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Physics of the energy cascade process in solar wind turbulence and comparisons between theory and observations J.J. PODESTA, Space Science Center, UNH — The solar wind is the only astrophysical plasma directly accessible to in-situ plasma measurements and is an important testing ground for theories of turbulence in collisionless astrophysical plasmas. The physics of the energy cascade process and its relationship to the cross-helicity cascade and the wave-vector anisotropy in Fourier space are among the most fundamental aspects of the subject and are believed to have important practical consequences for the heating of the solar wind and the solar corona. Several different phenomenological theories of incompressible MHD turbulence have appeared in the literature and it is not known which one, if any, correctly describe the energy cascade process in the solar wind. Detailed comparison between turbulence theories and solar wind measurements is the only way to validate any theory of solar wind turbulence. In this presentation, a brief review is given of recent comparisons between phenomenological turbulence theories and solar wind measurements. Some successes and outstanding problems are highlighted. Topics to be discussed include the applicability of the Iroshnikov-Kraichnan theory for describing the energy cascade in the solar wind, the possible scale-dependent alignment between velocity and magnetic field fluctations in the inertial range, and attempts to investigate critical-balance in the solar wind as formulated by Goldreich and Sridhar.

John Podesta
UNH, Space Science Center

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