Complexity analysis of GOY shell model via cumulative entropy

Víctor Fernández[1], Víctor Muñoz[1]

[1]*Departamento de Física, Facultad de Ciencias, Universidad de Chile, Las Palmeras 3425, Santiago.*

Abstract: Shannon entropy has established itself as one of the most important complexity measures in Science. Nonetheless, there is a latent controversy about the use of histograms for the calculation of this metric in the case of time series derived from continuous variables. Since binning can lead to bias in the results obtained, new techniques for the study of complexity have emerged. Di Crescenzo et al. (2009) introduced the concept of cumulative entropy, which, unlike Shannon entropy, is based on the cumulative probability distribution (CDF). In the present work, we apply this proposal to time series corresponding to chaotic systems, such as the Lorentz and the Rössler attractors. We use this method to calculate the cumulative entropy associated to Gledzer-Yamada-Ohkitani MHD shell model simulations. Development is currently underway to implement complexity-entropy maps based on the CDF of a time series, which would avoid the problems associated to binning involved in the calculation of the Shannon entropy.

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Session: Space Plasma Physics and Nonlinear process in Space Geophysics.

Oral or Poster: Poster.