Abstract for GR-TR Conference on Statistical Mechanics and Dynamical Systems

Plenary Invited Invited Talk

On the interplay between chaos and order in a time-dependent barred galaxy model

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We study the distinction and quantification of chaotic and regular motion in a time-dependent Hamiltonian barred galaxy model. Recently, a strong correlation was found between the strength of the bar and the relative chaotic motion in the phase space of the time independent system. Here, we attempt to further explore this connection by studying the interplay of chaotic and regular behavior of the orbits when the mass parameters of the model evolve in time. This happens for example when one introduces linear time dependence in the parameters of the model to mimic, in some general sense, the effect of self-consistent interactions of the N-body problem. We propose a new way of using the GALI method as an efficient chaos detection tool to estimate the relative fraction of chaotic vs. regular trajectories in the phase space of such time-dependent potentials. We also find that the GALI indices, unlike the Lyapunov exponents, are able to capture short lived dynamical transitions during which an orbit can enter and exit islands of regular motion in time dependent case. Finally, we revisit the time independent problem and discuss a recent application of q-Gaussian statistics, which was able to distinguish weakly from strongly chaotic orbits even for the relatively short time intervals that correspond to one Hubble time in galactic evolution.