DY 55: Poster - Quantum Systems

Time: Thursday 16:00–18:00 Location: Poster A

DY 55.1 Thu 16:00 Poster A

Reappearance of Localization in Open Chaotic Systems with a Partial Barrier — •Martin Körber[1], Arnd Bäcker[1,2], and Roland Ketzmerick[1,2] — [1]TU Dresden, Institut für Theoretische Physik, Dresden — [2]MPI für Physik komplexer Systeme, Dresden

The chaotic dynamics of generic Hamiltonian systems is governed by partial barriers. They also strongly influence the system's quantum-mechanical properties and lead to a localization of eigenstates on either side of a partial barrier. If the classical flux across a partial barrier is larger than the Planck cell, eigenstates delocalize in closed systems. In open systems, however, we observe that the resonance states localize again if the escape rate through the opening is sufficiently large. Here, we present a model which predicts the localization transition of a resonance state based on its decay rate.

DY 55.2 Thu 16:00 Poster A

Global structure of regular tori in a generic 4D symplectic map — •Steffen Lange[1], Franziska Onken[1], Arnd Bäcker[1,2], and Roland Ketzmerick[1,2] — [1]TU Dresden, Institut für Theoretische Physik, Dresden — [2]MPI für Physik komplexer Systeme, Dresden

The dynamics of Hamiltonian systems (e.g., planetary motion) can be investigated by symplectic maps. While the phase-space structures of 2D symplectic maps are well established, much less is known for higher dimensions.

Using 3D phase-space slices[1] and frequency analysis we investigate the global organization of regular tori of a generic 4D symplectic map with a mixed phase space[2]. We show how all of the regular 2D-tori are organized around a skeleton of elliptic 1D-tori in the 4D phase space. The 1D-tori occur in two types of one-parameter families: The first type are Lyapunov families attached to elliptic-elliptic periodic orbits. We explain how the second type originates from remnants of broken resonant 2D-tori. In combination these results allow for describing the self-similar hierarchy of regular tori in the 4D phase space analogous to the island-around-island hierarchy in 2D maps.

[1] M. Richter, S. Lange, A. Bäcker, and R. Ketzmerick, *Visualization and comparison of classical structures and quantum states of four-dimensional maps*, Phys. Rev. E **89**, 022902 (2014)

[2] S. Lange, M. Richter, F. Onken, A. Bäcker and R. Ketzmerick, *Global structure of regular tori in a generic 4D symplectic map*, Chaos **24**, 024409 (2014)

DY 55.3 Thu 16:00 Poster A

Structure of eigenstates of four-dimensional quantum maps — •Florian Ide[1], Shashi C. L. Srivastava[2], Arnd Bäcker[1,2], and Roland Ketzmerick[1,2] — [1]TU Dresden, Institut für Theoretische Physik, Dresden — [2]MPI für Physik komplexer Systeme, Dresden

We investigate the structure of eigenstates of quantized 4D maps whose classical dynamics has a mixed phase space in which regions of regular and chaotic motion coexist. One of the challenges is the strong increase in computing time of the matrix diagonalization in the semiclassical limit, which can be minimized by a symmetry reduction. Furthermore, a direct visualization of eigenstates in 4D phase-space is not possible. By applying the method of 3D phase-space slices [1] we visualize Husimi functions of eigenstates and compare them with the classical phase-space structures. This allows for identifying regular states, chaotic states and also scarred states concentrating around hyperbolic periodic orbits.

[1] M. Richter, S. Lange, A. Bäcker, and R. Ketzmerick, *Visualization and comparison of classical structures and quantum states of four-dimensional maps*, Phys. Rev. E **89**, 022902 (2014)

DY 55.4 Thu 16:00 Poster A

Coupling of microcavities — •Jakob Kreismann — TU Ilmenau, FG Theoretische Physik II, Postfach 10 05 65, 98684 Ilmenau

Microcavity lasers made of dielectric disk-shaped resonators with sizes in the micrometer range have gained a lot of interest in recent years. A drawback of pure disk resonators for microlaser applications is their isotropic light output. To overcome this problem, deformed cavities were proposed such as limacon-shaped resonators which display directional light emission attractive for microcavity lasers.

In this work the coupling of a disk resonator to a limacon-shaped cavity is studied using three dimensional FDTD calculations. For this purpose a limacon resonator is placed on top of a disk resonator, a whispering gallery mode with high Q-factor is excited inside the disk resonator and its coupling into the limacon cavity is analyzed for different geometric configurations.

DY 55.5 Thu 16:00 Poster A

Is the fractal Weyl law valid in partially absorbing systems? — •Moritz Schönwetter and Eduardo G. Altmann — Max-Planck-Institut für Physik komplexer Systeme, Dresden

The fractal Weyl law is a prominent showcase for the nontrivial effect of classical dynamics in a quantum systems. It states that in a chaotic system with an opening the number of long-living quantum states grows with the system size as a power law with a fractional exponent. The exponent is the fractal dimension of the classical invariant set. We study systems in which the opening partially reflects classical trajectories. In this case the fractal dimension of the classical invariant set is equal to the phase-space dimension. Yet, we observe that the number of long-living resonances still scales with a nontrivial exponent. We explain this observation using a statistical procedure that estimates an effective volume available for the resonances. This procedure suggests that in the semiclassical limit the fractal Weyl law is valid with a modified fractal dimension, which cannot be recovered directly from the classical invariant set and its measures.

DY 55.6 Thu 16:00 Poster A

Dynamics of dissipative quantum lattice systems with interaction — •Stefan Wolff and Corinna Kollath — Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

Most experimental systems are subjected to environmental influences. Typically the coupling to such an environment is one of the main problems for the realization of quantum devices, since it leads to an exponential fast decoherence. However, the interplay of dissipation and interaction can lead to fascinating effects such as unconventional non-exponential behavior. For example in interacting bosonic quantum-many-body systems coupled to a Markovian environment, quantum coherence decays algebraically.

In our studies we apply the Lindblad master equation for an interacting lattice system. We present results obtained using stochastic wave function sampling with time-dependent DMRG-methods to investigate the relevant system dynamics.