Evidence for a New Paradigm for Solar Coronal Jets Continued: Jets in an Active Regions

Alphonse C. Sterling, Ronald L. Moore,
David A. Falconer, Navdeep Panesar, et al.

(Supported by NASA's LWS program)

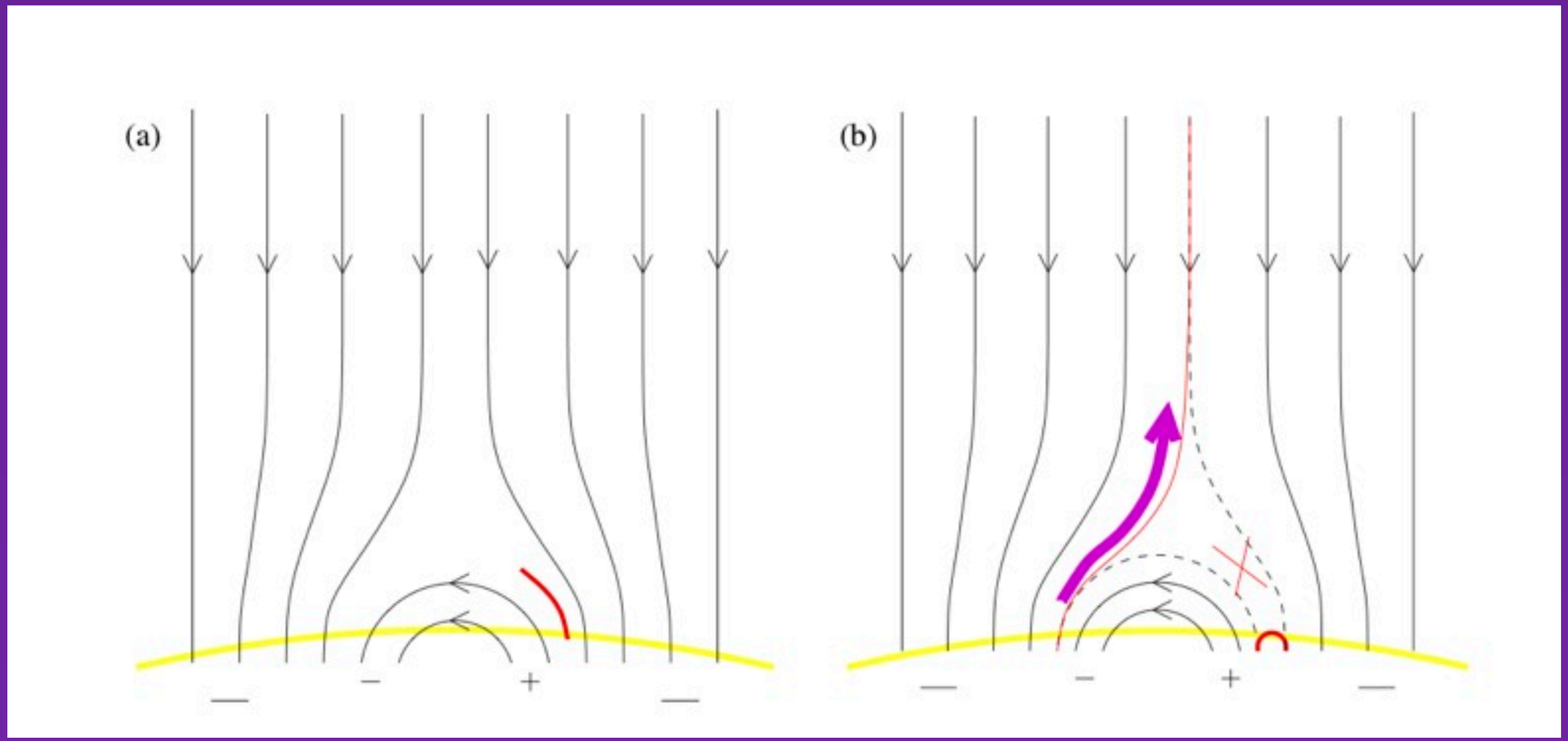
Introduction: Solar X-Ray Jets

- Observed since the Yohkoh days (Shibata et al. 1992; also Shimojo et al. 1996, etc.)
- Yohkoh (SXT) saw them mainly in active regions.
- Hinode/XRT found them to be plentiful in polar coronal holes (Cirtain et al. 2007; also Savcheva et al. 2007, etc.)
- In polar coronal holes: size~50,000 km x 8000 km; rate ~60/day (Savcheva et al. 2007).
- Often have a "jet bright point" on one side ofthe jet's base.
- Often-discussed mechanism is based on emerging flux ("emerging-flux model"). (Shibata et al. 1992; see also Moore et al. 2010.)

Certain et al. (2007)

Hinode/XRT

Emerging-Flux Model for (X-Ray) Jets



Supported by numerical simulations: Yokoyama & Shibata (1995), Nishizuka et al. (2008), Archontis et al. (2013), Moreno-Insertis et al. (2013), Fang et al. (2014), etc.

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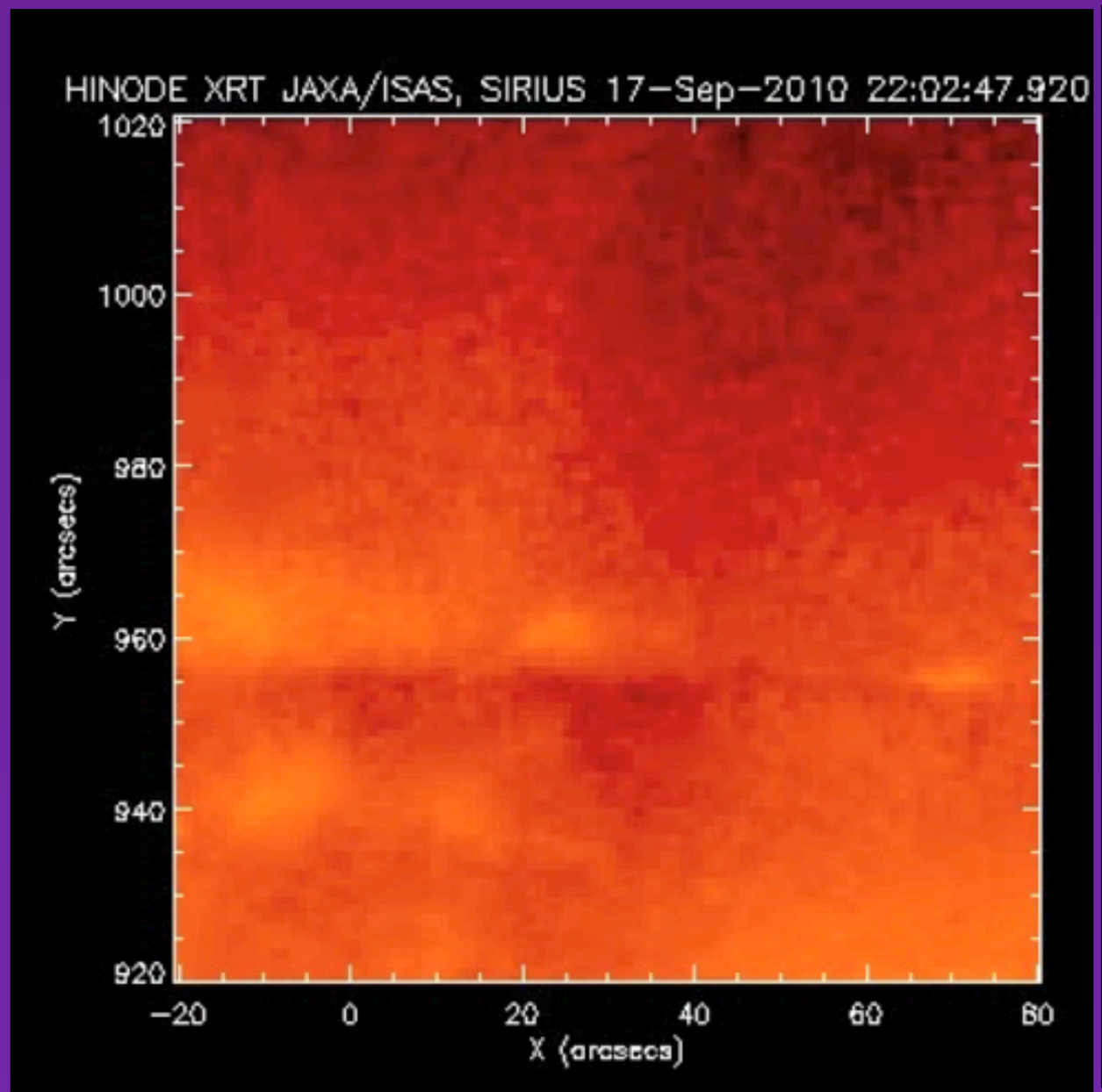
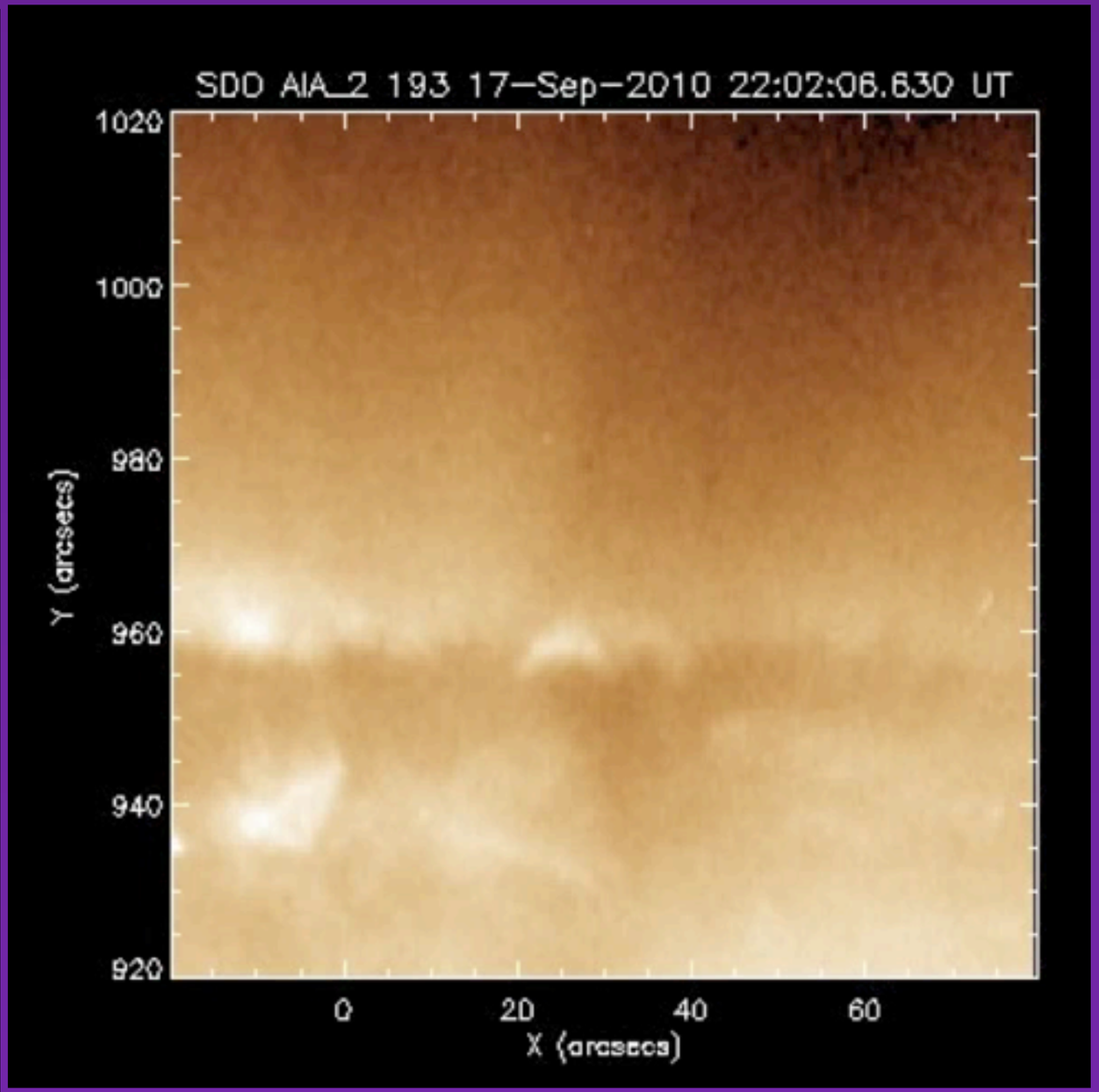
XRT



AIA 193



Sterling et al. (2015) Event 18

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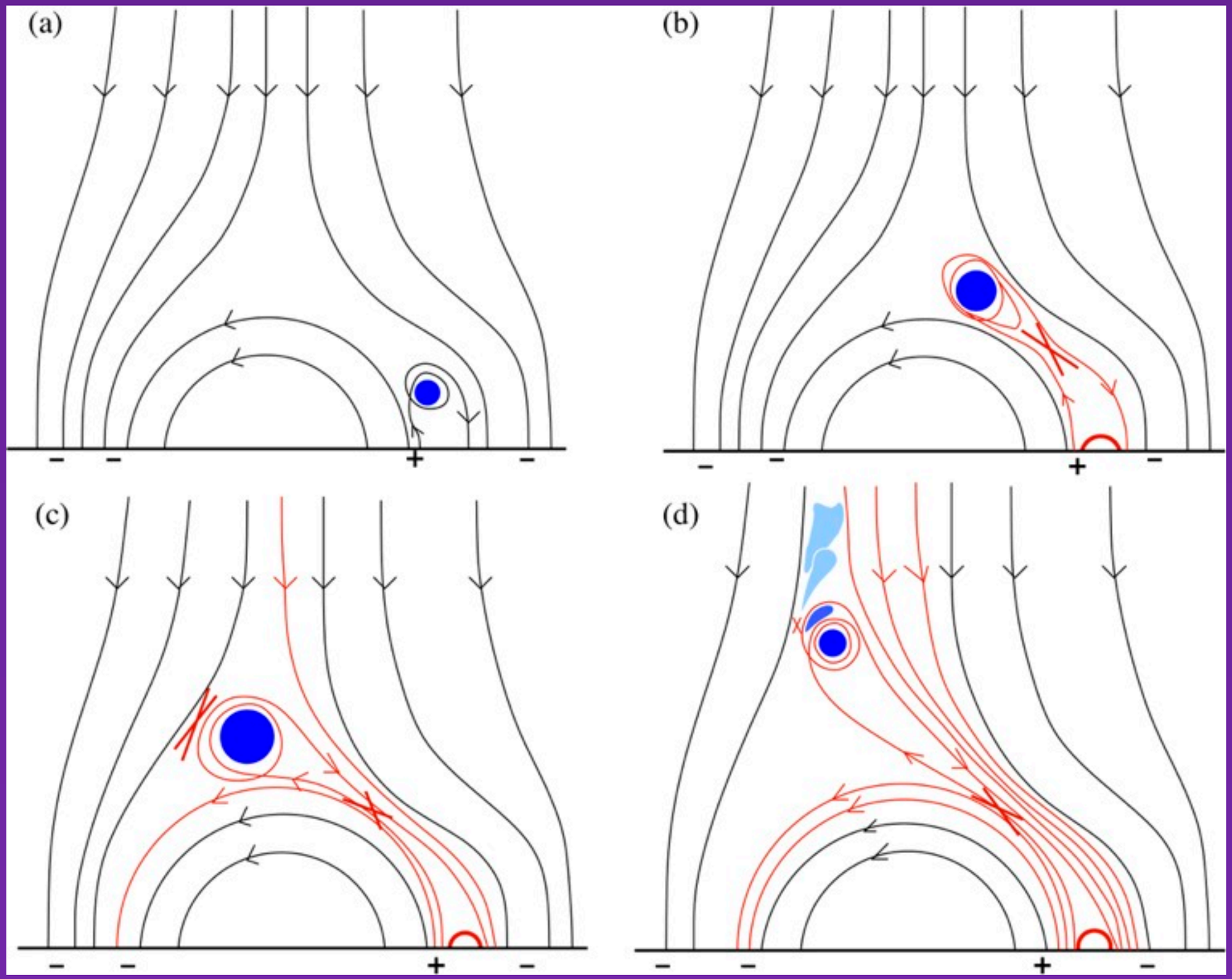
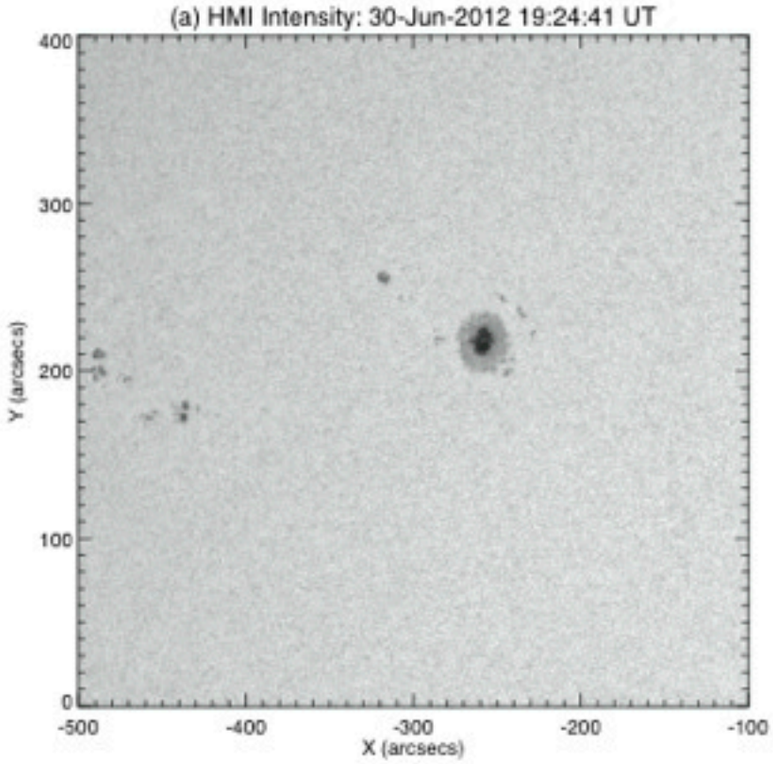


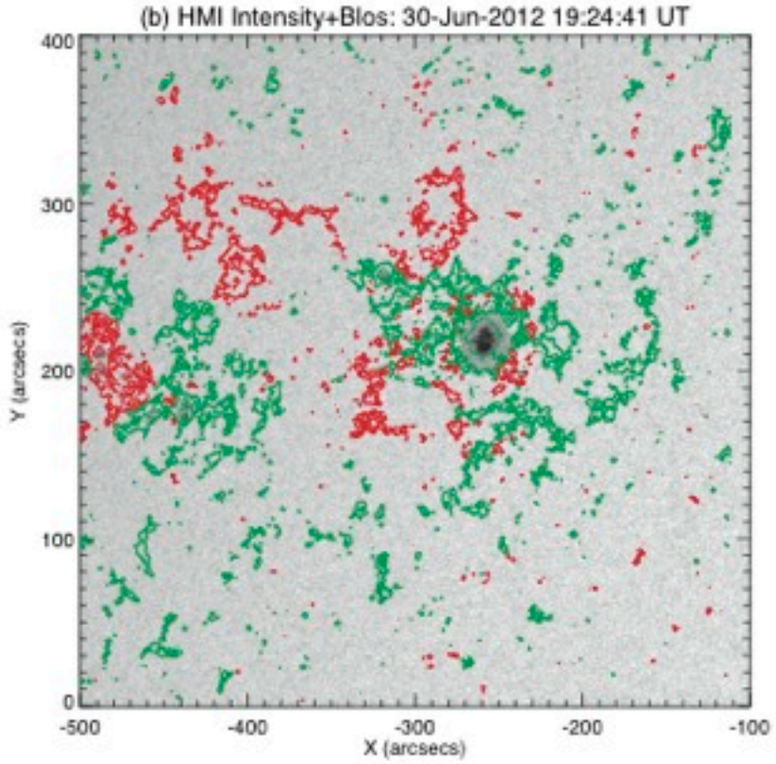
Sterling et al. (2015)

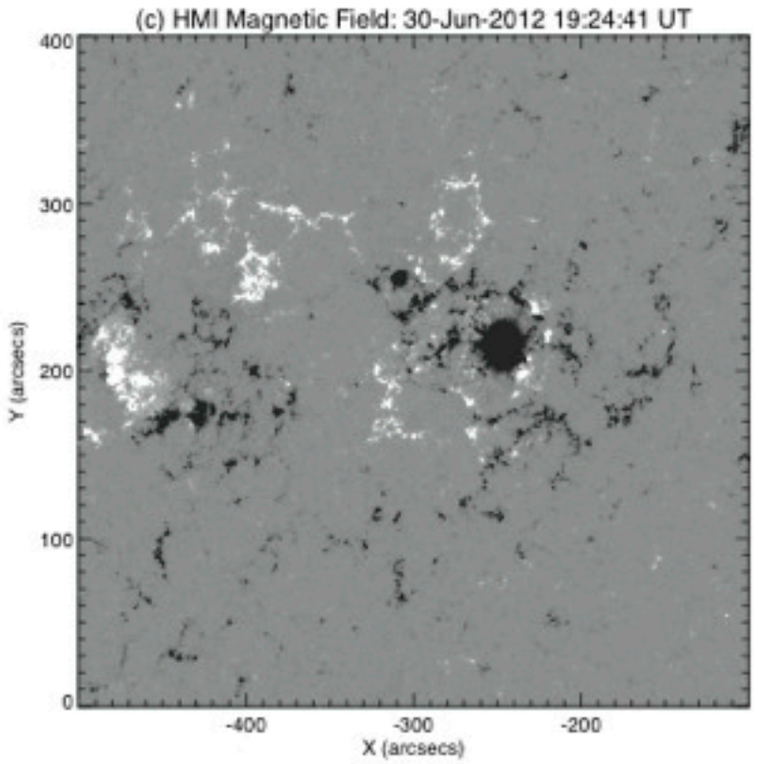
Sterling, Moore, Falconer, & Adams (2015):

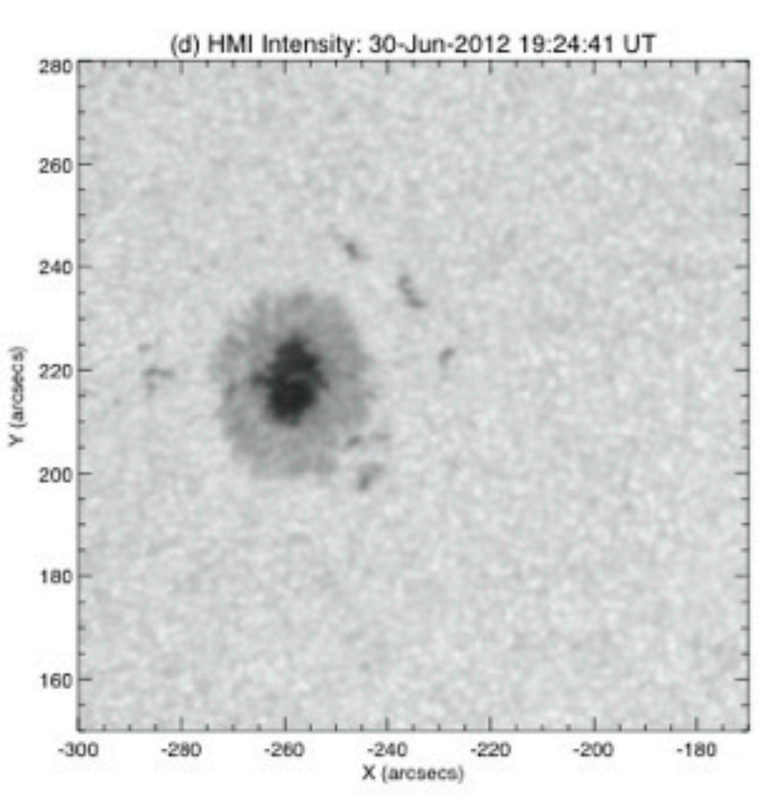
- Studied 20 Hinode/XRT X-ray jets ***in polar coronal holes*** during SDO period.
- These jets were randomly selected during a previous investigation (Moore et al. 2013).
- Examined at least AIA 304, 171, 193, and 211Å channels (~0.05, 0.6, 1.6, and 2.0 MK, respectively).
- Found all events to either show or be consistent with minifilament eruptions originating from the jet bright point location, and leading to the jets. (Also, e.g., Nisticò et al. 2009, Hong et al. 2010, Raouafi et al. 2010, Shen et al. 2012, Adams et al. 2014.)
- Therefore, the minifilament eruptions are scaled-down versions of "typical" filament eruptions, where the jet bright points correspond to flare arcades.

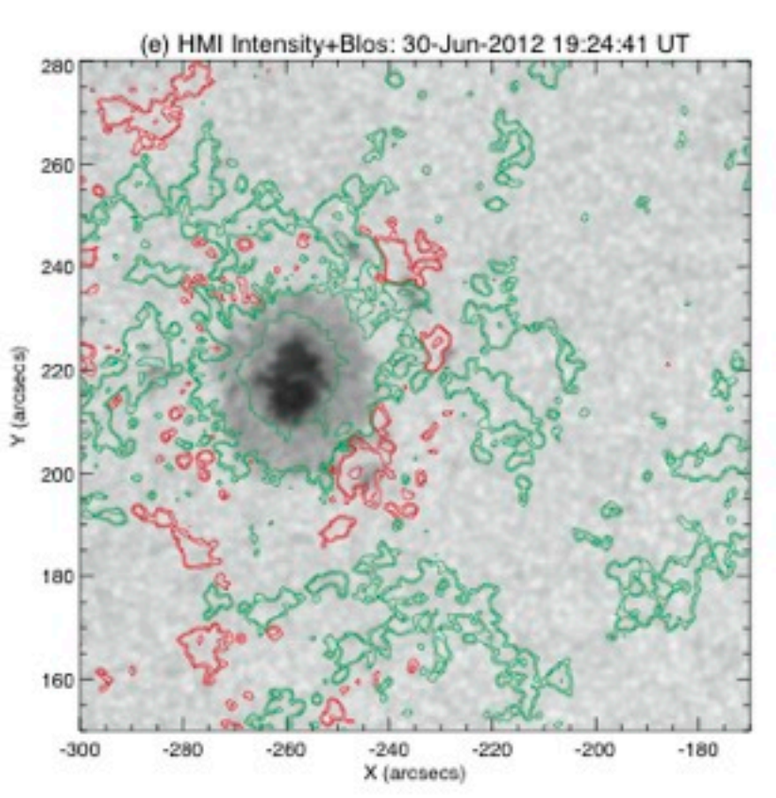
- Coronal jets are also common ***in active regions***. Do they also originate from minifilament eruptions? We address here with AIA and HMI observations of jets in one active region. (Hinode was observing elsewhere.)

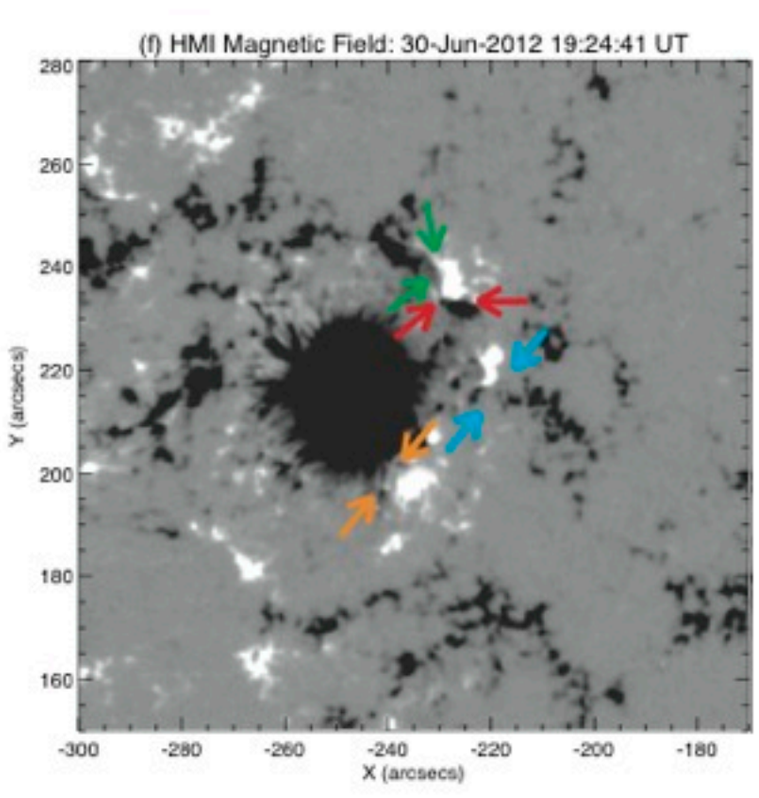












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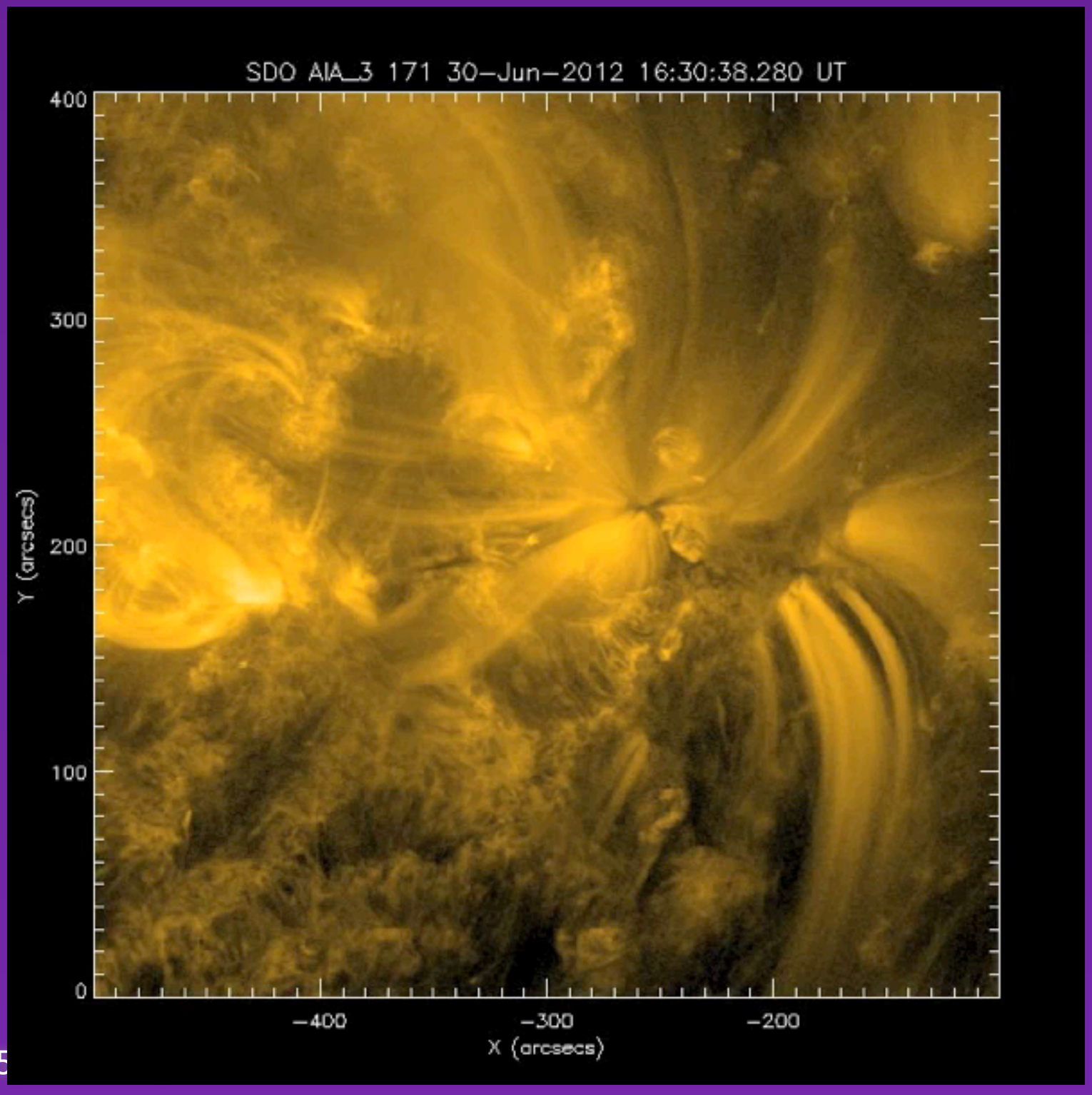
AIA 171



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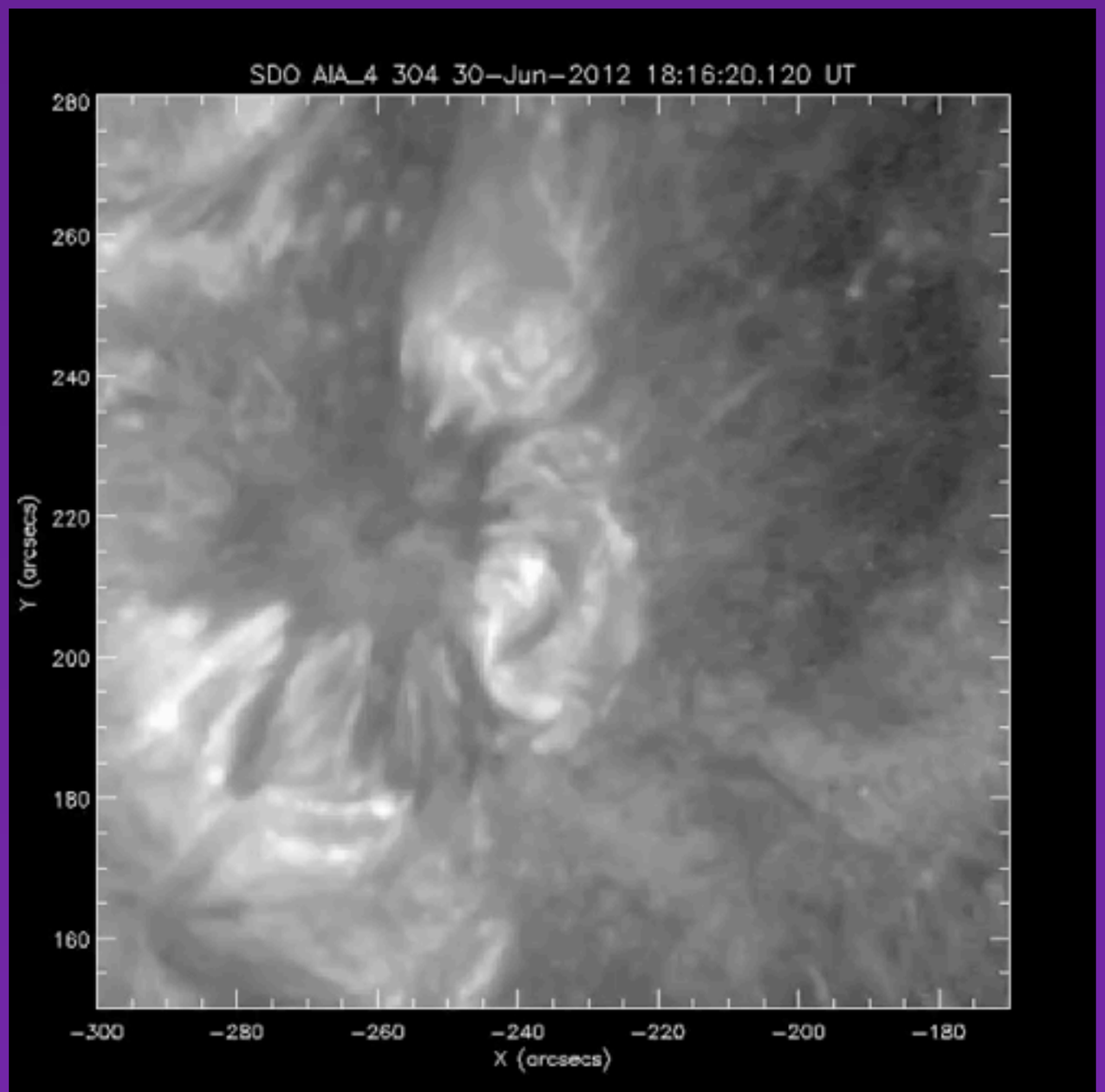

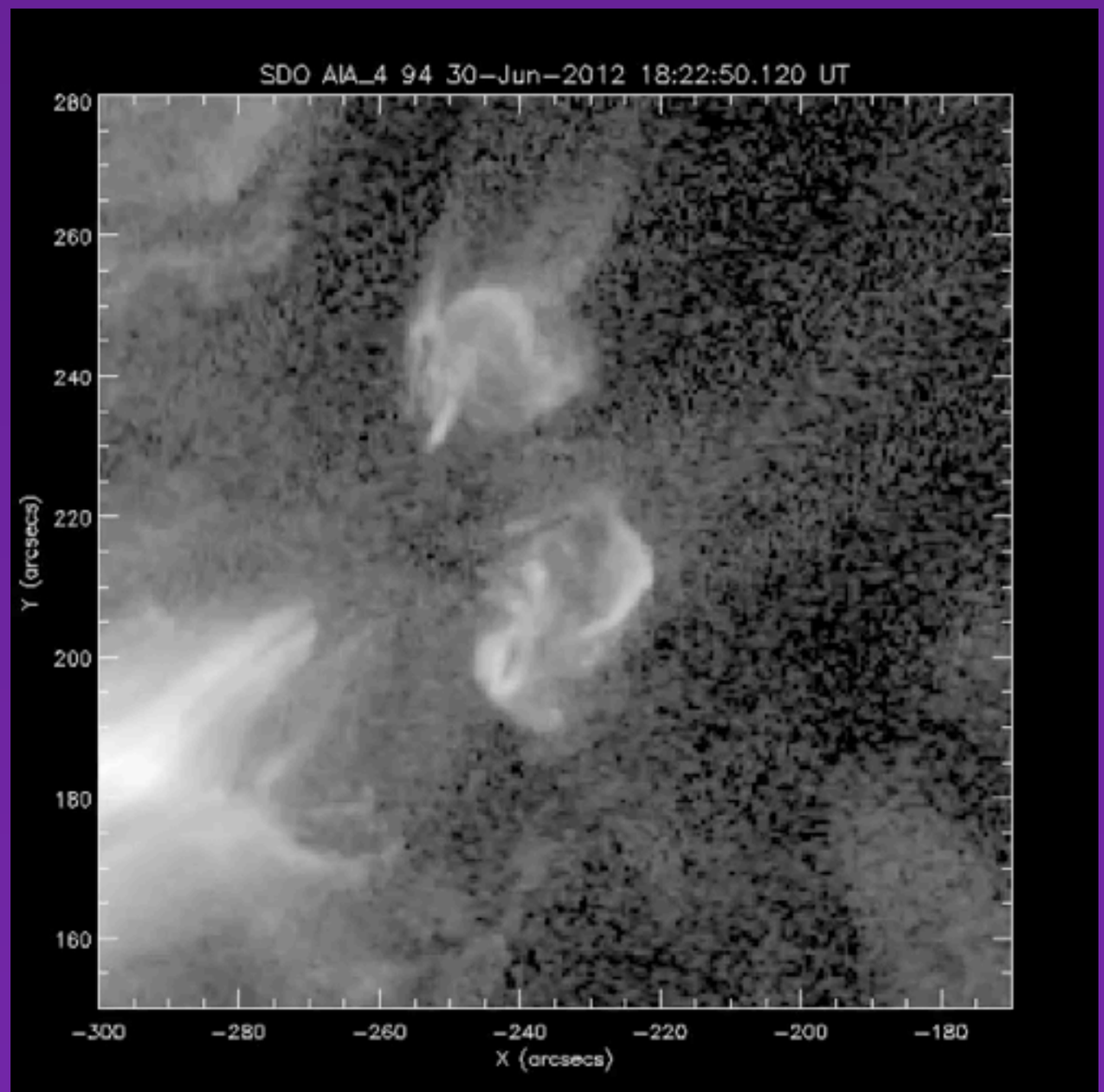

AIA 304

AIA 94

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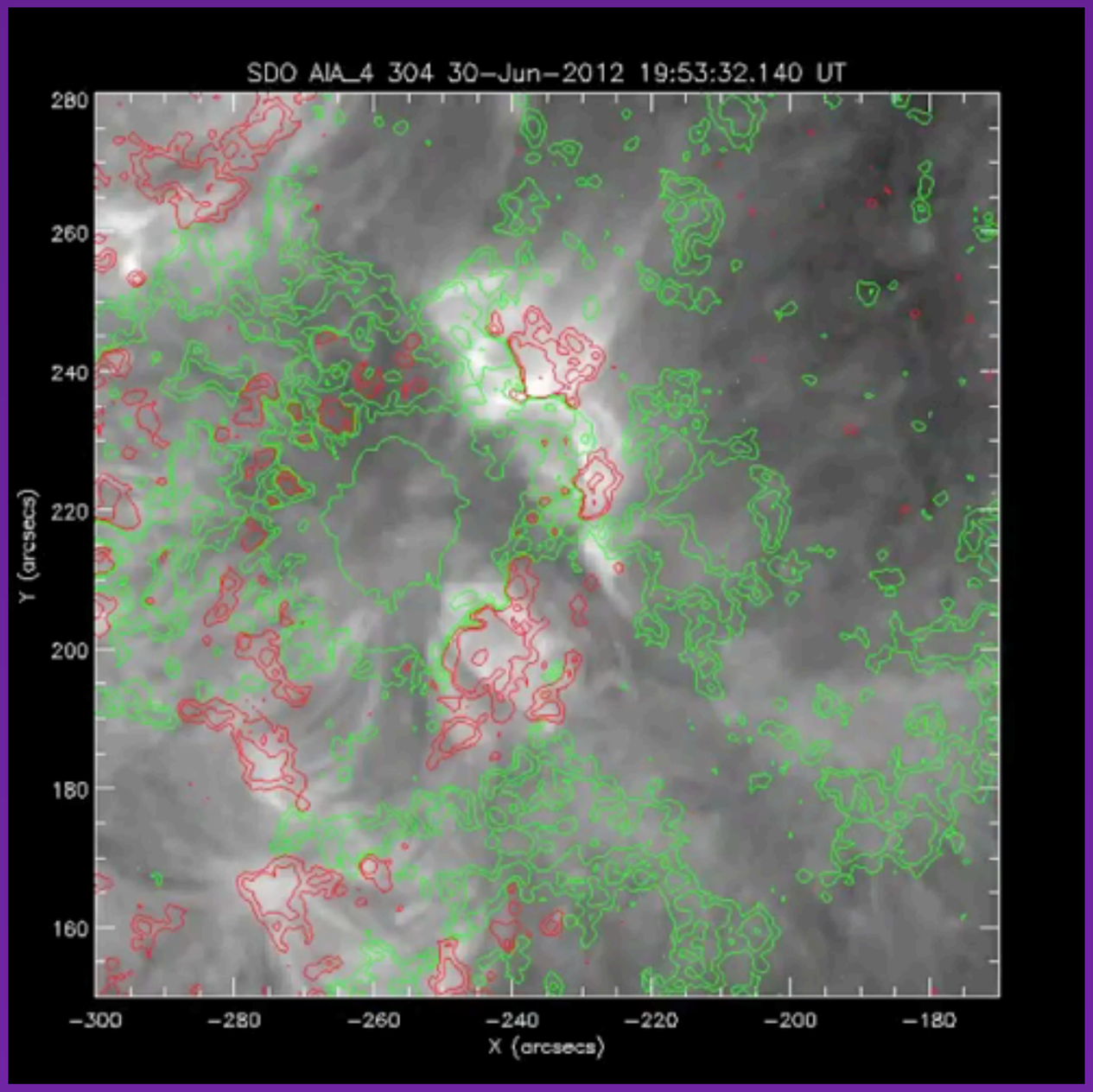
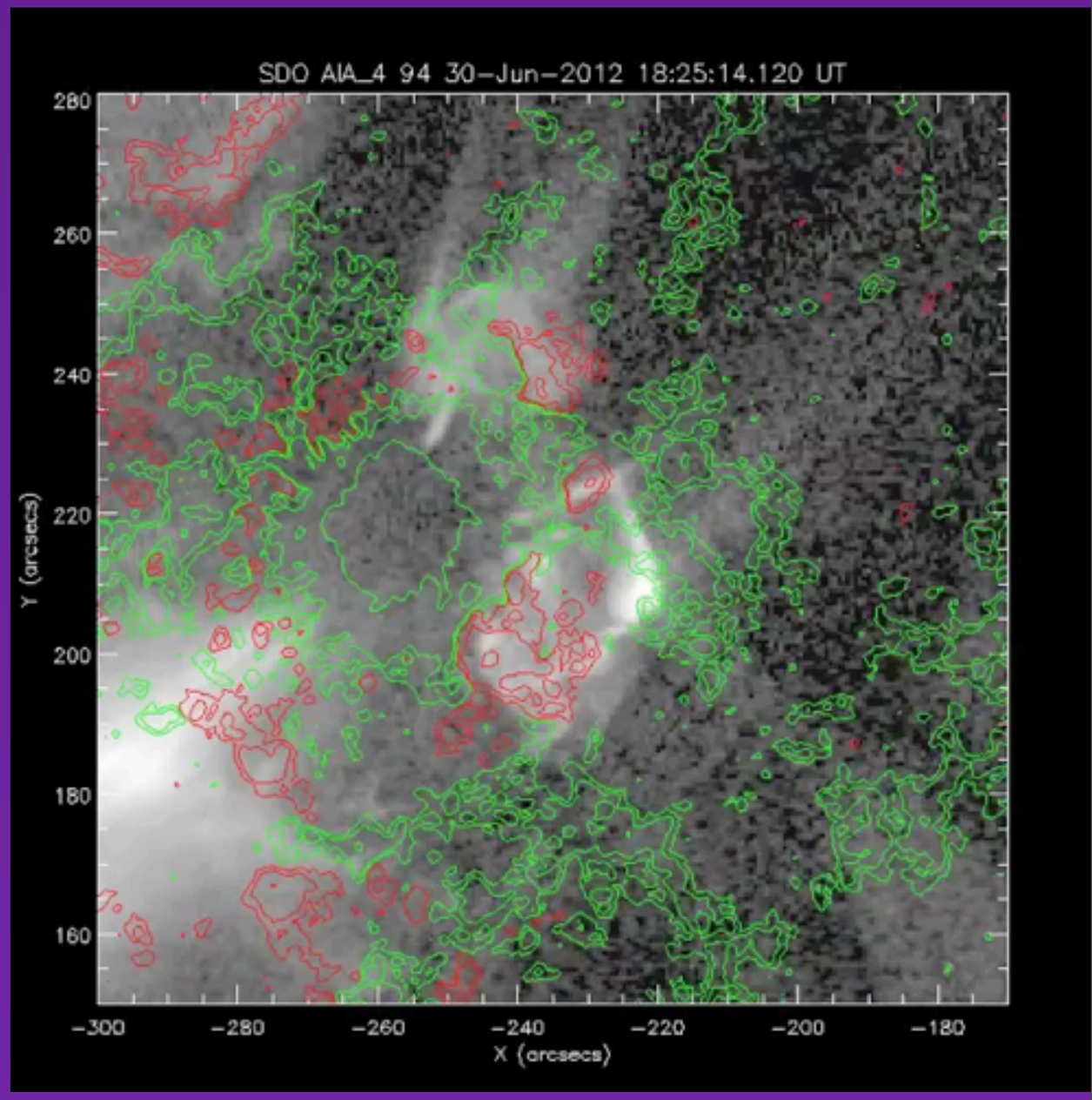
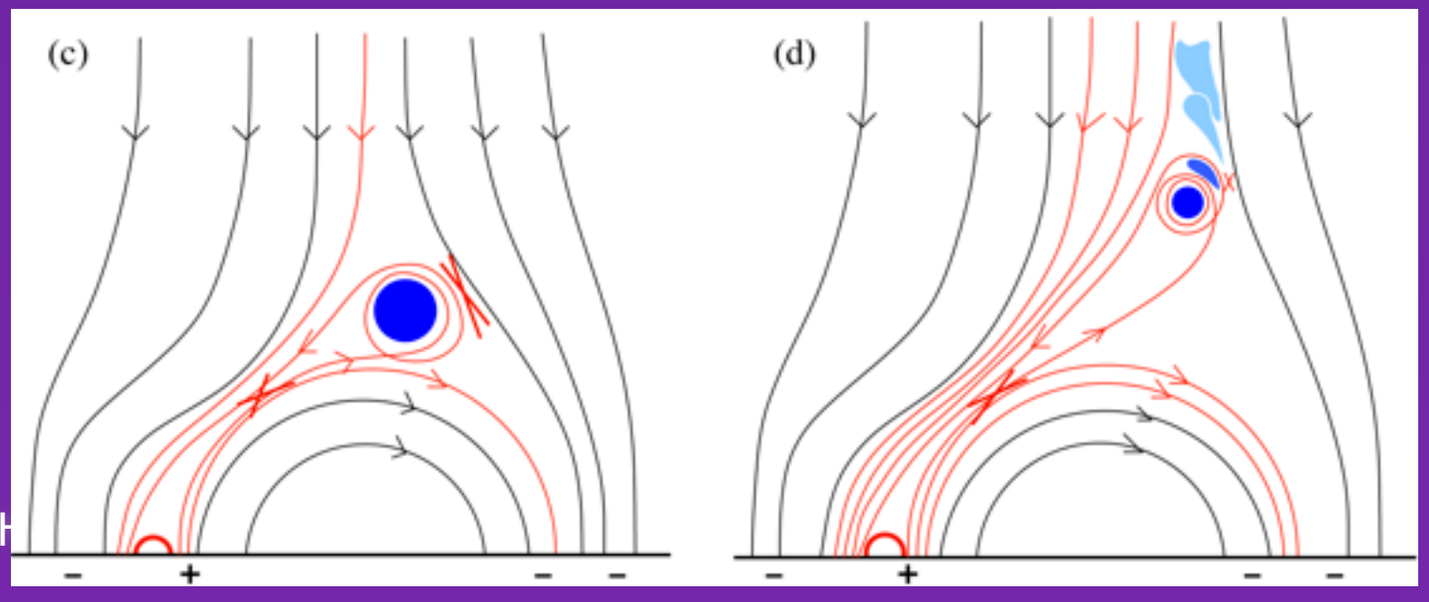




AIA 304

AIA 94



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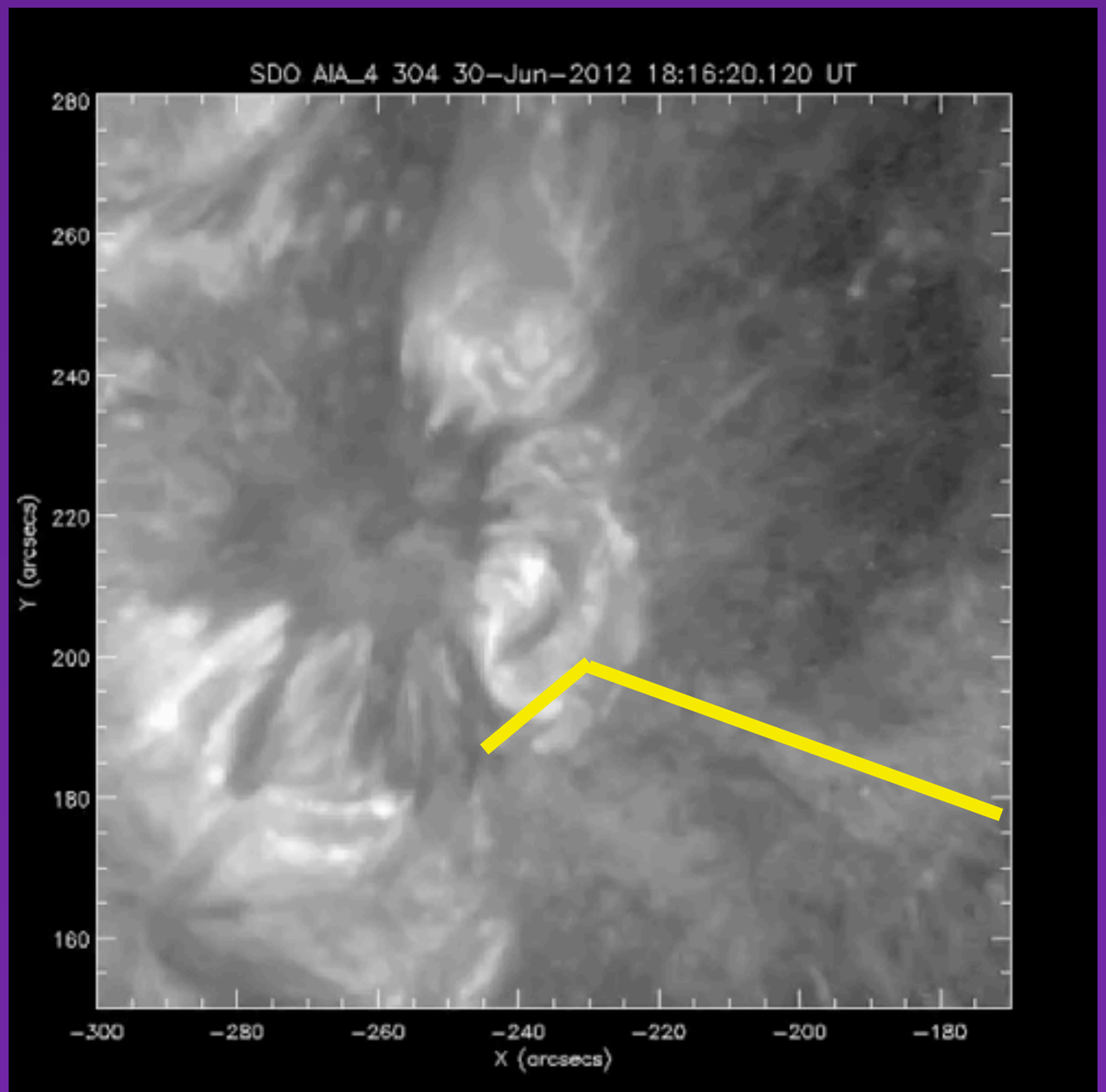

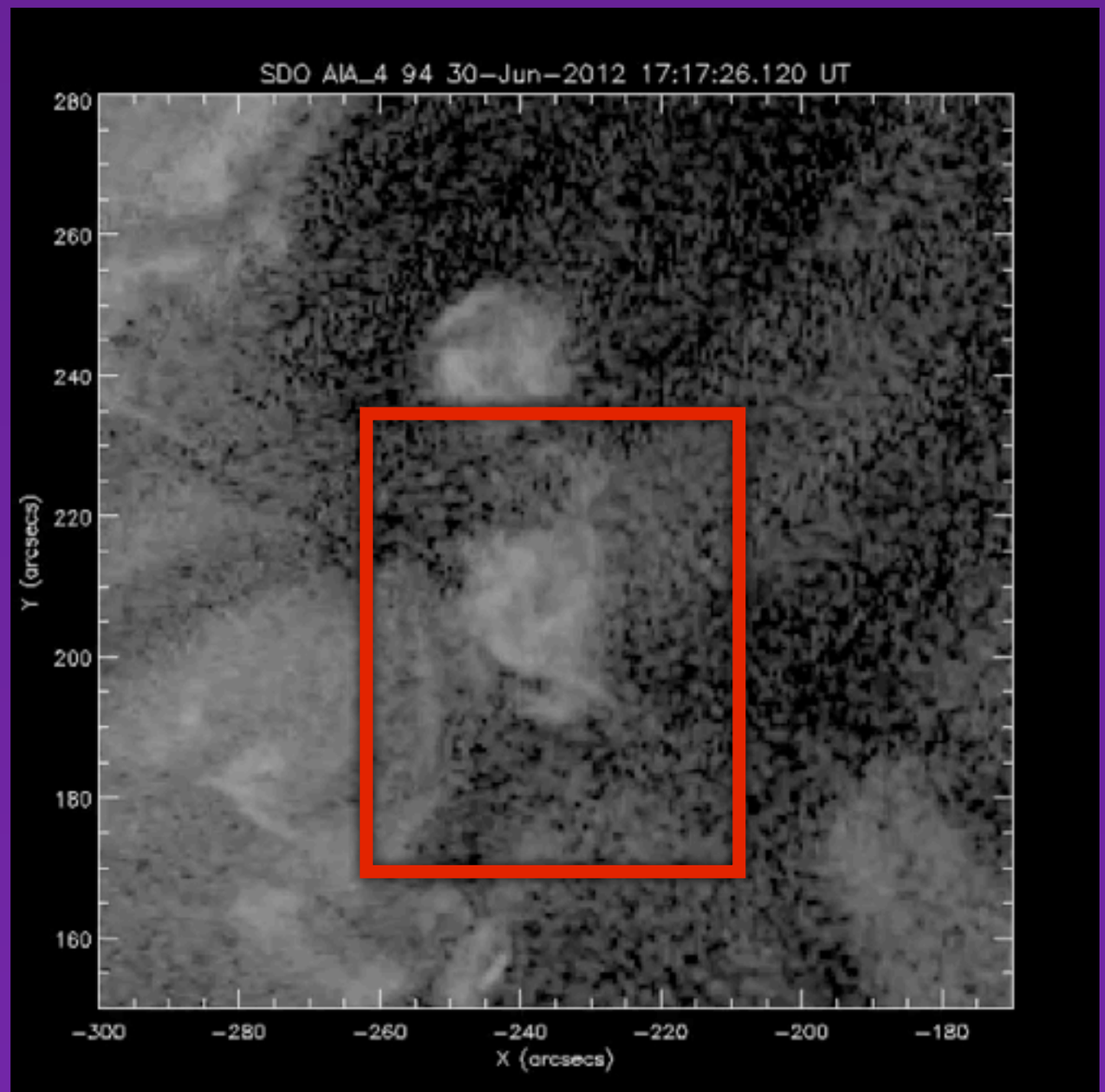

AIA 304

AIA 94

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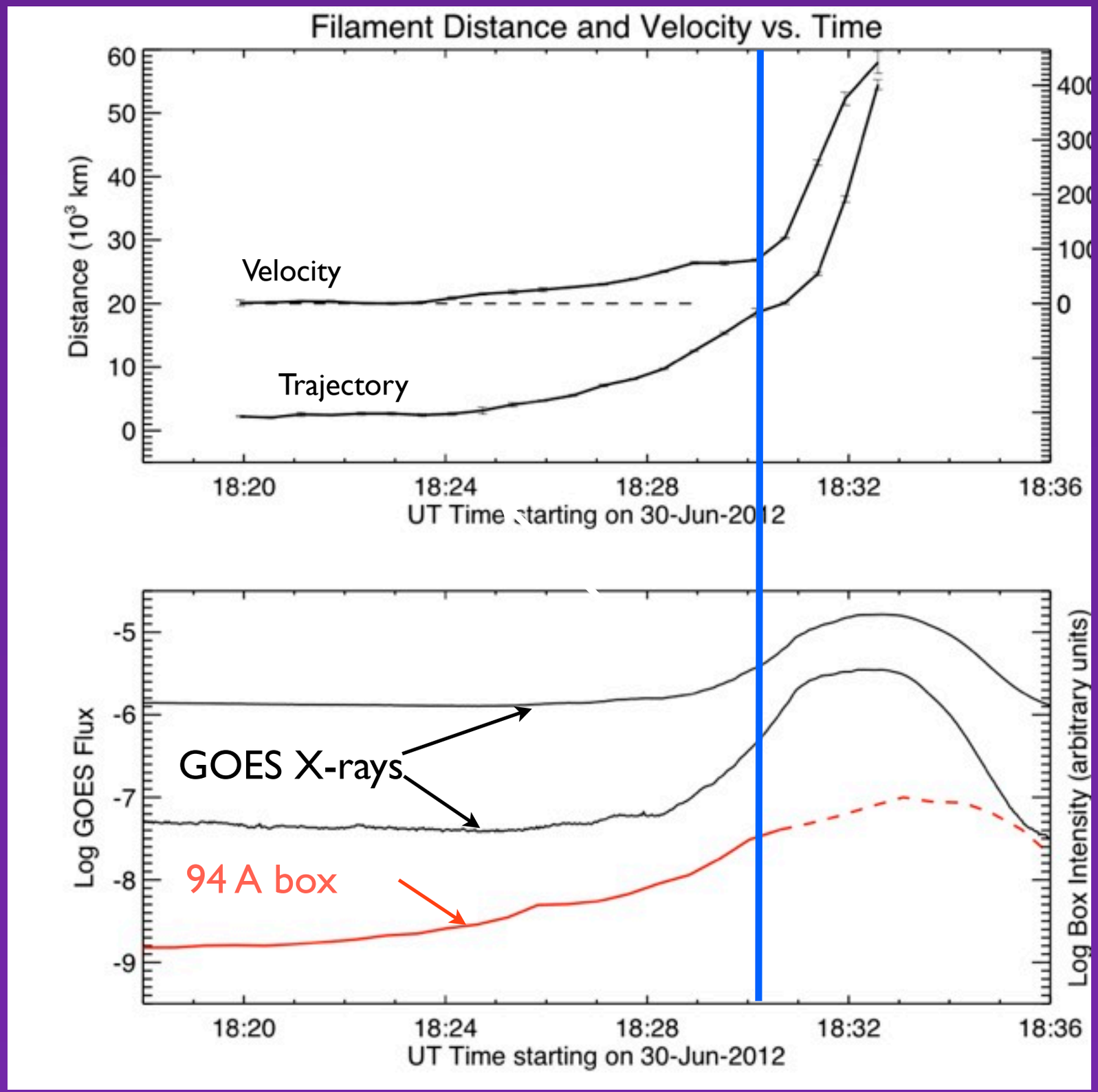

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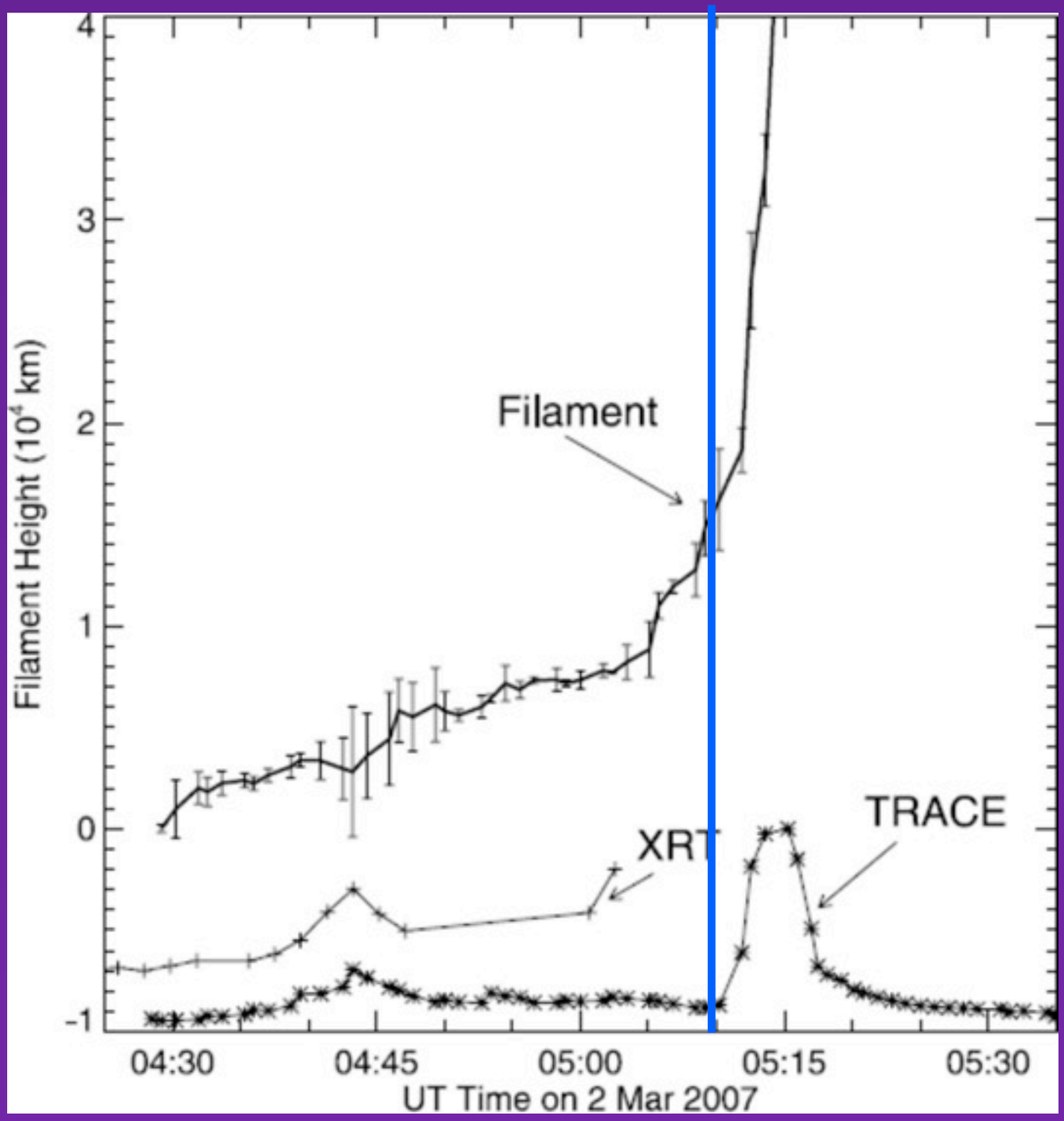

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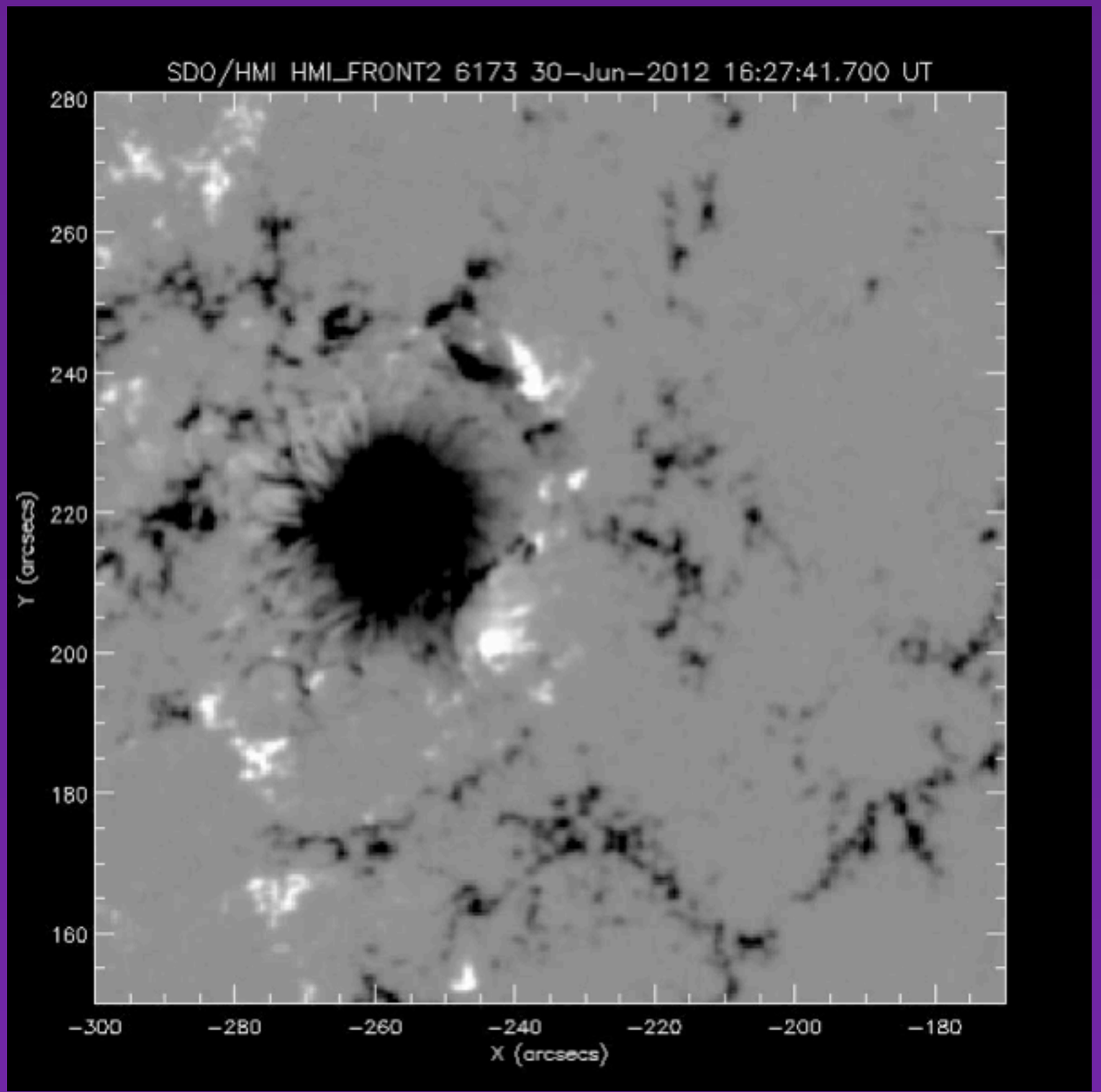

Minifilament eruptions (jets) often occur at flux-cancelation sites. Flux emergence may play a role in triggering eruptions. (Also, e.g., Kano et al. 2010; Shen et al. 2012; Young & Muglach 2014a, b; Chandrashekhar et al. 2014, Adams et al. 2014.)

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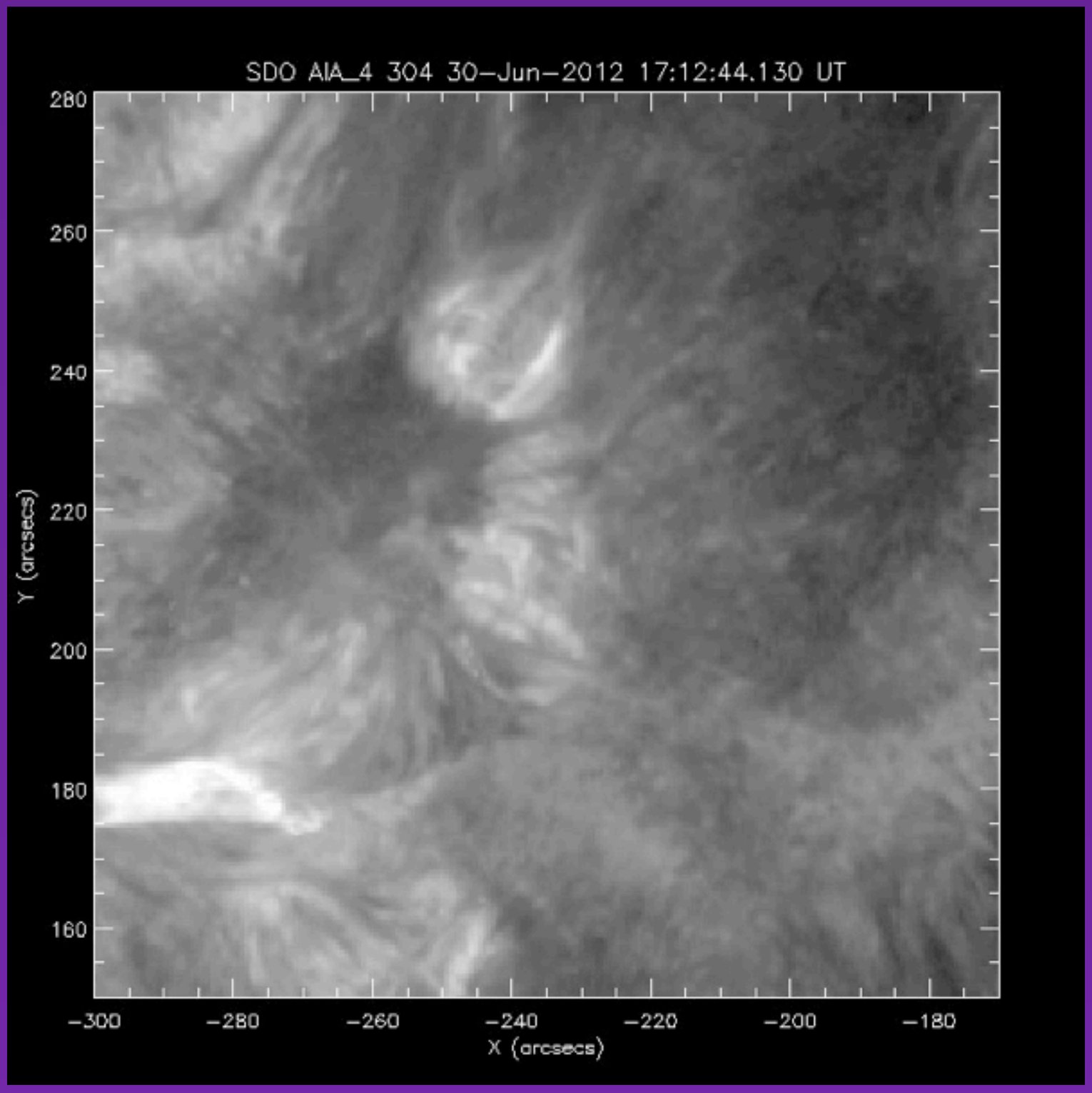

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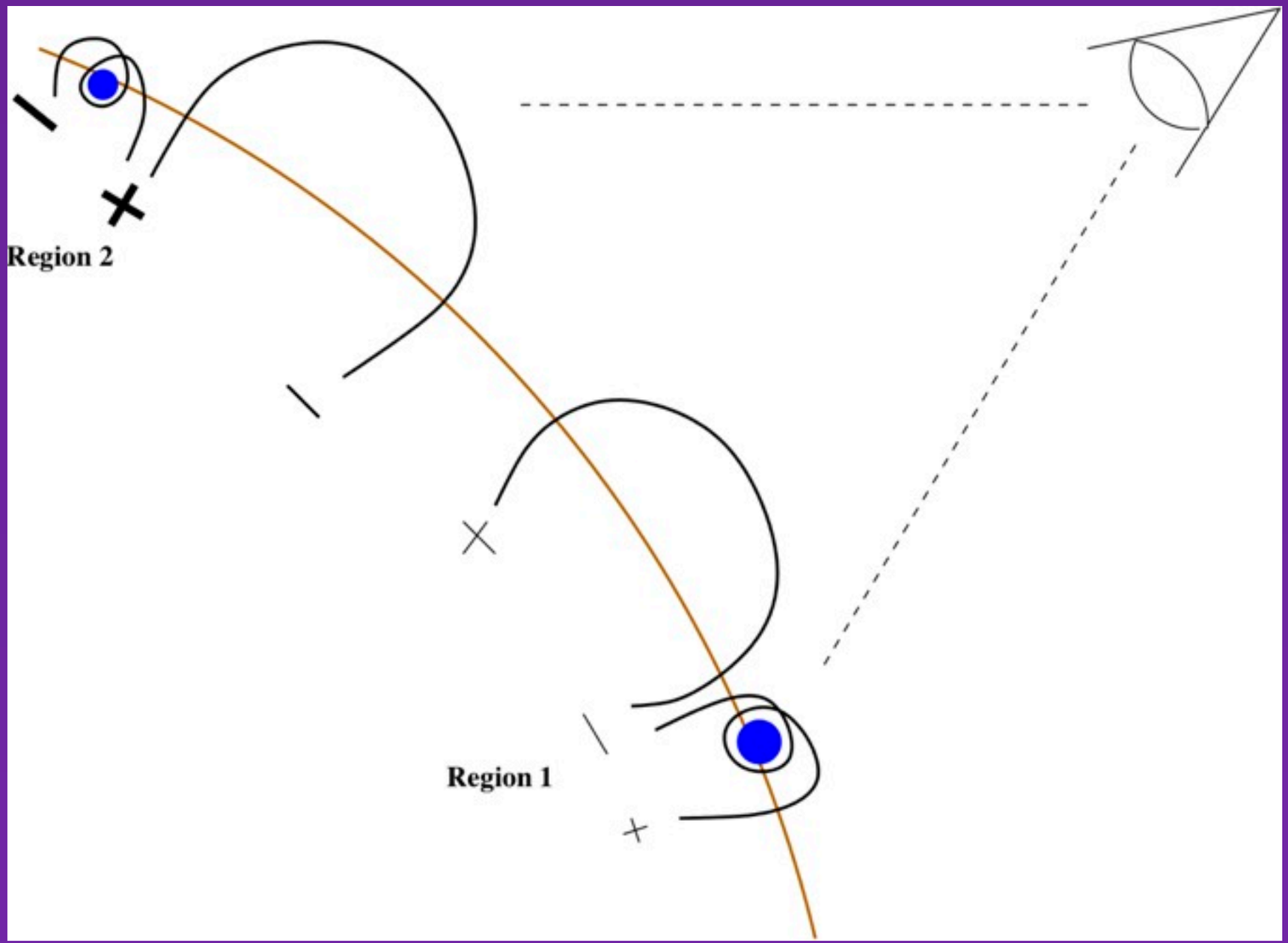
AIA 304



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Summary and Conclusions

- Observed in detail three coronal jets with AIA and HMI.
- All three clearly originate from minifilament eruptions.
- Jet-base brightenings start after minifilament starts moving outward; this is the same as flare emission starting after filaments start rising.
- Several other jets are similar. But - several strong, violent jets have less-clear origins:
  - Appear to be ejected (mini)filament material, but cannot see earliest stages of development.
  - Minifilament material may exist, but hidden by obscuring material and/or low altitude at start (very compact minifilament).
- Originate at neutral lines. Usually have flux cancelation. Emergence may play a role in some cases.
- Conclusion: When we can see the earliest stages, source of jets look like minifilament eruptions. Can't see many cases, but they too are consistent with minifilament eruptions (e.g., occur at neutral lines, and cool material expelled from low down).

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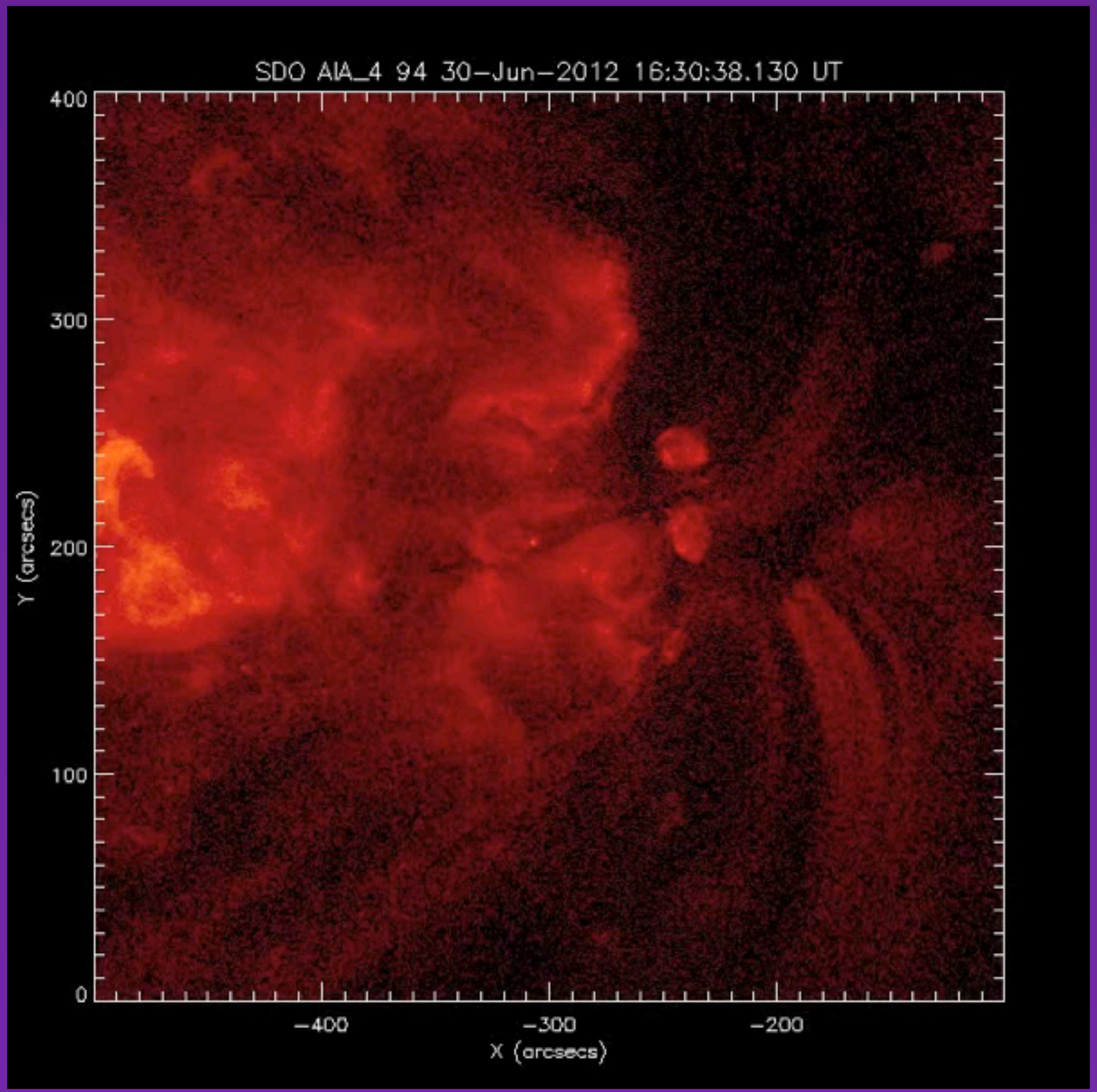

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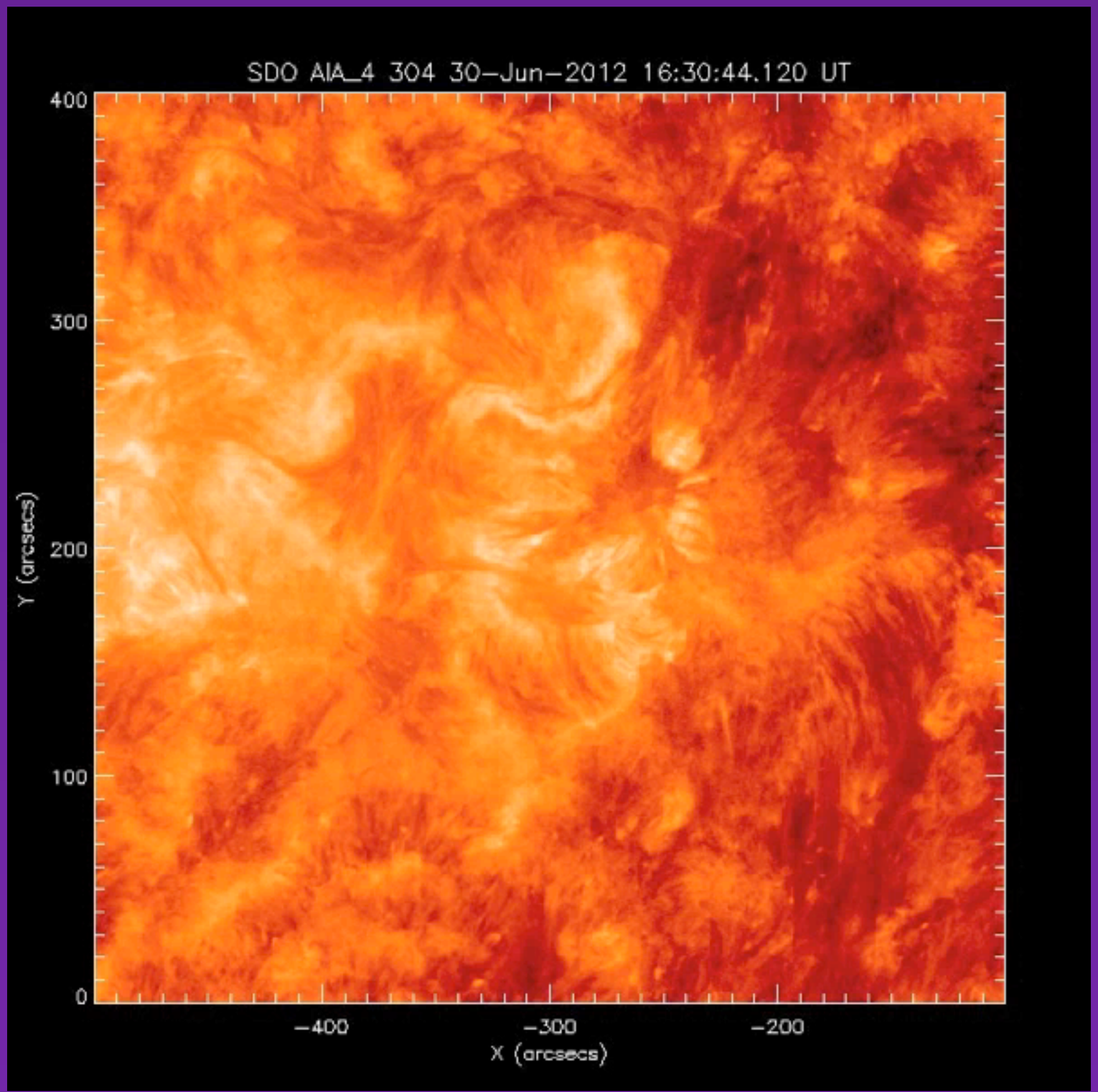

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