

Universality in Quantum Chaos

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In plain words chaos refers to extreme dynamical instability and unpredictability. Yet in spite of such inherent instability, quantum chaos exhibit remarkable universality. The quantum energy levels of many different systems with classically chaotic dynamics display the same statistical behavior. The corresponding spectral statistics can be described by Random Matrix Theory.

In this talk I will explain the origins of such universality based on a semiclassical approach. In particular, the emphasis will be on the role of classical periodic orbits and their correlations. I will then discuss deviations from universality. Two factors will be considered: hidden structures in quantum Hamiltonians and breaking of ergodicity. In both cases the anomalous spectral statistics can be traced back to certain anomalies in the spectrum of classical periodic orbits.