DY 43: Poster Session: Quantum Chaos and Many-Body Dynamics

Time: Thursday 15:00–18:00 Location: P2

DY 43.1 Thu 15:00 P2

Localization persisting under aperiodic driving — •Hongzheng Zhao[1,2], Florian Mintert[2], Johannes Knolle[2,3,4], and Roderich Moessner[1] — [1]Max Planck Institute for the Physics of Complex Systems, Dresden, Germany — [2]Imperial College London, London, United Kingdom — [3]Technical University of Munich, Munich, Germany — [4]Munich Center for Quantum Science and Technology, Munich, Germany

Localization may survive in periodically driven (Floquet) quantum systems, but is generally unstable for aperiodic drives. In this work, we identify a hidden conservation law originating from a chiral symmetry in a disordered spin-1/2 XX chain. This protects indefinitely long-lived localization for general–even aperiodic–drives. Therefore, rather counter-intuitively, adding further potential disorder which spoils the conservation law delocalizes the system, via a controllable parametrically long-lived prethermal regime. This provides a first example of persistent single-particle 'localization without eigenstates'. Reference: arXiv:2111.13558

DY 43.2 Thu 15:00 P2

Prethermalization in confined spin chains — •Stefan Birnkammer, Alvise Bastianello, and Michael Knap — Technical University Munich, Germany

Unconventional nonequilibrium phases with restricted correlation spreading and slow entanglement growth have been proposed to emerge in systems with confined excitations, calling their thermalization dynamics into question. Here, we investigate the many-body dynamics of a confined Ising spin chain, in which domain walls in the ordered phase form bound states reminiscent of mesons. We show that the thermalization dynamics after a quantum quench exhibits multiple stages with well separated time scales. The system first relaxes towards a prethermal state, described by a Gibbs ensemble with conserved meson number. The prethermal state arises from rare events in which mesons are created in close vicinity, leading to an avalanche of scattering events. Only at much later times a true thermal equilibrium is achieved in which the meson number conservation is violated by a mechanism akin to the Schwinger effect.

DY 43.3 Thu 15:00 P2

Enhanced state transfer by complex instability in coupled tops — •Maximilian Friedrich Irenäus Kieler and Arnd Bäcker — TU Dresden, Institut für Theoretische Physik, Dresden, Germany

By considering coupled tops we provide a mechanism for a fast transfer between two specific states representing bits. This crucially relies on that fact that the semiclassical limit corresponds to a higher-dimensional system which allows for more types of stability of fixed points than the two-dimensional case. Tuning the parameters, the coupled tops have fixed points with complex instability. Quantum mechanically this allows for a rapid transfer between coherent states located at these points, which is much faster than the coexisting dynamical tunneling.

DY 43.4 Thu 15:00 P2

Quantum signatures of partial barriers in 4D symplectic maps — •Jonas Stöber, Arnd Bäcker, and Roland Ketzmerick — TU Dresden, Institut für Theoretische Physik, Dresden, Germany

Partial transport barriers in the chaotic sea of Hamiltonian systems restrict classical transport, as they only allow for a small flux between phase-space regions. Quantum mechanically for 2D symplectic maps one has a universal quantum localizing transition: quantum transport is suppressed if the Planck cell of size h is much greater than the flux Φ, while mimicking classical transport if h is much smaller. The scaling parameter is Φ/h.

In a higher-dimensional 4D map one would naively expect that the relevant scaling parameter is Φ/h^2. However, we show that due to dynamical localization along resonance channels the localization length modifies the scaling parameter. This is demonstrated for coupled kicked rotors for a partial barrier that generalizes a cantorus to higher dimensions.

DY 43.5 Thu 15:00 P2

Metallicity in the Dissipative Hubbard-Holstein Model: Markovian and Non-Markovian Tensor-Network Methods for Open Quantum Many-Body Systems — •Mattia Moroder[1], Martin Grundner[1], François Damanet[2], Ulrich Schollwöck[1], Sam Mardazad[1], Thomas Köhler[3], Sebastian Paeckel[1], and Stuart Flannigan[4] — [1]Department of Physics, Ludwig-Maximilians-Universität München, München, Germany — [2]Institut de Physique Nucléaire, Atomique et de Spectroscopie, CESAM, University of Liège, B-4000 Liège, Belgium — [3]Department of Physics and Astronomy, Uppsala University, Uppsala, Sweden — [4]Department of Physics & SUPA, University of Strathclyde, Glasgow G4 0NG, United Kingdom

We investigate the impact of dissipation on polarons and bipolarons in the paradigmatic Hubbard-Holstein model. We do so by combining the non-Markovian hierarchy of pure states (HOPS) method and the Markovian Quantum Jump (QJ) method with the newly-developed projected-purification (PP) method for matrix-product states (MPS).

By studying the system's dynamics after global quenches from different ground states, we show that dissipation reduces the polaron's mobility and the electron pairing.

We also find that PP gives a significant speedup (proportional to the phononic local Hilbert space dimension) and allows to systematically converge all observables to very high accuracy in an automated fashion.

DY 43.6 Thu 15:00 P2

Time evolution in the one-magnon subspace of the sawtooth chain at the quantum-critical point. — •Jannis Eckseler and Jürgen Schnack — Fakultät für Physik, Universität Bielefeld, Postfach 100131, D-33501 Bielefeld, Germany

It is known for the sawtooth chain to develop a flat band at the quantum-critical point of $J_1 = 2J_2$ [1]. We are looking at the time evolution of several observables in the one-magnon subspace of the sawtooth chain, especially near that point.

[1] J. Schulenburg, A. Honecker, J. Schnack, J. Richter, H.-J. Schmidt, Phys. Rev. Lett. 88 (2002) 167207

DY 43.7 Thu 15:00 P2

Nonequilibrium dynamics in quantum spin systems with neural quantum states — •Damian Hofmann[1], Giammarco Fabiani[2], Johan Mentink[2], Giuseppe Carleo[3], Martin Claassen[4], and Michael Sentef[1] — [1]Max Planck Institute for the Structure and Dynamics of Matter, Center for Free-Electron Laser Science (CFEL), Luruper Chaussee 149, 22761 Hamburg, Gemany — [2]Radboud University, Institute for Molecules and Materials, Heyendaalseweg 135, 6525 AJ Nijmegen, The Netherlands — [3]Institute of Physics, École polytechnique fédérale de Lausanne (EPFL), 1015 Lausanne, Switzerland — [4]Department of Physics and Astronomy, University of Pennsylvania, Philadelphia, PA 19104, USA

Neural quantum states (NQS) are a variational ansatz in which a neural network is used to parametrize the quantum state of a many-body system. NQS-based methods can be applied to learning both ground states and dynamics of quantum many-body systems by optimizing the network weights as variational parameters. In this poster, we present our current efforts in applying NQS methods to simulating strongly correlated quantum systems in and out of equilibrium. In particular, we highlight our recent work on understanding the stability properties of time-evolution algorithms for NQS based on the time-dependent variational Monte Carlo method (Hofmann et al., SciPost Phys. 12, 2022). Furthermore, we will present our ongoing research into the application of NQS to learning states in quantum spin liquid systems.

DY 43.8 Thu 15:00 P2

Source-driven optical microcavities — •Lukas Seemann and Martina Hentschel — TU Chemnitz

Optical microcavities – open billiards for light – are known to possess far field emission patterns that sensitively depend on their geometric shape: the geometry determines the light's nonlinear dynamics and, via the associated unstable manifold and invariant measure, the emission characteristics. However, this behavior might change, and new features can be added, when the microcavity is driven by a local internal light source [1]. Here, we investigate the properties of optical microcavities with sources both with ray and with wave methods. To this end we extend the ray picture by the phase information and collect the wavelength-dependent phase information along the ray trajectories. We use phase-space methods to analyze the source-induced time-dependent dynamics and compare the Poincaré surface of section for rays with phase to the Husimi function dynamics of wave solutions, thereby exploring chances and limitations of ray-wave correspondence.

[1] J.-K. Schrepfer, S. Chen, M.-H. Liu, K. Richter, and M. Hentschel, Phys. Rev. B 104, 155436 (2021)