RECENT INSIGHTS INTO THE NATURE OF TURBULENCE IN THE SOLAR WIND

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During the past several years, studies of solar wind turbulence using data from Cluster and other spacecraft, and results from new numerical simulations, have revealed new aspects of solar wind turbulence. I will try to highlight some of that research. At the shortest length scales and highest frequencies, there is renewed interest in determining how the turbulence dissipates, e.g., whether by kinetic Alfvén waves or whistler turbulence. Finding observational evidence for exponential damping of solar wind fluctuations has proven challenging. New studies using a combination of flux gate and search coil magnetometer data from Cluster have extended this search (in the spacecraft frame of reference) to more than 10 Hertz. New models and simulations are also being used to study the dissipation. A detailed study of fluctuations in the magnetosheath suggests that turbulent dissipation could be occurring at very thin current sheets as had been suggested by two-dimensional MHD simulations more than 20 years ago. Data from the four Cluster spacecraft, now at their maximum separation of 10,000 km provide new opportunities to investigate the symmetry properties, scale lengths, and the relative proportion of magnetic energy in parallel and perpendicular wave numbers of solar wind turbulence. By utilizing well-calibrated electron data, it has been possible to take advantage of the tetrahedral separation of Cluster in the solar wind near apogee to measure directly the compressibility and vorticity of the solar wind plasma.