Turbulent Dissipation Challenge: Convergence of Current Ideas

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The solar wind is a weakly collisional, strongly turbulent plasma in a supersonic, super-Alfvenic spherical expansion.

One of the most striking features of the solar wind is indeed the very large number of degrees of freedom which are excited: the electromagnetic fields and plasma properties of the solar wind show fluctuations over a wide range of time scales ranging from the solar rotation period up to the local electron plasma period.

Coulomb collisions are infrequent enough

=> fluctuations and waves play a fundamental role in determining the properties of the ambient solar wind, providing through wave-particle interactions the necessary scattering of the particles, thus regulating the energy transport and dissipation in the plasma and associated particle heating.

• Good observations at ion scales
• Computational power to resolve ion scales => increased interest at ion scales
Global spectrum of solar wind electromagnetic fluctuations
- 2 months of Wind data in the ambient solar wind near L1 -

[Salem, 2000]

New observations:
[Sahraoui et al. 2009, 2010]

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Dissipative processes and Heating

• How are dissipation and the resulting heating taking place at kinetic scales? What are the different competing processes under different solar wind conditions?
• Many processes have been suggested: wave-particle interactions, role of coherent structures, stochastic heating to name a few).
• There is no clear understanding of which are important under a given set of solar wind conditions and no clear consensus in the community has emerged yet.

⇒ Turbulent Dissipation Challenge!
⇒ To bring the community (observers, theoreticians, and simulators) together and work together towards a convergence of our current ideas.
  – Study/Simulate the same set of problems using different models.
  – Provide “artificial spacecraft data” to the observers
Session: Thursday AM and PM

• 4 Invited Talks:
  - Ben Chandran: Dissipation of Turbulence in Collisionless Plasmas
  - Chuck Smith: Why a Turbulence Challenge
  - Jason TenBarge: The Turbulence Challenge: Perspectives and Prospectives
  - Homa Karimabadi: Piecing Together Physics of Turbulence in the Solar Wind

• Discussion:
  - Session 1: Summary and Focus/Refine/Update the science questions of the TurboChallenge
  - Session 2: Agreement on how to proceed forward: what simulations, what initial conditions, what solar wind conditions (select data intervals from Cluster, Wind etc.) to fix the plasma parameters.

• Contributed Talks:
  Slides from Greg Howes, Jiansen He, Bernie Vasquez, Tulasi Parashar, Chadi Salem
Follow up

• Define action Items.
• Follow up Session at Next Fall AGU in SF
Please attend the sessions and participate in this lively, active, passionate debate and discussions. Your opinion counts!

See you all there!