Geophysical Research Abstracts
Vol. 16, EGU2014-10801, 2014
EGU General Assembly 2014

Compressible coherent structures at ion scales in the solar wind turbulence

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The nature of solar wind turbulence around plasma kinetic scales is still under debate. It is known that in a neighborhood of the ion scales, the spectral shape changes and fluctuations become more compressible. Here we present for the first time a multi-satellite analysis of compressible coherent structures around the ion spectral break. We detect a certain number of soliton-like one-dimensional structures. Most of the structures appear to be two-dimensional. Generally, the structures propagate quasi-perpendicular to the mean field. Estimated velocity in the plasma frame can be finite. The mean spatial scale is determined to be $\simeq$250 km, which is of the order of 20 ion inertial lengths or 5 ion Larmor radius for the analyzed time interval in the slow solar wind. It is known that in usual fluid turbulence most of the energy dissipation happens within coherent structures. Our observations in the solar wind provide constraints on theoretical modeling of small scale turbulence and dissipation in collisionless magnetized plasmas.