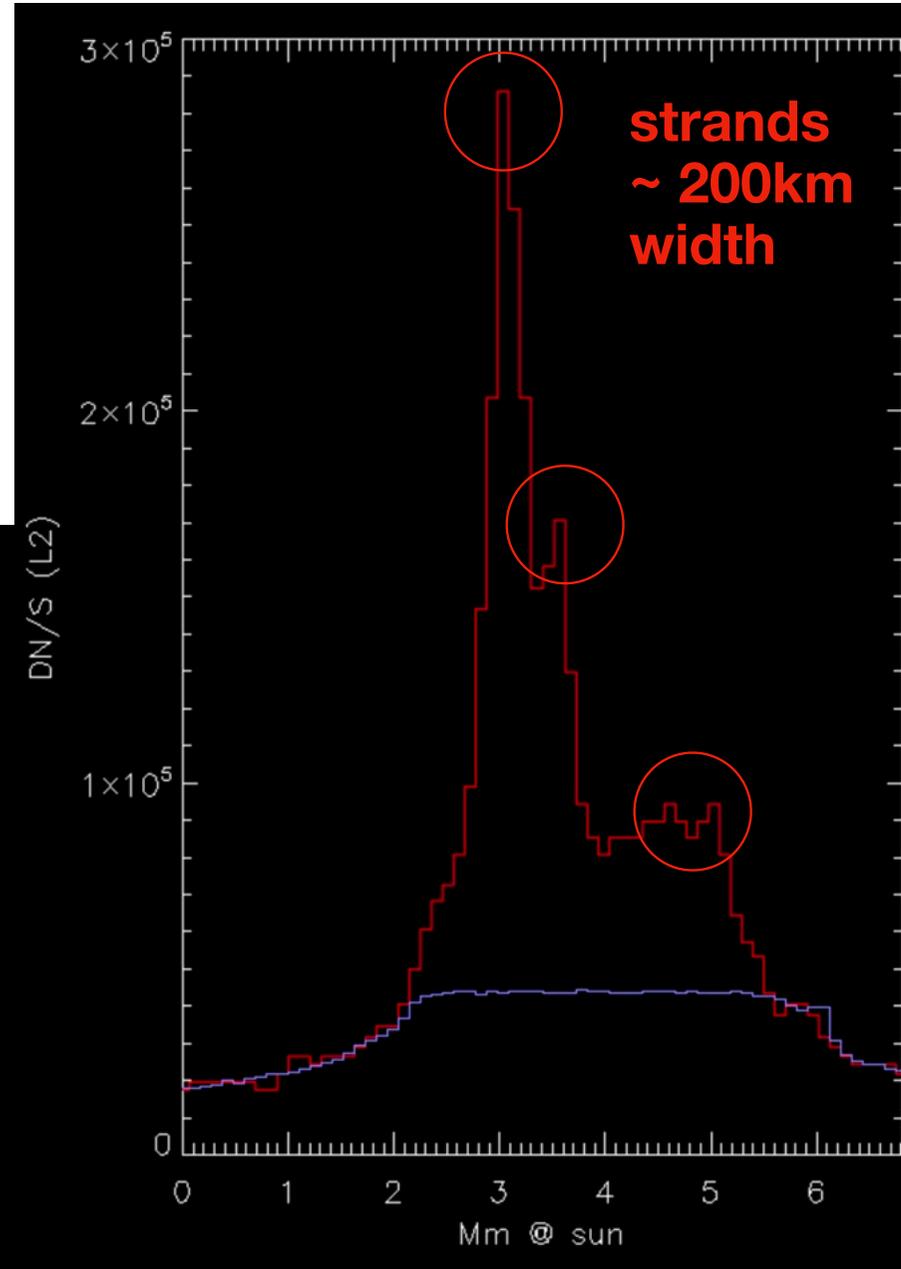
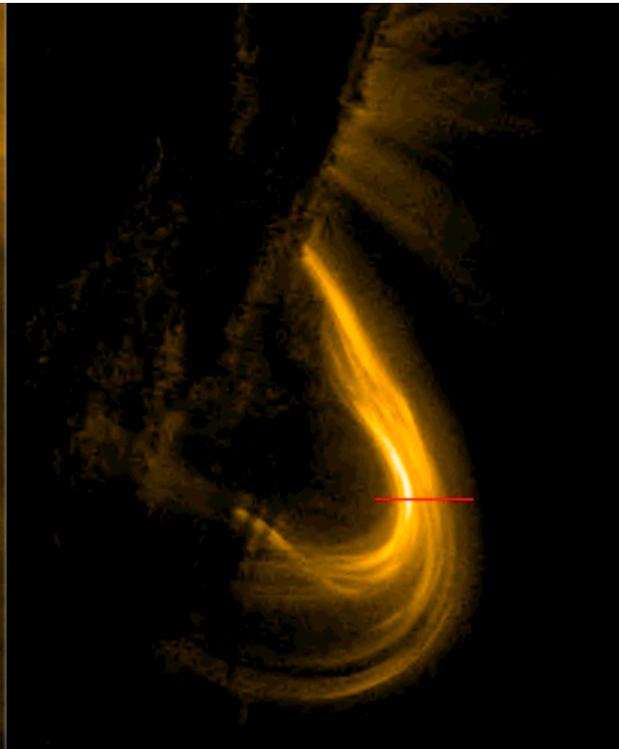
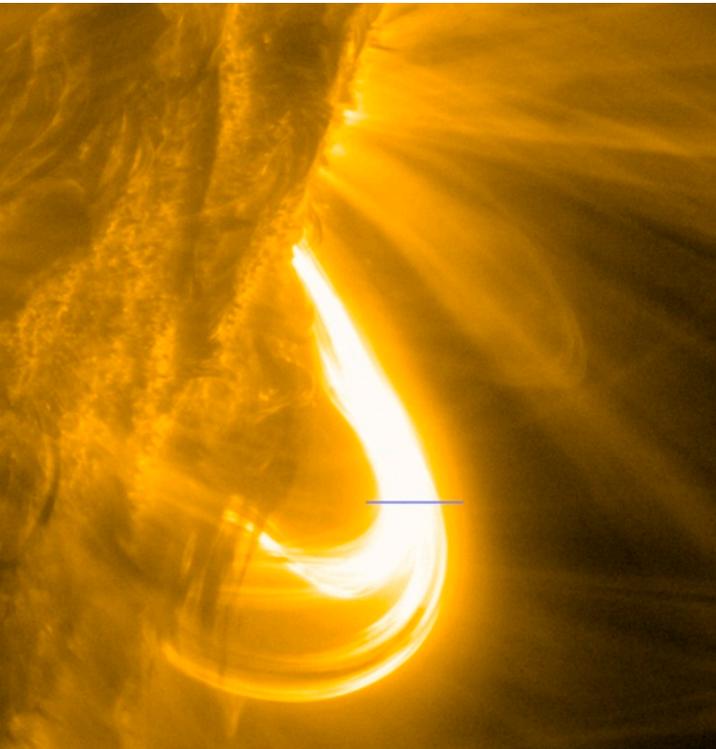


Regular images at low cadence, strongly compressed short exposures at high cadence, sustainable for many hours!

Ryan et al , 2025
Collier et al, 2026

- Exposure: 2s
- Telemetry: 1 MiB
- Bit-depth: 15 bit
- Compression x7.34

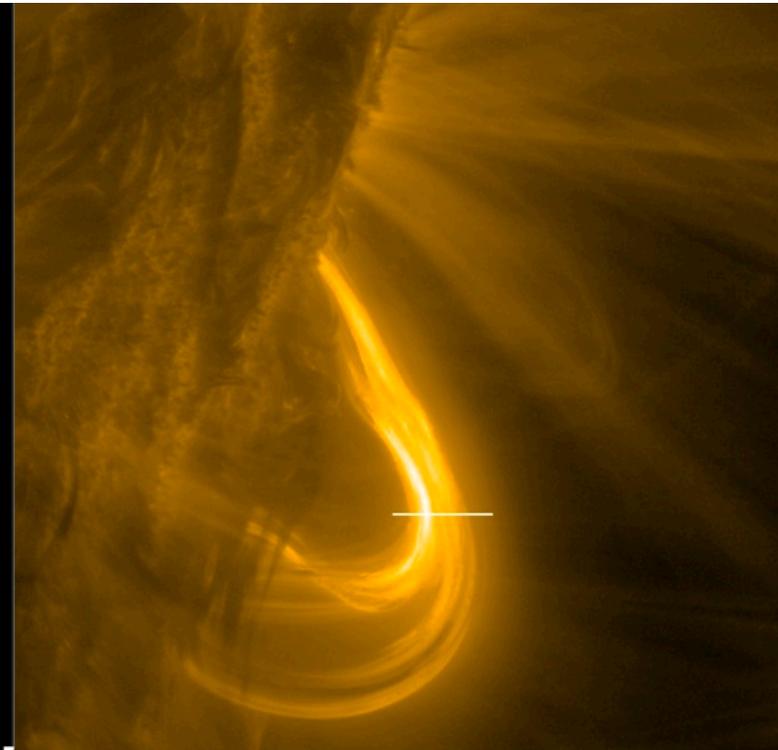
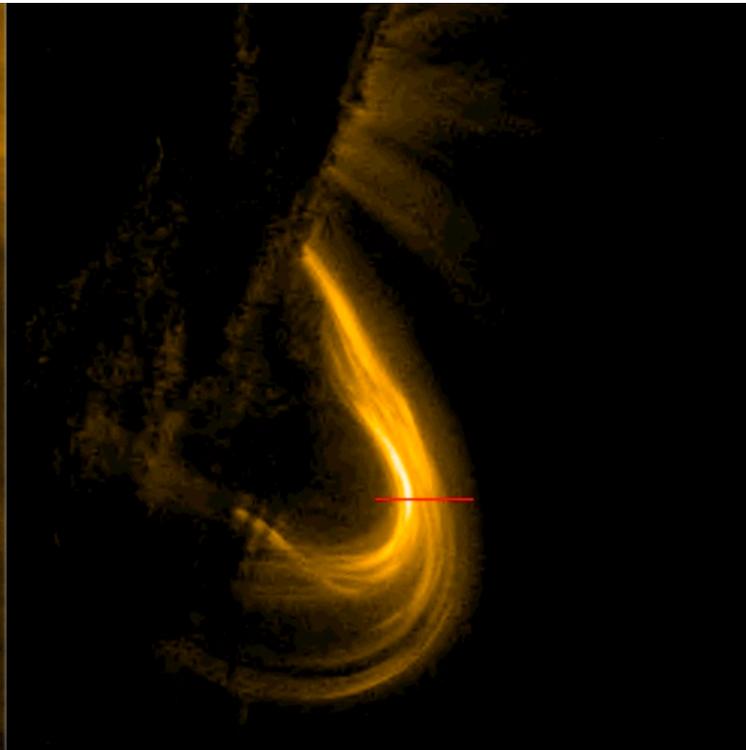
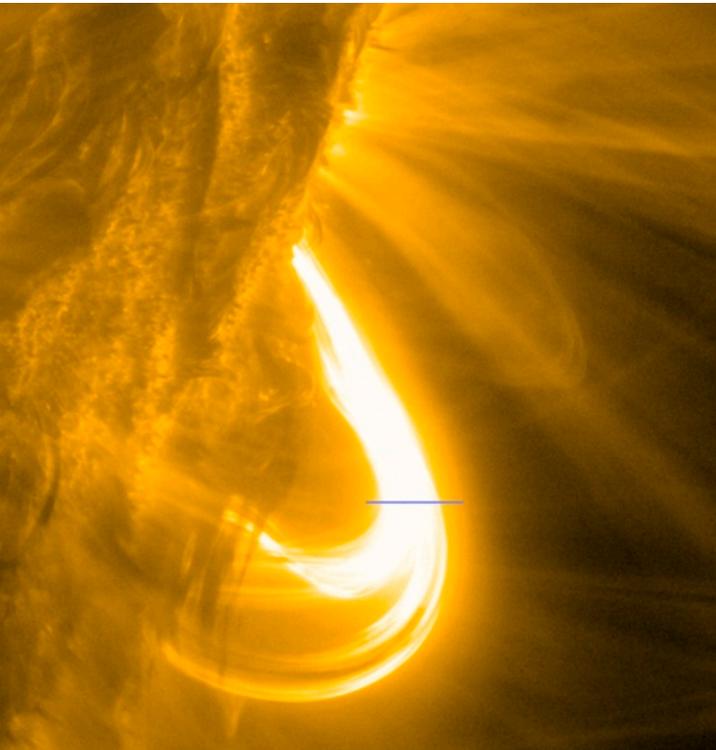
- Exposure: 0.04s
- Telemetry: 0.06
- Bit-depth: $\ll 15$ bit
- Compression x124

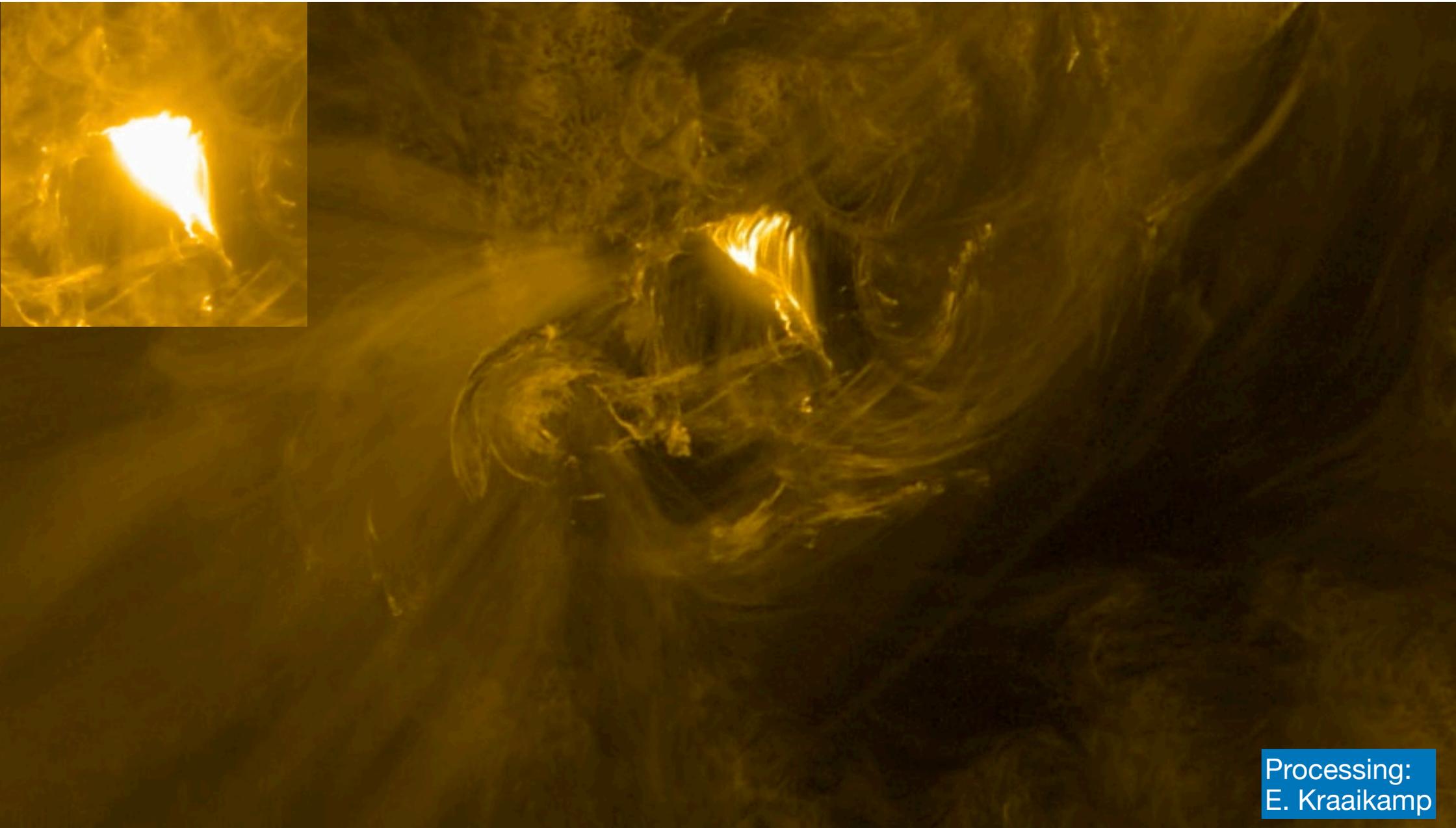


- **Exposure: 2s**
- **Telemetry: 1 MiB**
- **Bit-depth: 15 bit**
- **Compression x7.34**

- **Exposure: 0.04s**
- **Telemetry: 0.06**
- **Bit-depth: <<15 bit**
- **Compression x124**

- **Bitdepth: 21 bit**



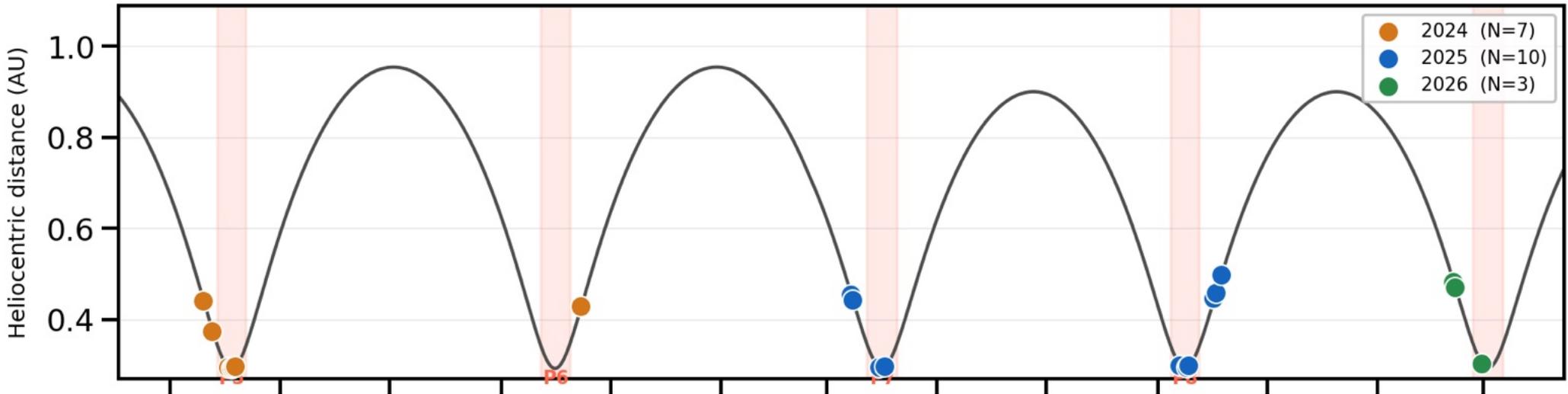


Processing:
E. Kraaikamp

Major Flare SOOP

Major Flare SOOP Executions 2024 - 2026 (N = 20)

Image: Laura Hayes

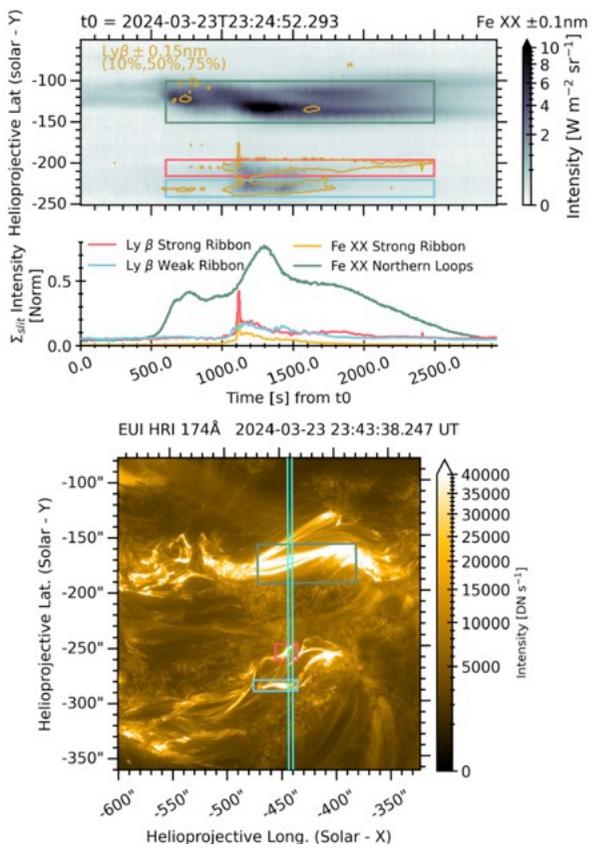


	B	C	M	X
Flares in HRIEUV sequences	45	30	10	0

Number of STIX flares (Laura Hayes, https://github.com/hayesla/stix_flarelist_science) happening during HRIEUV high cadence sequences and in the HRIEUV FOV up till end 2024. [Work by Daye Lim](#)

SPICE High-Cadence Sit & Stare

- 2023 & 2024: 5.1s cadence, 4" slit
- 2025 – now: 2.1s cadence, 2" slit



Talk by
Graham Kerr

Table 3 Flares jointly observed by STIX and EUI/HRI_{EUV} during the Solar Orbiter Major Flare campaign. Events listed in **bold font** are those have confirmed SPICE observations of the flare sources. Additional instruments that observed each flare are listed in the right-most column.

Label	Date	Time ^a [UT]	GOES class	Joint observations
A	2024-03-19	23:21	M2.2	EOVSA, GOES, IRIS slit, SDO, XRT (Be-med & Be-thick), EIS
B	2024-03-23	22:44	C5.9	GOES, IRIS slit, SDO, XRT (Be-med)
C		22:54	C8.0	GOES, IRIS slit, SDO, XRT (Be-med)
D		23:41	M2.5	EOVSA, GOES, IRIS slit, SDO, XRT (Be-med), EIS
E	2024-03-24	00:53	C9.9	EOVSA, GOES, IRIS slit, SDO, XRT (Be-med)
F		01:48	M2.2	GOES, IRIS slit, SDO, XRT (Be-med)
G		02:09	M2.7 ^b	GOES, IRIS slit, SDO, XRT (Be-med)
H	2024-04-02	20:55	~B5 ^c	Not seen from Earth
J		20:59	~B3 ^c	
K		21:32	~B6 ^c	
L	2024-04-04	20:05	C2.5 ± 0.3 ^c	Not seen from Earth
M		20:12	C5.0 ± 0.6 ^c	
N		21:16	M1.0 ± 0.1 ^c	
P		21:42	C3.2 ± 0.3 ^{b,c}	
Q	2024-04-05	20:11	C9.9 ± 1.1 ^c	Not seen from Earth
R		21:46	C1.4 ± 0.2 ^c	
S		22:19	C1.1 ± 0.1 ^c	
T		23:45	~B5 ^c	
U	2024-10-15	16:24^d	C2.6	GOES, IRIS slit, SDO, XRT (Be-thin), EIS
V		18:27	M2.1	GOES, SDO, XRT (Be-thin), EIS
W		19:48	C4.0	GOES, SDO, IRIS slit, XRT (Be-thin)
X		23:08^d	C9.4	GOES, SDO, IRIS slit, XRT (Be-thin), EIS

STIX



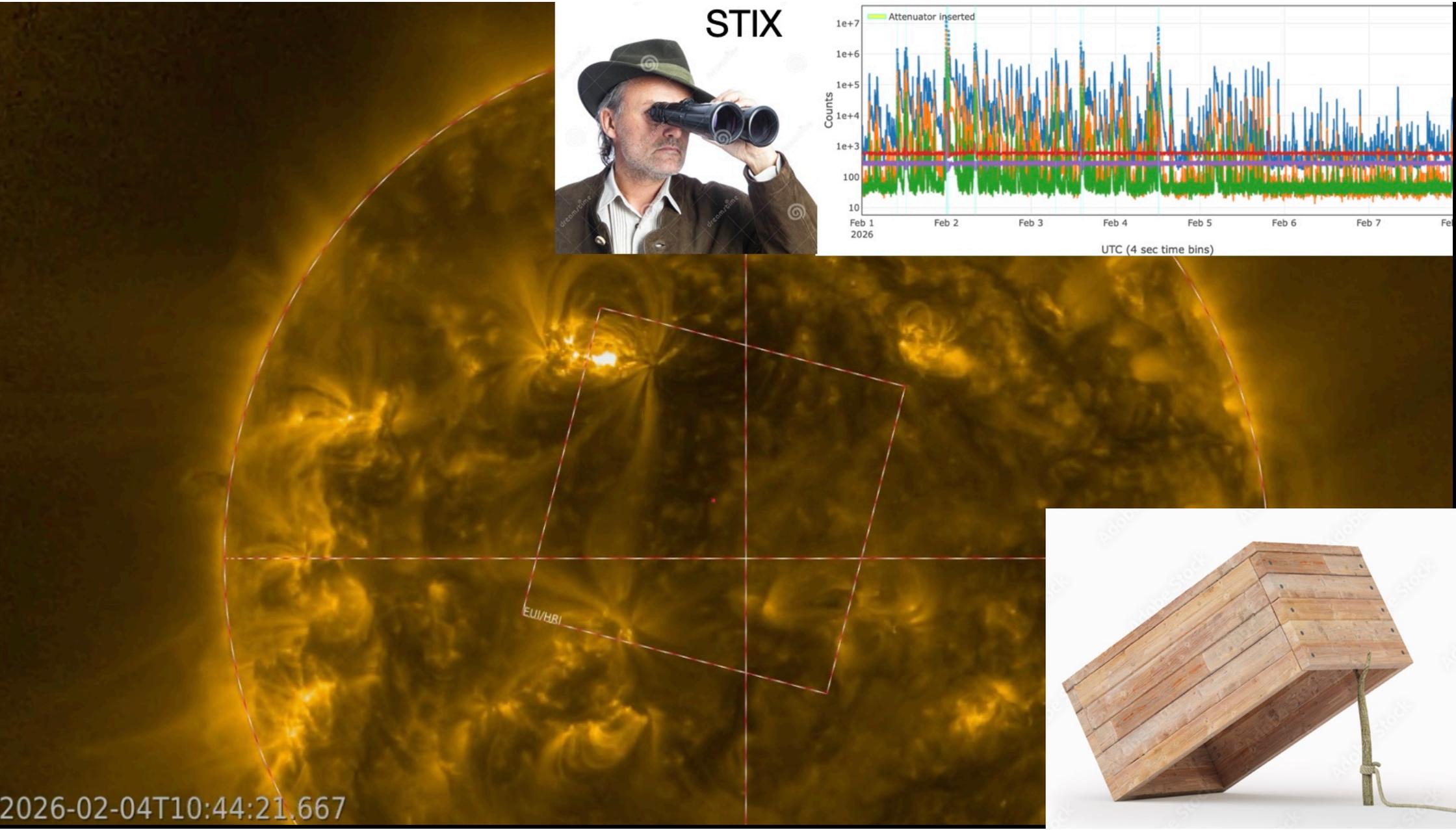
flare triggers

a.k.a. Flare Hunting SOOP

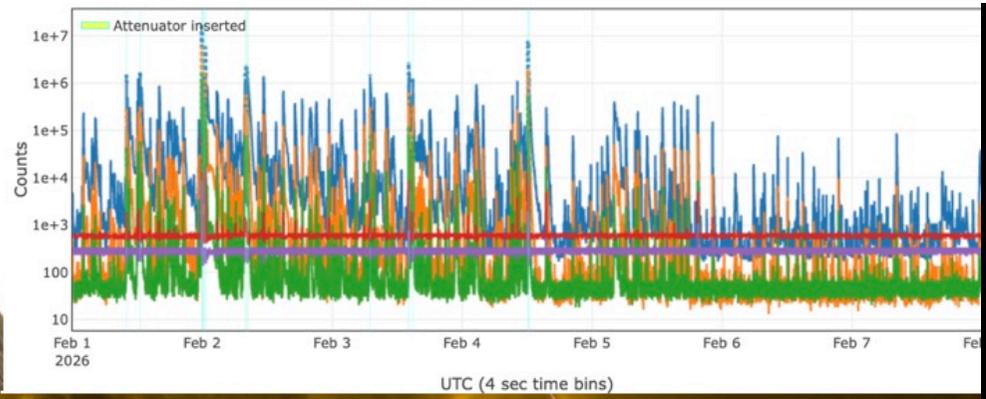
NOAA
4366

EUI/HRI

2026-02-01T00:44:02.378

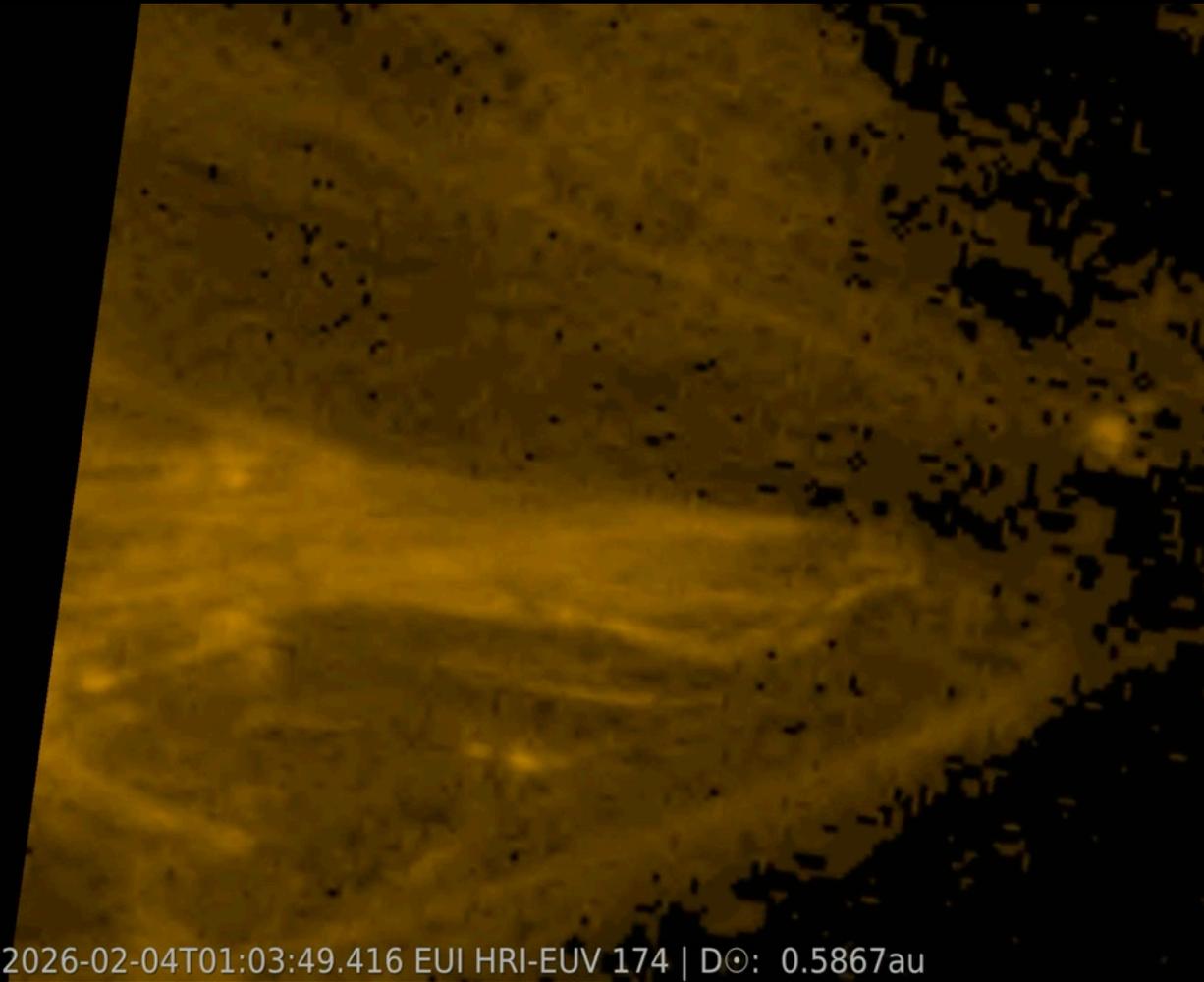
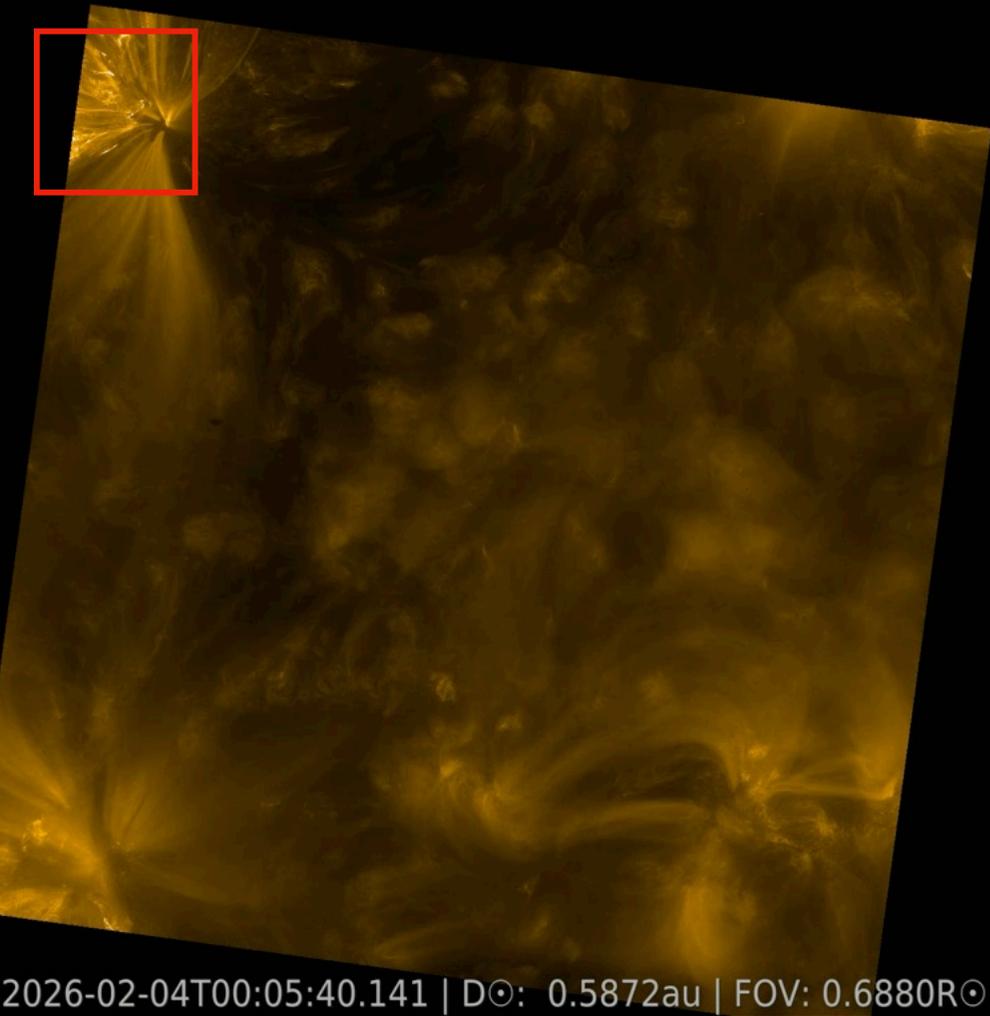


STIX



2026-02-04T10:44:21.667





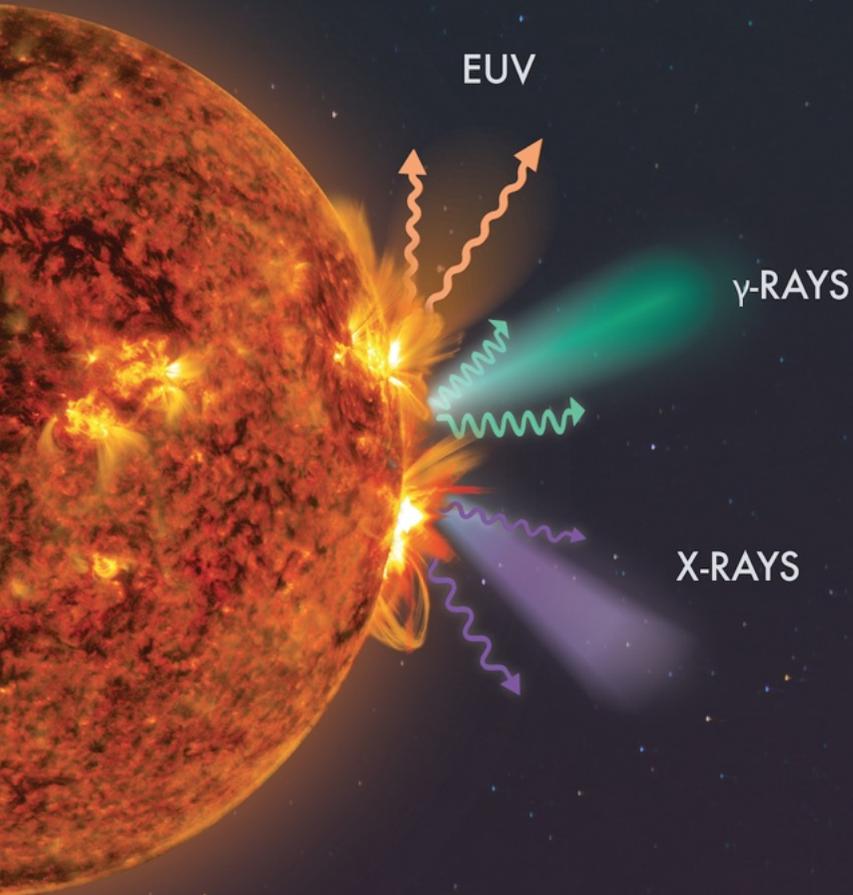
2026-02-04T00:05:40.141 | D_☉: 0.5872au | FOV: 0.6880R_☉ 2026-02-04T01:03:49.416 EUI HRI-EUV 174 | D_☉: 0.5867au

Take home messages

1. EUI / HRIEUV has observed >10 M flares and > 100 C or B-flares at unprecedented spatial and temporal scales while **avoiding saturation**
2. Telemetry burn-out is avoided by
 - heavy compression of short exposures
 - STIX flare triggering
3. Unresolved flare features at 110km (1 pix) and 2s (cadence) scales.
4. HRIEUV is only 1 channel
 - Coordinated observations in the Major Flare SOOP are essential
 - SPARK, the ESA M8 mission proposal builds upon these ideas

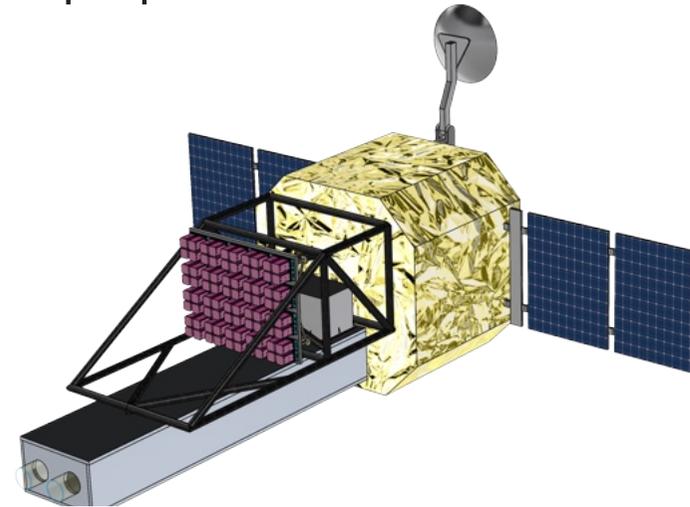
SPARK

Solar Particle Acceleration Radiation and Kinetics



Submitted in response to the ESA's call for an M-class mission opportunity 2025
 Lead Proposer - Dr. Hamish Reid, UCL Mullard Space Science Laboratory, RH5 6NT, UK
 Email: hamish.reid@ucl.ac.uk; Phone +44 1483 204 107

mission proposed for the ESA M8 mission call.



Channel	$\Delta\lambda$	Main spectral lines	$\log T_{max}$	Telescope
94 Å	10 Å	Fe XVIII - 93.93 Å	6.9	T1
132 Å	10 Å	Fe XX - 132.84 Å, Fe XXIII - 132.91 Å, Fe XXII - 135.81 Å	7.2	T1
171 Å	10 Å	Fe IX - 171.53 Å, Fe X - 174.53 Å	5.8	T2
304 Å	10 Å	He II - 303.78 Å	4.9	T2

poster B-6.32 Hamish Reid