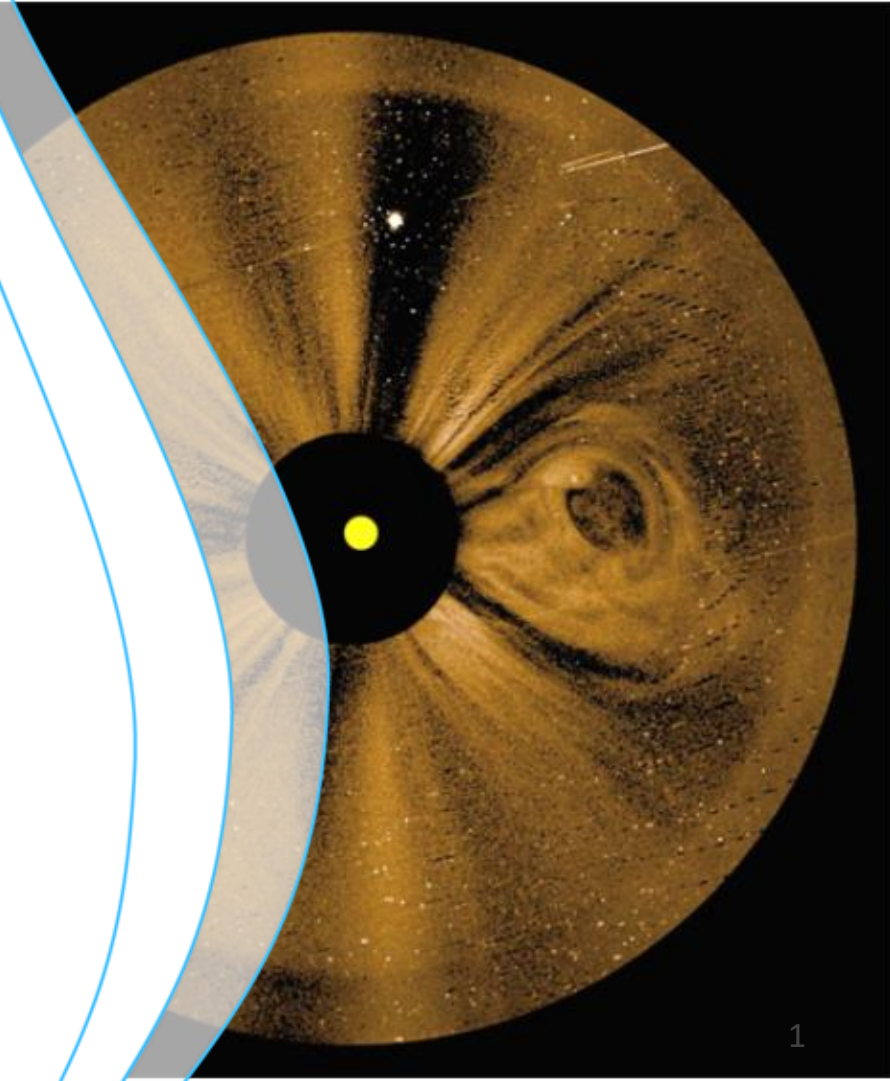
PUNCH Science

Sarah Gibson, Craig DeForest, and the PUNCH Team

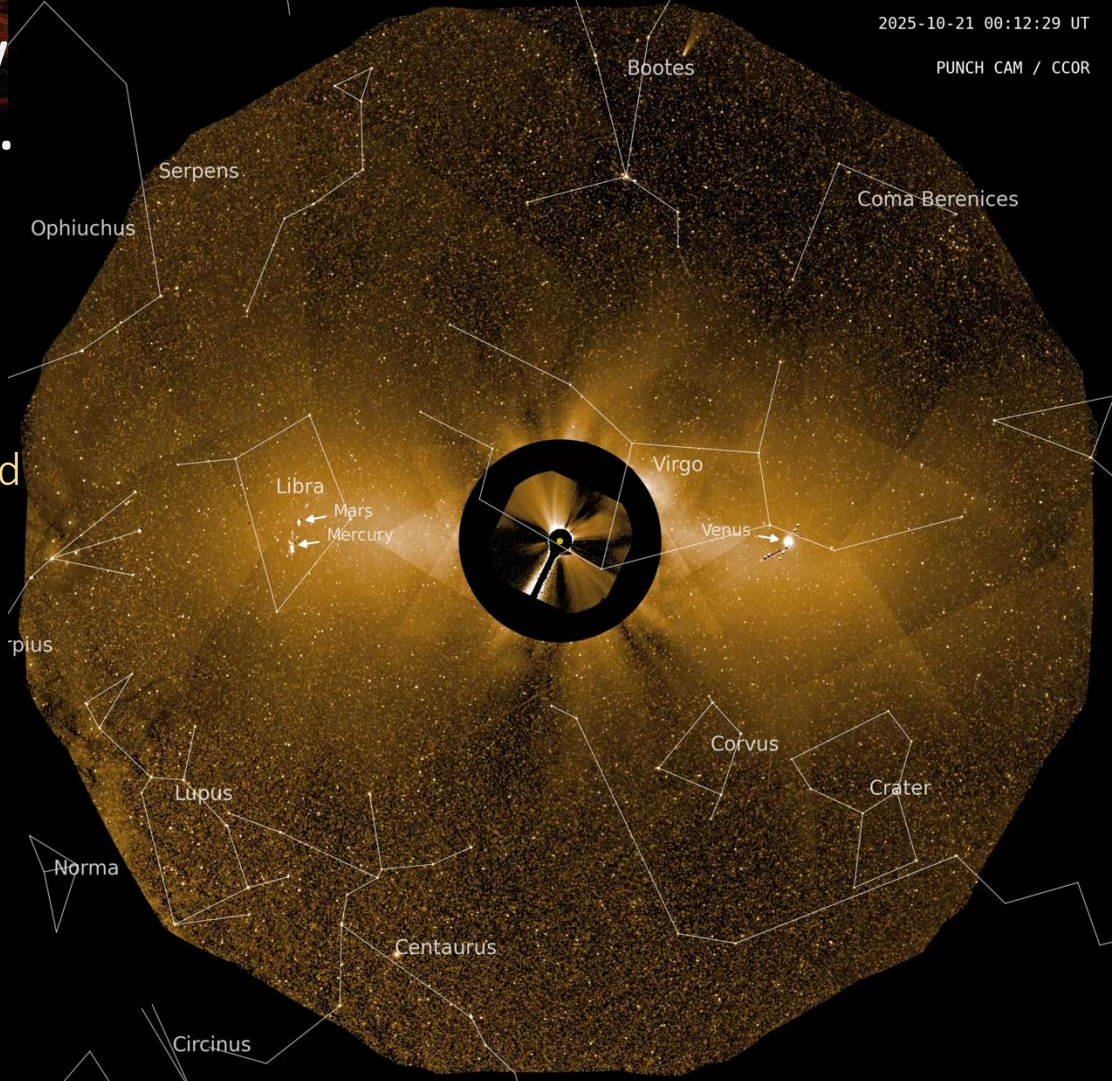
PUNCH 7, SwRI
May 12, 2026



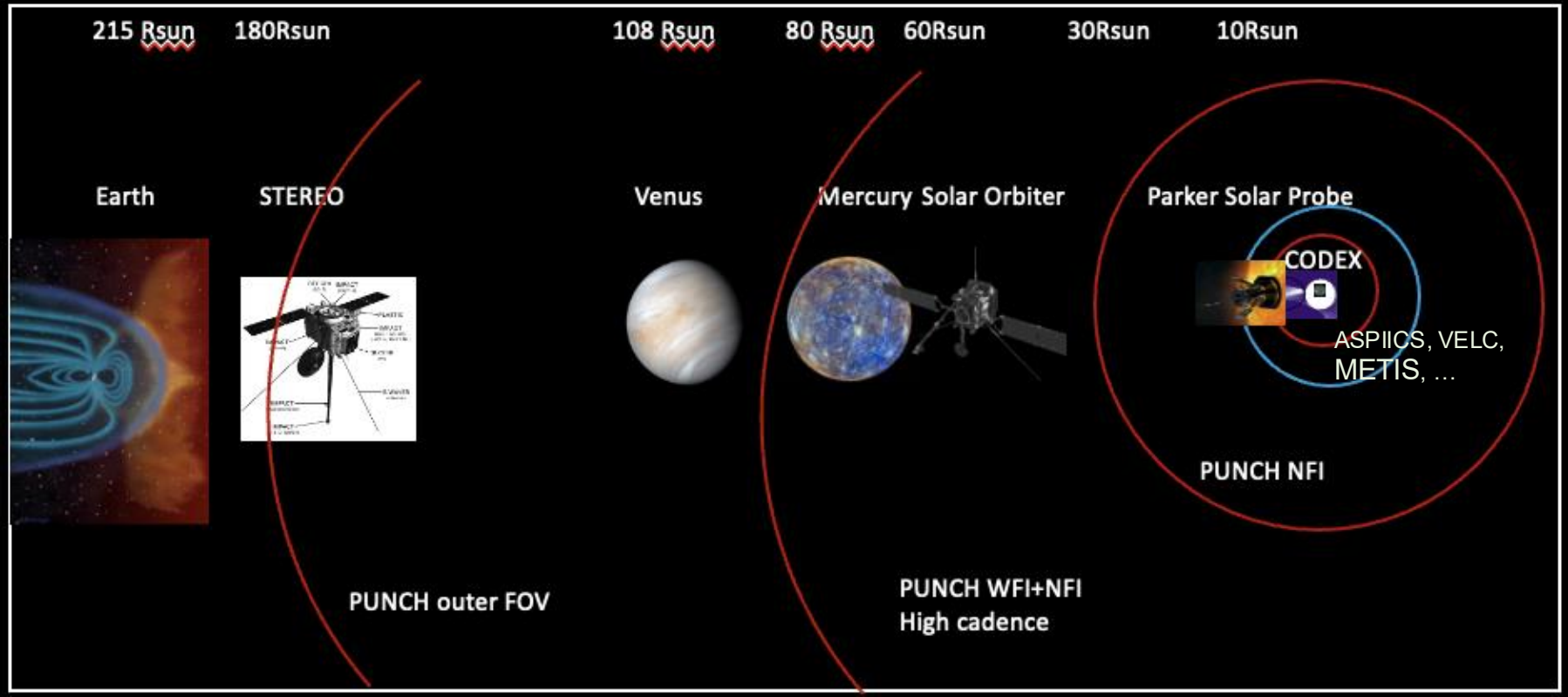
This material presented here is based upon work supported by NASA's PUNCH Small Explorer Mission

PUNCH data show the Sun in context.

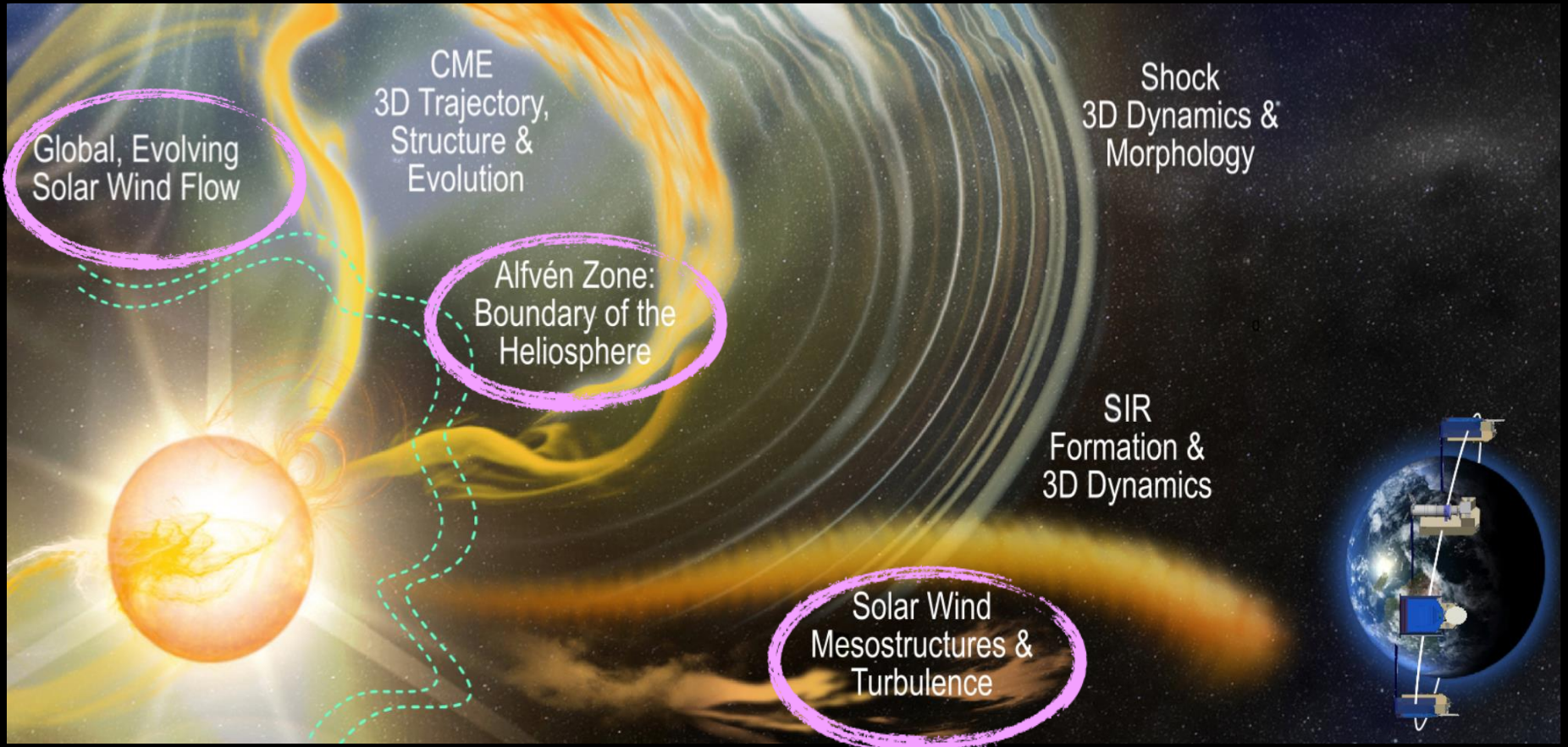
- 90° field of view
- This movie: NOAA's CCOR in inner field
- Solar wind streams visible to ~100 Rs
- CMEs visible to 45° from Sun



PUNCH: Global Context



The Big Picture on the Young Solar Wind

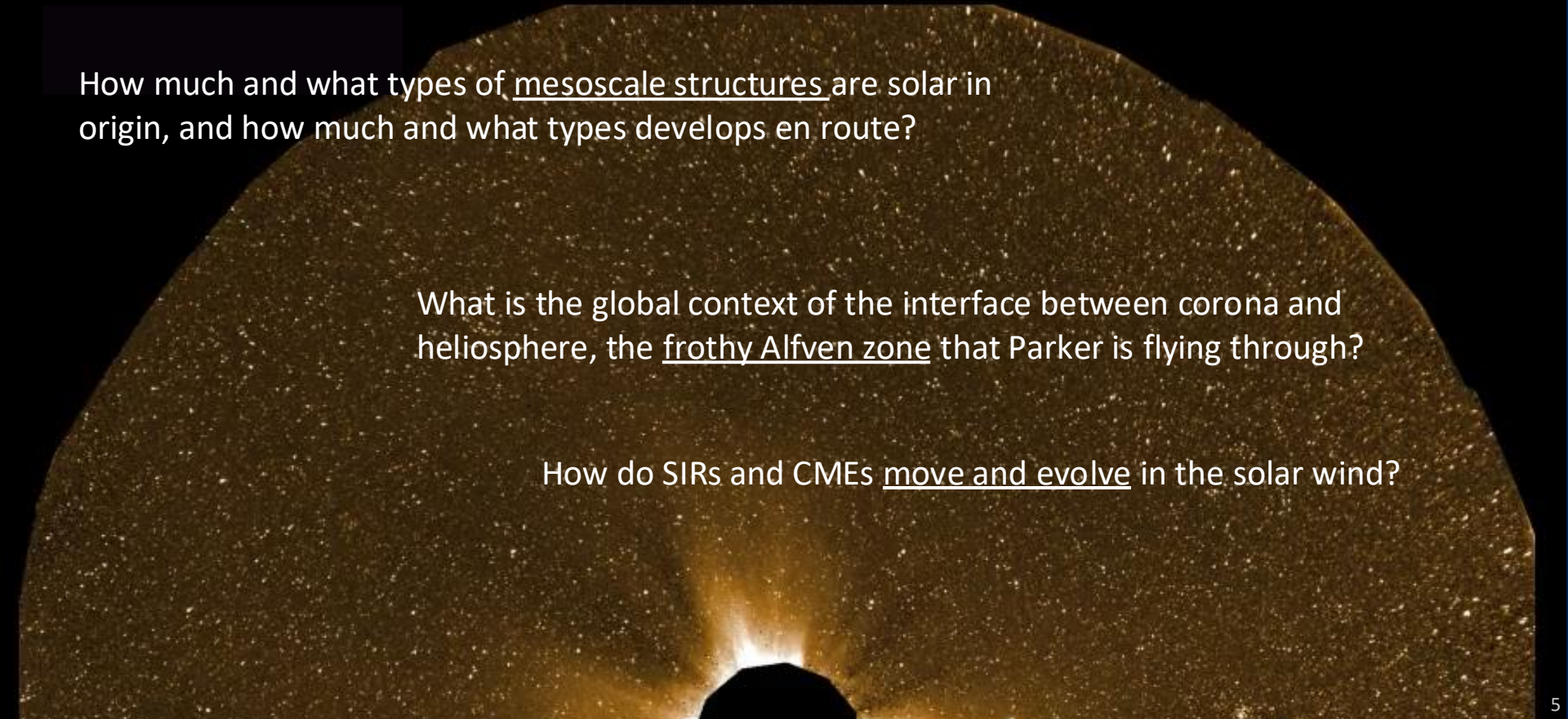


PUNCH Science Data: Flow Maps

How much and what types of mesoscale structures are solar in origin, and how much and what types develops en route?

What is the global context of the interface between corona and heliosphere, the frothy Alfven zone that Parker is flying through?

How do SIRs and CMEs move and evolve in the solar wind?



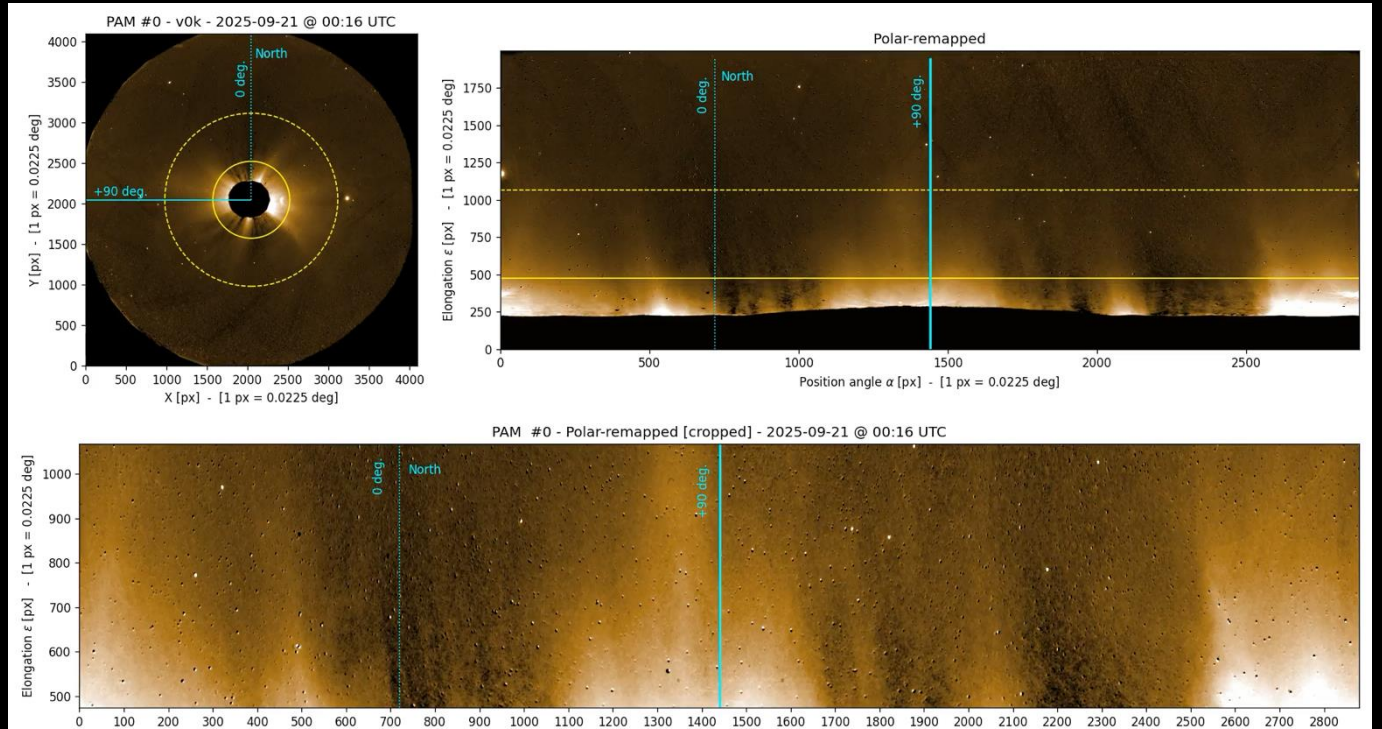
PUNCH Science Data: Flow Maps

Tuesday

11:05 AM	First Interplanetary Solar Wind Flow Maps series from PUNCH data	Raphael Attié, George Mason University / NASA GSFC
11:20 AM	Go with the Flow – Solar Wind Tracking with PUNCH	Chris Lowder, SwRI

Wednesday Hands-on activity

Raphael Attie



Turbulence/Alfven Surface

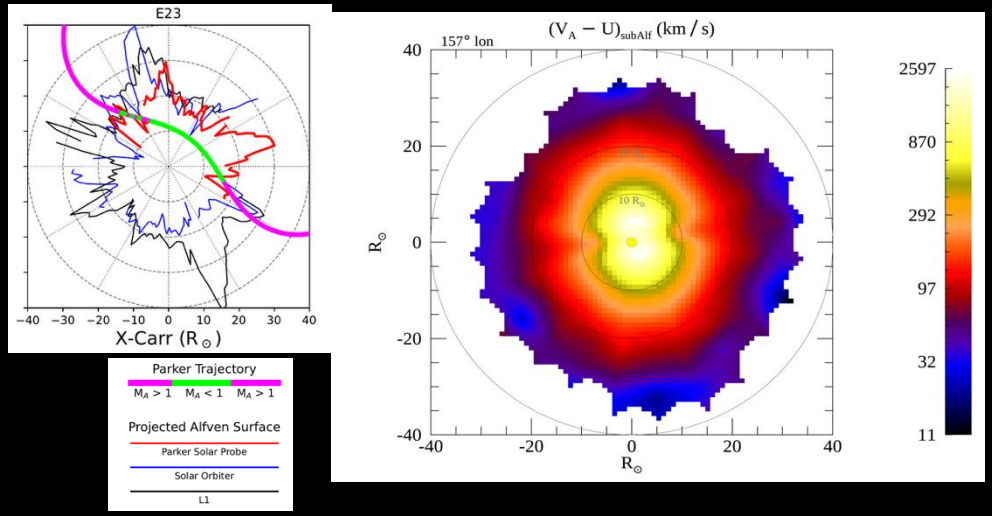
Wednesday

8:30 AM – 10:00 AM	**Section 5 – PUNCH Turbulence/Alfven Surface** Chairs: Raphael Attie and Steve Cranmer	
8:30 AM	(Invited Talk) Obtaining turbulence spectral information from remote observations	Francesco Pecora, University of Delaware
8:50 AM	1/f Noise in the Heliosphere: a Target for PUNCH Science	Jiaming Wang, University of Delaware
9:05 AM	Turbulence Investigations Across Space and Time with PUNCH	William Matthaeus, University of Delaware
9:20 AM	Mapping the Sun's Alfven Zone with PUNCH	Rohit Chhiber, University of Delaware and NASA Goddard Space Flight Center
9:35 AM	Presenter Panel Discussion and Q & A	

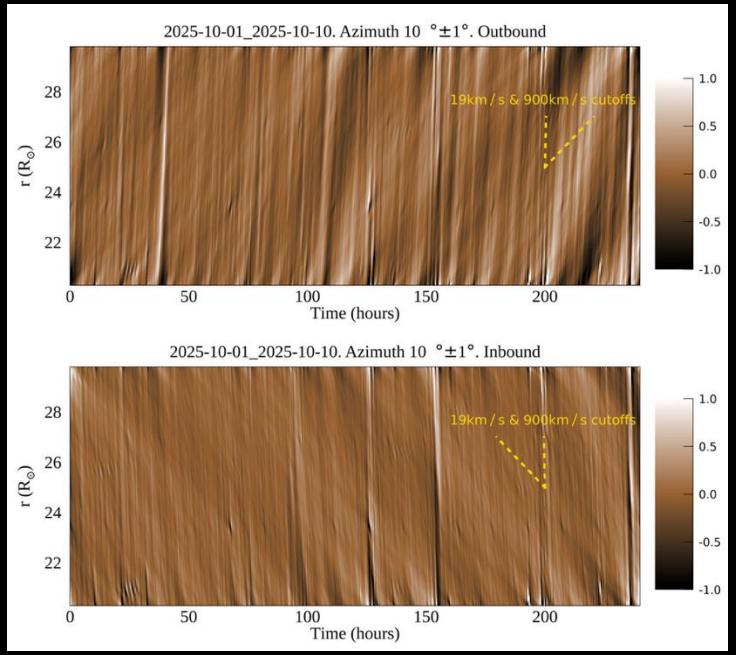
The Sun's Alfvén Zone

Rohit Chhiber (see also poster by Mateo Admire)

Context from in-situ and model data
Preliminary results based on Fourier motion-filtering of PUNCH data

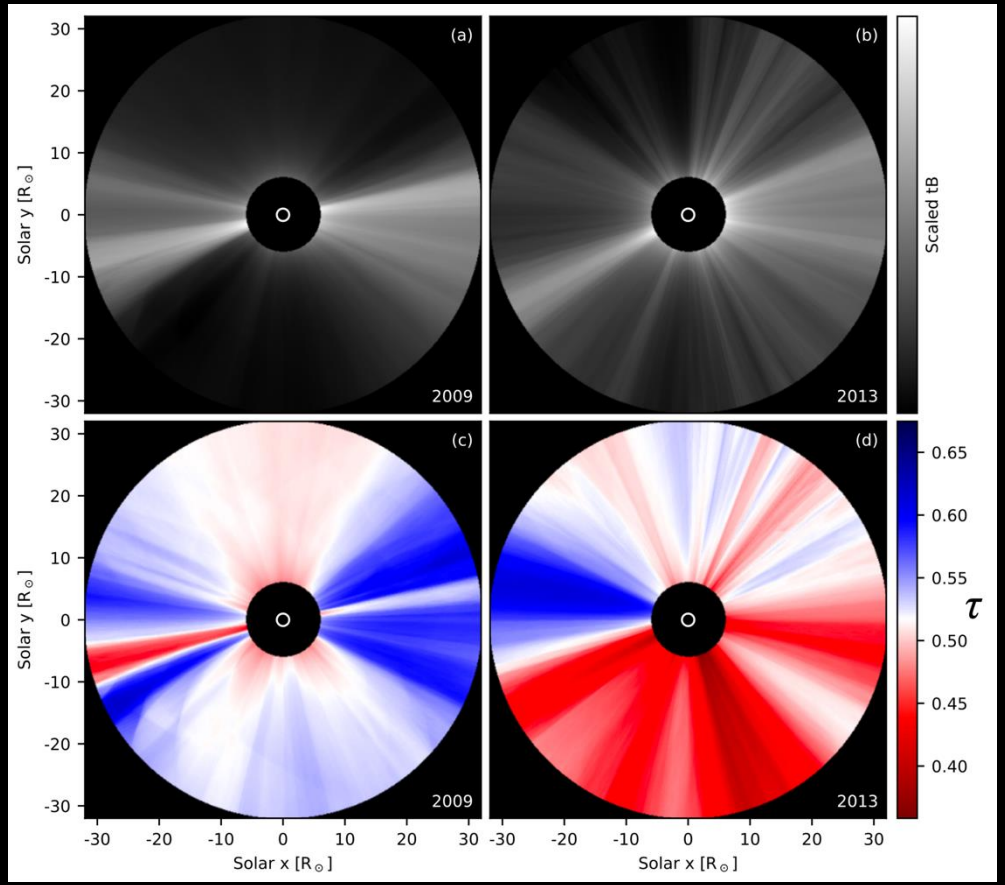


In-situ observations and solar wind models provide complementary insights on locations and flow speeds associated with the Alfven zone



Top: Preliminary results based on Fourier motion-filtering of PUNCH images, separately showing outbound and inbound features

STRIA: a 3D testbed for realistic density striations

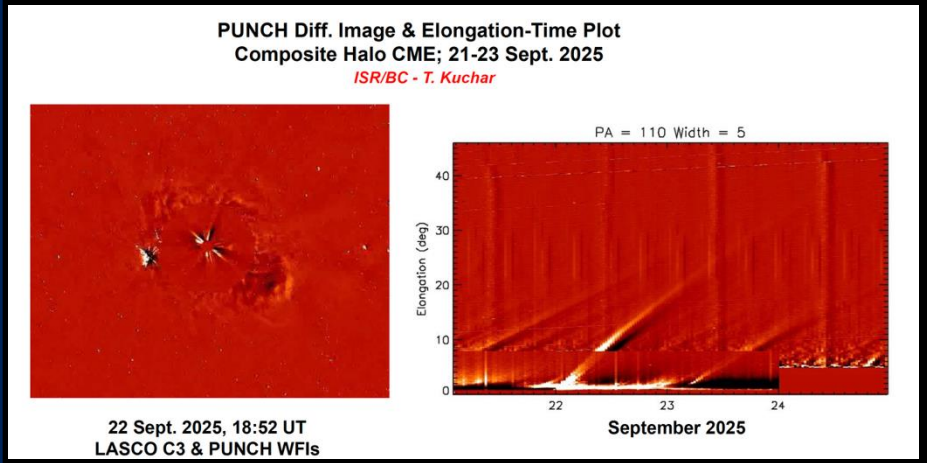


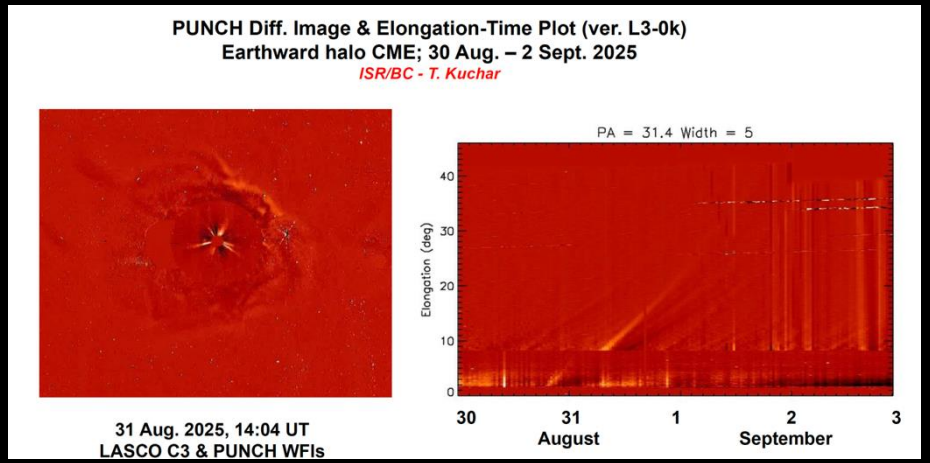
- The STRIA code simulates fine-scaled density striations as well as **"blobs"** (some flowing out, some flowing in) to test our flow-tracking algorithms.
- Rotation produces a low level of time variability (as multiple flux tubes sweep past) that could be mistaken for **compressible turbulence.**
- For more, see **Trestan Simon's PUNCH-7 poster.**

Steve Cranmer and Trestan Simon

CME Tracking

Dave Webb and Tom Kuchar





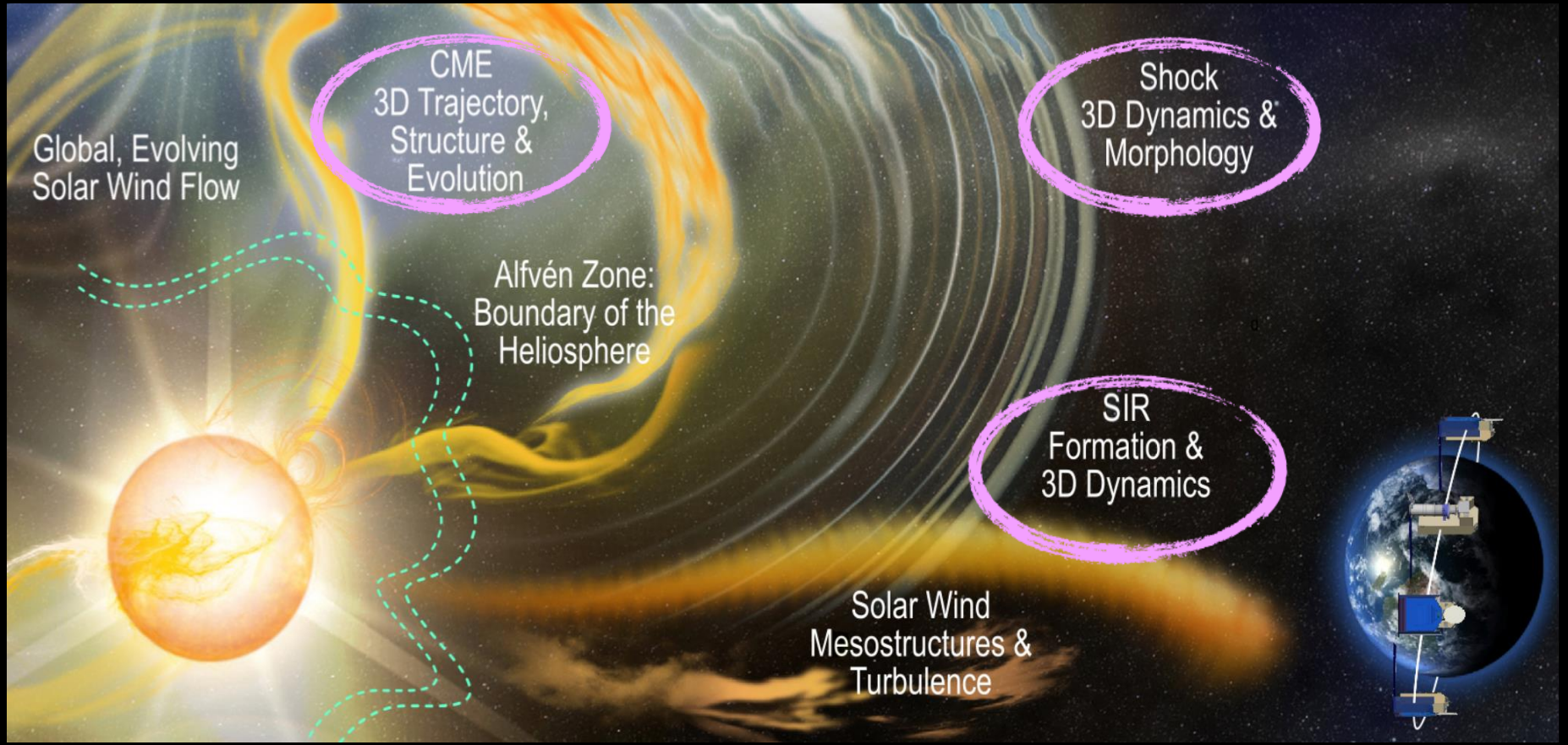
Thursday

10:50 AM	Analysis of Halo CMEs with PUNCH Observations	David Webb, ISR/Boston College

Tuesday

1:50 PM	(Virtual Talk) CME Tracking and Semi-automatic Reconstructions with PUNCH	Eleni Nikou, NRC Research Associate, U.S. Naval Research Laboratory

The Big Picture on the Young Solar Wind



PUNCH Science Data: Polarization

What are CME 3D trajectories/arrival times at Earth?

What is the 3D structure (and substructure) of CMEs and SIRs?

How does solar wind dimensionality vary?

PUNCH Science Data: Polarization

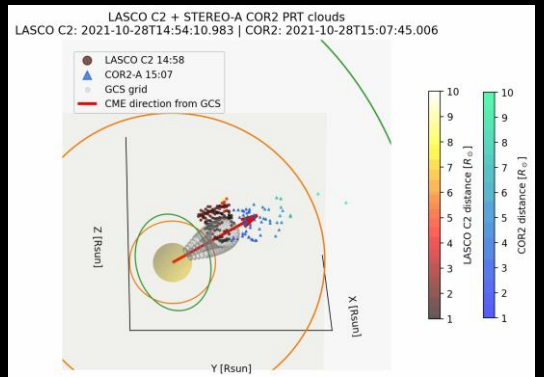
Tuesday

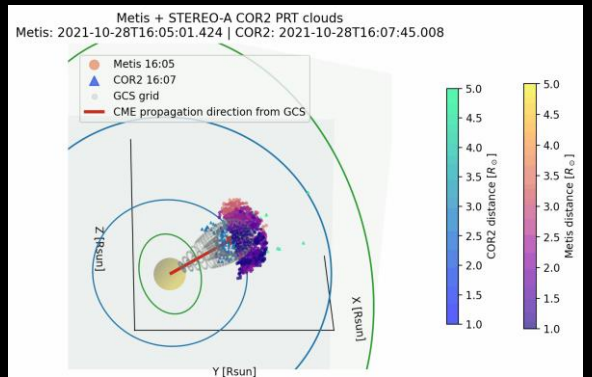
10:30 AM	(Invited Talk) Packing a PUNCH: Wide-field polarimetry of the heliosphere	Ritesh Patel, Southwest Research Institute, Boulder
10:50 AM	The Polarization Ratio and PUNCH	Curt A. de Koning, University of Colorado/Cooperative Institute for Research in Environmental Sciences

Wednesday

10:30 AM	(Invited Talk) Polarization and 3D Kinematic studies of CMEs from multi-mission observations: toward Metis–PUNCH synergies	Yara De Leo, INAF - Astrophysical Observatory of Catania (Italy) and University of Graz (Austria)
10:50 AM	CME in 3D with PUNCH	Anna Malanushenko, HAO/UCAR

Yara de Leo

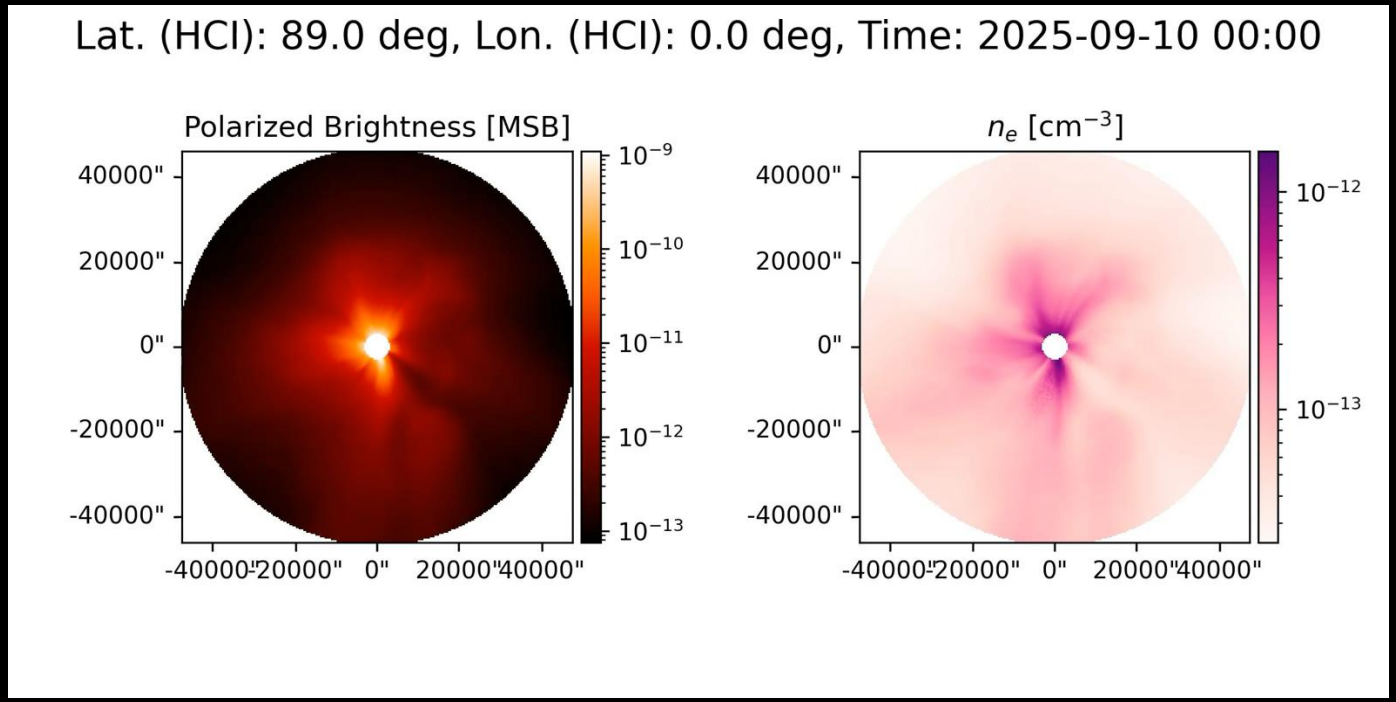




PUNCH Science Data: Tomography

Wednesday

11:05 AM	Tomographic Reconstructions of Coronal Mass Ejections with Physics-Informed Neural Radiance Fields	Robert Jarolim, High Altitude Observatory, NSF NCAR

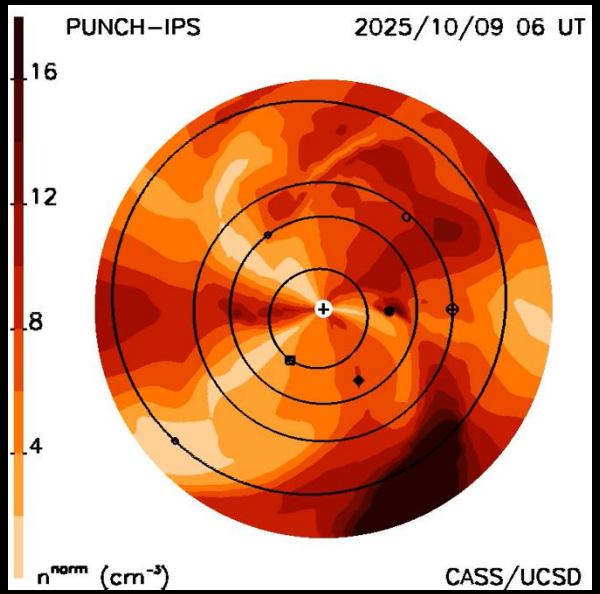


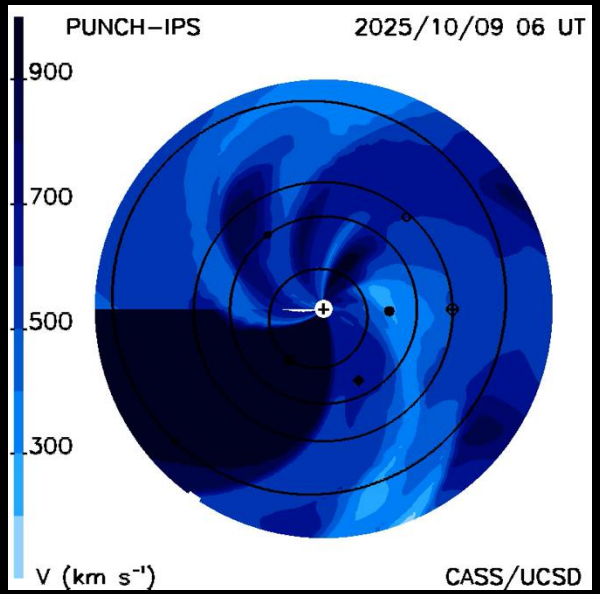
Robert Jarolim

PUNCH Science Data: Tomography

Wednesday

11:20 AM	UCSD Time-Dependent 3-D High-Resolution Reconstructions Using PUNCH Images: What We Have Done To Date	Bernard Jackson, Department of Astronomy and Astrophysics, University of California, San Diego, 9500 Gilman Drive #0424, La Jolla, CA 92093-0424, USA





Bernie Jackson

PUNCH Synergies

Tuesday

1:00 PM - 2:30 PM	**Section 3 - Synergistic Missions** Chairs: Mihir Desai and Cherilynn Morrow	
1:00 PM	(Invited Virtual Talk) Detection and Dynamics of Waves and Flows in the Inner to Middle Solar Corona	Dipankar Banerjee, Indian Institute of Space Science and Technology
1:20 PM	Linking Slow Wind Intervals to Streamers and Pseudostreamers Topologies and Dynamics	Arpit Kumar Shrivastav, Southwest Research Institute, Boulder
1:35 PM	MUSE and PUNCH: a Harmonious Outreach Collaboration	Rebecca Robinson, SETI Institute

Wednesday

1:00 PM - 2:30 PM	**Section 7 - Synergistic Modeling/Data Analysis Tools** Chairs: Marcus Hughes and Nicholeen Viall	
1:00 PM	(Invited Talk) Supporting PUNCH Science with the WSA Model: Capabilities and Opportunities	Samantha Wallace, Embry-Riddle Aeronautical Univ.
1:20 PM	Automatically Plotting and Identifying Interplanetary Coronal Mass Ejection and Stream Interaction Region in In Situ Observations	Heather Elliott, Southwest Research Institute, San Antonio, TX
1:35 PM	Next-Generation Solar Wind Modeling: Differentiable Framework and its Synergy with PUNCH	Prateek Mayank, SWx TREC, University of Colorado, Boulder
1:50 PM	Simulating Mesoscale CME Structures As Seen By PUNCH	Ward Manchester, University of Michigan

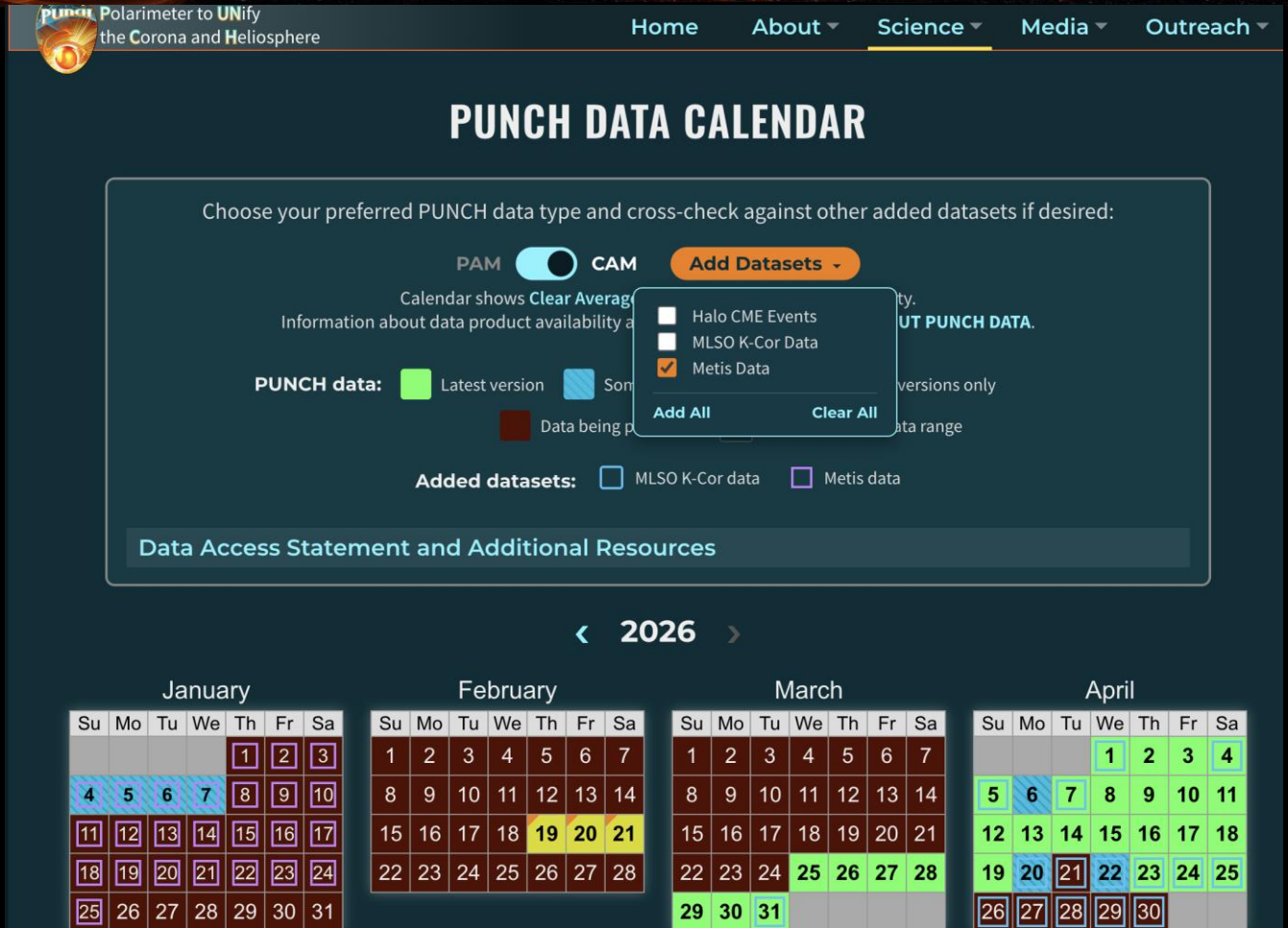
PUNCH Connect

Thursday

8:30 AM - 10:00 AM	**Section 9 - PUNCH Connect Part 1** Chairs: Sarah Gibson and Craig DeForest	
8:30 AM	In memory of Volker Bothmer	
8:45 AM	PUNCH CONNECT: Collaborative Event Analysis	Barbara Thompson, NASA Goddard Space Flight Center
9:00 AM	(Invited Talk) Ensemble modeling of 30 August 2025 CME in the inner heliosphere and comparison with multi-spacecraft observations	Elena Provornikova, JHU APL
9:20 AM	Leveraging an alignment of PUNCH, CODEX and Metis to reveal the outflow and acceleration of the solar wind	Nicholeen Viall, NASA Goddard Space Flight Center

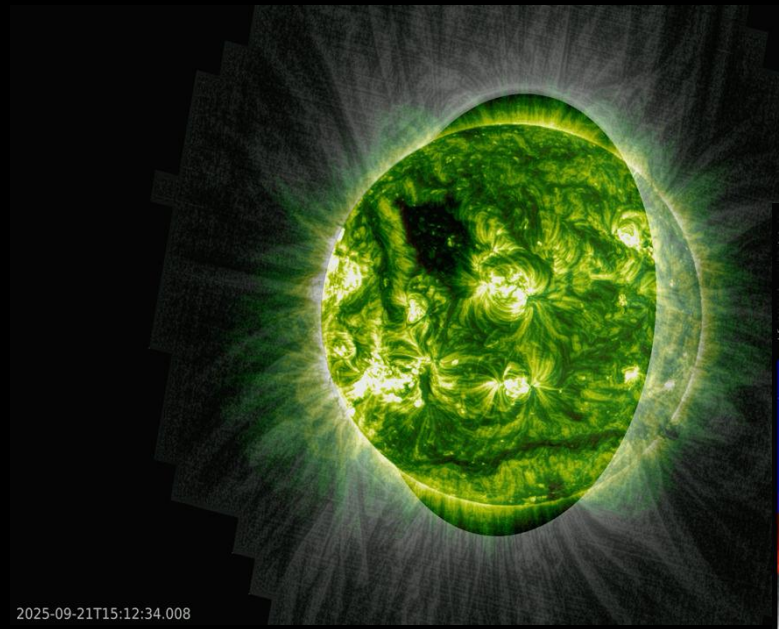
10:30 AM - 12:00 PM	**Section 10 - PUNCH Connect Part 2** Chairs: Heather Elliottt and Anna Malanushenko	
10:30 AM	(Invited Talk) Probing realistic CME model with the Icarus heliosphere model and PUNCH observations	Tinatin Baratashvili, Centre for mathematical Plasma Astrophysics, KU Leuven
10:50 AM	Analysis of Halo CMEs with PUNCH Observations	David Webb, ISR/Boston College
11:05 AM	PUNCH observations of CME shocks and associated particle acceleration	Mihir Desai, Southwest Research Institute, San Antonio TX
11:20 AM	Interaction-Driven Sheath Formation and Geoeffectiveness of Successive CMEs	Shirsh Soni, University of Iowa

PUNCH Connect

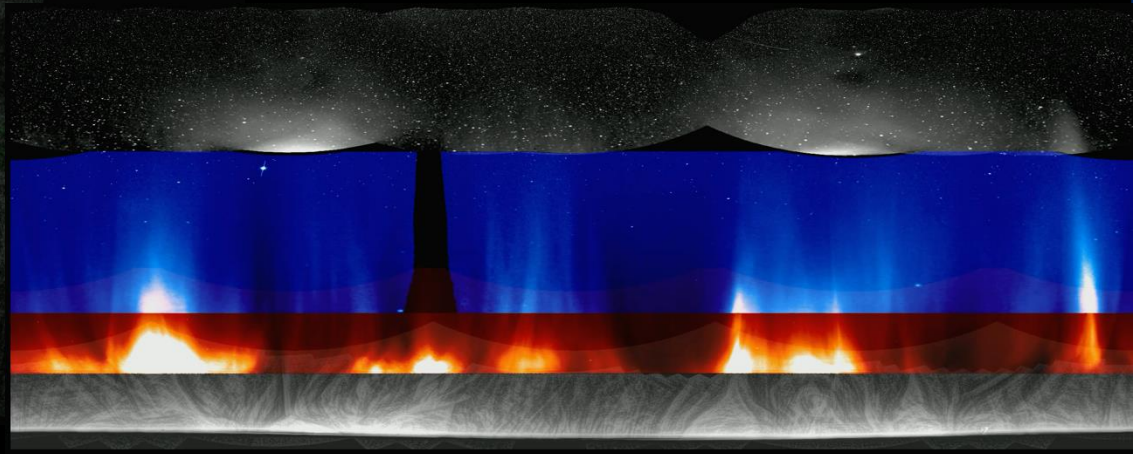


Don Kolinski

PUNCH Connect

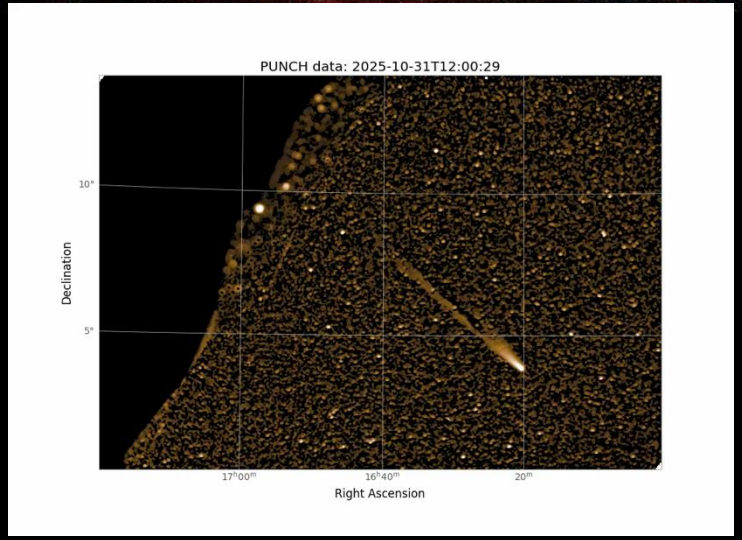


SDO/AIA, STEREO/EUVI, SOLO/EUI, ASPIICS (Patel et al 2026)



ASPIICS, LASCO C2/C3, PUNCH WFI

PUNCH Serendipities



Thursday

3:00 PM – 4:30 PM	**Section 12 – PUNCH Rib-bone Science** Chairs: Barbara Thompson and Michael Kirk	
3:00 PM	(Invited Talk) Photometry and Polarimetry of faint moving objects with PUNCH.	Simon Porter, Southwest Research Institute
3:20 PM	Searching for asteroids in PUNCH data	Kevin Walsh, Southwest Research Institute
3:35 PM	PUNCH and High-Altitude Aurora	Bea Gallardo-Lacourt, NASA/CUA
3:50 PM	QuickPUNCH Data for Space Weather Research and Operations	Dan Seaton, Southwest Research Institute

Get Involved!

https://punch.space.swri.edu

punch-science mailing list
(contact punch-help@mailman.boulder.edu)

- Bimonthly science telecons (Sandboxes)
- PUNCH CONNECT