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Inertial and dissipation ranges of small scale/electron turbulence in the Solar Wind

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Most of observational work on solar wind (SW) turbulence has been devoted to large-scale/MHD scales where the Kolmogorov scaling k-5/3 is frequently observed. Turbulence at frequencies above the proton gyrofrequency (fci$\sim$0.1Hz) has not been thoroughly investigated and remains far less well understood. Above fci the spectrum steepens to $\sim$f-2.5 and a debate exists as to whether the turbulence has become dominated by dispersive kinetic Alfvén waves and is dissipative, or has evolved into a new dispersive turbulent cascade dominated by whistler waves. Here we present recent results on the nature of this small-scale turbulence (up to 100 Hz) using the high resolution STAFF-SC data. These studies are made using two complementary methods: the k-filtering and the surrogate data methods. The k-filtering is a multipoint measurement technique that allows one to identify the nature of the turbulence and to calculate 3D k-spectra from the omega-ones (Sahraoui et al, PRL, 2006). To investigate small scale SW turbulence, one needs to take advantage of the times when the separation of the four Cluster spacecraft was small. Given separations of 200km, and a typical speed of the solar wind of 600km/s, one expects to be able to study frequencies down to 3Hz. The surrogate data technique (Sahraoui, PRE, 2008) completes the previous studies that use only the power spectra (where the phases of the fluctuations are ignored) by making extensive use of the Fourier phases of the turbulent signals to investigate coherent structures and intermittency.