Nanojets of Coronal Heating Patrick Antolin



Movie of event, courtesy of NASA visualisation studio



10,000 km



ESPM Meeting - 2021





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Nanojet properties Local response

- Intensity bursts ~ nanoflare ≤ 10²⁵ erg
- Jet-like features
 transverse / oblique to
 guide field
- Short lived <10 s 15 s
- v ~ 100–200 km/s
- Lengths: $1000 2000 \text{ km} = \frac{5}{2} \frac{5}{998}$
- Widths: ~500 km
- Single or clustered occurrence
- Countable ~150 events
- Plasmoids for largest
- Uni-directional



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Nanojet properties **Global response**

- Transverse displacement of rain strands
- Nanojets spread along & across the loop, number increase with time
- Nanojets precede formation of coronal strands
- DEM analysis: heating to coronal temperatures (up to 5 MK)





Heating





Braiding & twist evolution



- $\sum \sim 150$ nanojets in 13 min, spread across & along loop
- Suggestive of MHD avalanche

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Reconnection Nanojets in the Solar Corona

3D MHD numerical modelling with PLUTO

• Nanojets match with component **magnetic reconnection:** transverse advection of field lines accelerated by magnetic tension

Discussion

- Unidirectional nature (no clear bidirectional jet) <-> effect of curvature & braiding (*Pagano+, submitted*)
- Global response suggestive of MHD avalanche
- Driver: prominence loss of stability; we conjecture largely independent of reconnection driver (*Sukarmadji+ in prep*, see poster talk)
- Rain role: catalyst for reconnection; high resolution tracer of coronal dynamics
- Nanojets: direct observational signature of reconnection-driven nanoflare

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photosphere





