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Scaling exponents of the velocity structure functions in the interplanetary medium

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Abstract. We analyze the scaling exponents of the velocity structure functions, obtained from the velocity fluctuations measured in the interplanetary space plasma. Using the expression for the energy transfer rate which seems the most relevant in describing the evolution of the pseudo-energy densities in the interplanetary medium, we introduce an energy cascade model derived from a simple fragmentation process, which takes into account the intermittency effect. In the absence and in the presence of the large-scale magnetic field decorrelation effect the model reduces to the fluid and the hydromagnetic p-model, respectively. We show that the scaling exponents of the q-th power of the velocity structure functions, as obtained by the model in the absence of the decorrelation effect, furnishes the best-fit to the data analyzed from the Voyager 2 velocity field measurements at 8.5 AU. Our results allow us to hypothesize a new kind of scale-similarity for magnetohydrodynamic turbulence when the decorrelation effect is at work, related to the fourth-order velocity structure function.

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