Propagation Of Information In Space-Time Chaos (General)

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Lyapunov exponents provide perhaps the most detailed description of chaotic properties. They allow estimating information flows as well as the number of effective degrees of freedom. However, their relevance is partly obscured by the difficulty of determining them from experimental data. We discuss the connection between the propagation of correlations (and of mutual information) and convective Lyapunov exponents in three different classes of systems: a Hamiltonian model, the complex Ginzburg-Landau equation, and an experimental setup with delayed feedback. In all such cases, we find that the optimal propagation velocity coincides with a zero of the convective Lyapunov spectrum. In the last case, we also briefly discuss the method to determine the convective exponent starting from experimental data. Finally, the possibility of ``nonlinear'' propagation is addressed too.

The Invariant Measure of Spatio-Temporal Chaos" (Research)

It is well known that space-time chaos is characterized by many active degrees of freedom, but the way such distributed degrees of freedom contribute to determine the probability distribution is still an unclarified problem. In particular, it has not been yet convincingly proven how the effective fractal dimension depends on the resolution. We attack the problem by extending the concept of Lyapunov exponents to open systems (i.e. subsets of formally infinite lattices). This new type of approach confirms the previously conjectured scaling behaviour and provides the basis for linking the fractal dimension to the dynamics of infinitesimal perturbations through a sort of generalization of the Kaplan-Yorke formula.

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