

Generalized two-scale Cantor set for solar wind turbulence

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Multifractality arises naturally in many nonlinear systems [1], in particular in systems related to the intermittent turbulence of the solar wind [2-5]. Using generalized dimensions and singularity spectra allow us for a better understanding of dynamic of multifractal time series. We have analysed the time series of the solar wind plasma parameters measured in situ by Helios in the inner heliosphere. We have used Grassberger and Procaccia method for calculation of the generalized dimensions of the solar wind attractor in the phase space directly from the cleaned experimental signal. The obtained solar wind spectrum is consistent with that for the multifractal measure on the weighted baker's map [4, 5]. Here we also analyse multifractality of the two-scale Cantor set [1]. This example of multifractal has two rescaling parameters and a probability measure. For eddies in the cascade we assume two different scales and obtain a more general situation than in the usual p -model for fully developed turbulence [6]. We solve numerically transcendental equation in order to obtain generalized dimensions and singularity spectrum for the two-scale Cantor set. We compare the resulting generalized dimensions for the solar wind and for the two-scale Cantor set with the different scales. We also analyse similarities and differences between resulting spectra. This comparison shows similar character of multifractality of the solar wind and the two-scale Cantor set. We hope that obtained parameters for this model could be a useful tool for analysis of the turbulence in the solar wind.

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