

Outflows Big and Small: Observations of Solar Eruptions with a Range of Sizes and Energies

P. Hess¹, P. Liewer², G. Stenborg³, R. Colaninno¹, Y.M. Wang¹

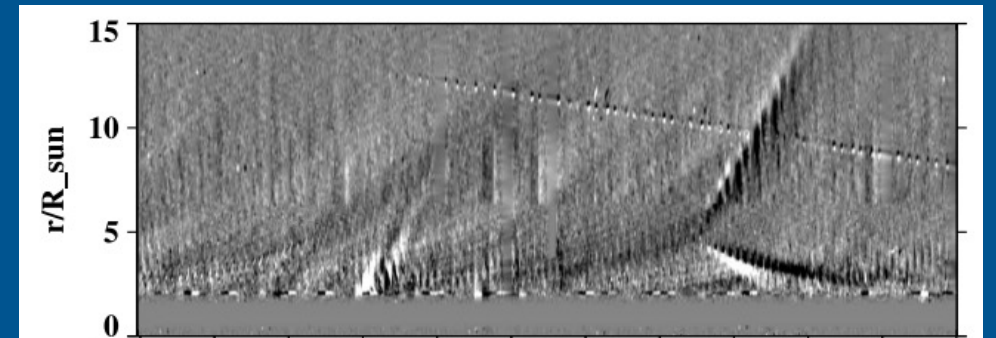
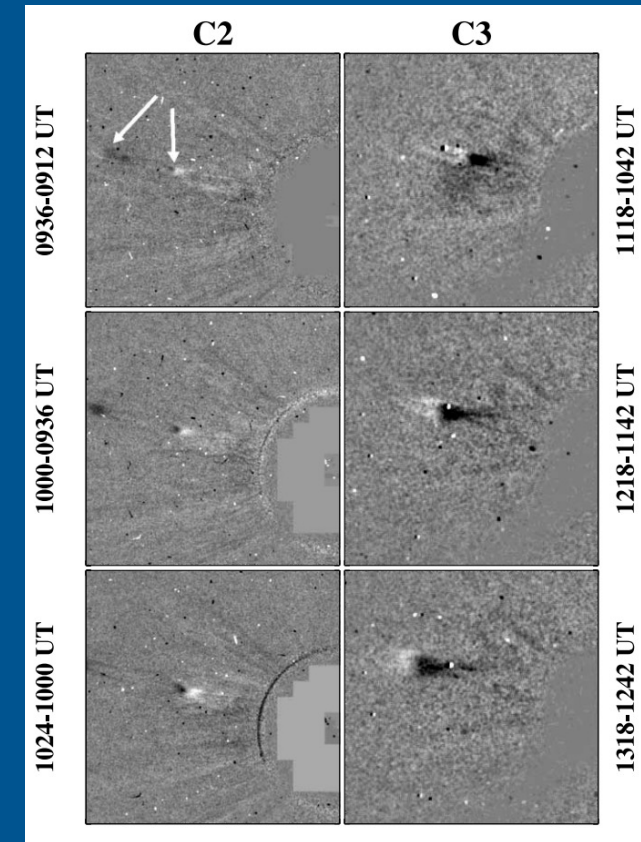
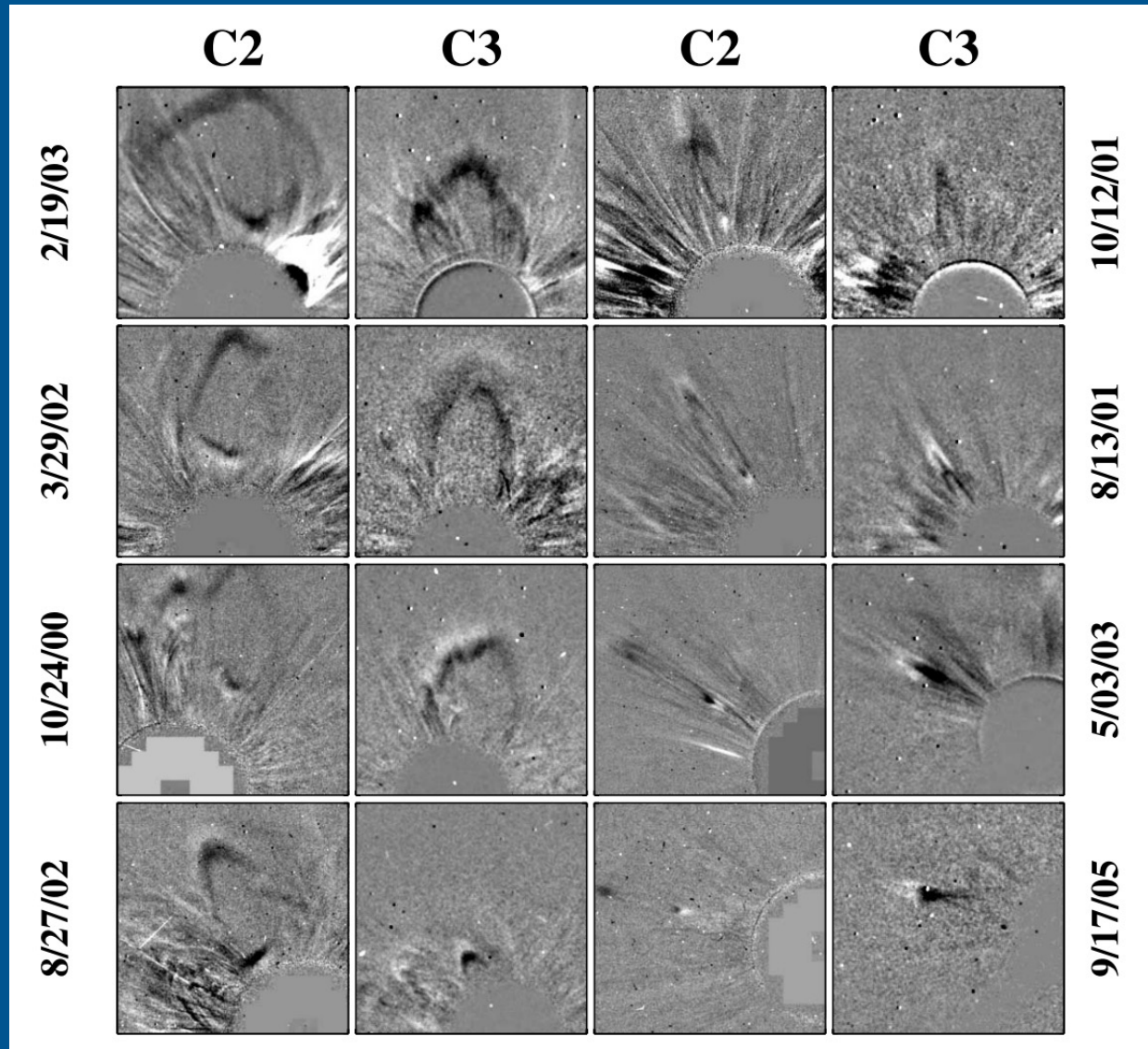
1. U.S. Naval Research Laboratory, Washington DC

2. Jet Propulsion Laboratory, Pasadena, CA

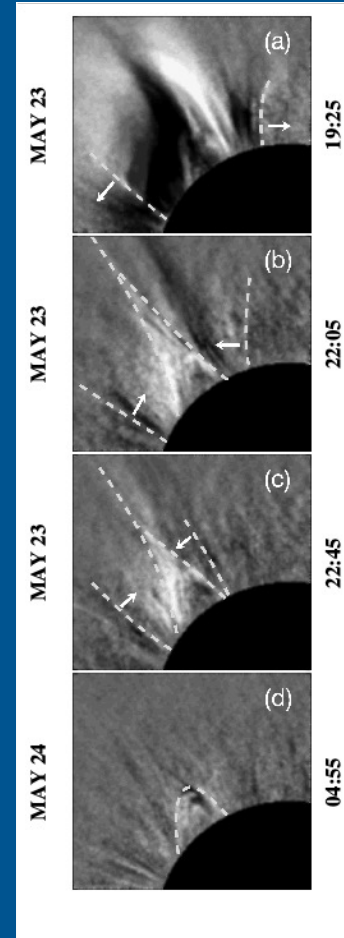
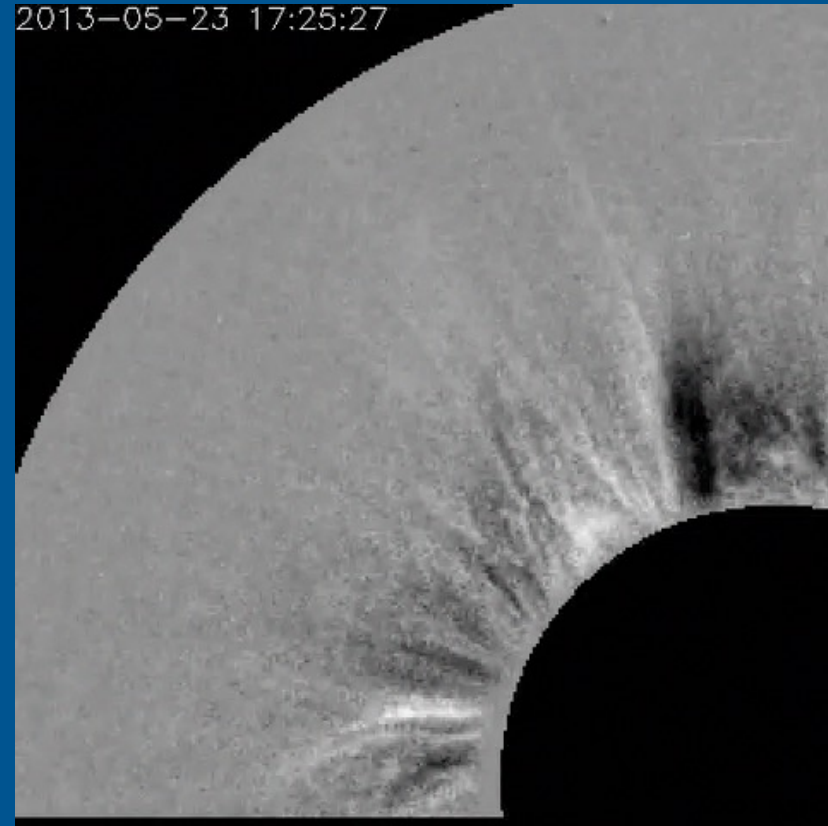
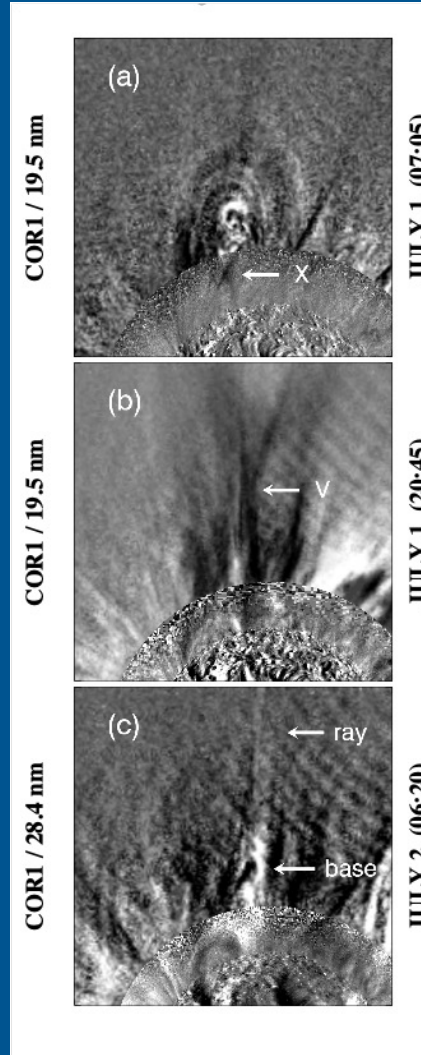
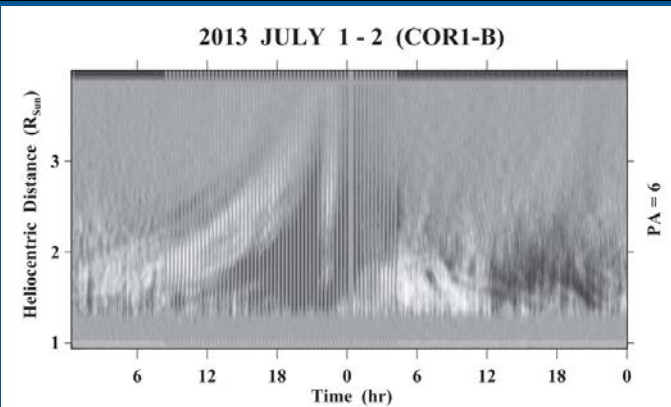
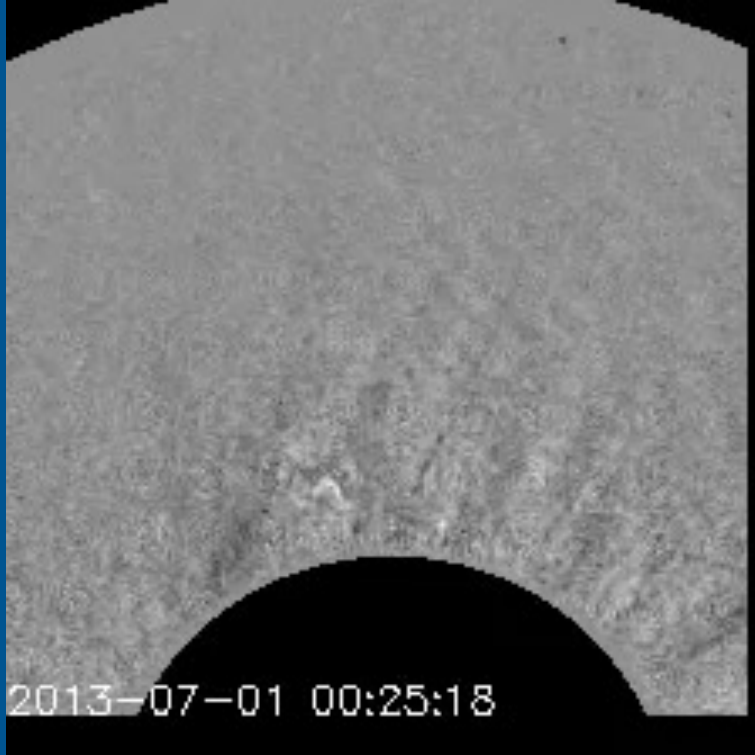
3. Johns Hopkins University Applied Physics Laboratory, Laurel, MD

- Heliospheric Imagers at 1 AU provided crucial information on CME evolution beyond the corona, as well as regular outflows into the solar wind
- The next generation of heliospheric imagers (WISPR, SoloHI) can improve these observations due to a vastly improved spatial resolution
- Furthermore, these new instruments can provide information on smaller scale outflows in the solar wind that would have been difficult to resolve from 1 AU
 - **Streamer Blobs** – The pinching off of smaller flux ropes caused by reconnection at the tip of the helmet streamer
 - **Streamer Blowouts** – Typically Filaments/Flux Ropes erupting from within a helmet streamer. Not powerful enough to reorient the corona around them, instead getting channeled by the streamer into the open field along the plasma sheet
 - **Pseudostreamer Eruptions** – Essentially large scale jets that may or may not contain a filament and produce narrow, fan-like eruptions that quickly fade from observability

Streamer Blobs

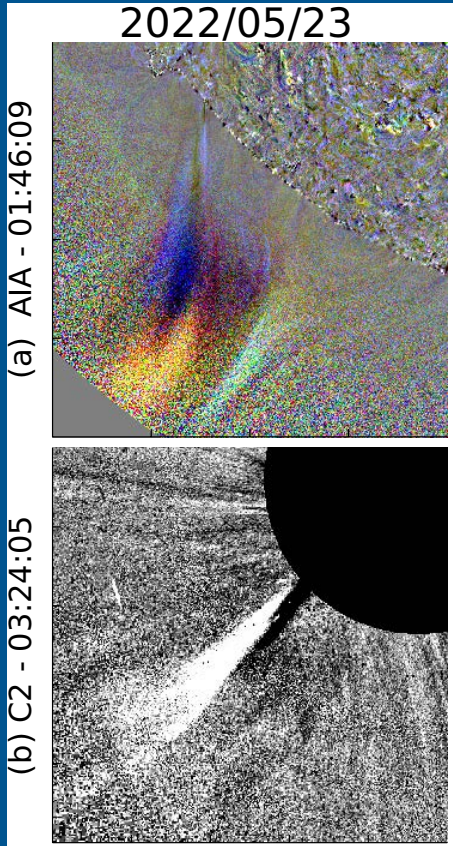


Streamer Blowout



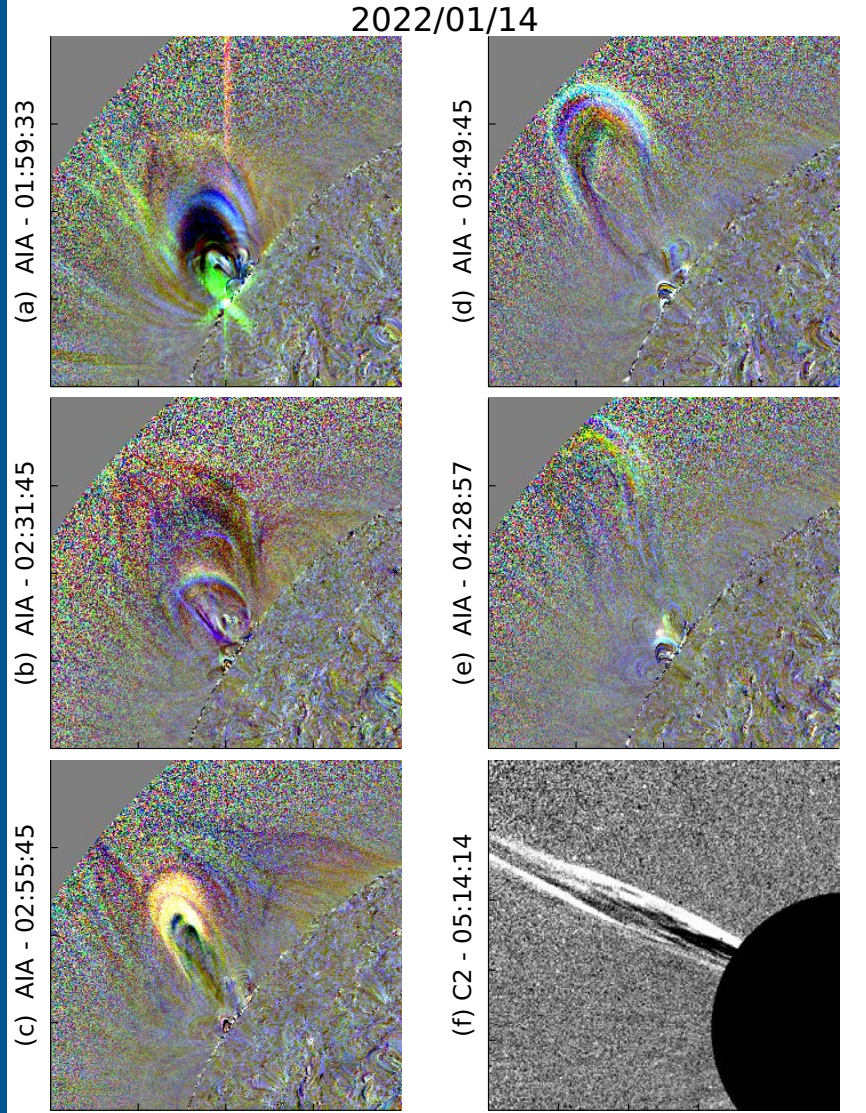
Psuedostreamer Eruptions

2022/05/23

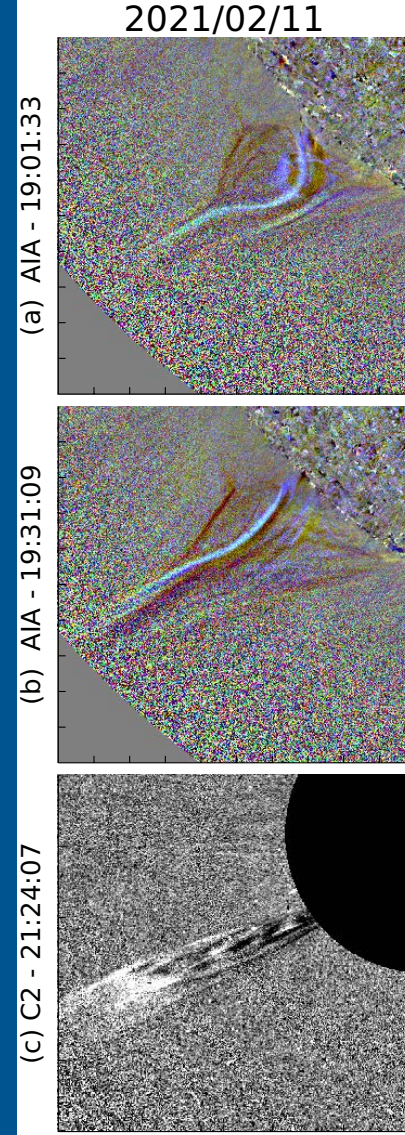


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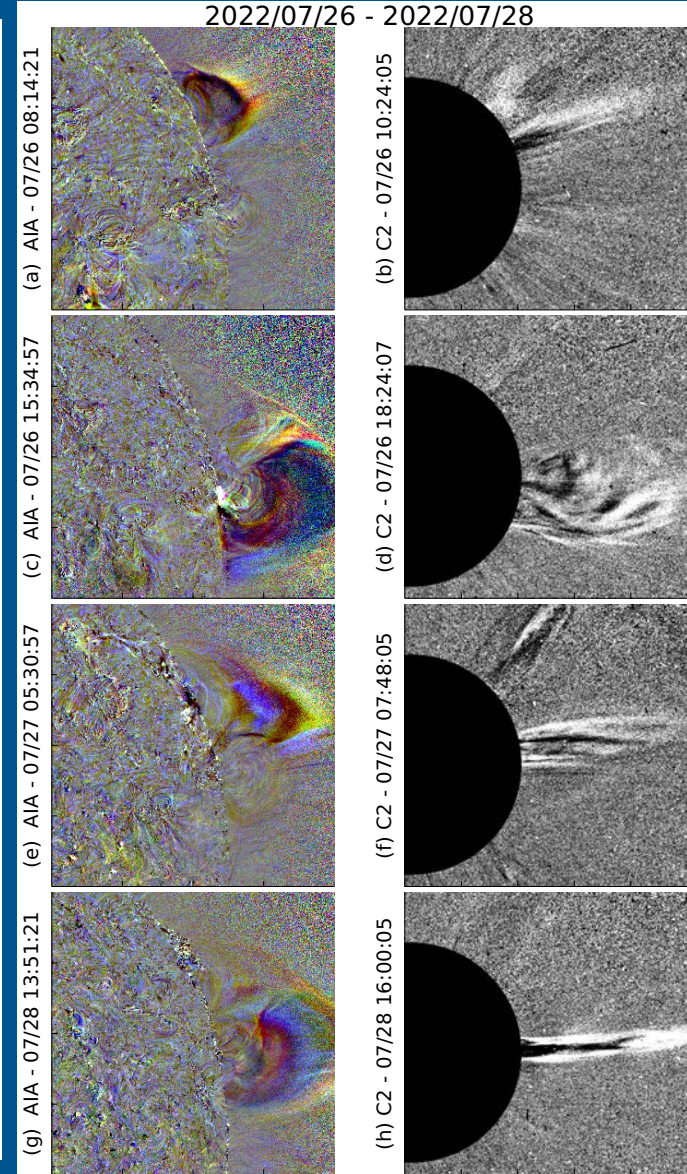
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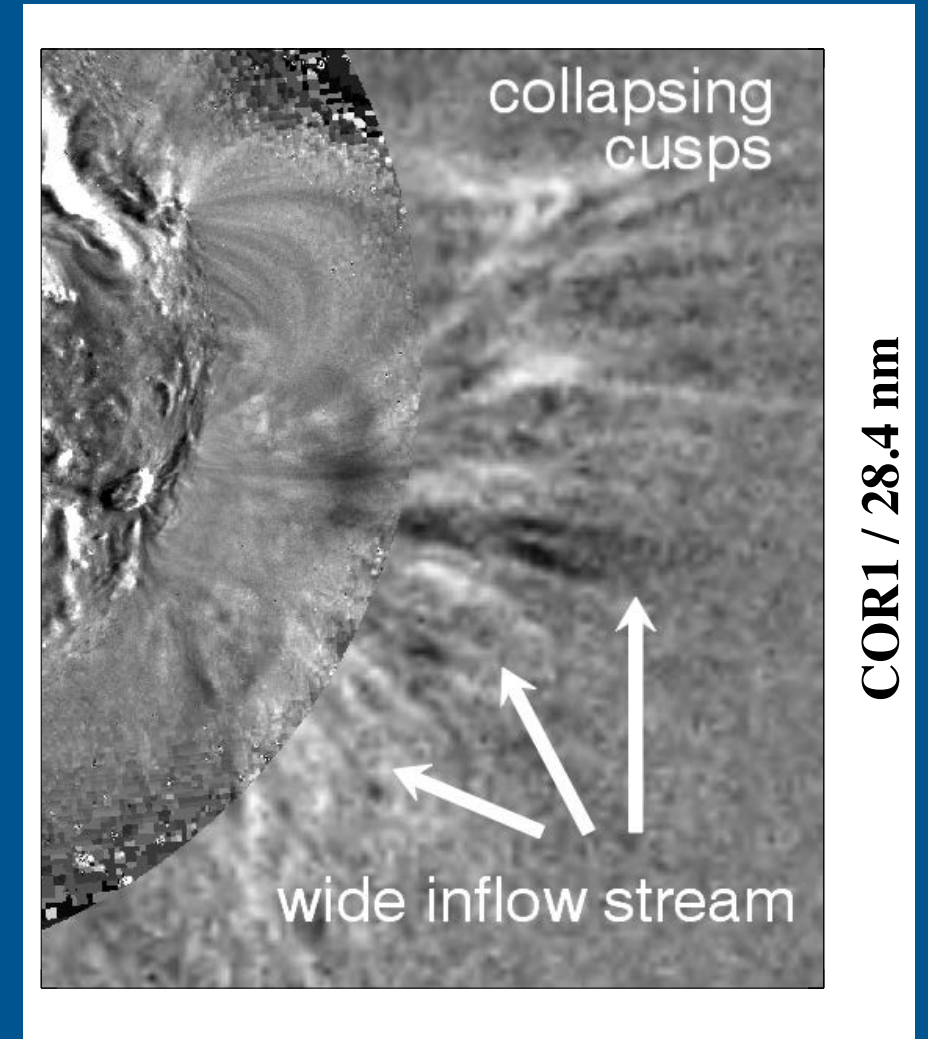
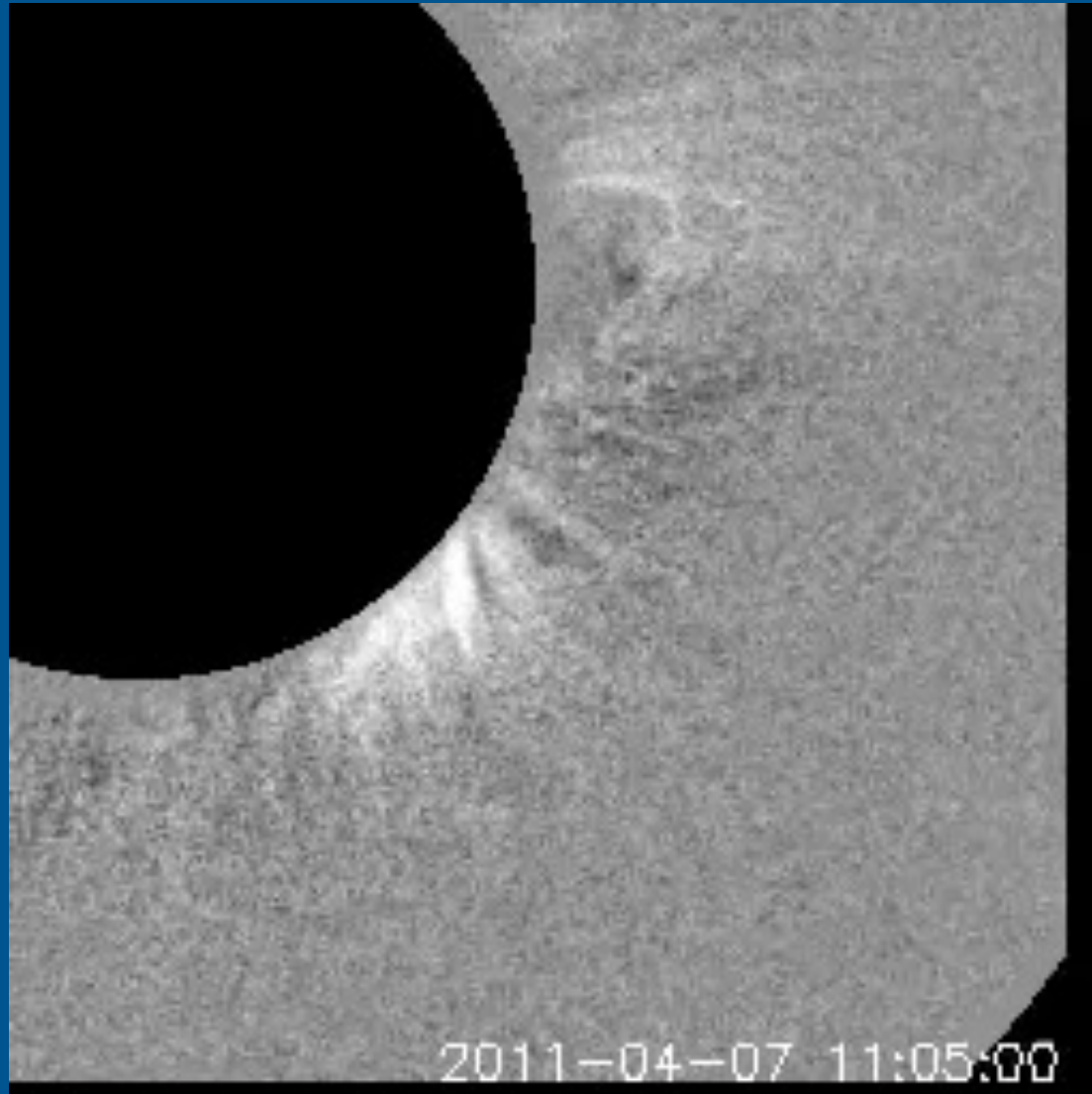
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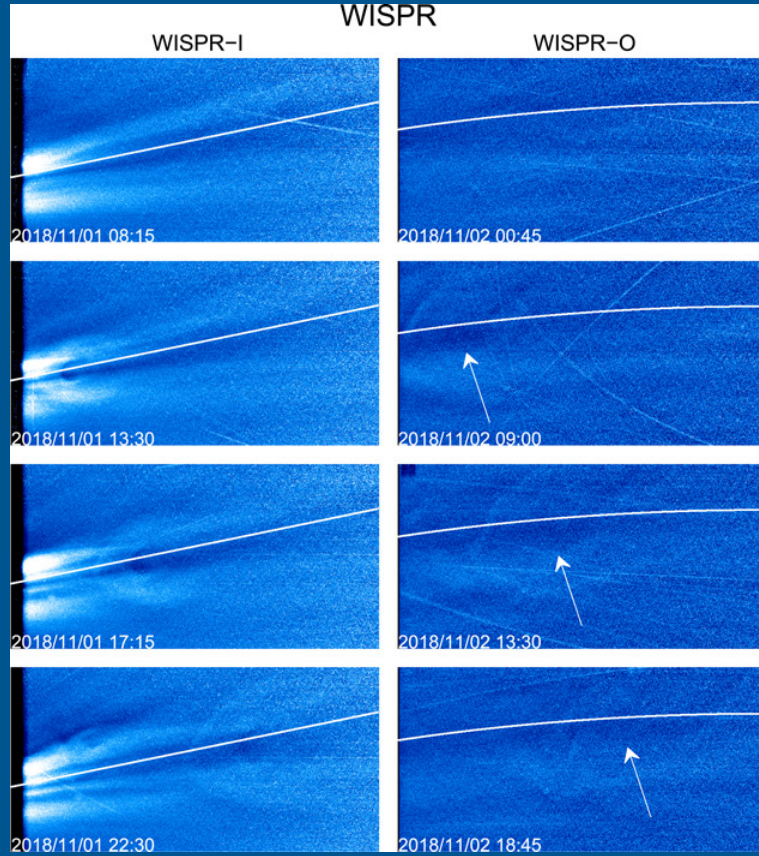
2022/07/26 - 2022/07/28



Importance of Perspective

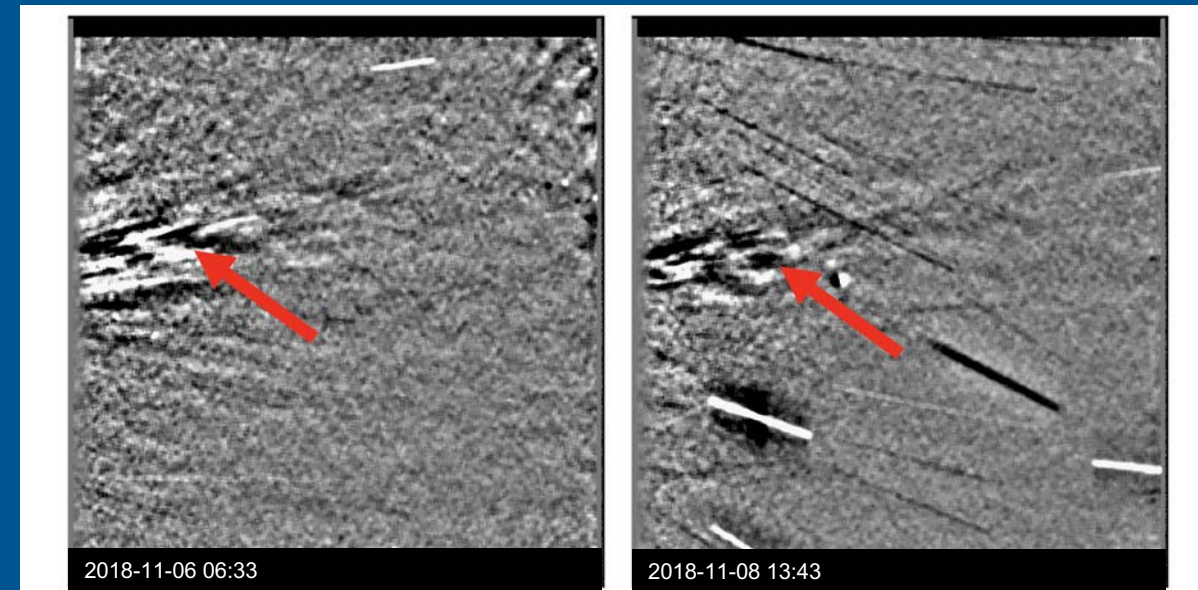
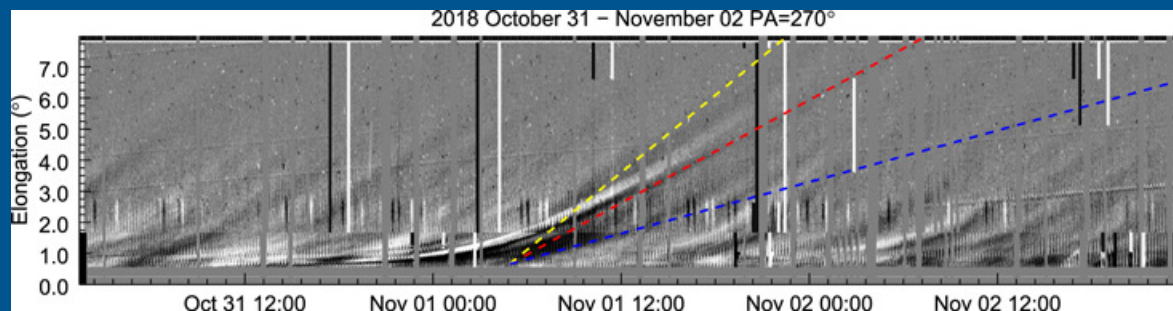


Apparent Flux Rope Structure



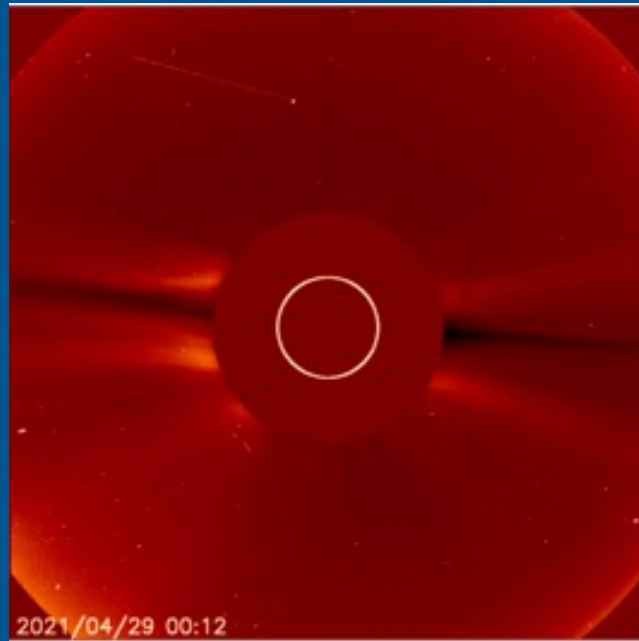
- Throughout every PSP encounter, flux rope like structures flowing from the streamer belt have been imaged with central cavities and trailing claw or 'v' structures
- These flux ropes range from small blobs slowly propagating in the solar wind to streamer blowout eruptions and, more recently, even larger CMEs

Hess et al 2020

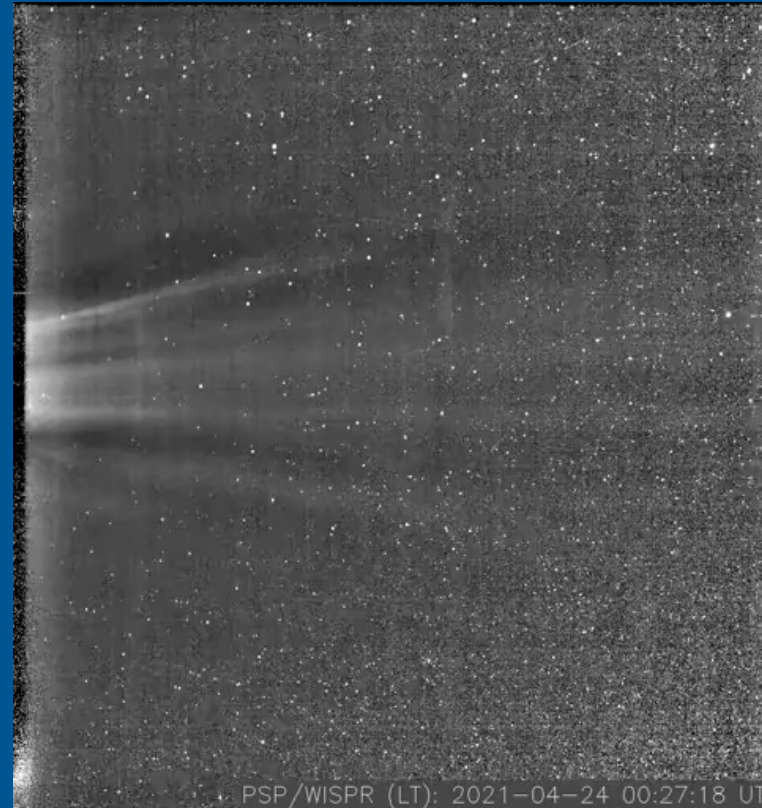


Viewing the Streamer Belt "Edge On" – E8

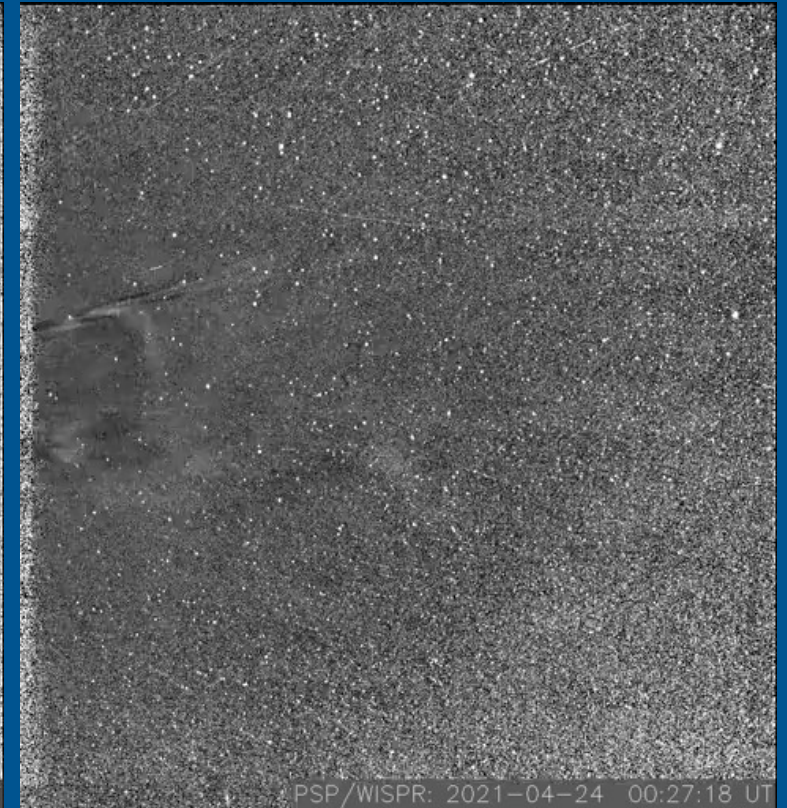
LASCO C2



WISPR-I 'LT'

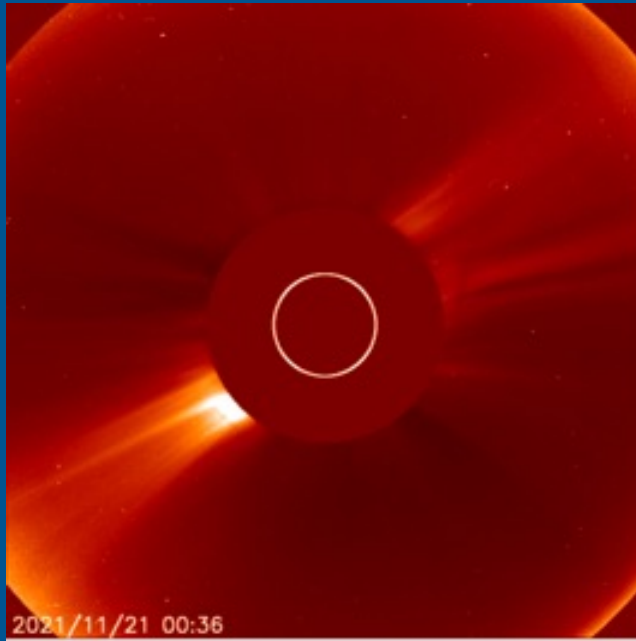


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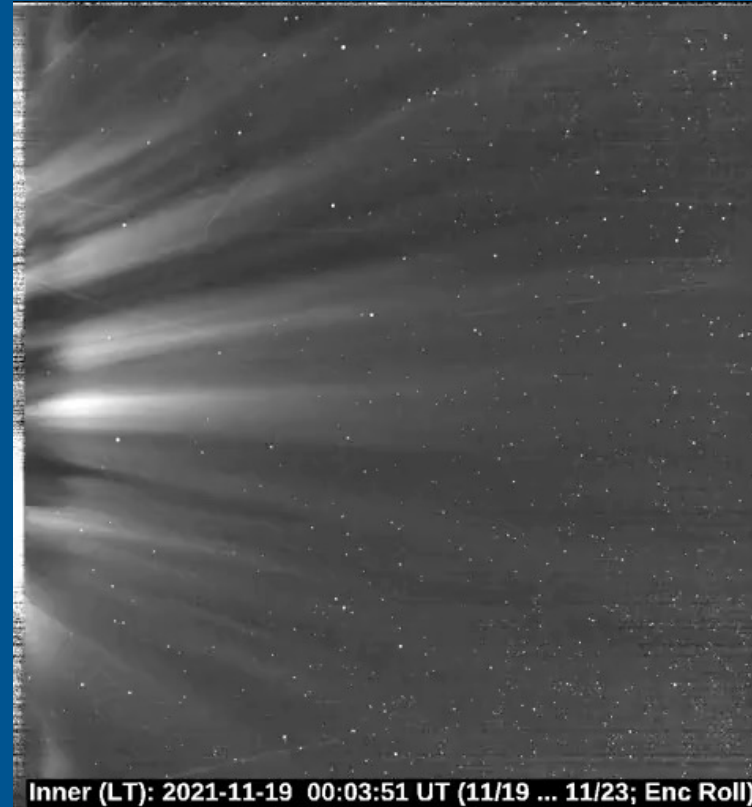


Viewing the Streamer Belt "Face On" – E10

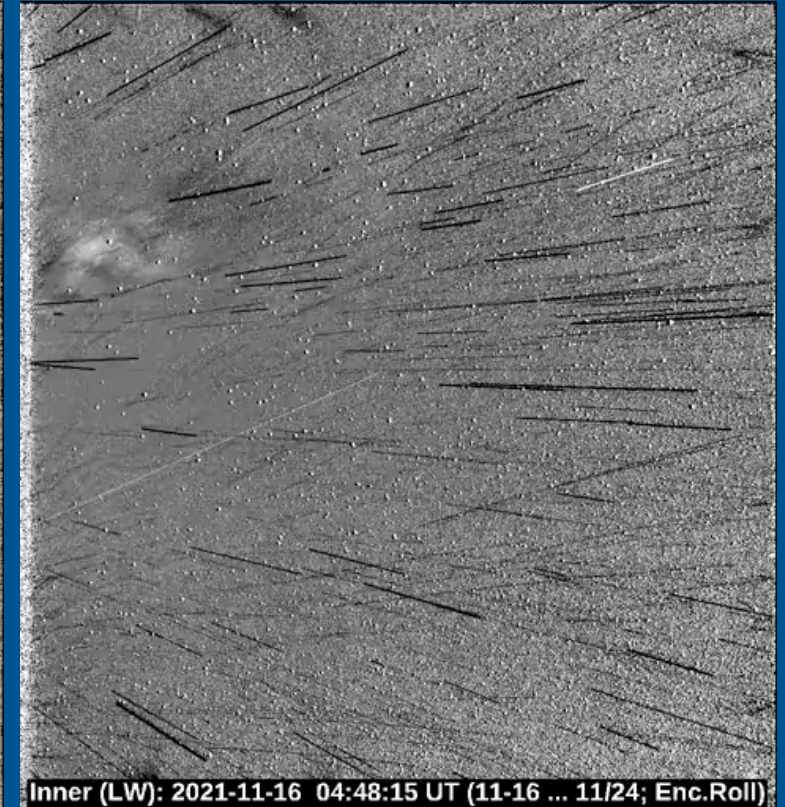
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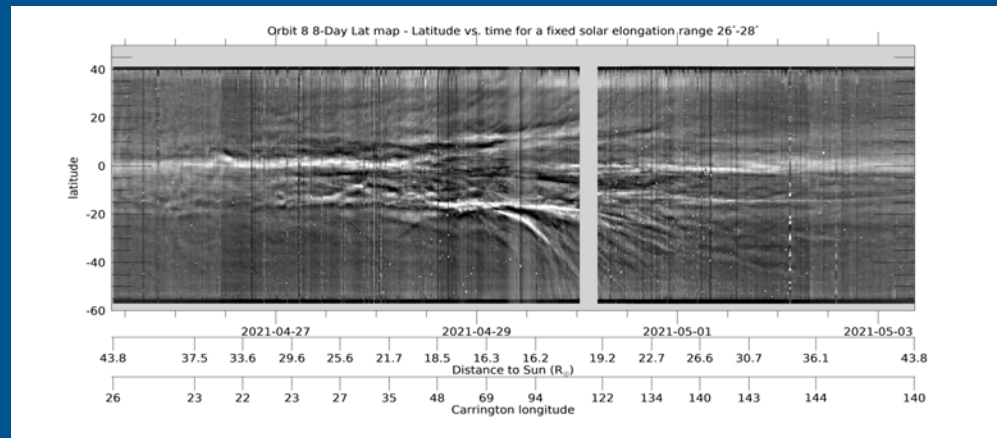
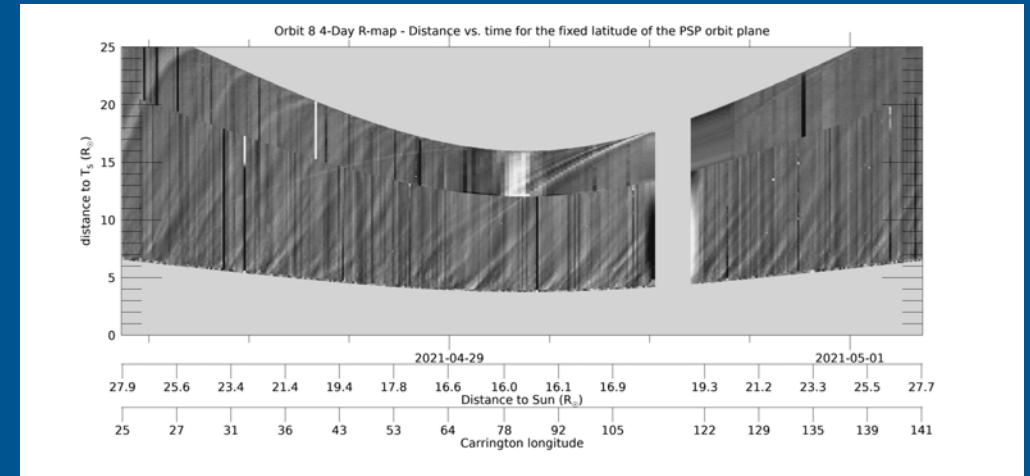
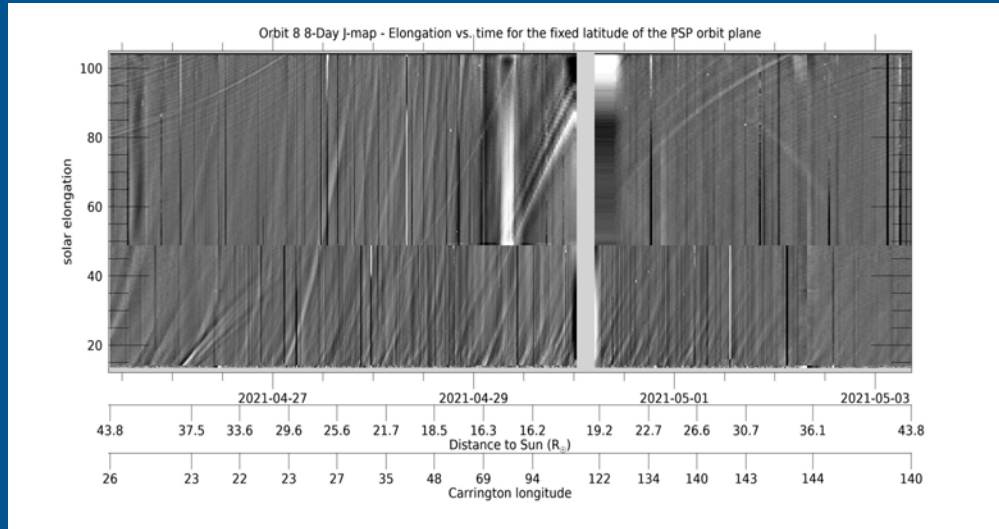
WISPR-I 'LT'



WISPR-I 'LW'

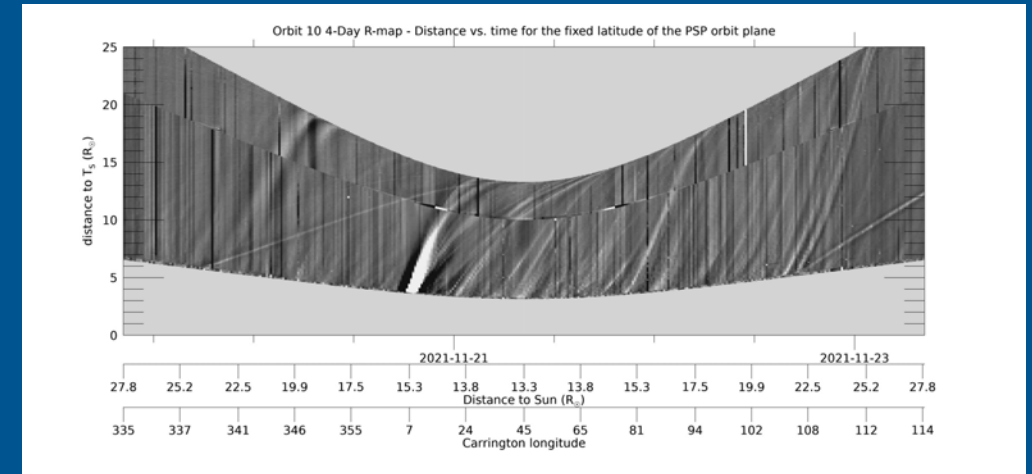
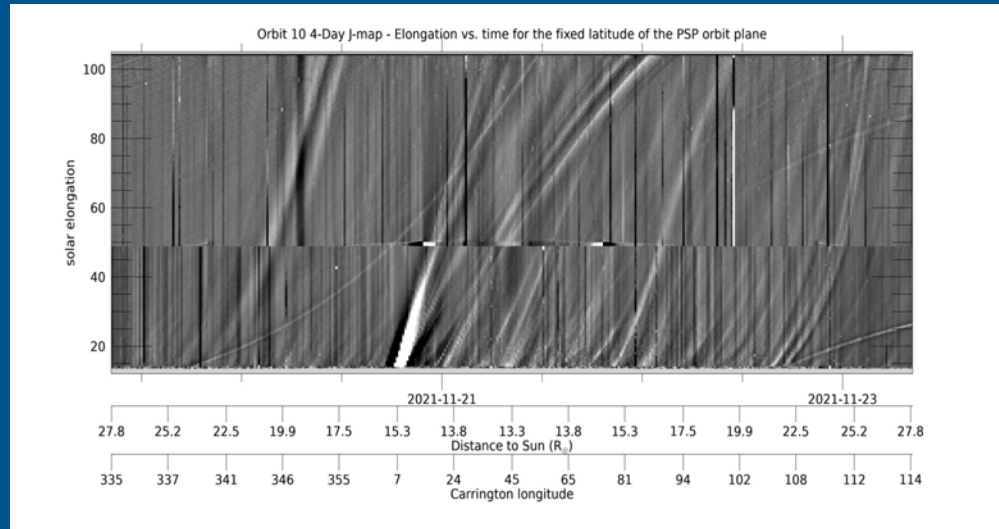


Encounter 8 Maps

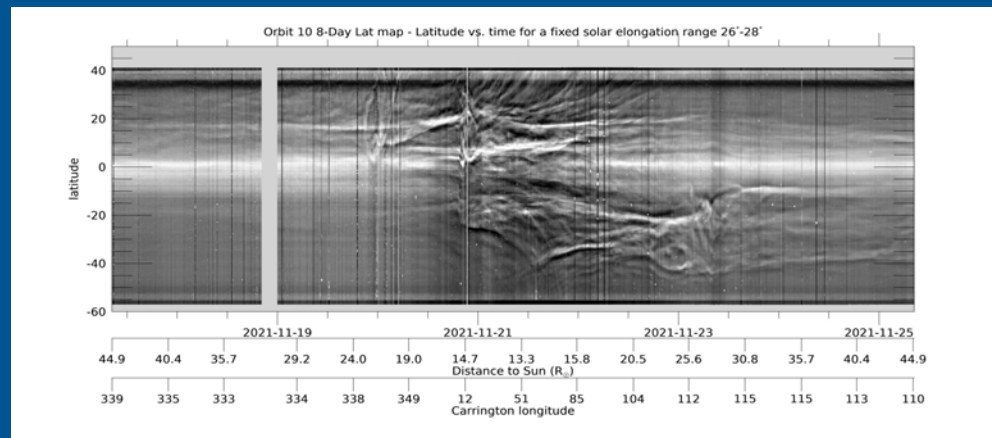


Maps provided by
NASA/JPL/CALTECH
and available on WISPR
encounter summary pages
at wispr.nrl.navy.mil

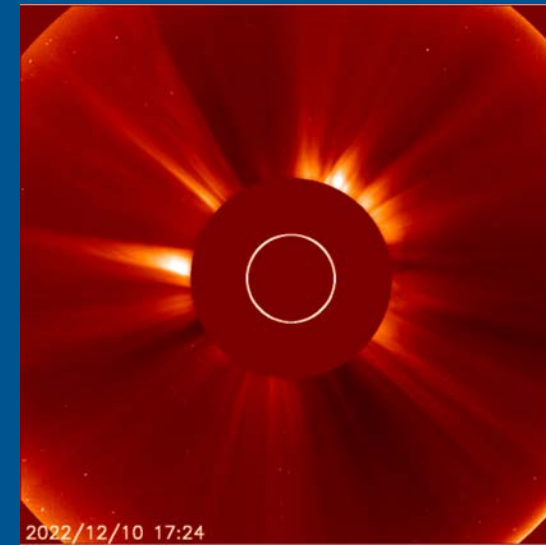
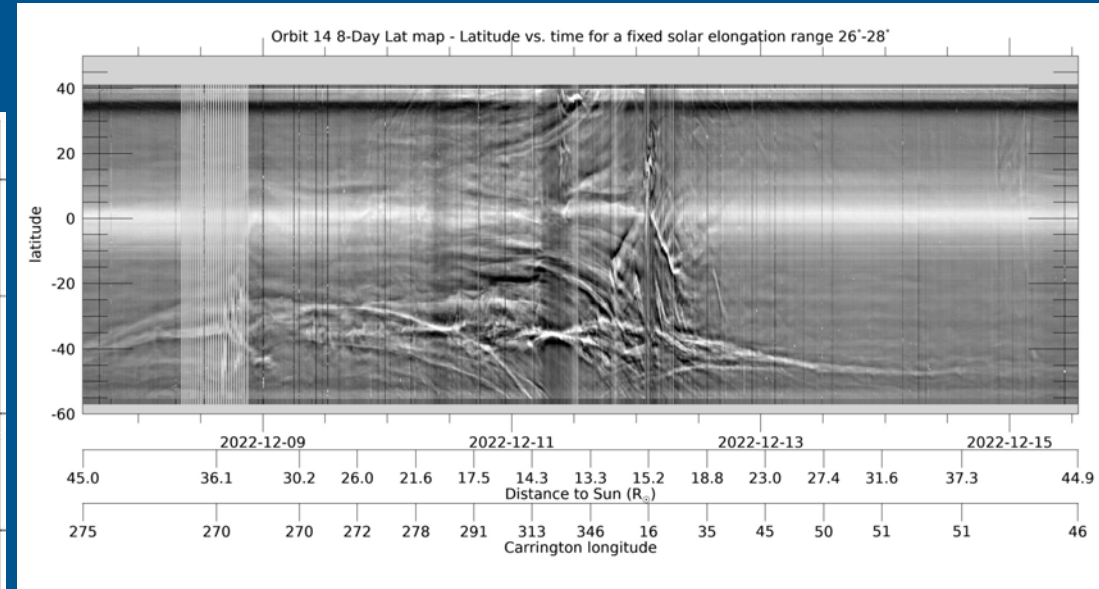
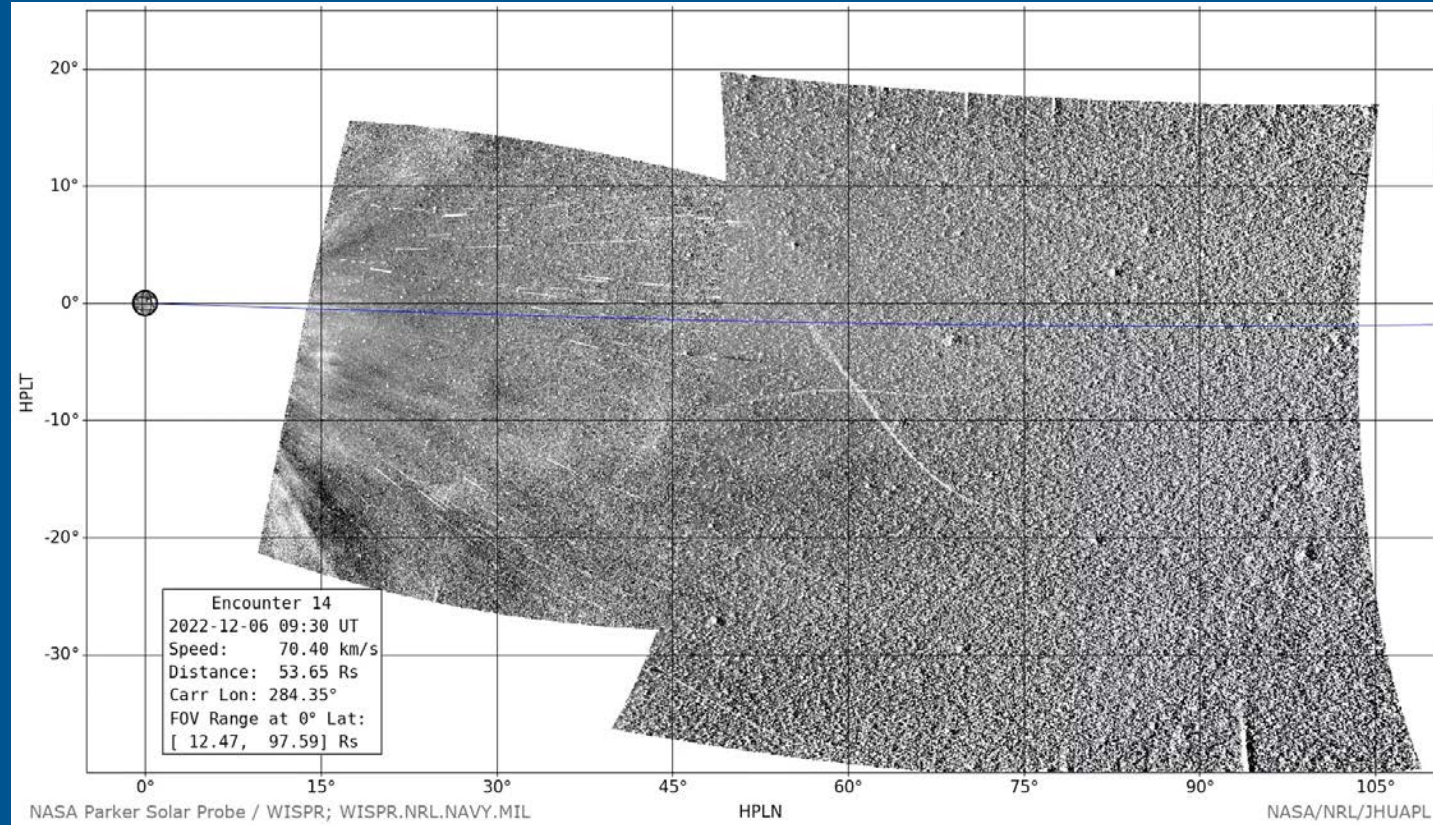
Encounter 10 Maps



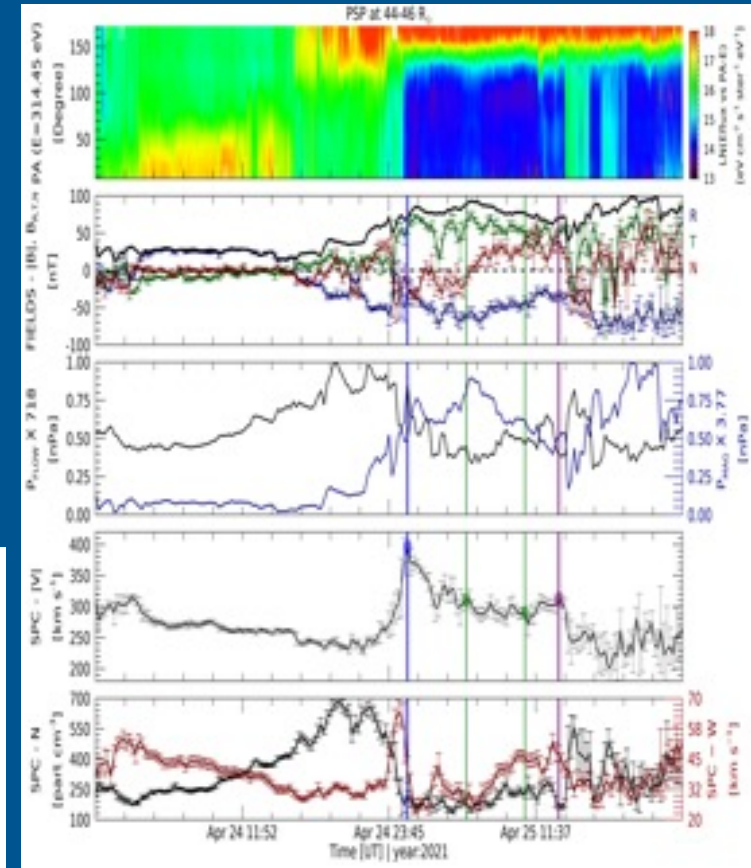
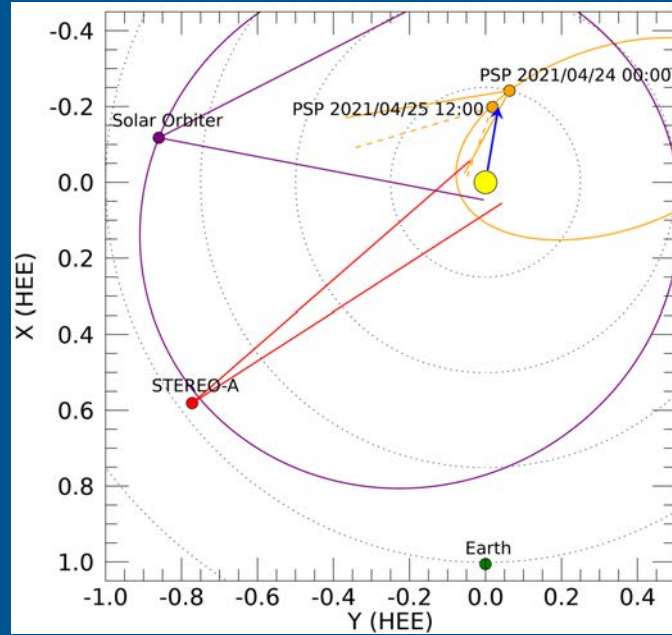
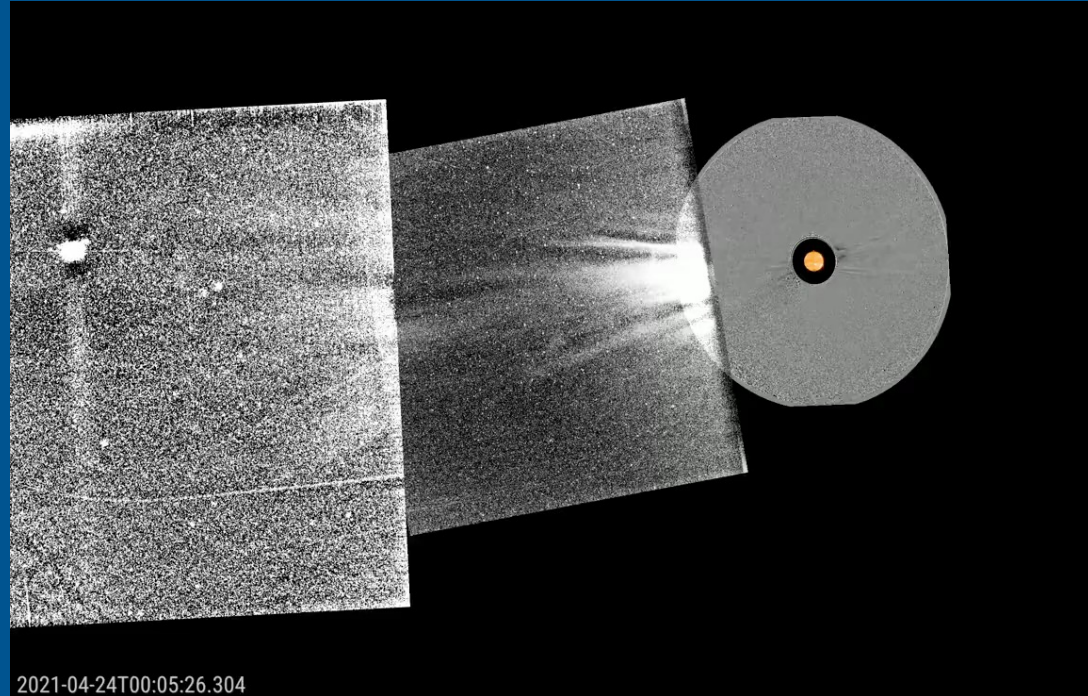
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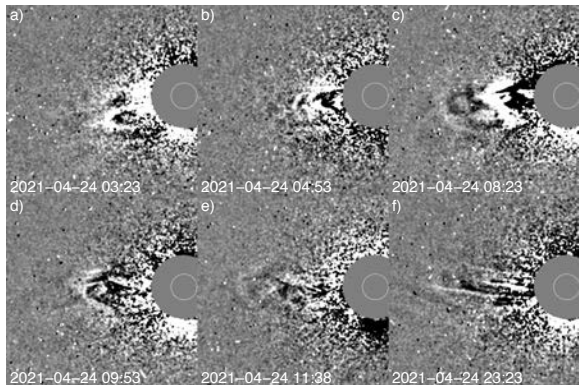
Encounter 14



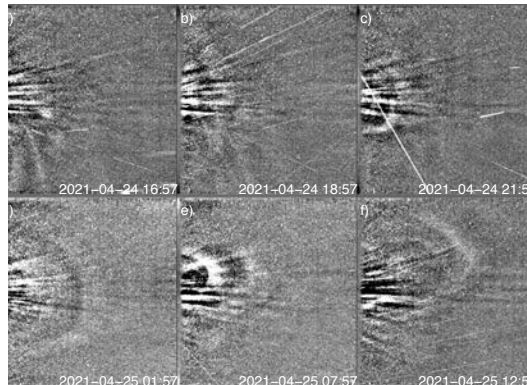
Linking Imaging of Blowout with In-situ data



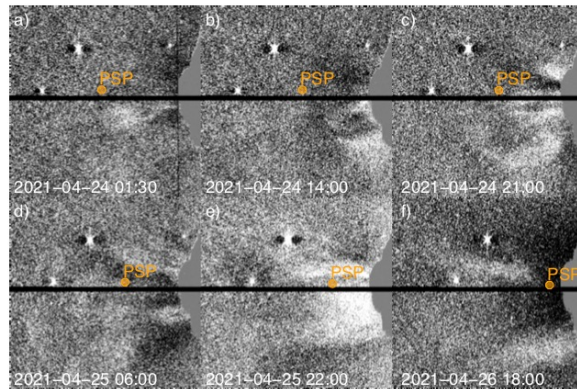
STEREO-A COR2



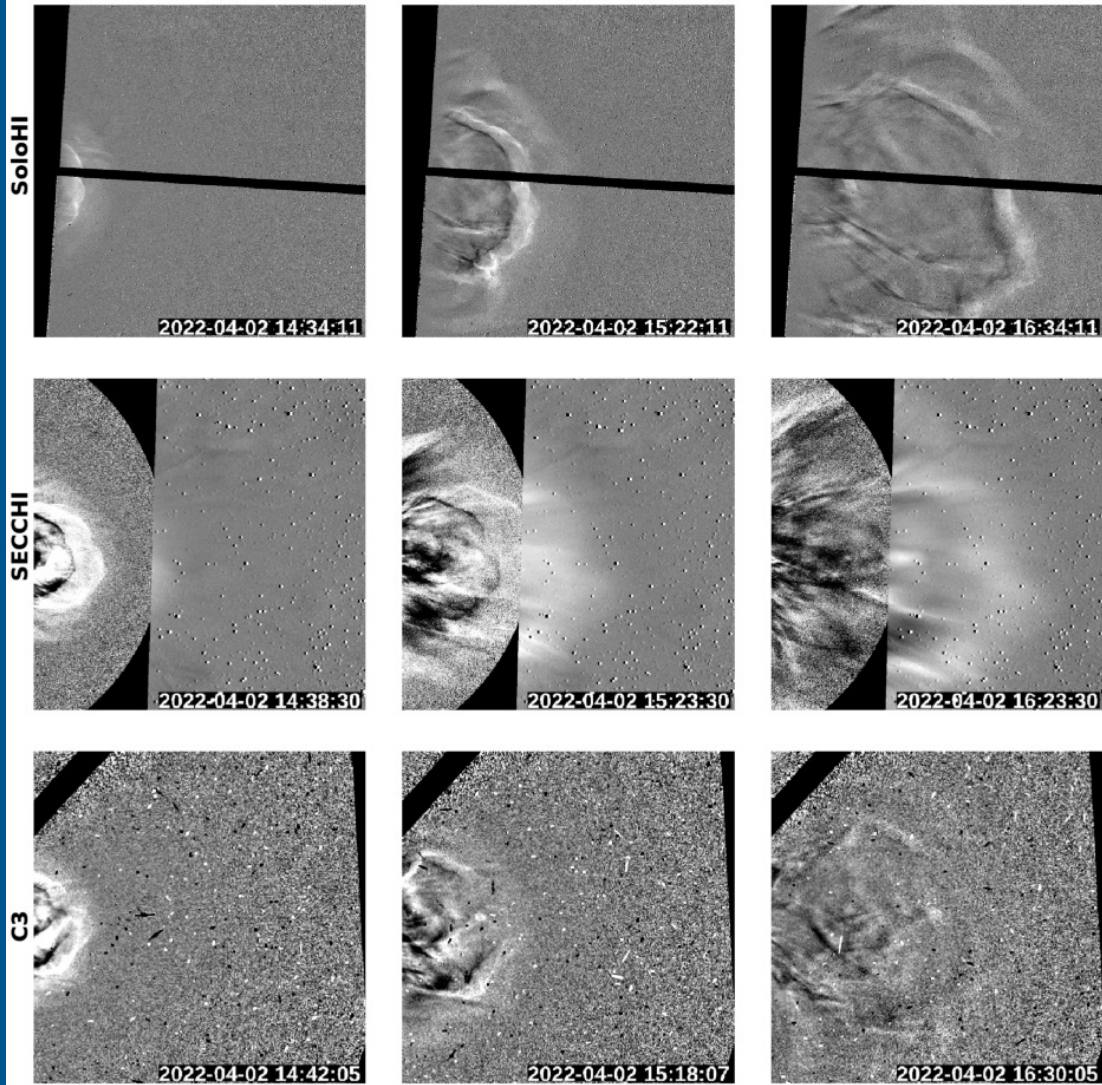
WISPR-I



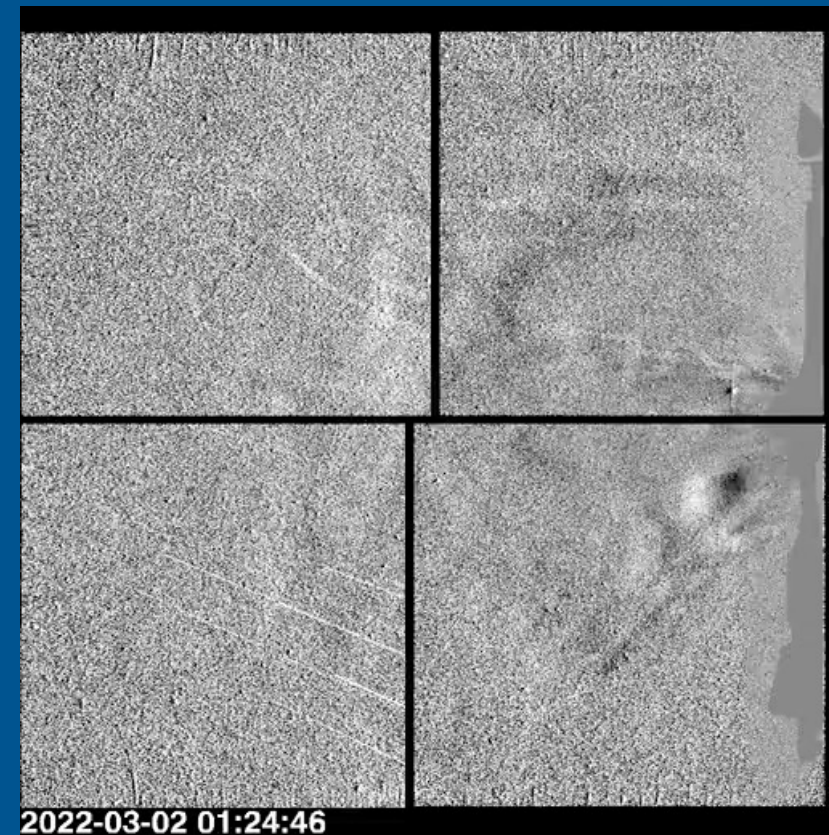
SoloHI



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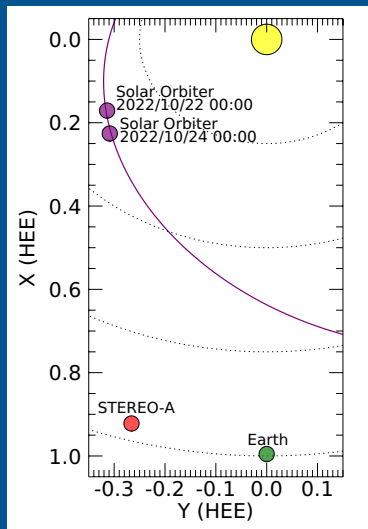
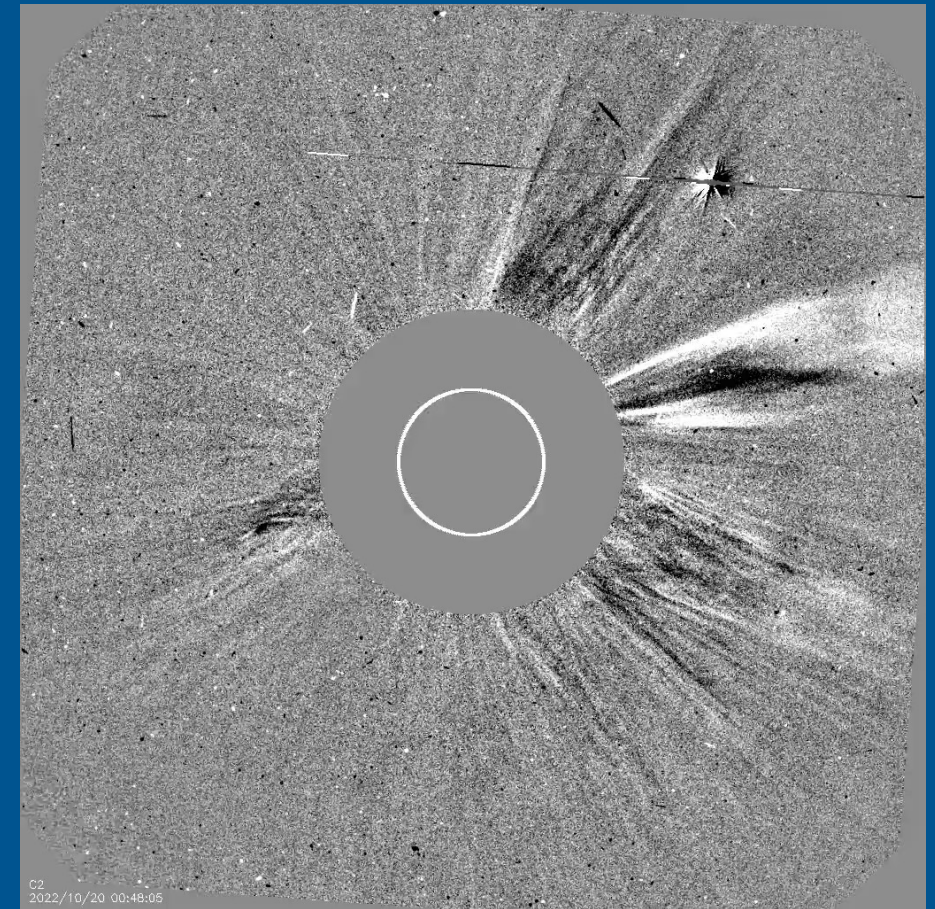
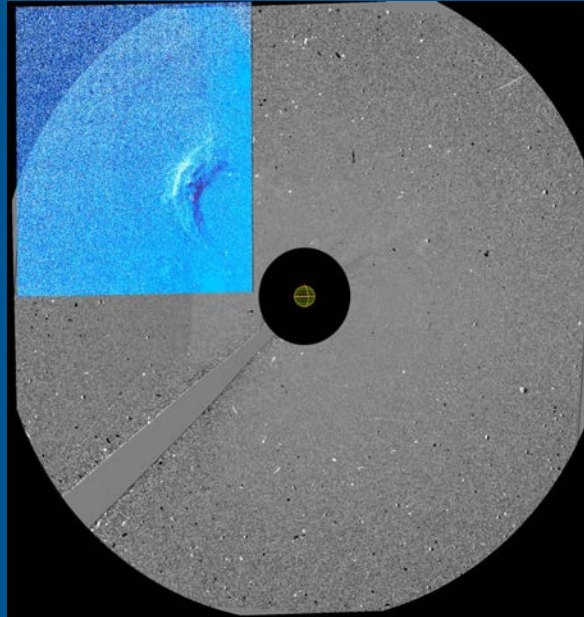


- The Solar Orbiter Heliospheric Imager (SoloHI) provides quasi-stationary images combining the traditional coronagraph and HI fields of view

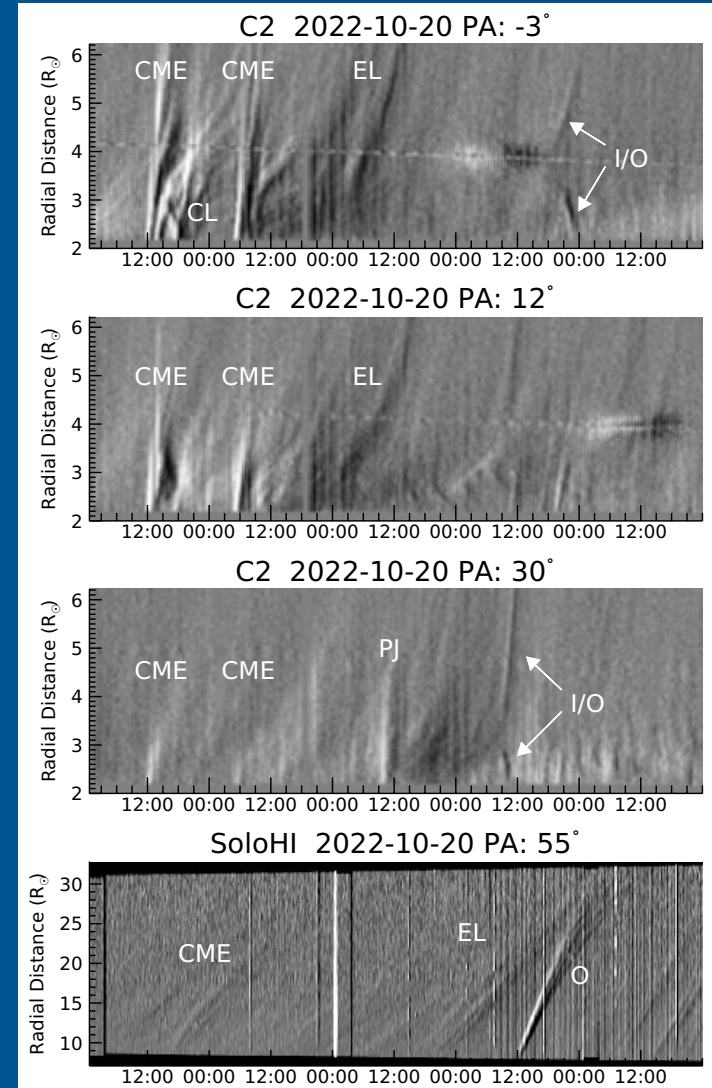
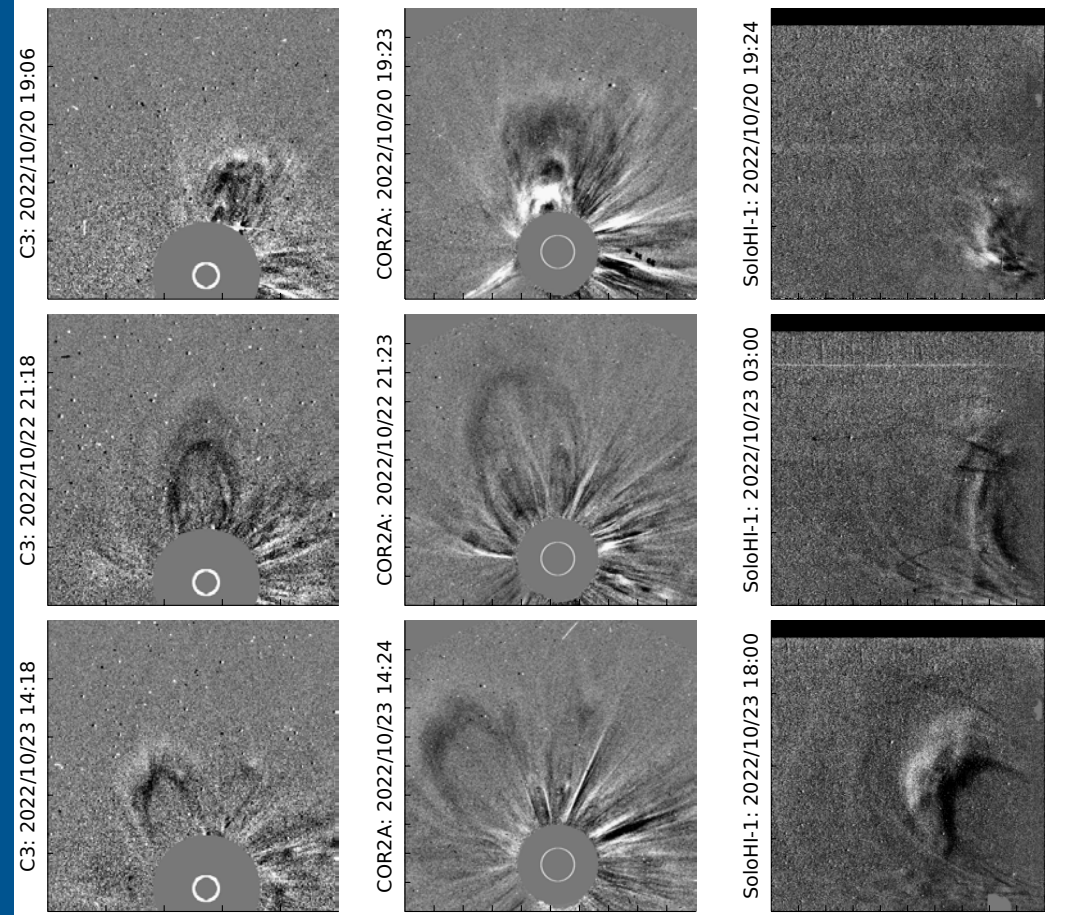
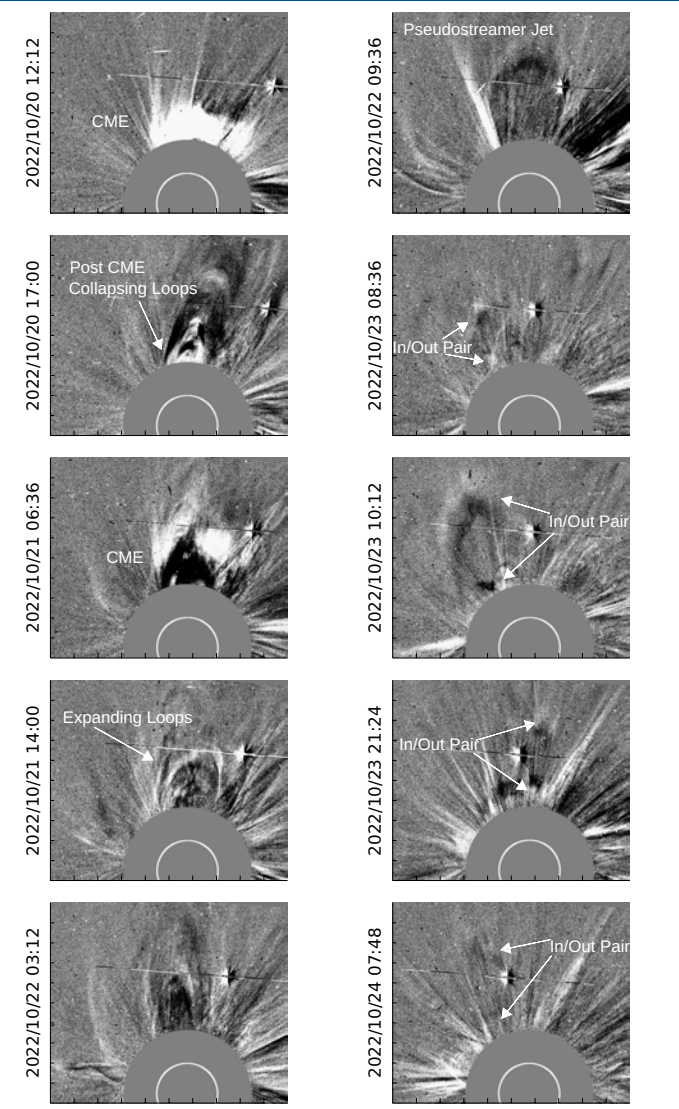


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(submitted)

Expanding SoloHI Loops



Comparing Observations



Conclusions and Summary

- Our new generation of heliospheric imagers give us unprecedented views of erupting transients of all sizes in the solar wind
- The nature of the eruptions of each pass for PSP and Orbiter will be highly dependent on the inclination of the plasma sheet
- The small scale blobs and blowouts, while not being impactful from a space weather perspective, provide significant flux and structure to the solar wind
- The complexity of these observations also present new challenges in how we present and analyze the data, and new techniques will be needed