Self-similar dynamics of solar wind turbulence

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Time delayed differences of solar wind variables such as the components of velocity and magnetic field possess probability distribution functions (PDFs) that do not exhibit self-similar scaling. Even when restricted to time differences in the inertial range of the turbulence, there are still significant deviations from self-similar behavior, contrary to Kolmogorov's similarity hypothesis. However, recent statistical studies using large solar wind data sets indicate that time delayed differences of the kinetic and magnetic energy densities, ρv^2 and B^2, do possess self-similar first order PDFs. This suggests the possibility that the stochastic process $x(\tau) = B^2(t+\tau) - B^2(t)$ may be self-similar for time delays τ in the inertial range. To test this hypothesis the covariance function of the process $x(\tau)$ is estimated from in-situ solar wind measurements and compared to the covariance function obtained from the theory of self-similar processes. The results of the data analysis shall be presented and implications for the modeling of solar wind turbulence will be discussed.