13. How Does Plasma Origin and/or Magnetic Topology affect Solar Wind Acceleration?

**Scene Setters:** Steve Cranmer (acceleration theories), Yeimy Rivera (leveraging observations)

**Session Organizers:** Samantha Wallace (UMN, NASA GSFC), C. Nick Arge (NASA GSFC), Aleida Higginson (JHU/APL)

- Is a solar wind parcel’s acceleration profile altered in any way by the magnetic topology at the source and/or release mechanism, or is there only an imparted observational signature?
- What role do waves or reconnection play in accelerating the solar wind? How can we confirm theories with observations and modeling? What observations are needed?
- What new observations (PSP, SO, DKIST), approaches, and tools are critical to obtaining a full understanding of how the solar wind is accelerated?
What are the mechanisms?

Source of solar wind plasma

Open/steady field lines
- Thermal balance at TR
- What creates suprathermal tails in the chromosphere?

Closed/variable field lines
- On what spatial scale does interchange reconnection occur?

Granular scales (spicules & jets in the chromosphere)

Supergranular scales (canopy & magnetic carpet)

Subsonic wind scales (plasmoids & KHI at cusps)

Wave damping

Distributed nanoflares

Turbulent cascade

(if Type II spicules are driven by waves/turb., not reconnection!?)
Yeimy Rivera (leveraging observations)

DKIST + PSP observing waves at the Sun and in the heliosphere
The source location, release, and acceleration of the solar wind are related on large-scales, and on average. Some theories have them inextricably linked. However, they may not be. And when they aren’t, they are separate physical questions, having different physical impacts on the heliosphere, and with different distinguishing observables.

<table>
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<tr>
<th>Source Location: AR, CH, or QS (B field strength and coronal/atmospheric heating)</th>
<th>Mechanism of Release: reconnection (height/topology jets vs Pseudo vs helmet streamer) or continuously open</th>
<th>Acceleration: reconnection, Waves, turbulence</th>
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<td>Impacts on the Heliosphere</td>
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<td>Defining observables</td>
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Session outcomes

To date, we have made significant progress in understanding the solar wind life cycle from its source to impact on heliosphere. However, this has been done in large part through:

• Characteristic relationships and correlations of variables over all solar wind populations over years, solar cycles, etc.
• Theories and models digging into the physics

To make progress now:

• Tease out from models and theory what are the key observables that can be used to test them, and understand the physics.
  • Identify individual cases of wind originating from specific source regions
  • models to provide connectivity to source region
  • Observations to parse out release and acceleration mechanisms

Take advantage of using multiple observational assets such as PSP, SO, DKIST, and STEREO
Continuing the Conversation

AGU session SH032: Utilizing Next Generation Helio Missions to Address Long Standing Solar Wind Mysteries, which will discuss multi-messenger science, including Parker Solar Probe and future Solar Orbiter, IMAP, and DKIST to tackle open questions about the solar wind.

AGU PSP and SO sessions

Parker One meeting – APL March 23 – 27

Late winter or spring meeting in the DC area? If you want to take part, email Samantha.Wallace@nasa.gov or Charles.n arge@nasa.gov