Disentangling Expansion Effects and Collisional Relaxation in the Solar Wind

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SHINE Meeting
Session #1
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Velocity Distribution Function (VDF)

- Probability distribution of the velocities of individual particle
- Measured with in-situ instruments
- Equilibrium distribution: Maxwell-Boltzmann
- Deviations from equilibrium
  - Temperature anisotropy
  - Secondary populations: beams, halos, & strahlen
  - Among different particle species:
    - Unequal temperatures
    - Unequal bulk velocities
- Indications of plasma’s history

Feldman et al. (*JGR*, 1973)

*IMP-6*
Global Versus Local Processes

Expansion
- Large-scale changes to fluid properties

Coulomb collisions
- Inter-particle exchanges of energy/momentum

Microinstabilities
- Limits on deviations from equilibrium

Turbulence
- Spectra of fluctuations

Matteini et al. (SSR, 2012)
Expansion

Marsch et al. (*JGR*, 1982)

Marsch et al. (*JGR*, 1984)
Collisions


Microinstabilities

- Solar wind expansion drives plasma toward $\beta_{||p} - T_{\perp p}/T_{||p}$ instability boundaries.

- Evidence of enhanced magnetic activity and temperatures near instability boundaries (with caveat from Hellinger & Travnicek 2014).

- Which instability boundaries (i.e. proton cyclotron vs. mirror) limit the expansion?

- How do other sources of free energy contribute to growth of instabilities?
Turbulent Structures

- How does expansion affect turbulence?
- How does turbulence affect expansion?

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Where does turbulence onset (Alfvén surface? $\beta = 1$ surface)?

Osmanov et al (2014)

DeForest et al (2016)
Entangled Plasma-Processes

Matteini et al. (*GRL*, 2007)

Bennett A. Maruca (U. Del.)

Marsch (*SSR*, 2012)
<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. R. Lichko</td>
<td>Magnetic pumping as a source of heating in the solar wind</td>
</tr>
<tr>
<td><strong>K. Horaites</strong></td>
<td>Kinetic Theory and Fast Wind Observations of the Electron Strahl</td>
</tr>
<tr>
<td>A. R. Macneil</td>
<td>Tests for coronal electron temperature signatures in suprathermal electron populations at 1 AU</td>
</tr>
<tr>
<td>R. A. Qudsi</td>
<td>Using Higher-Order Moments to Quantify Ion-Beam Strength in the Solar Wind</td>
</tr>
<tr>
<td>B. A. Maruca</td>
<td>Solar-Wind Observations of Collisional Thermalization among Multiple Ion-Species</td>
</tr>
<tr>
<td><strong>G. A. Graham</strong></td>
<td>Evolution of Solar Wind Strahl: Observations from Cassini’s Interplanetary Voyage</td>
</tr>
</tbody>
</table>
Session SH020

“Disentangling Expansion Effects, Collisionless Processes, and Collisional Relaxation in the Solar Wind”

Invited Speakers

Kelly E. Korreck (CfA/SAO)

Lorenzo Matteini (Meudon)

Abstract submission

Early submission: Wednesday, July 26

Deadline: Wednesday, August 2