Irregular space plasmas dynamics: entropy production vs fractality

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One of the most relevant feature of turbulent fluids, included Space Plasmas, is the irregularity of the fields defining their local state (for example magnetic field, electric current and bulk velocity in the Solar Wind). In particular, time series of local quantities collected by in situ measurements, e.g. by satellites, as well as remote sensing data, e.g. those from trans-medium communications, show scale-dependent statistical behaviour suggesting the local state fields to be better represented as fractal or multi-fractal measures rather than smooth functions of time and position.

While a wide literature has developed about the occurrence of these measures in irregular space plasmas, and their taxonomy, what is still lacking is a theoretical explanation predicting the geometric-topological characteristics of these measures from the continuous medium physics, or from kinetic representations of it.

In this work, we investigate the possibility that some Extremal Entropy Production principle determines the multi-fractal properties of dissipative structures in space plasmas.