Karlsruher Institut für Technologie

Fakultät für Physik

Physikalisches Kolloquium

Steven M. Anlage, University of Maryland

»Can Waves be Chaotic?«

Einführung: A. Ustinov

Chaos is a ubiquitous phenomenon in the classical world. It appears in dripping faucets, human heartbeats, electrical circuits, lasers, etc. However, there is now interest in the wave and quantum properties of systems that show chaos in the classical (short wavelength) limit. These 'wave chaotic' systems appear in many contexts: nuclear physics, acoustics, two-dimensional quantum dots, and electromagnetic enclosures, for example. Random Matrix Theory (RMT) predicts the universal fluctuating properties of quantum/wave systems that show chaos in the classical/ray limit. Microwave cavities, with classically chaotic ray dynamics, have proven useful for experimental tests of universal fluctuations in wave-chaotic systems. We have developed a microwave cavity experiment that mimics solutions to the Schrödinger equation for a two-dimensional infinite square well potential, and developed protocols to eliminate system-specific details (coupling, short-orbits) that would otherwise obscure the underlying universal properties. I will present experimental tests of RMT predictions of both closed and open quantum systems, as simulated by our microwave cavity analog experiment. As a specific example we have examined quantum interference effects in the transport properties of nanoscopic systems, as simulated in the microwave cavity. The cavity is free of complications arising from finite temperatures (thermal smearing, inelastic scattering), and the excitation of two-level systems that can cause the electrons to "decohere" and drop out of the quantum-coherent transport process. The Landauer-Büttiker formalism is applied to obtain the conductance of a corresponding mesoscopic quantum-dot device, and we find good agreement for the probability density functions of the experimentally derived surrogate conductance, as well as its mean and variance, with the theoretical predictions based on RMT.

Freitag, 16.04.2010, 17 Uhr c.t.,

KIT, Campus Süd,
Otto-Lehmann-Hörsaal, Physik-Flachbau (Geb. 30.22).
Anschließend Nachsitzung im Gastdozentenhaus „Heinrich Hertz“

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