Abstract

I will describe the first three-dimensional (3-D) dispersion relations and wavenumber spectra of magnetic turbulence in the solar wind at sub-proton scales. The analysis takes advantage of the short separations of the Cluster spacecraft (d/sim 200, km) to apply the {\it k}-filtering technique to the frequency range where the transition to sub-proton scales occurs. The dispersion diagrams show unambiguously that the cascade is carried by highly oblique Kinetic Alfv\'en Wave with $\omega\eq 0.1\omega_{ci}\sin the plasma rest frame down to <math>k_perp\rbo_i\sin 2$. The wavenumber spectra in the direction perpendicular to the mean magnetic field consists of two ranges of scales separated by a breakpoint in the interval $[0.4,1] k_perp\rbo_i\sin Above the breakpoint, the spectra follow the Kolmogorov scaling <math>k_perp^{-1.7}\sin k_perp^{-1.7}\sin k_perp^$