GOES-R Solar UltraViolet Imager Extended Coronal Imaging

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Agenda

- Background

- Overview of the Campaign

- Preliminary Analysis Results

- Recommendation

Geostationary Operational Environmental Satellite (GOES-R)

Launched:

GOES-R: November 19, 2016

GOES-S: March 1, 2018

Nadir-pointed instruments:

    Advance Baseline Imager (ABI)

   Geostationary Lightning Mapper (GLM)

Sun-pointed instruments:

    EUVS and X-ray Irradiance Suite (EXIS)

    Solar UltraViolet Imager (SUVI)
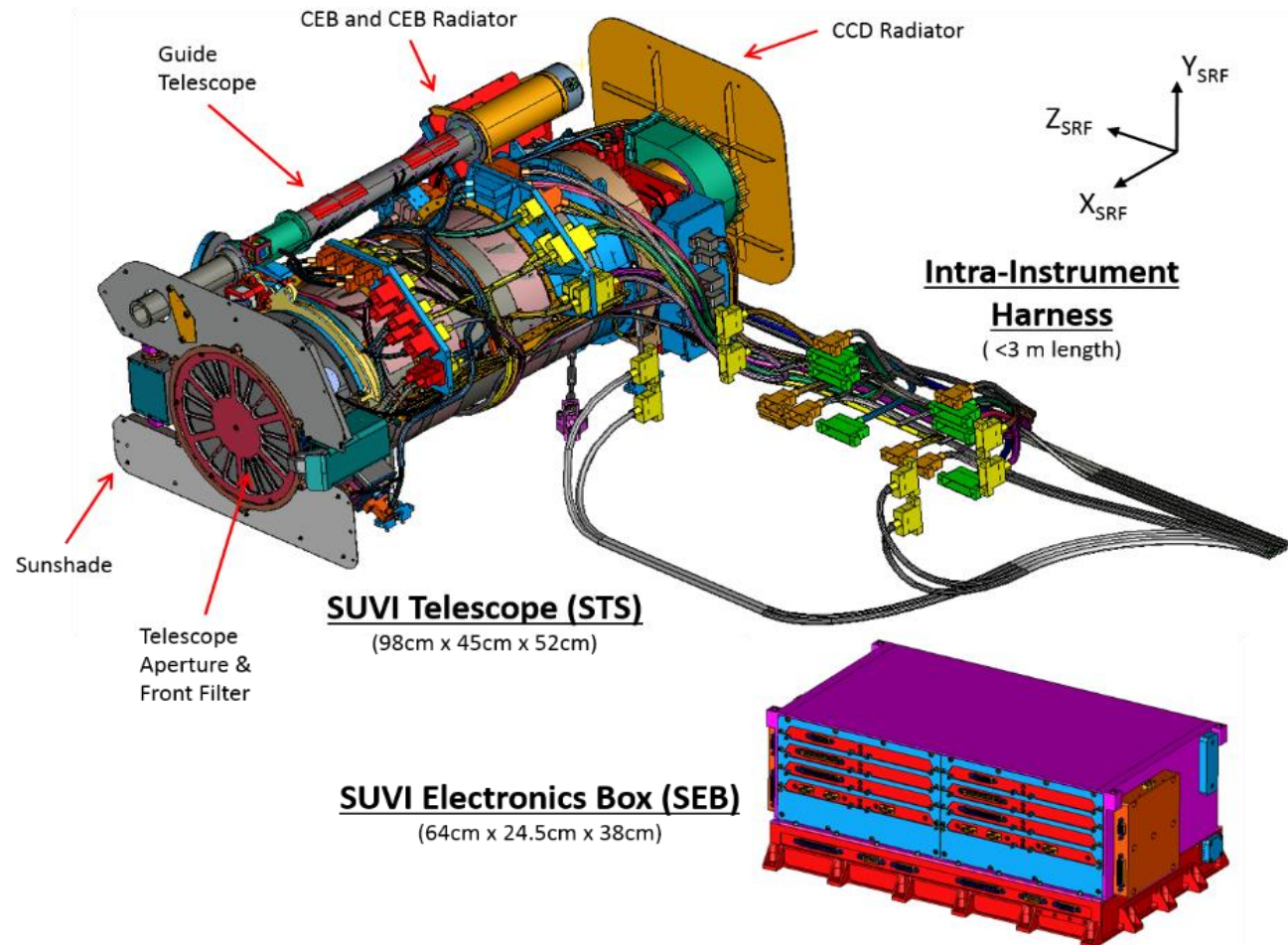
Bus-mounted instruments:

    Space Environment In-Situ Suite (SEISS)

    Magnetometer

- Advance Baseline Imager (ABI)
- Geostationary Lightning Mapper (GLM)
- Solar UltraViolet Imager (SUVI)
- SPP Orbit Configuration
- Fully Deployed Solar Wing Subsystem
- Magnetometer
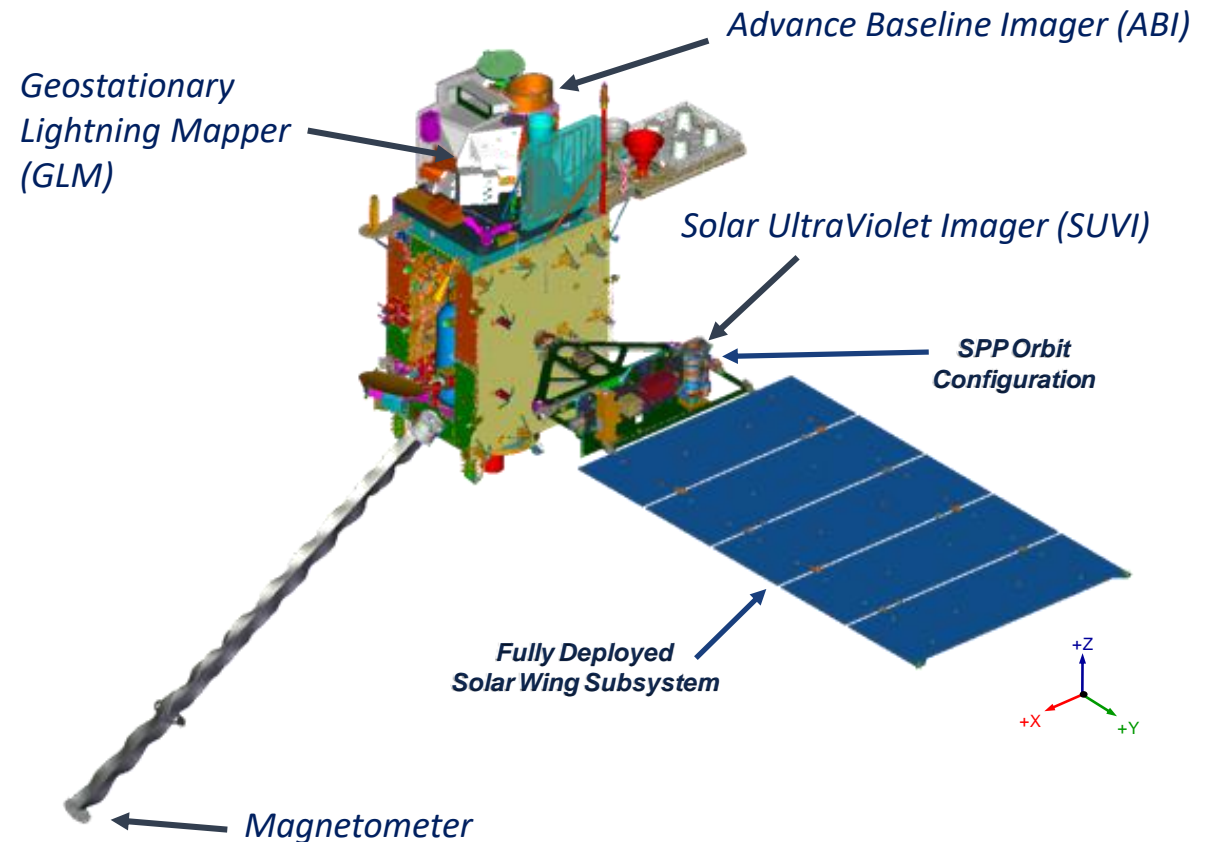
Solar UltraViolet Imager (SUVI)

- Generalized Cassegrain Telescope
- Multilayer coated primary and secondary mirrors
- Six channels:
  - 9.4nm, 13.1 nm, 17.1nm, 19.5nm, 28.4nm, 30.4nm
- Entrance and analysis filters for bandpass & OOB rejection
- 53 arcmin x 53 arcmin CCD
- Guide Telescope (GT) provides Sun-pointing information
- Spacecraft controls gimbals with the GT data

CEB and CEB Radiator

CCD Radiator

Guide Telescope

Y_{SRF}

Z_{SRF}

X_{SRF}

Intra-Instrument Harness
(<3 m length)

Sunshade

Telescope Aperture & Front Filter

SUVI Telescope (STS)
(98cm x 45cm x 52cm)

SUVI Electronics Box (SEB)
(64cm x 24.5cm x 38cm)

Motivation

Observation:

- SUVI image shows significant corona
    - ❖ Largest among solar imagers
- No UV coronagraphs

Action:

- Image EUV corona up to a few solar radii
- Explore CME detection capability

Implementation:

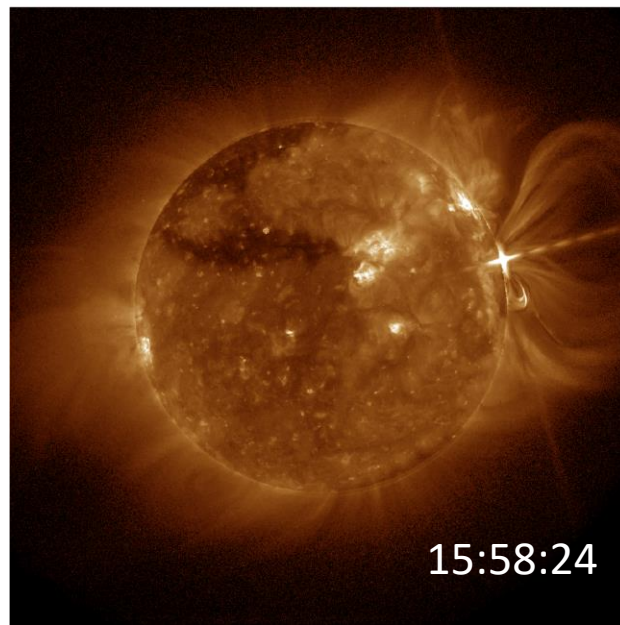- Off-point SUVI Line-of-Sight away from the Sun
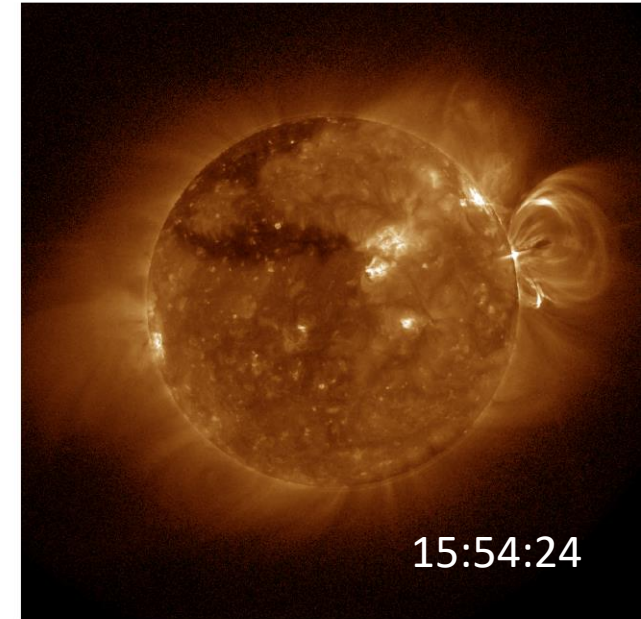

53 arcmin
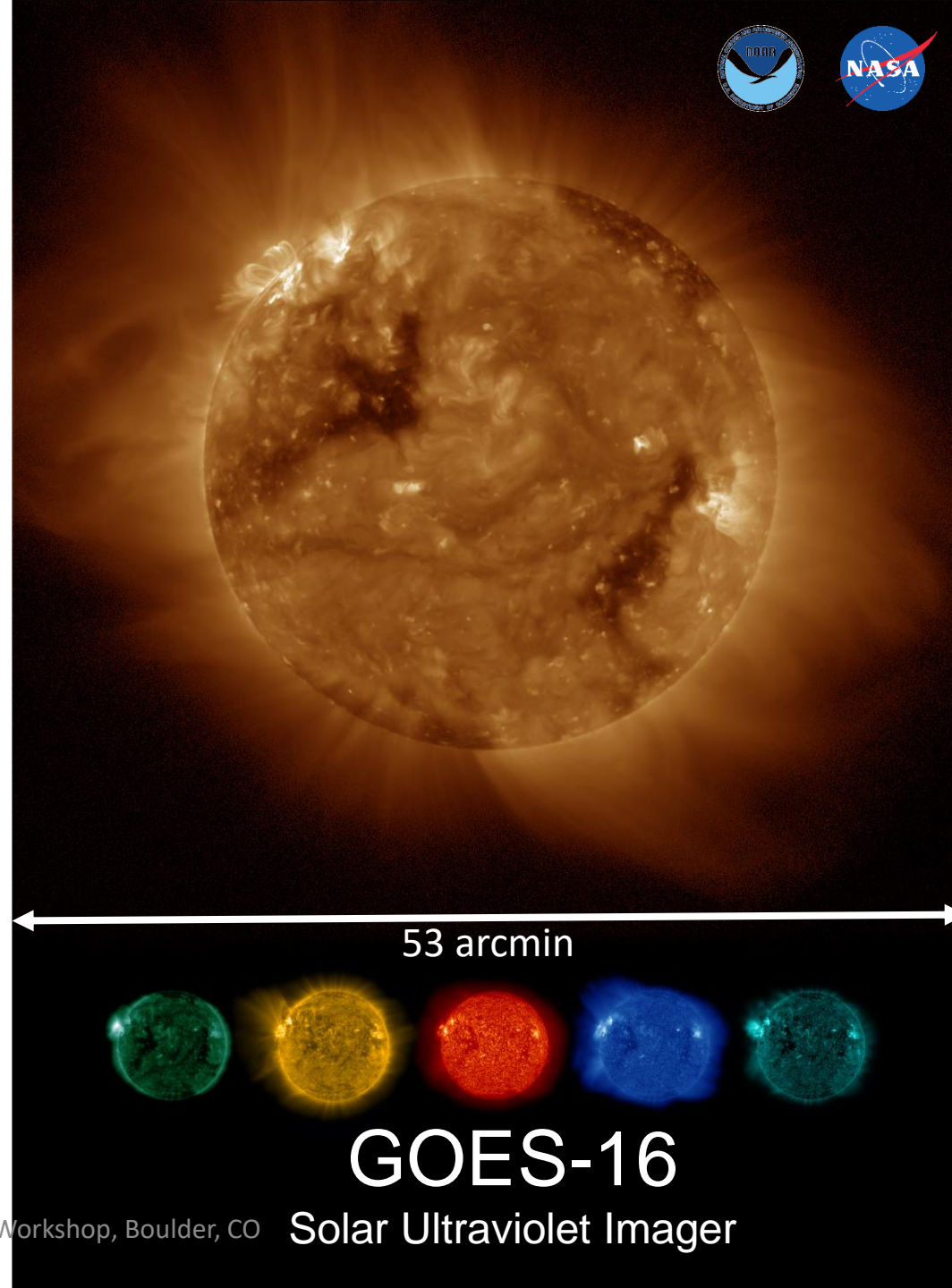
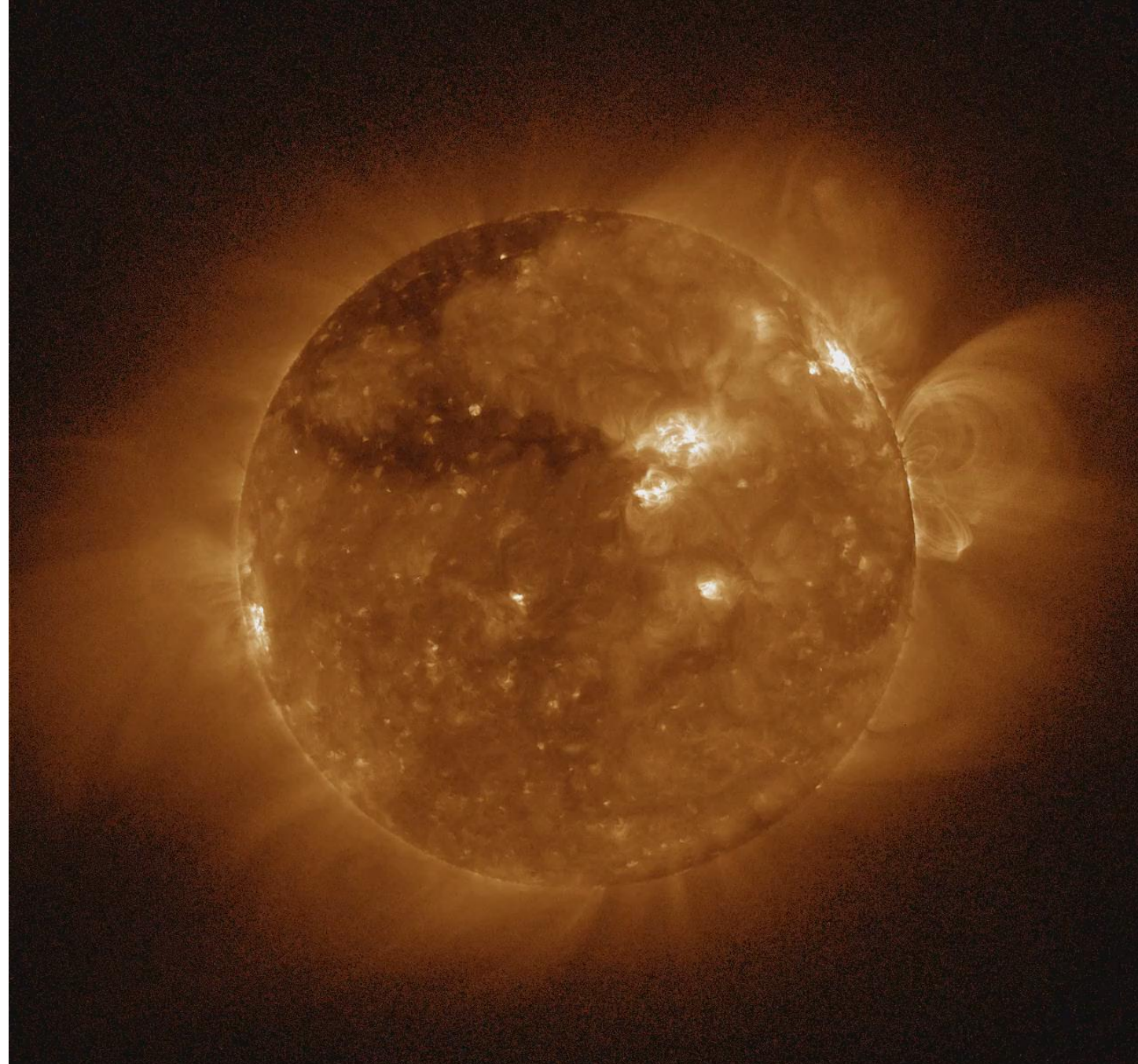53 arcmin

GOES-16
Solar Ultraviolet Imager

Caught on camera: X8.2 flare

19.5 nm

2017 September 10*

15:18:24

15:48:24

15:54:24
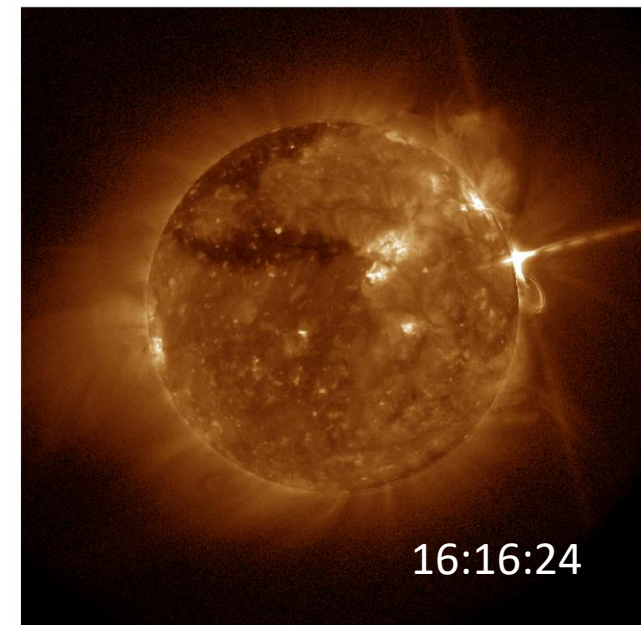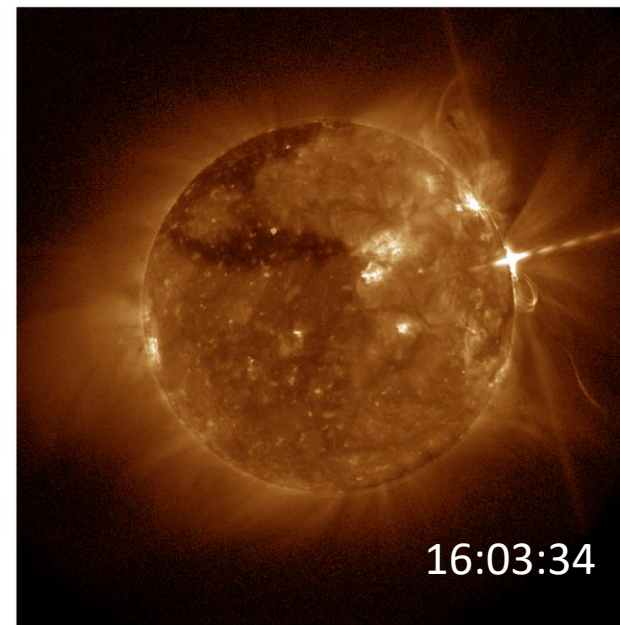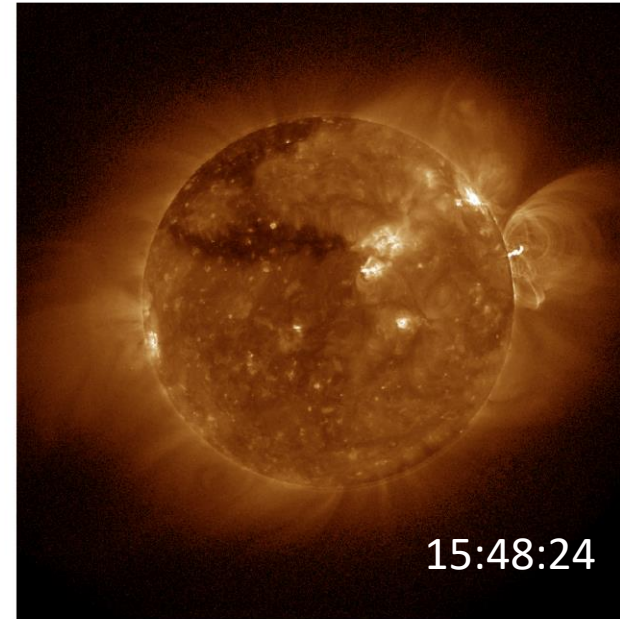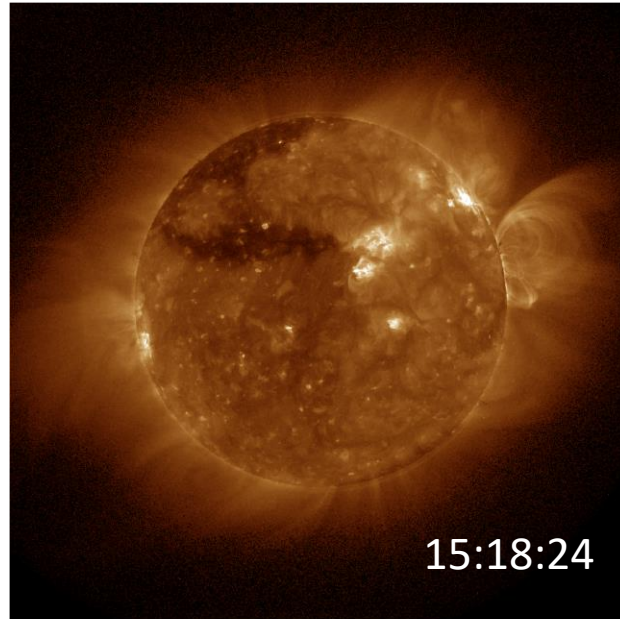
* Seaton, et al, The Astrophysical Journal Letters, 852:L9 (7pp), 2018 January 1

15:58:24

16:03:34

16:16:24

GOES-16/SUVI 195 Å   2017-09-10 15:01:14

First Investigation

- On GOES-16, February 12-13, 2018

- Two patterns, in two wavelengths
  - 17.1 nm, 19.5 nm
  - 9-panel: 17.1nm in forward, 19.5nm in reverse
  - 7-panel: Both images at each offset
  - 4 arcmin overlap
  - Glass images
  - 25 – 200 secs exposures
  - One execution per each pattern
  - ~ 2 hours execution for each
  - Created composite images
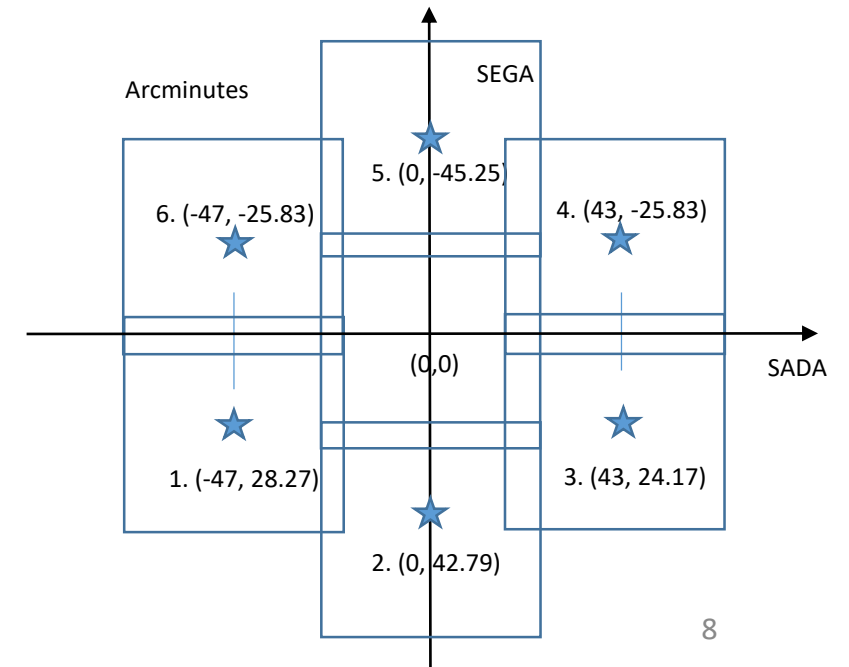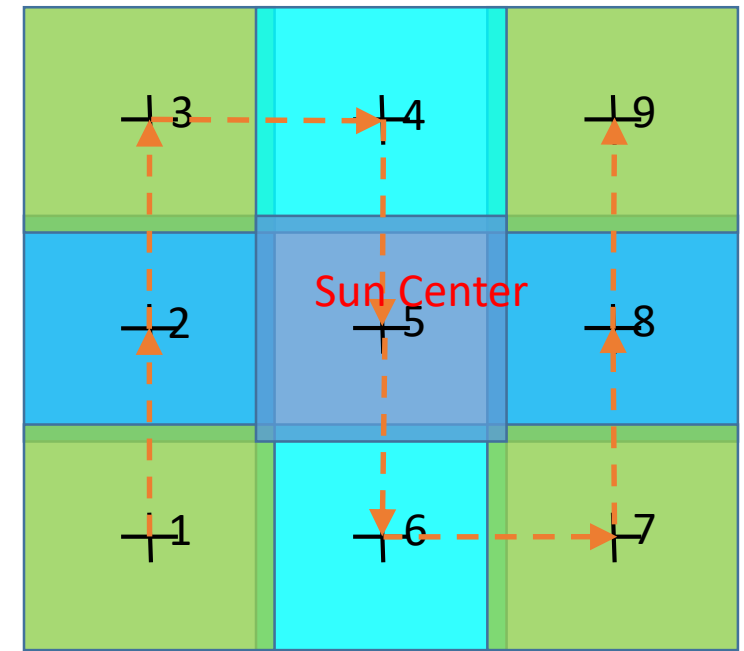
17.1 nm composite
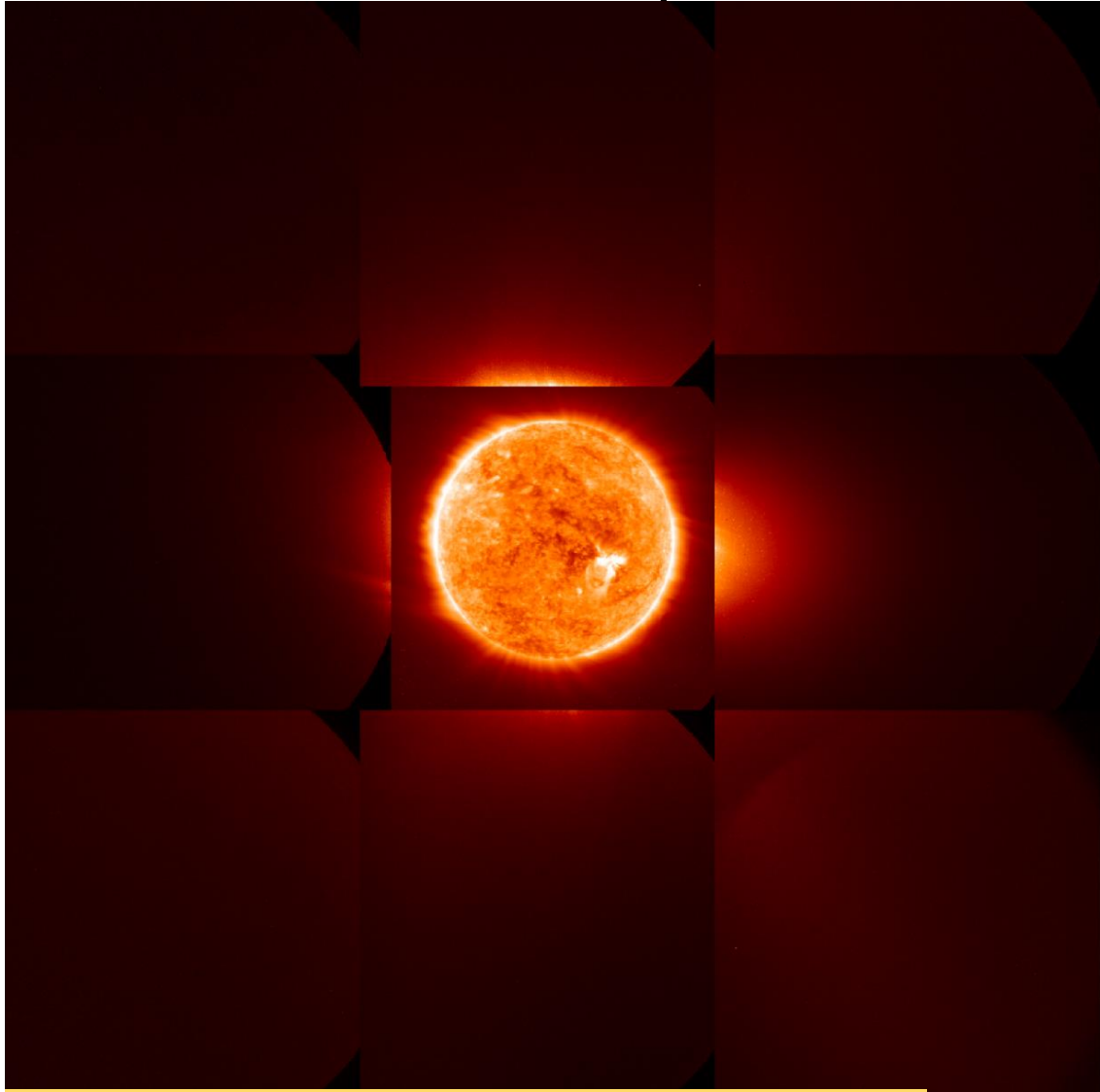
19.5 nm composite
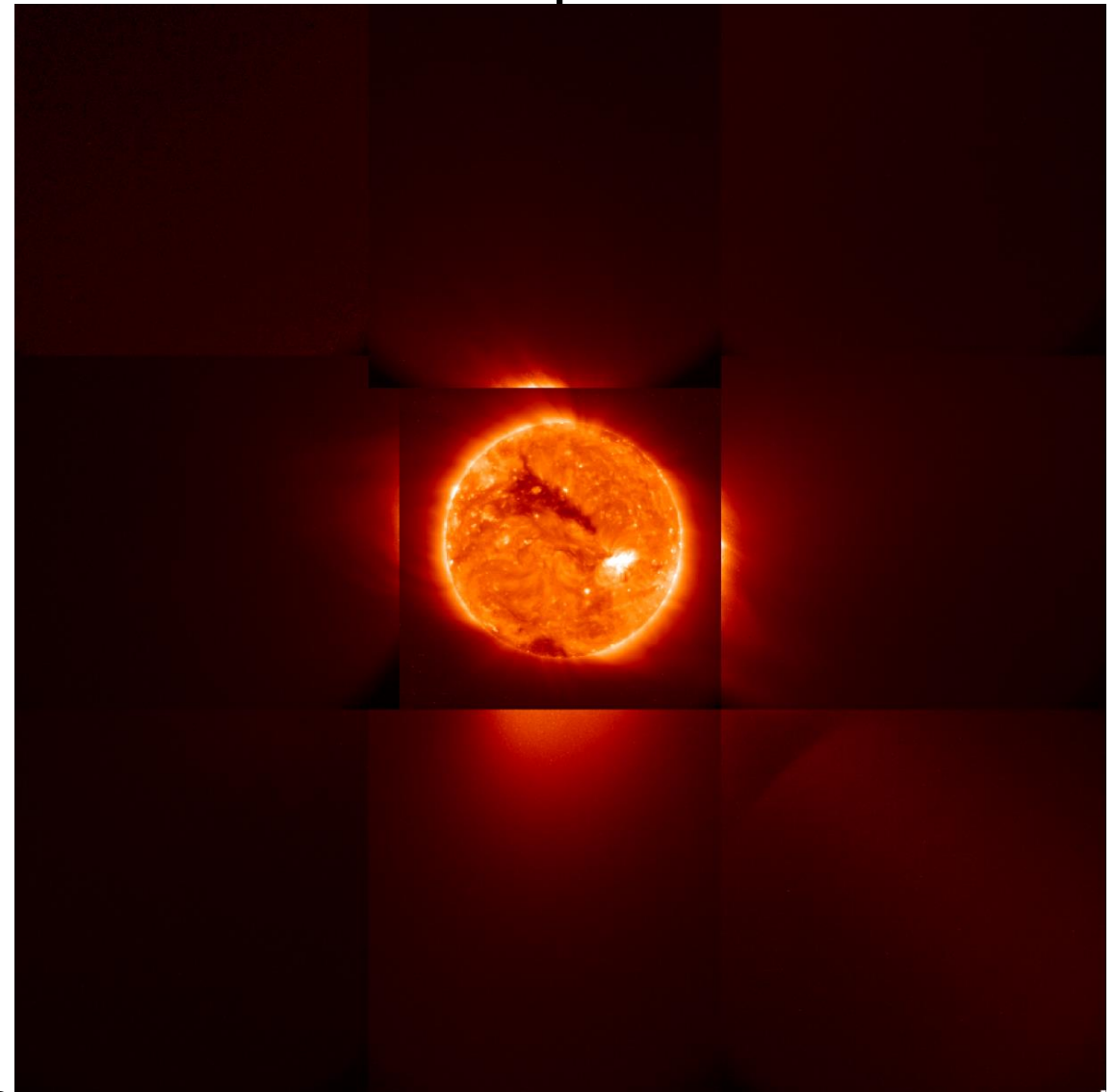
4.7*R$_{sun}$

Space Weather Workshop, Boulder, CO

February 12-13, 2018
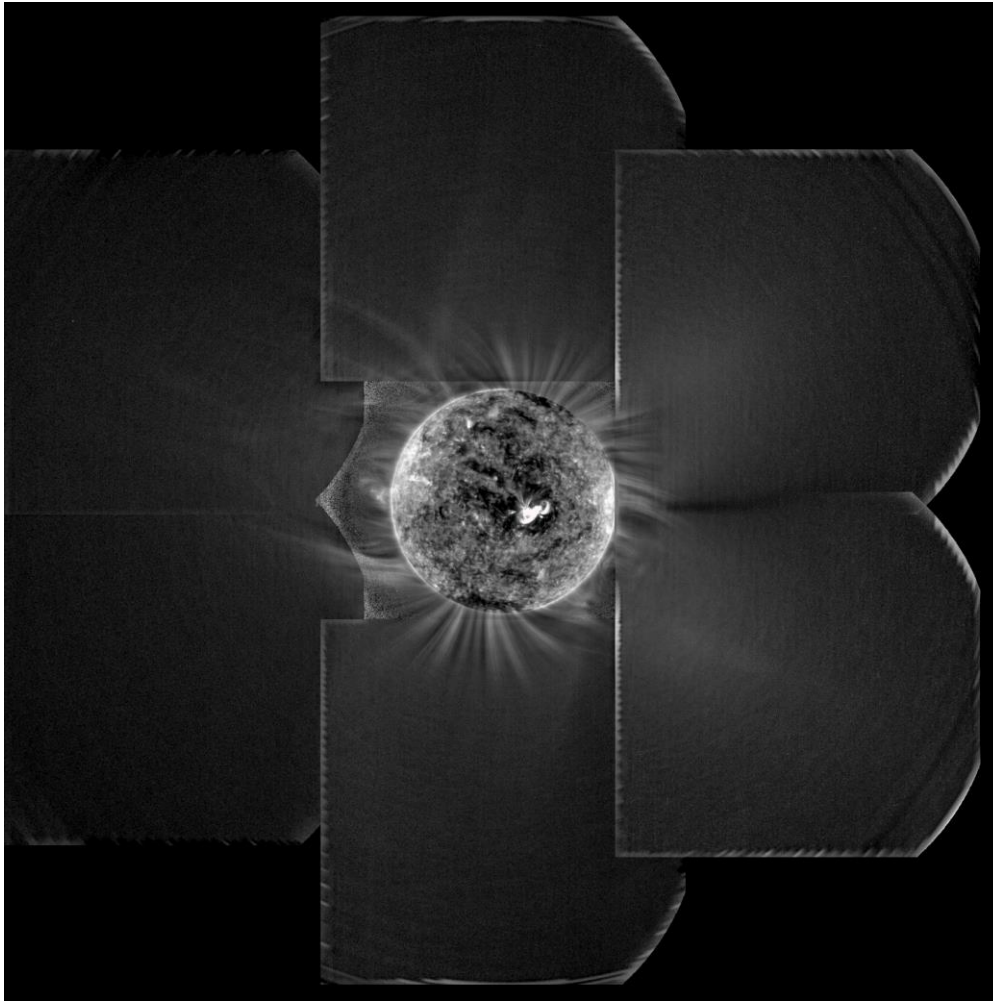
17.1 nm   19.5 nm
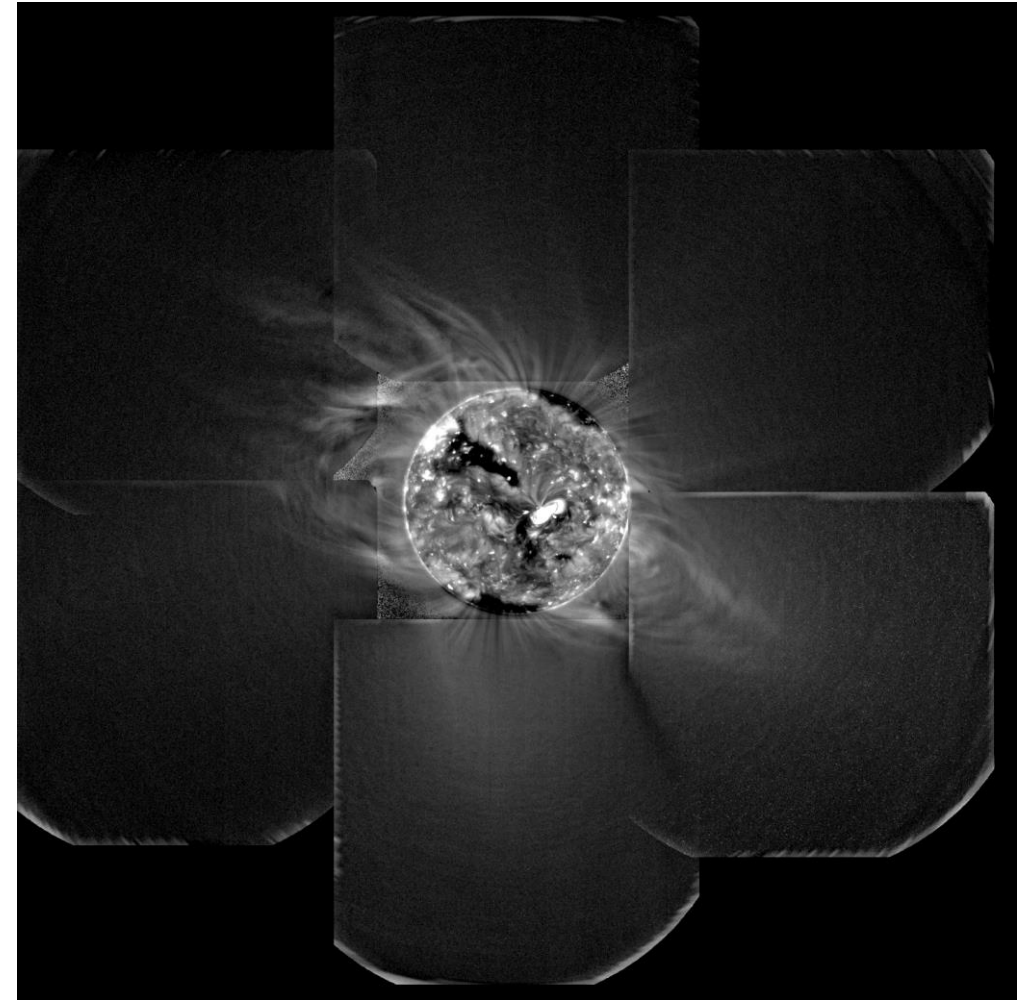
Demonstrated: EUV Corona exists to a few solar radii, even for quiet Sun

GOES-17, June 4-7, 2018

- 3-panel option

- Exposure duration reduced w/on-chip binning

- Overlap, accounting for pointing errors, reduced to 2 arcmin
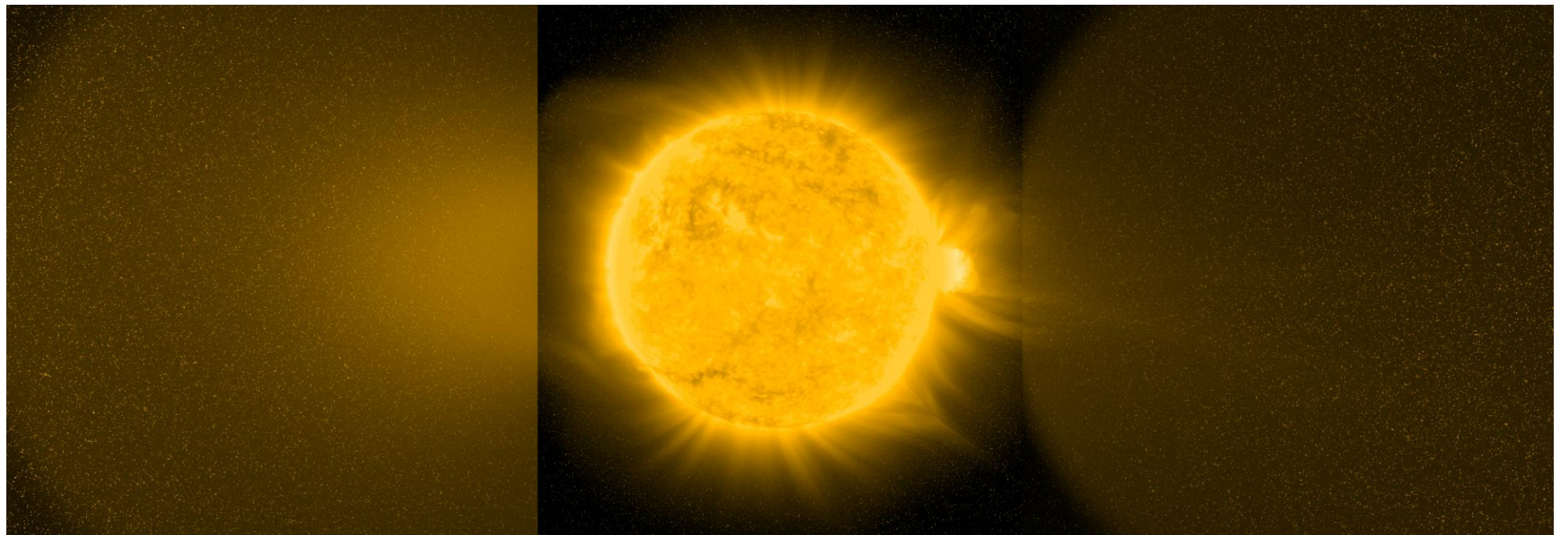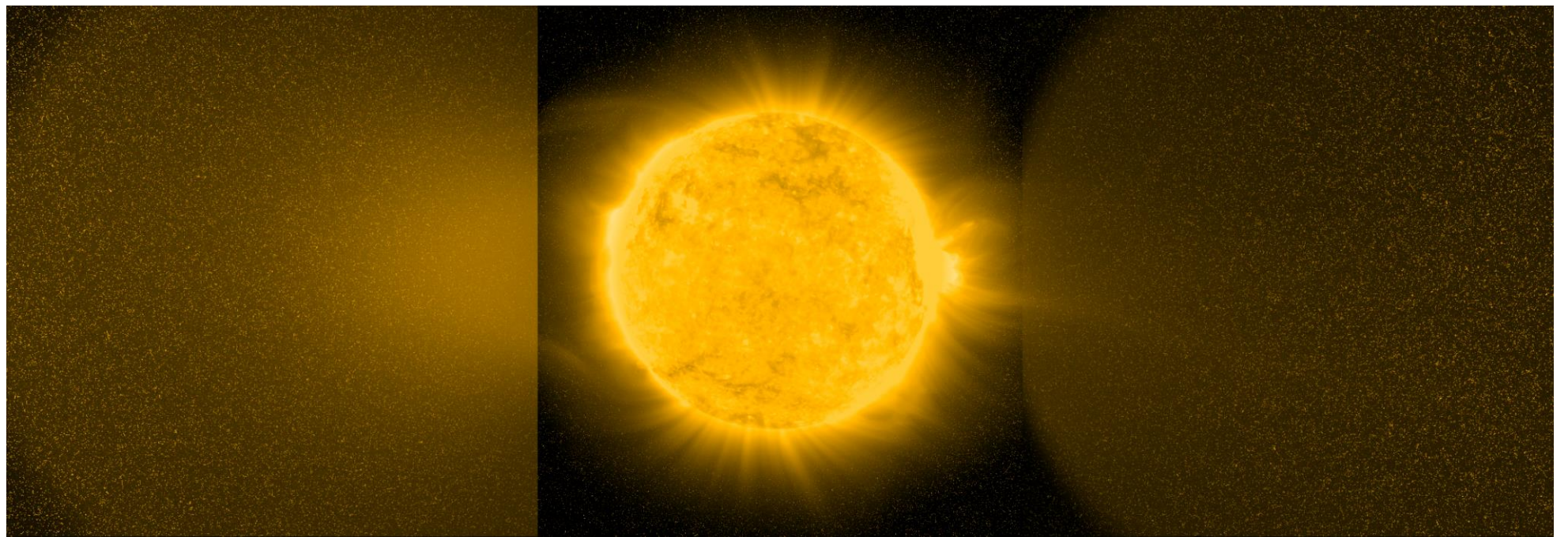
- 72 hour execution

- Precursor to an operational concept

Sun Center
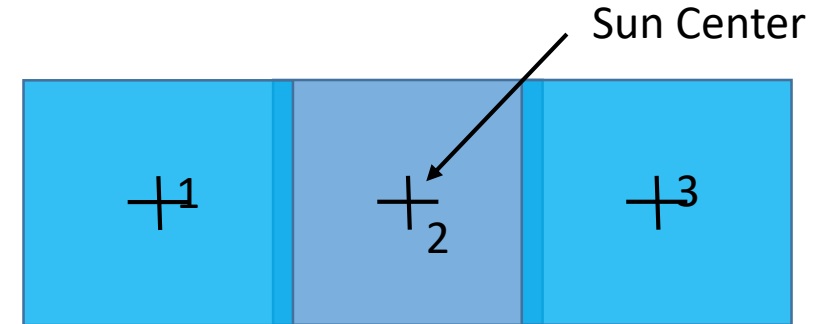
17.1nm

20180604_131458

GOES-17 Preliminary, Non-Operational Data

20180605_230203

19.5nm
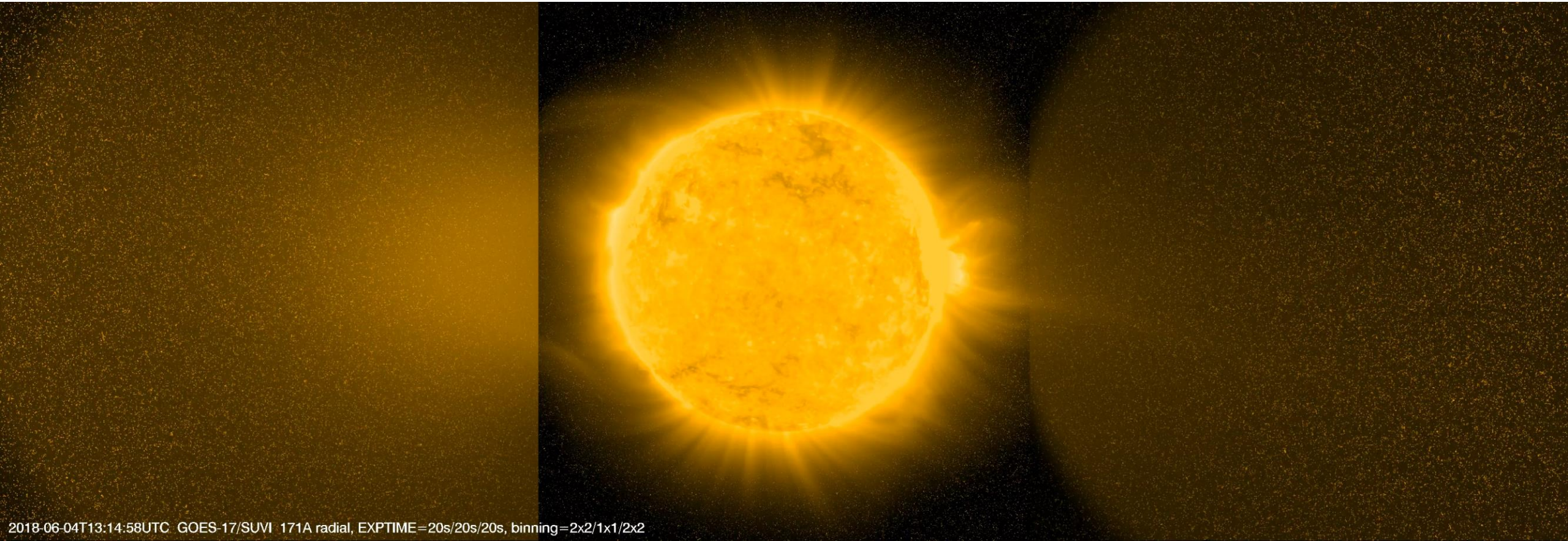
20180604_131523

GOES-17 Preliminary, Non-Operational Data
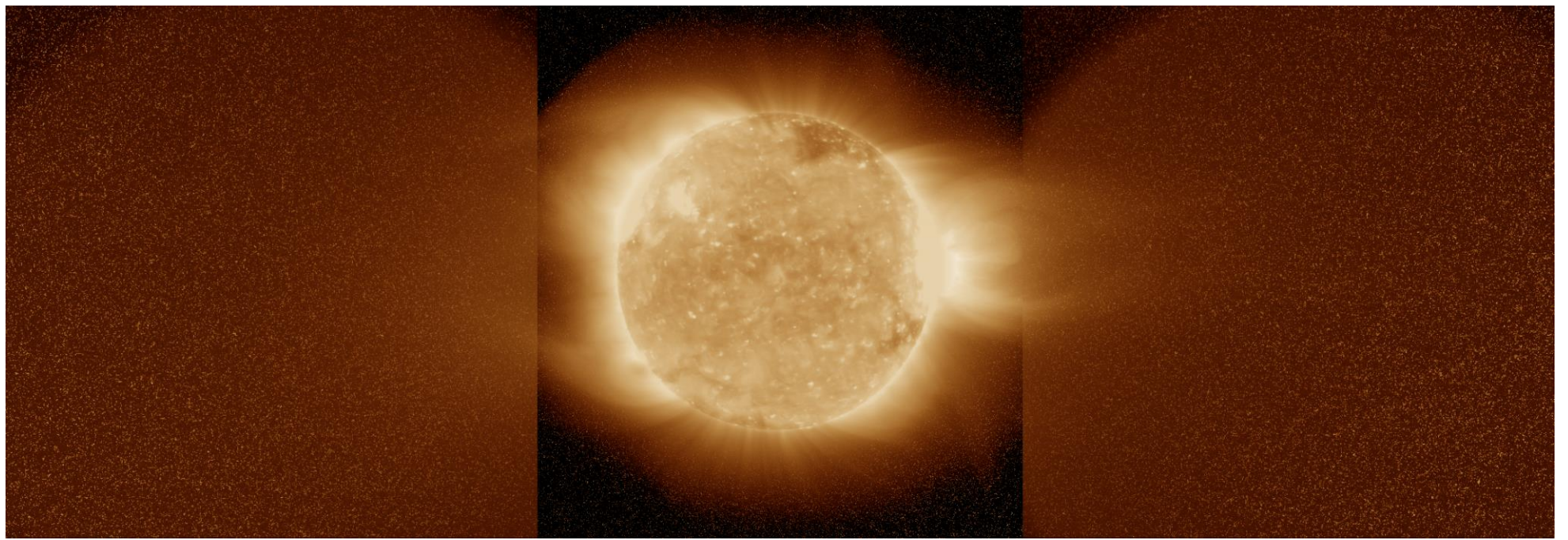
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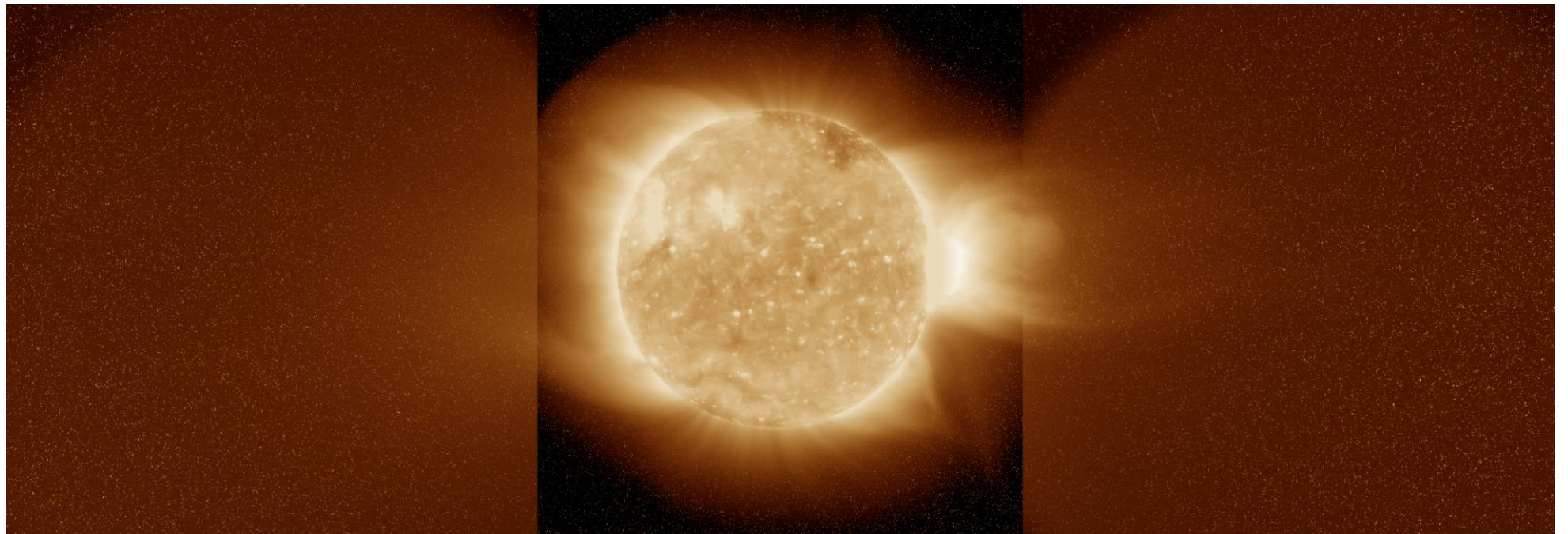
17.1 nm

2018-06-04T13:14:58UTC GOES-17/SUVI 171A radial, EXPTIME=20s/20s/20s, binning=2x2/1x1/2x2
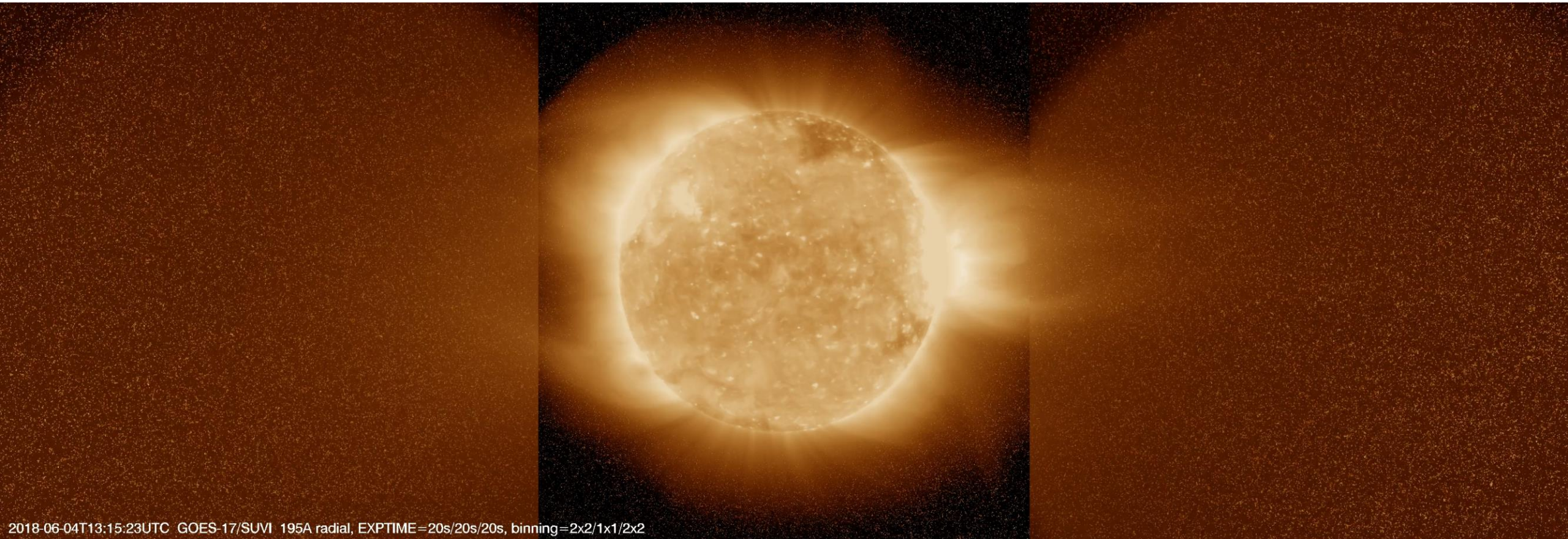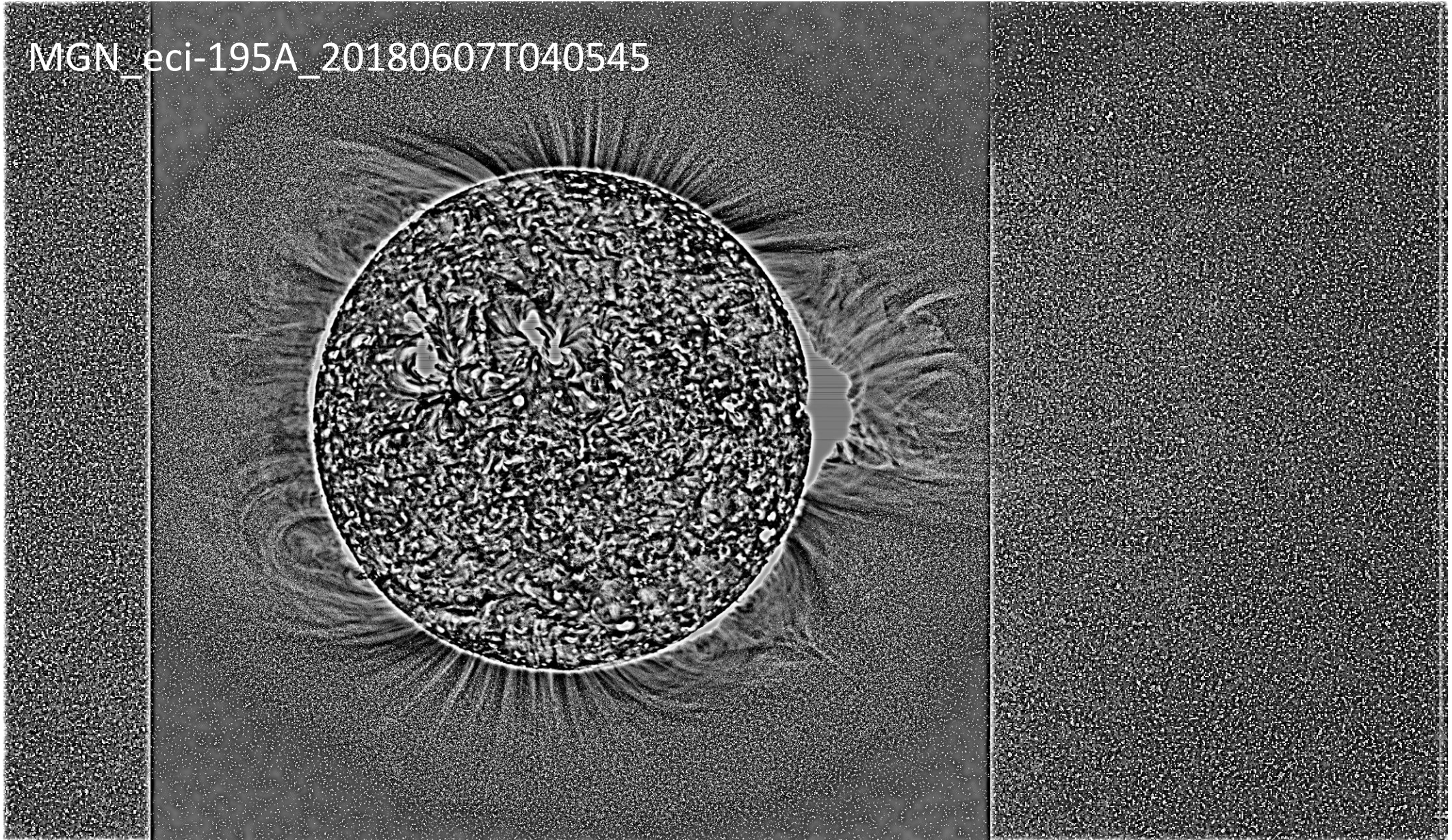
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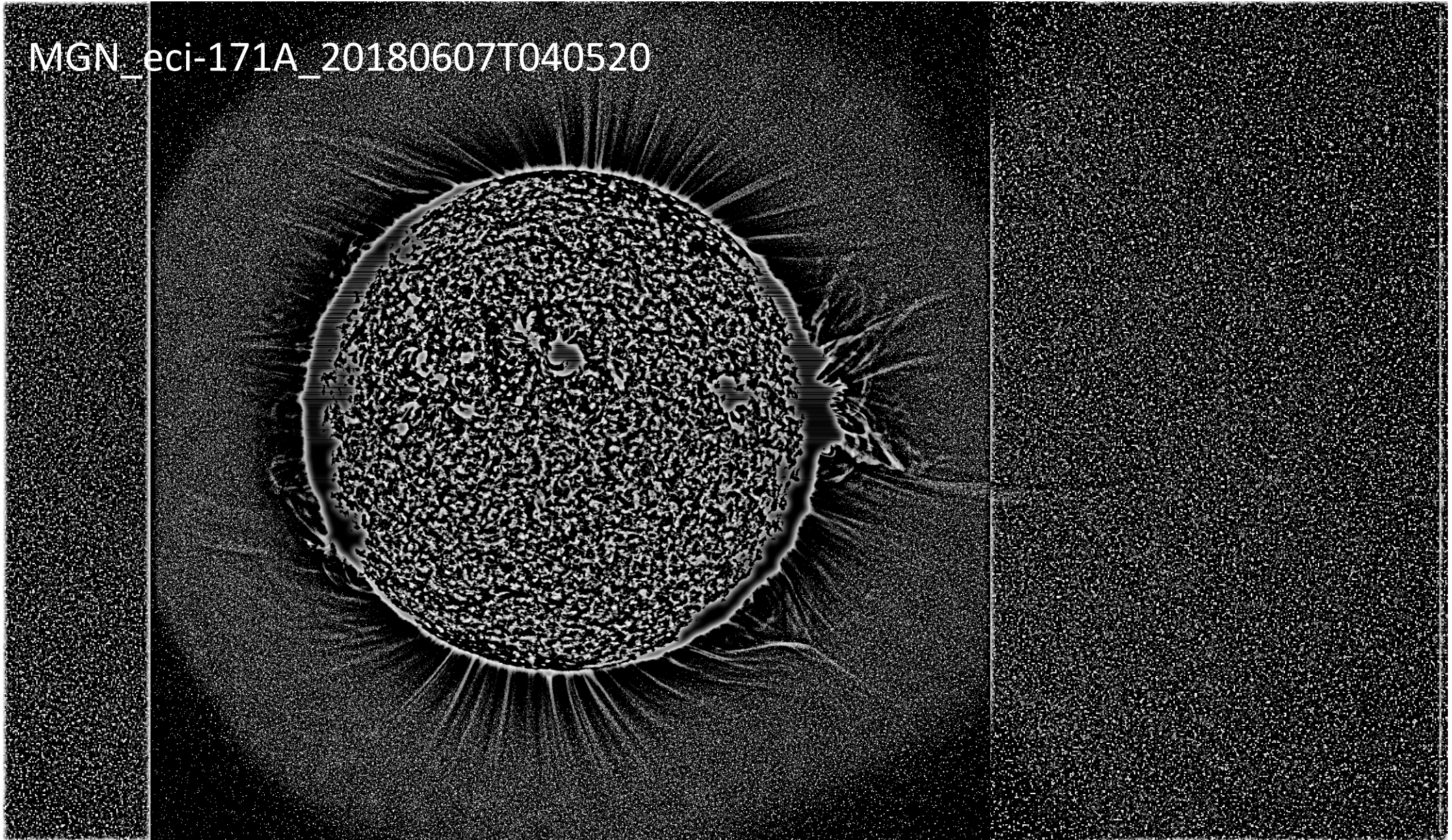
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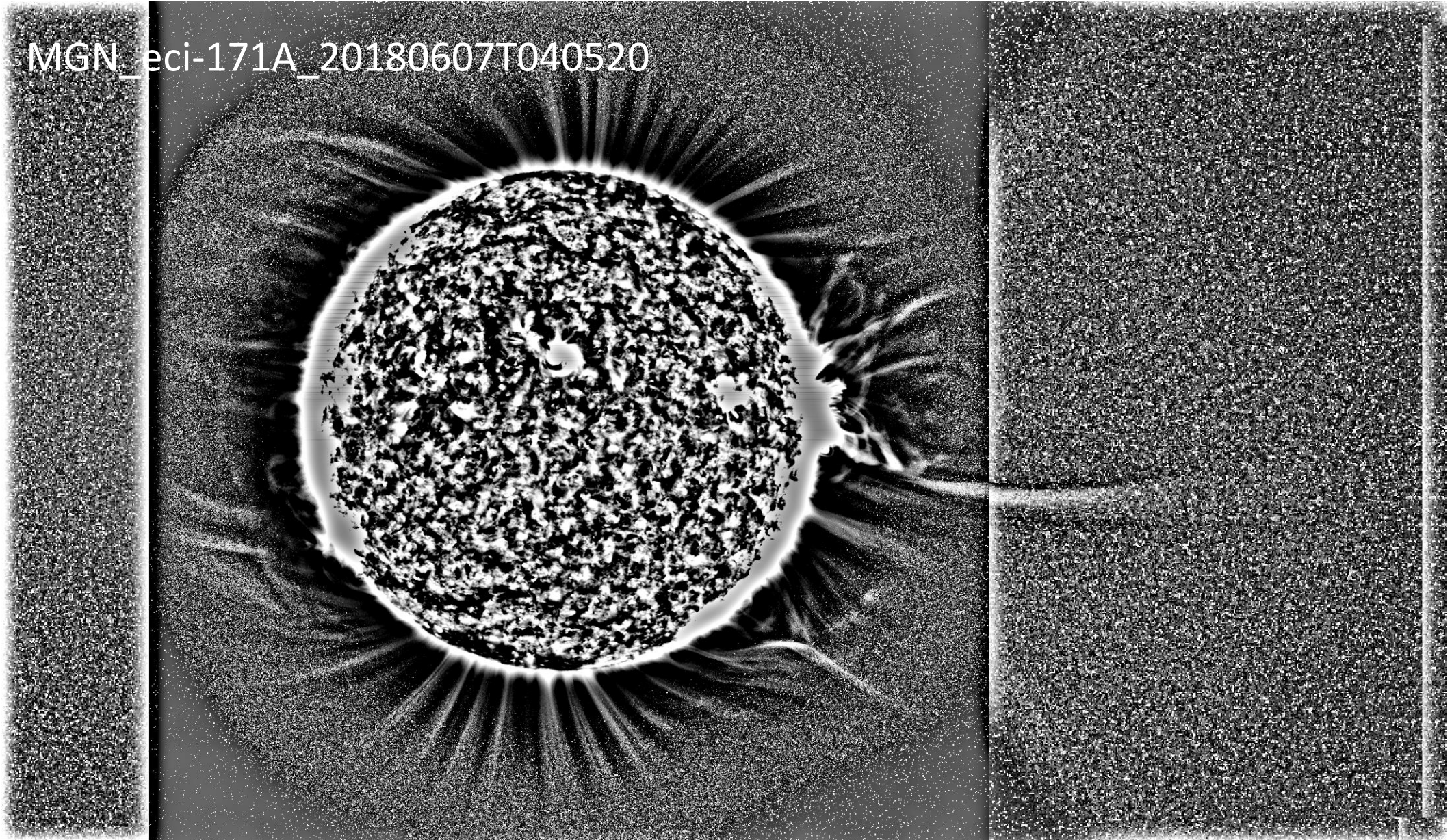
GOES-17 Preliminary, Non-Operational Data

2018-06-04T13:15:23UTC GOES-17/SUVI 195A radial, EXPTIME=20s/20s/20s, binning=2x2/1x1/2x2

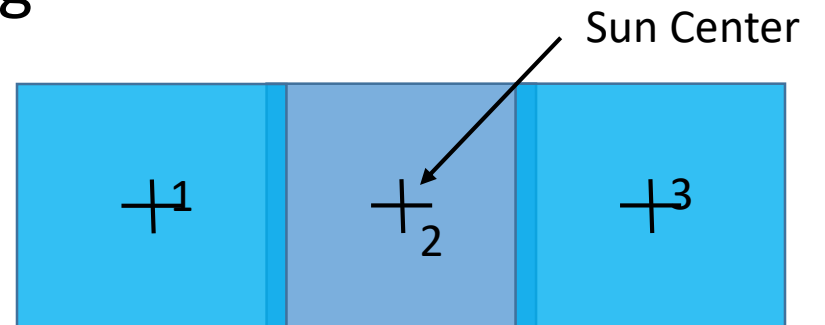MGN_eci-195A_20180607T040545
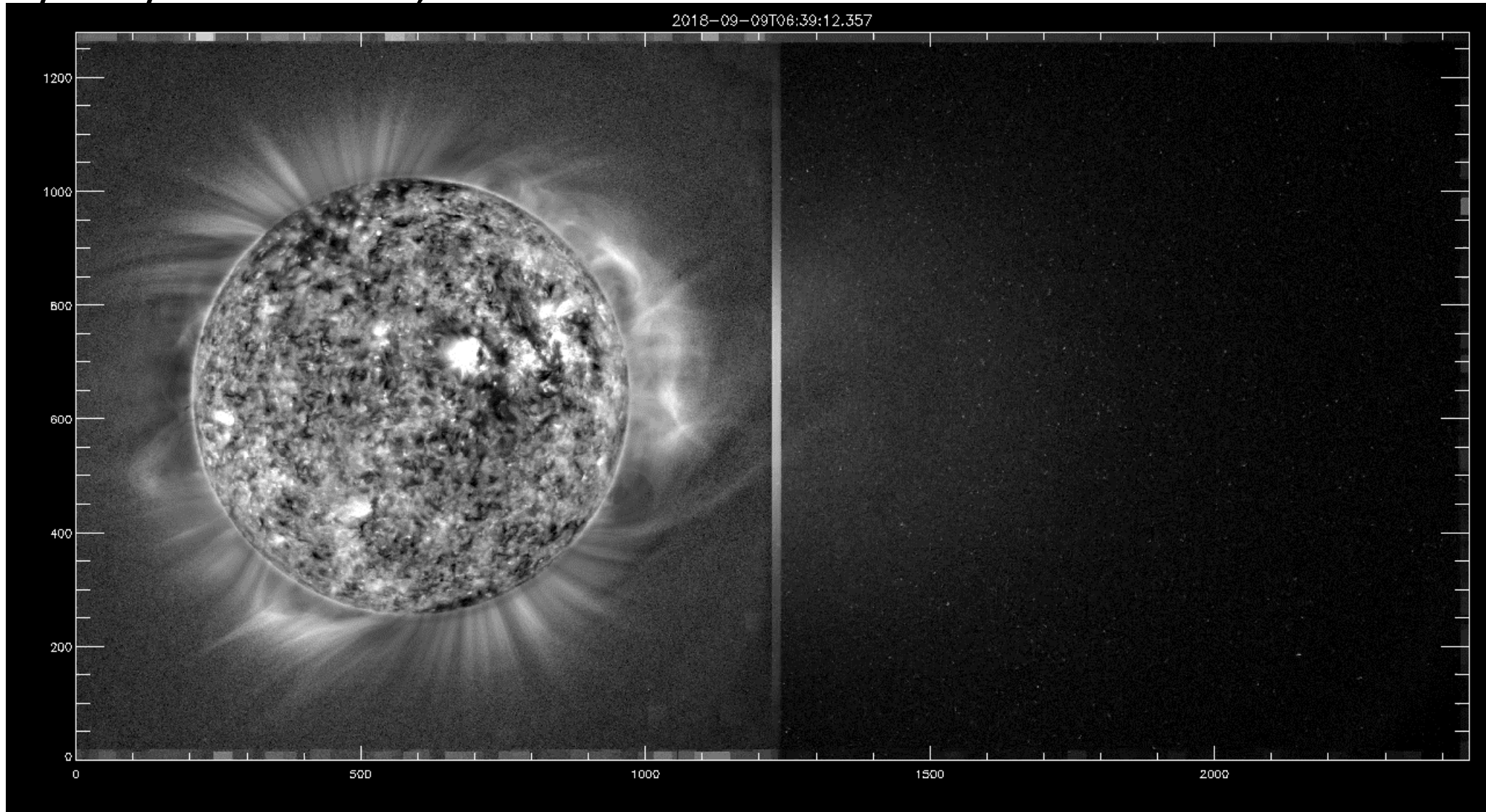
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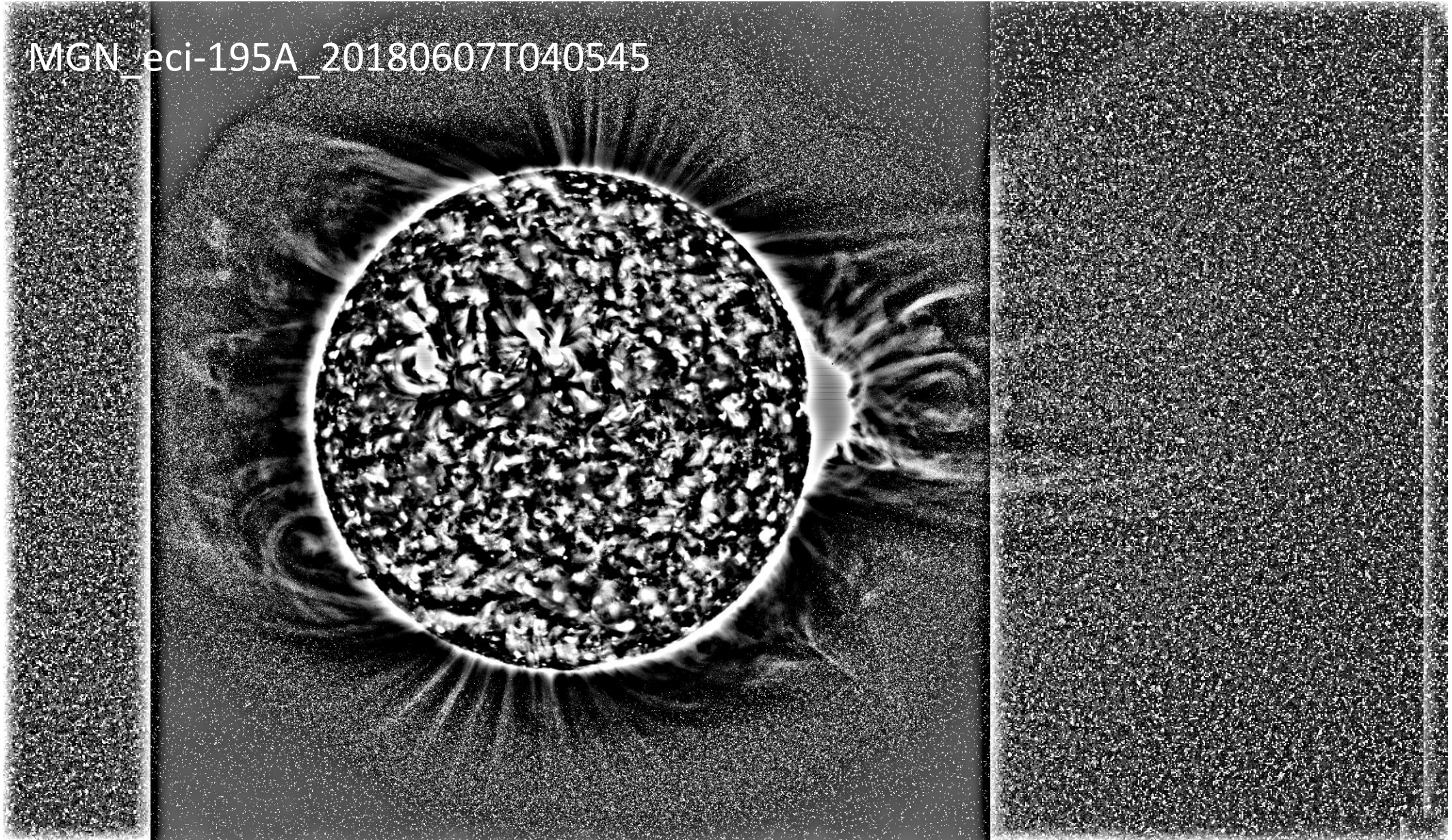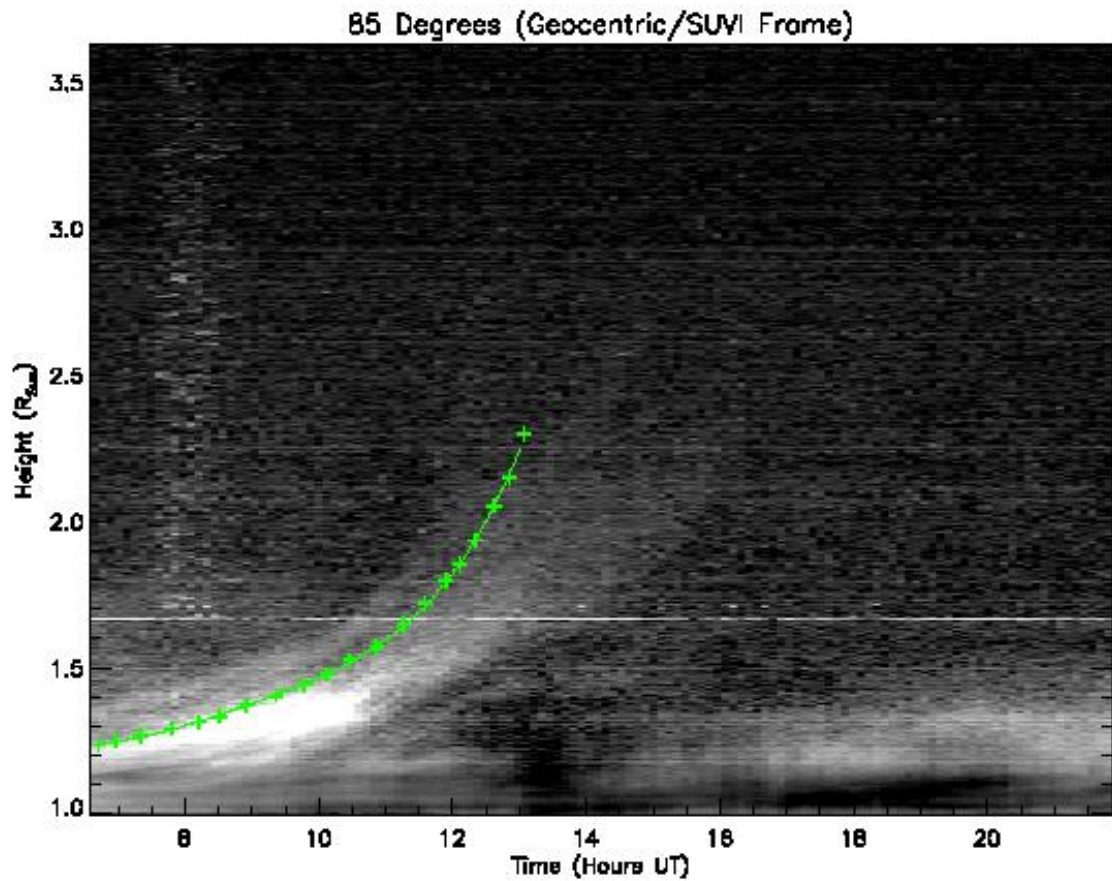
GOES-17, August 7 – September 13, 2018

- 3-panel options

- Exposure duration reduced w/on-chip binning

- Added 30.4nm

- ~5 week execution

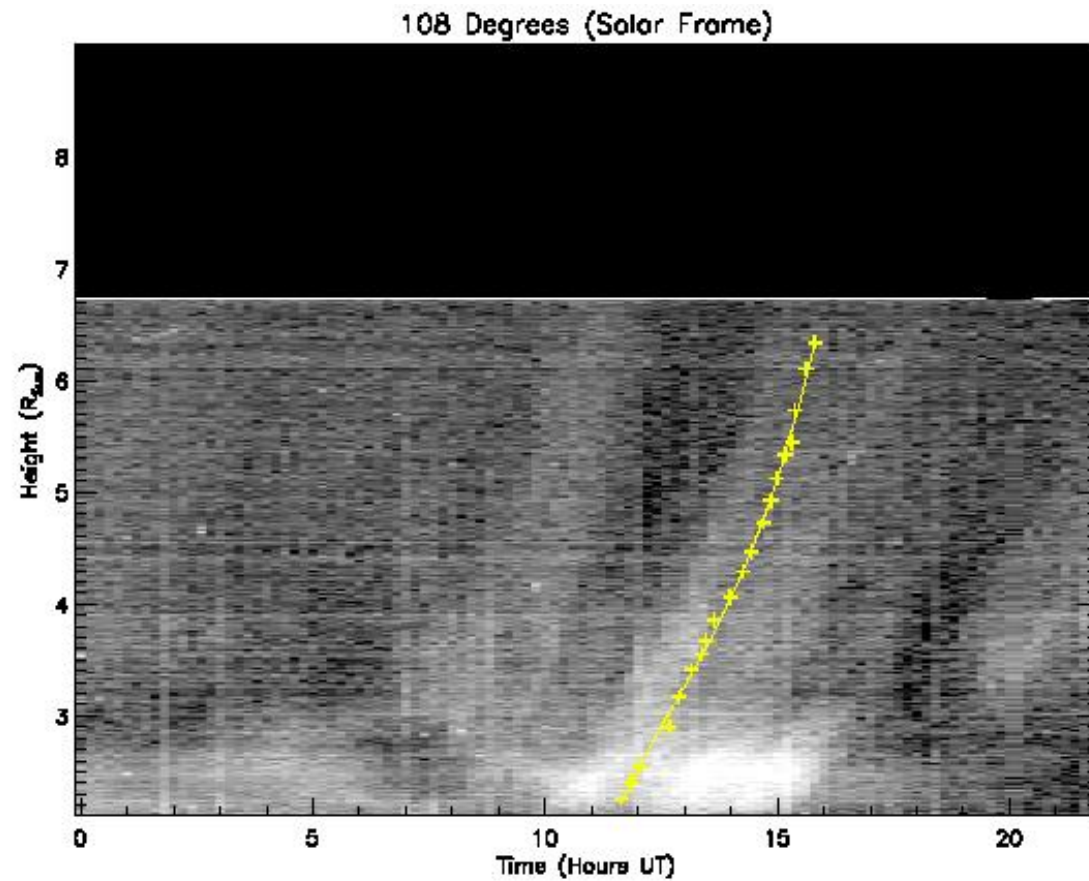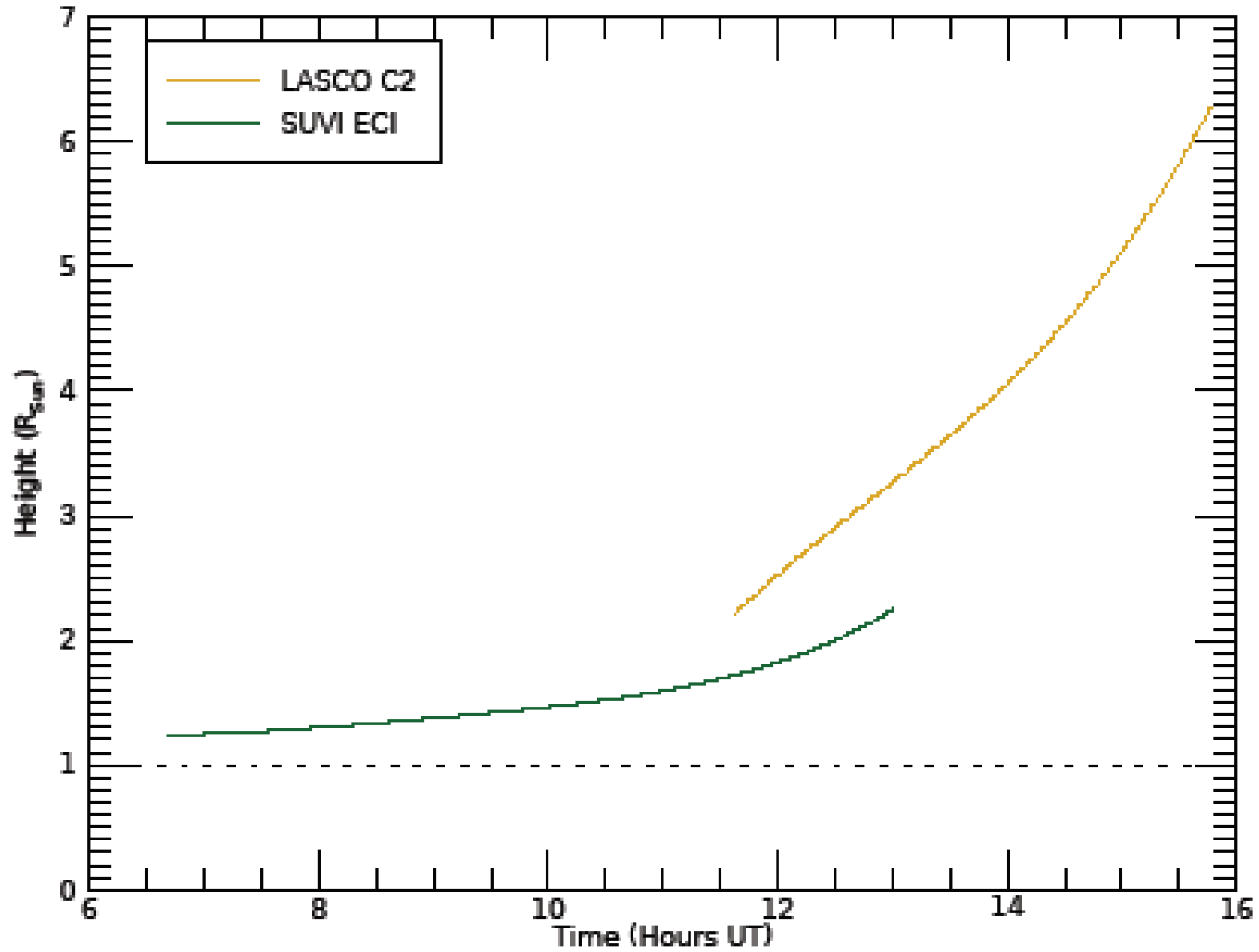- Objective: tracing CME from onset
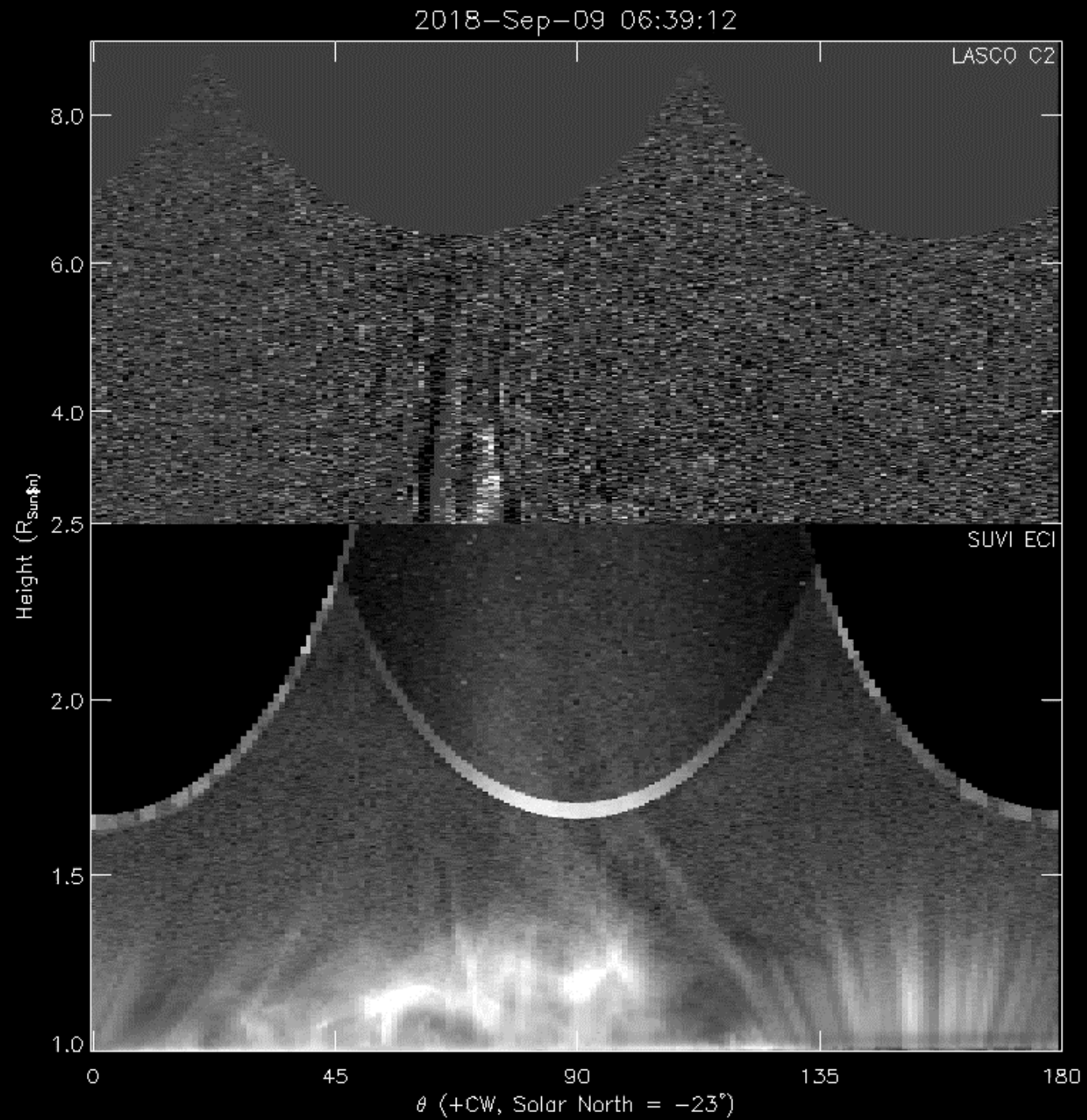
09/09/18 CME, 17.1 nm

SUVI

LASCO

2019 Sep 9 Eruption
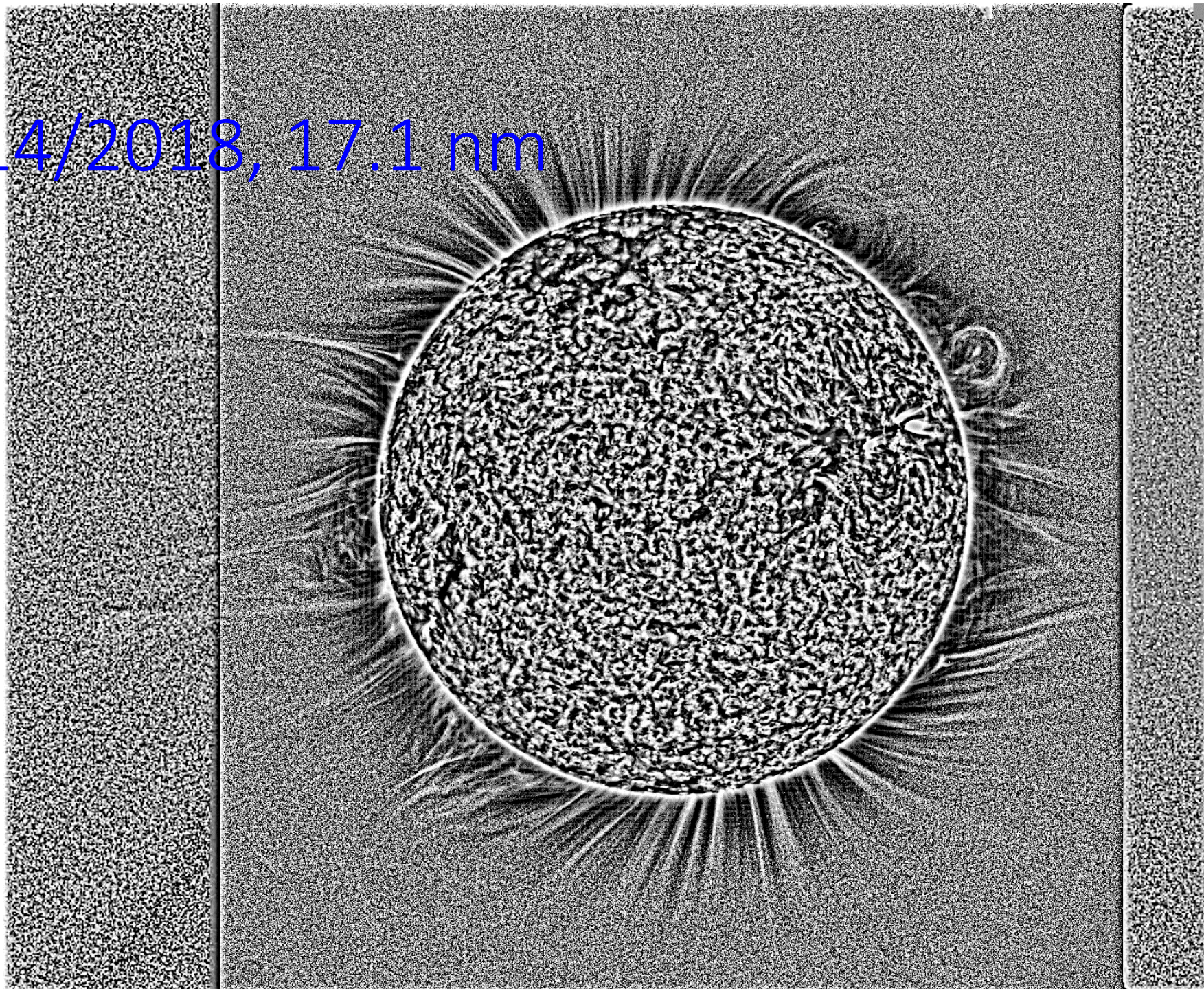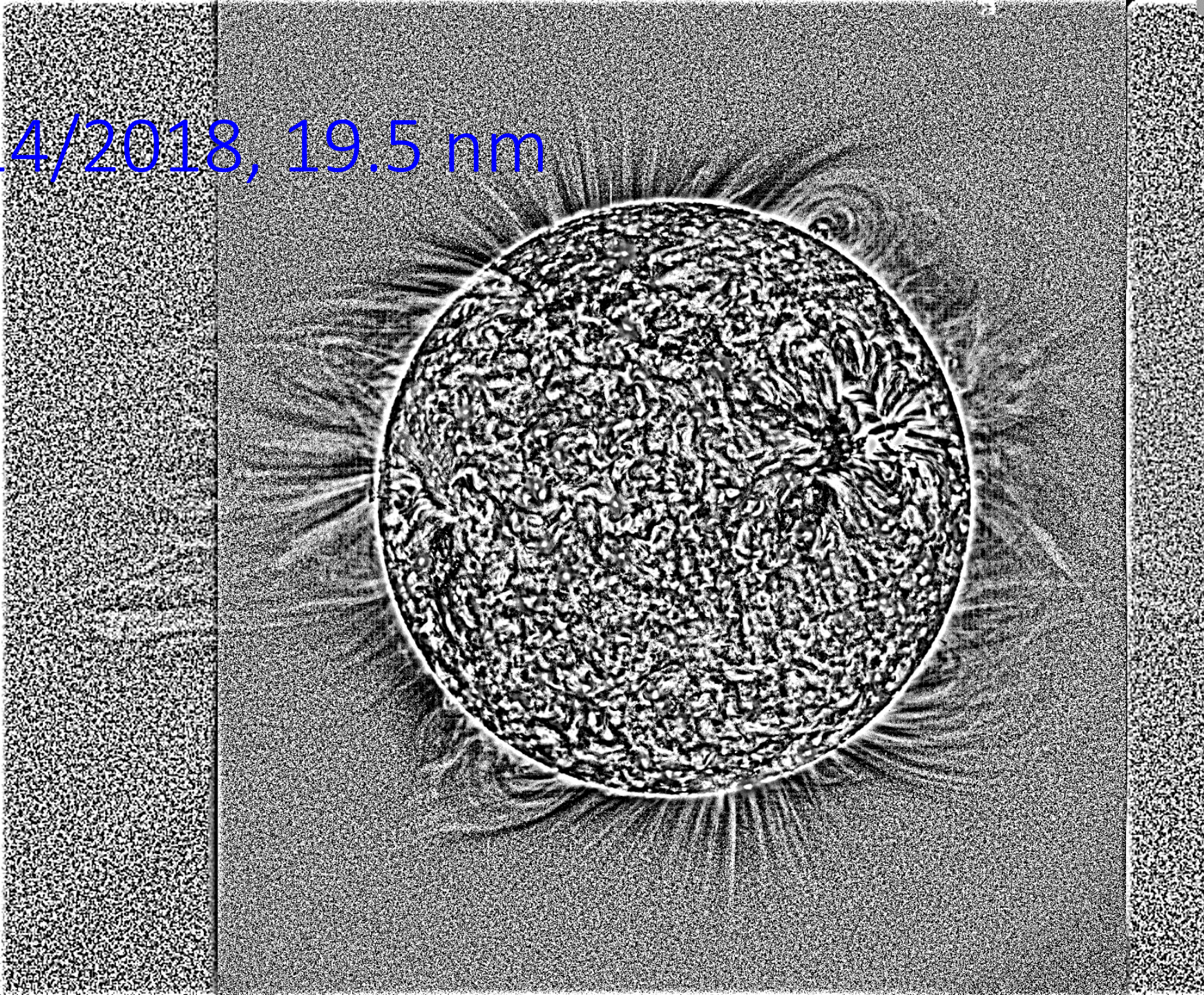
SUVI –
LASCO
connection

08/14/2018, 17.1 nm

08/14/2018, 19.5 nm

Near-Term

- Pursuing a plan to execute ECI for a few months in 2019
- NCEI developing ECI products

Recommendation for Long-Term

- A Wide FOV (6-8*Rsun across) EUV Imager!

- There will be a GOES-East and a GOES-West

- One of the SUVI's can operate in an ECI "mode"
  - Can provide data to support COSIE and SunCET missions

- GOES-U, scheduled for launch in 2024 will have a white light Coronagraph (CCOR)
  - Imaging area: 3.7-17*Rsun
  - SUVI on the same platform will observe the Sun nominally

- SUVI from the "other" GOES satellite function in the ECI mode

A Great Opportunity for GOES-R instruments to observe Solar corona from the solar limb to the outer edge of the FOV of CCOR