ANALYZE THE IRREVERSIBILITY OF SOLAR WIND MAGNETIC FLUCTUATIONS USING COMPLEX NETWORKS

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Abstract: The solar wind is a particular interesting case of a turbulent and non-collisional plasma, that has been widely studied during the last decades using several approaches. To understand its dynamics from another perspective, we have modeled this plasma as a complex system. We applied the method known as *Horizontal Visibility Graph* to obtain the *Kullback-Leibler Divergence* [1] to study the reversibility on magnetic fluctuations [2]. For this, we have used the method in two cases: first, on *Particle In Cell* simulations of a magnetized plasma [3], considering a wide variety of different kappa distributions, to explore the relation between the complexity of the turbulence and the kappa index; and second, on solar wind magnetic field time series, considering slow and fast wind, data obtained from the Wind mission, to characterize the behavior of the fast or slow solar wind. Our results seem to indicate that the shape of the particle distributions and macroscopic plasma parameters like the solar wind speed are related with the KLD value, and therefore the reversibility of the magnetic field time series, suggesting that complex networks may be a valuable alternative tool to study turbulent plasma systems.

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