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Turbulence and other processes for the scale-free texture of the fast solar wind

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The higher-order statistics of magnetic field magnitude fluctuations in the fast quiet solar wind are quantified systematically, scale by scale. We find a single global non-Gaussian scale-free behavior from minutes to over 5 hours. This spans the signature of an inertial range of magnetohydrodynamic turbulence and a $\sim$1/f range in magnetic field components. This global scaling in field magnitude fluctuations is an intrinsic component of the underlying texture of the solar wind which co-exists with the signature of MHD turbulence but extends to lower frequencies. Importantly, scaling and non- Gaussian statistics of fluctuations are not unique to turbulence and can imply other physical mechanisms- our results thus place a strong constraint on theories of the dynamics of the solar corona and solar wind. Intriguingly, the magnetic field and velocity components also show scale-dependent dynamic alignment outside of the inertial range of MHD turbulence.

References: Hnat et al, Phys. Rev. E, 84, 065401 (R), (2011)