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Geophysical Turbulence Program Seminar

National Center for Atmospheric Research

Recent results in observations of solar wind turbulence: single and multiple spacecraft observations

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Abstract:

During the past thirty years, observations of solar wind turbulence have progressed very much in parallel to the theoretical understanding of MHD turbulence. A standard view has developed, in which the initial level of Alfvenic fluctuations gives way to a stronger cascade driven by large scale shear, and eventually, in the outer heliosphere, driven by excitations associated with interstellar pickup ions. Enough is understood about this example of anisotropic nearly incompressible MHD turbulence that it is feasible to assemble a theory that accounts approximately for the three dimensional distribution of turbulence in the heliosphere. Closely related issues are the quantitative understanding of plasma heating and scattering of cosmic rays, both associated with MHD turbulence. After reviewing this baseline description, we focus here on several recent observational results:

First, systematic single spacecraft observations have revealed further detail about the anisotropy of the turbulence. In particular the anisotropic distribution of energy is almost mirrored in the distribution of cross helicity (Alfvenicity), except for the almost purely two dimensional fluctuations, which have lower cross helicity.

Second, there is a systematic difference in the type of anisotropy seen in fast and slow wind. Fast wind, originating at higher latitudes and/or in coronal holes, appears to have a more slab-like and less two dimensional character. The opposite tendency is seen in slow wind.

Third, we review the status of multispacecraft observation of turbulence at 1AU near earth orbit. We have assembled a growing ensemble of two spacecraft datasets from ACE, Wind, Geotail, Imp8 and Cluster spacecraft experiments. From these analyses we have determined both the correlation scale and Taylor microscale from true two point single time measurements. Finally, we discuss preliminary results of a comparison of Taylor microscale and dissipation scale from solar wind observations, leading to some speculative remarks concerning the nature of dissipation processes in the low collisionality solar wind plasma.

When:
16 January 2007
Tuesday, 2:30 pm (Refreshments at 2:15pm)

Where:
Center Green 1
Room 2126

Support Silvia Gentile, 497-2480