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# Quantifying and modelling the scaling properties of solar wind turbulence

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The solar wind provides a natural laboratory for observations of MHD turbulence over extended temporal scales. A hallmark of turbulence is scaling in statistical measures of fluctuations in the flow. For in- situ plasma observations this is quantified by testing for scaling in the Probability Density Functions (PDF) of fluctuations in the time-series either directly, or via structure function analysis. In practice there are statistical limitations presented by a finite length time series. We consider a generic method of conditioning the data that overcomes these to recover the underlying scaling in a finite length time series, and test its applicability using an idealized Le'vy flight.

Having obtained the scaling exponents that characterize the data we will discuss their physical significance. For example, one can appeal to universal behaviour to compare the exponents from different turbulent systems as has been done to attempt to identify passive scalars in the flow; this approach leads to a quantitative demonstration of the compressive nature of solar wind MHD turbulence. Comparisons can also be made, at least in principle, with turbulence phenomenologies which predict both an underlying scaling exponent (for example, 1/3 in the case of Kolmogorov) and an intermittency correction.

The scaling exponents motivate SDE models- this can be approached either by a Fokker-Planck model with nonlinear diffusion coefficient or by fractional kinetics. These formalisms are quite generic and have connections to understanding these systems in terms of the statistical mechanics of correlated, out of equilibrium systems generally.