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Statistical properties of solar wind discontinuities and intermittent turbulence

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Recent studies have compared properties of the magnetic field in simulations of Hall MHD turbulence with spacecraft data, focusing on methods used to identify classical discontinuities and intermittency statistics. Comparison of ACE solar wind data and simulations of 2D and 3D turbulence shows good agreement in waiting-time analysis of magnetic discontinuities, and in the related distribution of magnetic field increments. The discontinuities are not distributed without correlations, but rather they show non-Poisson correlations, possibly in the form of burstiness or voids, present in the data at least up to the typical correlation scale. A similar conclusion emerges from Poisson analysis of the simulation dataset.
Our tentative conclusion is that Poisson's random noise might well characterize the very large scale solar wind fluctuations. However in the inertial range (scales of few hours in the spacecraft frame) the analysis suggests the presence of correlations, and the waiting times between events display an associated bursty character.
This supports the viewpoint that solar wind turbulent fluctuations at least in part are related to the presence of large structures of highly conducting
plasma. The discontinuities or bursty coherent structures represent in this view the current sheets that form between magnetic flux tubes which may be a signature of intermittent, anisotropic, fully developed MHD turbulence.
Some of these current sheets could be reconnection sites. We're finding a way to identify the reconnection regions with high reconnection rate, as a subset of these current sheets.