Guiding Questions for SHINE 2011 Turbulence Session:
The Dissipation of Solar Wind Turbulence
Session Leaders: John Podesta, Bill Matthaeus, and Greg Howes
SC Liaisons: Ben Chandran and Chuck Smith

I. OBSERVATIONS:

1. General observations of turbulent fluctuations:
   (a) What observations exist in support of, or in conflict with, proposed models of the turbulent fluctuations in the dissipation range? (KAWs, whistlers, current sheets, ion cyclotron waves, etc.)
   (b) What observational constraints exist on the ratio of the power in perpendicular fluctuations to that in parallel fluctuations, both in the inertial range as well as at the dissipative scales?
   (c) What observational evidence exists that supports a small but non zero amount of fluctuation energy in wave vectors that have significant parallel components? (SEP and GCR scattering)

2. Plasma heating by dissipation of turbulence:
   (a) What observable quantities (parallel and perpendicular temperatures, electron heat flux, etc.) are useful in constraining the physical mechanisms of plasma heating in the solar wind? How can these quantities be used to constrain the observed plasma heating?
   (b) What observational evidence exists for or against the importance of ion cyclotron damping in the solar wind?

3. Observational Analysis Methods:
   (a) What are the limitations of observational approaches to understand turbulence geometry and power distribution in wavevector space? (Minimum variance analysis, and k-filtering/wave-telescope methods, effects of the choice of averaging interval, limitations of the Taylor hypothesis)

II. THEORY/SIMULATION:

1. What are the salient properties and measurable predictions of various models for the turbulent fluctuations in the dissipation range? (KAWs, whistlers, current sheets, ion cyclotron waves, etc.) Specifically, what do these models predict for the physical dissipation mechanisms and for the partitioning of energy into ion, electron, and minor ion heating?

2. What numerical approaches are most useful for investigations of the solar wind dissipation range, and what are their primary advantages and limitations? (Hall MHD, Landau Fluid, gyrokinetics, hybrid/kinetic ion-fluid electron, PIC). NOTE: There seems to be a lot of contention on this topic, and if we can at least agree on the limitations of each approach, this will be a step forward.

3. What theoretical arguments support a small but non zero amount of fluctuation energy in wave vectors that have mainly parallel components?

4. Contrast the role of homogeneous vs inhomogeneous dissipation processes for the turbulence in the solar wind (linear collisionless damping vs. current sheets and intermittency)

5. What implications do the various theories for imbalanced/non-zero cross helicity plasma turbulence have for the physical mechanisms responsible for dissipation of the turbulence?

6. How do temperature anisotropies, including related instabilities, likely affect our interpretations of turbulent fluctuations and heating in the dissipation range?

III. GENERAL:

1. Discuss the controversial topic of the quasi-linear vs. inherently nonlinear (coherent structures and discontinuities) views of plasma turbulence.

IV. REQUEST for the SHINE community:

We hope that each of you planning to attend any of the turbulence sessions will consider bringing a few slides of your own that specifically address one or several of these questions.