

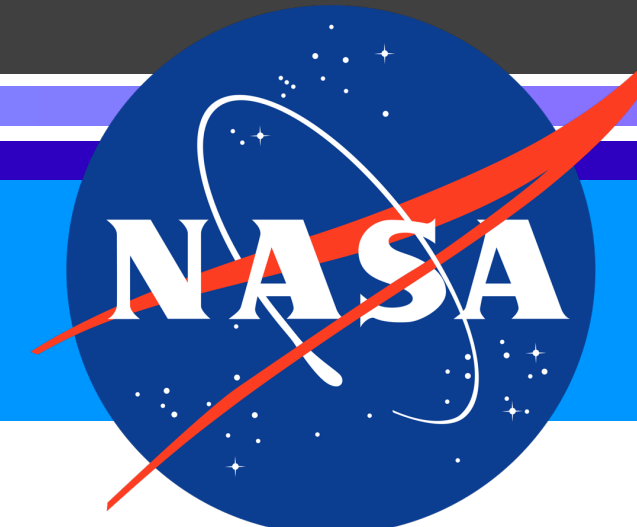
Using Möbius transformations to explore Parker Solar Probe magnetometer data



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Current research: polarization and angle analysis of in-situ plasma wave and perturbation observations

Motivation:

- When PSP encounters the Heliospheric Current Sheet (HCS) near the Alfvén surface, the amplitude in this region has a large dynamic range
- Amplitude values that approach "inf" and "0" are difficult to analyze with traditional methods
- Möbius transformations provide a new way to understand this data by preserving small-scale features while modulating overall amplitude
- Ask me about the general method!

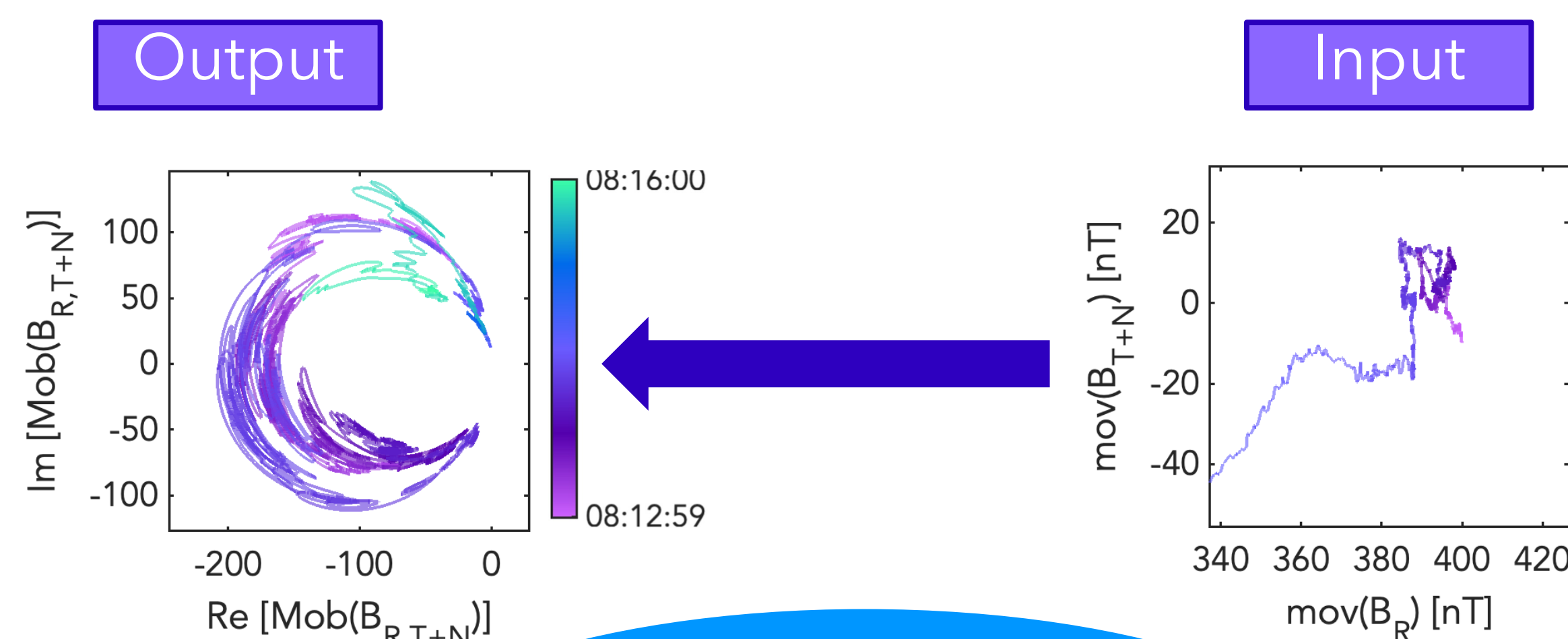
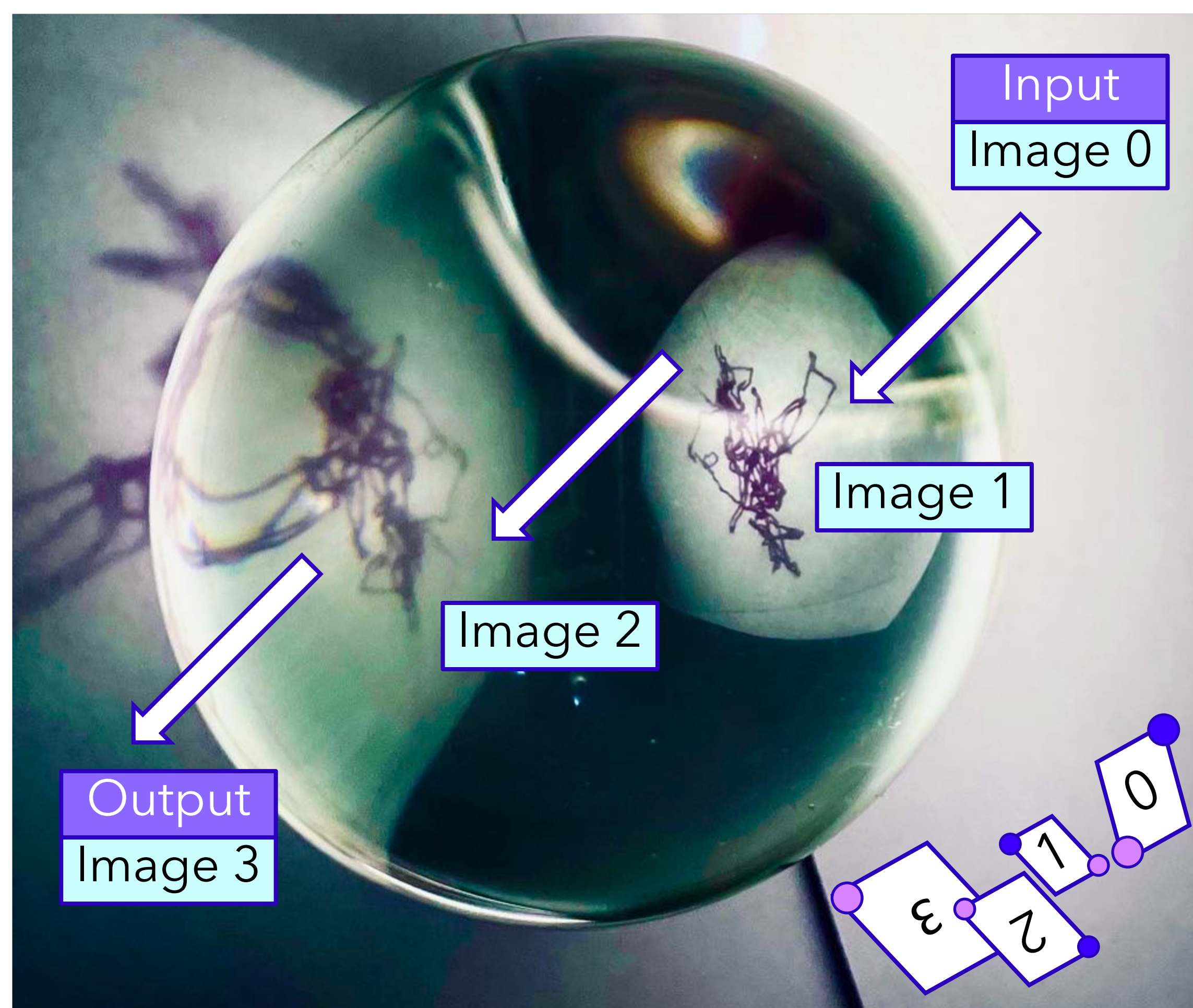
Project challenges:

- Can we find a PSP scientist able to help us interpret PSP timeseries?
- Which phenomena and magnetic features could we enhance and identify?
- Are there previously unobserved phenomena that we should look for?

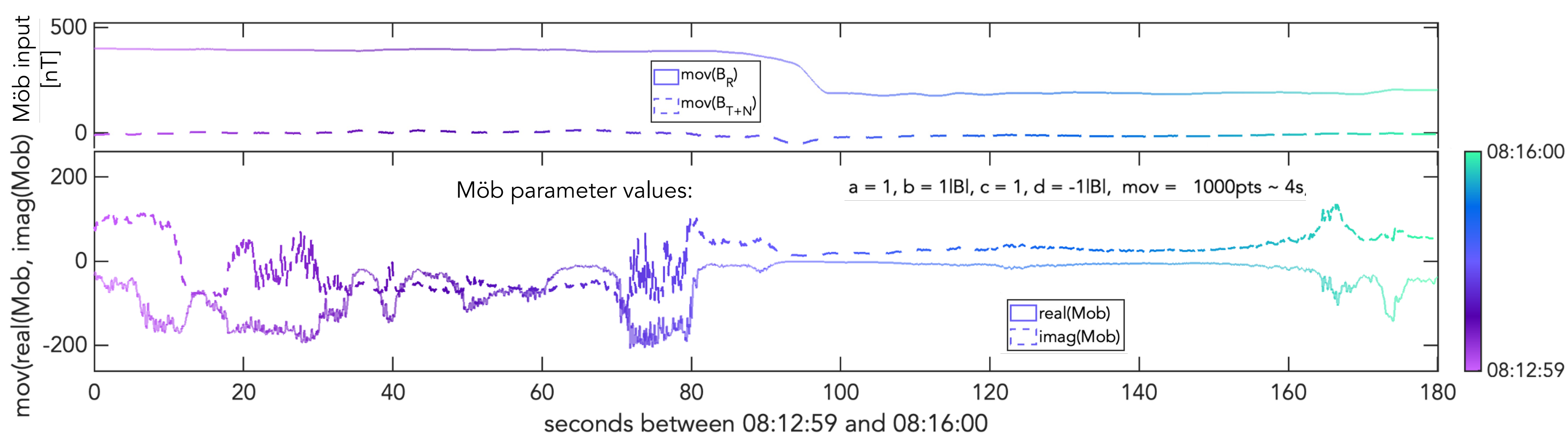
The PSP E8 HCS crossing:

- Alfvén surface: 7:18-7:52 on Apr 29, 2021
- Möb analysis: 8:13-8:16 on Apr 29, 2021

Visualization of main idea:



Möbius transformations can enlarge image features that are far from "lens"



hodogram
timeseries

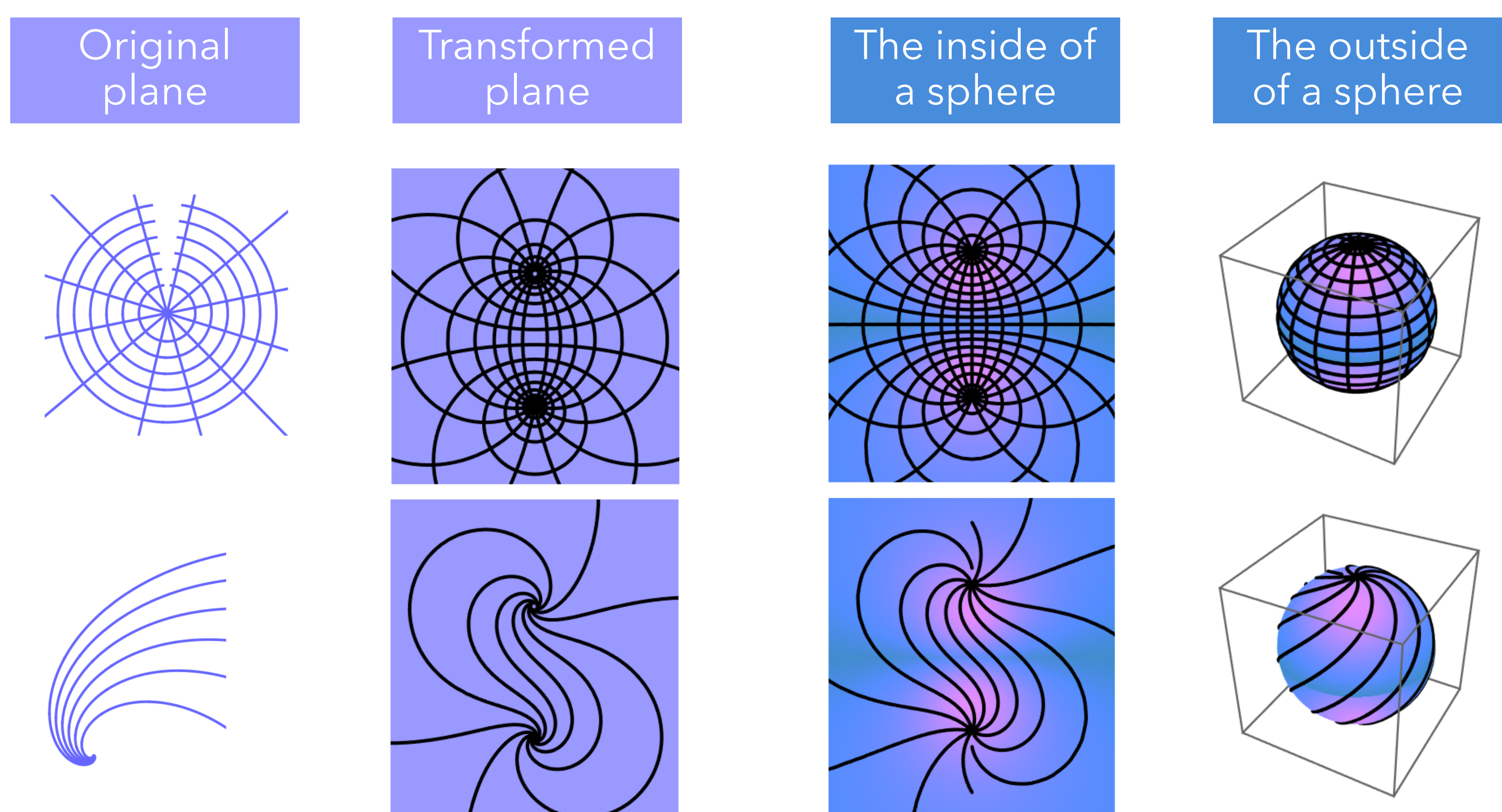
Research interests and connections to the PUNCH mission

Motivation:

- The heliosphere connects previous work on magnetic features in the solar wind to the Sun's magnetic topology
- Coronal mass ejections (CMEs) and transients are exciting and relevant to everyday life on Earth
- Expansion of magnetic structures is an invitation to use computational and differential geometry
- Transformations, projections and reconstructions are super interesting!

Möbius transformations are a convenient and bidirectional method of projecting images

A few Möbius transformation properties:



References and acknowledgements:

- We thank S. Bale for access to public PSP FIELDSDA data
- This work is funded by NASA grant #80NSSC20M0189
- J. C. Kasper et al. 2021, "Parker Solar Probe Enters the Magnetically Dominated Solar Corona", PRL 127, 2551