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Colloquium

Tangent map intermittency as an approximate analysis of intermittency in a high dimensional fully stochastic dynamical system

SPEAKER: Professor Henrik Jeldtoft Jensen (Centre for Complexity Science and Department of Mathematics, Imperial College, London).

DATE & PLACE: April 14, 2016. 13:00 - 14:00 Aula Naranja ICMAT. Calle Nicolás Cabrera 13-15. Campus Cantoblanco, UAM. Madrid.

ABSTRACT:

It is well known that tangent maps exhibit intermittency and they have e.g. been used by Procaccia and Schuster [PRA 28, 1210 (1983)] as a general theory of 1/f spectra. This suggests it is interesting to study to what extend one can establish a description in terms of a one-dimensional tangent map when dealing with a high dimensional stochastic systems. The Tangled Nature (TaNa) Model of evolutionary ecology is an ideal candidate for such a study. The fact that the model reproduces a broad range of the phenomenology of macroevolution and ecosystems indicates the relevance of the model. The model exhibits strong intermittency reminiscent of Punctuated Equilibrium and, like the fossil record of mass extinction, the intermittency in the model is found to be non-stationary – a typical feature of many complex systems. We derive a mean field map for the evolution of the likelihood function controlling the reproduction and find a tangent map. This mean field map is only able to describe qualitatively the intermittent dynamics of the full TaNa model. A situation we would expect to be typical for many high dimensional systems. Nevertheless, the description in terms of a one-dimensional tangent map appears to be illuminating.

Work in collaboration with Alvaro Diaz-Ruelas, Duccio Piovani and Alberto Robledo.

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