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

Plenary Invited | Invited Talk

Statistical Properties of Poincaré Recurrences and Their Applications

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In the present talk we analyze statistical properties of Poincaré retur n times sequences for chaotic dynamical systems. The theoretical results are discussed in the frameworks of local and global approaches and are il lustrated by numerical calculations for several discrete-time and continu ous-time systems. The local apporach is based on Poincaré's theorem an d Kac's theorem that establishes the interrelation between the mean retur m time and a probability measure of a local vicinity of a given point. Th e global approach uses the notion of Afraimovich-Pesin dimension (AP-dime nsion) that is introduced as a characteristic of Poincaré recurrences for the whole set. Statistical properties of Poincaré retirm times are studied in the presence of external noise sources. We also establish the interrelation between the statistics of Poincaré recurrences and the fr actal dimension of limit sets, as well as Lyapunov exponents and entropy.

The physical significance of the AP-dimension for Poincaré recurrences is discussed. In conclusion, we present some applications of the Poincar 'e recurrences theory to the problems of detecting stochastic resonance a nd stochastic synchronization effects in an overdamped Kramers oscillator and a cubic map with attractor crisis. We also consider the diagnostics of chaotic synchronization in two coupled Lorenz systems by calculating the AP-dimension.