

Greek-Turkish on Statistical Mechanics and Dynamical Systems 5-12 September 2010

Dynamics of Complex Systems with an emphasis on Criticality and Record Dynamics.

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Abstract:

Complex systems consisting of many interacting components often exhibit intermittent irregular dynamics.

The paradigm of Self-Organised Criticality emphasises systems in a stationary state created by the action of a slow external constant driving rate. SOC postulates that the driven system self-organises to a critical state. In the critical state the system is expected to exhibit abrupt releases of energy in the form of macroscopic events termed avalanches. The focus is on the probability distributions of the event sizes, which are presumed to be scale free power laws in the limit of infinite system size. Candidates for SOC are e.g. earthquakes, rain, forest fires and many others.

The scenario of Record Dynamics is concerned with non-stationary and non-critical complex systems undergoing relaxation in order to release a (generalised) internal strain induced at the moment of preparation. The rate of activity decreases as one over time and the distribution of event times follows a Poisson process in *logarithmic* time. The event sizes can follow any distribution. Systems, which appear to follow the log-Poisson, include spin-glasses, over-damped relaxing particle models, models of long time macroevolution and experiments on dynamics of ant colonies. Log-Poisson relaxation can also be related to onset of synchronisation.