Abstracts

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Monday, 20 April

Juan P. Garrahan (University of Nottingham)

Slow dynamics due to kinetic constraints, from classical to quantum

Classical many-body systems that display slow collective relaxation—the typical example being glass formers—do so due to effective constraints in the their dynamics. The simplest manifestation of this principle is in kinetically constrained models where dynamical constraints are explicit. I will review this approach to slow dynamics and explain how this way of thinking can extend to slow quantum systems, highlighting the crossover of ideas between classical and quantum non-equilibrium.

Pietro Brighi (University of Vienna)

Hilbert space fragmentation and anomalous dynamics in East-type kinetically constrained models

Kinetically constrained models are a fascinating, yet conceptually simple, platform for the study of non-equilibrium quantum many-body phenomena. In this talk, I will focus on chiral models, which lack inversion symmetry. Starting from the particle-conserving quantum East model, I will discuss its emerging quantum Hilbert space fragmentation and the related anomalous dynamics. I will then introduce the East-West model, and present its fascinating anomalous transport properties. Finally, in the last part of the talk, I will discuss recent results on dissipative kinetically constrained models in two dimensions, where the constrained nature of the dissipation yields robust bistability and interesting dynamical properties.

Vanja Marić (University of Ljubljana)

Slow dynamics from a nested hierarchy of frozen states

We identify the mechanism of slow heterogeneous relaxation in quantum kinetically constrained models (KCMs) in which the potential energy strength is controlled by a coupling parameter. The regime of slow relaxation includes the large-coupling limit. By expanding around that limit, we reveal a nested hierarchy of states that remain frozen on time scales determined by powers of the coupling. The classification of such states, together with the evolution of their Krylov complexity, reveals that these time scales are related to the distance between the sites where facilitated dynamics is allowed by the kinetic constraint. While correlations within frozen states relax slowly and exhibit metastable plateaus that persist on time scales set by powers of the coupling parameter, the correlations in the rest of the states decay rapidly. We compute the plateau heights of correlations across all frozen states up to second-order corrections in the inverse coupling. Our results explain slow relaxation in quantum KCMs and elucidate dynamical heterogeneity by relating the relaxation times to the spatial separations between the active regions.

Thomas Müller (ICTP Trieste)

Quantum Mpemba effect in chaotic systems with conservation laws

According to the eigenstate thermalization hypothesis, closed chaotic quantum systems relax after a quench into a Gibbs ensemble. At late times, the relaxation speed is determined by their local conservation laws and hydrodynamics. I show that there exist pairs of initial states which thermalize to the same ensemble, yet exhibit drastically different hydrodynamic relaxation. This enables a simple and robust realization of the quantum Mpemba effect: a system initially closer to equilibrium relaxes slower than one that starts farther away, despite both approaching the same final state.

Sreemayee Aditya (University of Cologne)

Quantum resource dynamics in random circuits and symmetry-constrained many-body systems

Quantum many-body dynamics naturally generate nonclassical correlations that can be understood through quantum resource theories. We study how resources such as resources evolve in random circuit models. In unconstrained systems, resources exhibit a universal rise–peak–fall behavior with logarithmic scaling of the peak time. Introducing conservation laws dramatically alters this picture: global coherence grows slowly via hydrodynamic transport, while local coherence shows algebraic scaling and, in Hamiltonian systems, broad plateau dynamics. These results reveal how constraints reshape resource spreading and establish quantum resources as sensitive probes of many-body dynamics and thermalization.

Enej Ilievski (University of Ljubljana)

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Shion Yamashika (University of Electro-Communications, Tokyo)

Quantum many-body Mpemba effect through Ruelle-Pollicott resonances

Relaxation towards equilibrium is often assumed to be slower when a system starts farther from equilibrium, but this intuition fails in the Mpemba effect. Recent advances in controllable quantum platforms have enabled the exploration of its quantum analogue, the quantum Mpemba effect (QME), yet its microscopic origin remains largely unclear. Here we provide a general framework for understanding the QME in closed quantum many-body chaotic systems by reformulating the equilibration process of local subsystems in terms of Ruelle-Pollicott (RP) resonances. We show that suppressing the initial-state overlap with the dominant RP resonant mode accelerates subsystem equilibration and thereby yields the QME. We further uncover that a novel type of strong QME can occur via complete translation-symmetry breaking of initial states. We substantiate our predictions using the prototypical kicked Ising chain and exotic yet experimentally relevant initial states inspired by number theory. These findings cast the QME in closed many-body systems into a unified framework with open-system analogues and provide experimentally accessible signatures on state-of-the-art quantum platforms.

Balázas Pozsgay (ELTE Budapest)

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Dávid Szász-Schagrin (University of Bologna)

Construction and simulability of quantum circuits with free fermions in disguise

We provide a systematic construction for local quantum circuits hosting free fermions in disguise, both with staircase and brickwork architectures. Similar to the original Hamiltonian model introduced by Fendley, these circuits are defined by the fact that the Floquet operator corresponding to a single time step can not be diagonalized by means of any Jordan-Wigner transformation, but still displays a free-fermionic spectrum. Our construction makes use of suitable non-local transfer matrices commuting with the Floquet operator, allowing us to establish the free fermionic spectrum. We also study the dynamics of these circuits after they are initialized in arbitrary product states, proving that the evolution of certain local observables can be simulated efficiently on classical computers. Our work proves recent conjectures in the literature and raises new questions on the classical simulability of free fermions in disguise.

Tommaso Roscilde (ENS Lyon)

Quantum dynamics in high dimensions: defying thermalization, and gaining long-range entanglement

Multipartite quantum entanglement is the fundamental trait which separates our macroscopic world and the microscopic one; as well as the central resource for long-sought quantum technologies of next generation. Identifying effective ways to produce many-body entanglement over the largest possible scales, and/or in the shortest possible times, is clearly a grand challenge for quantum many-body theory and non-equilibrium quantum statistical mechanics. In this talk I will discuss how turning to high-dimensional systems and/or long-range interacting systems is a natural choice for effective entanglement production. Large-scale multipartite entanglement can be achieved e.g. via pure-state thermalization to equilibrium phases with long-range order or even quasi-long-range order. This is a legitimate route, but in fact it is a rather limiting point of view. With power-law-decaying interactions, the most effective form of dynamics can lead to macroscopic entanglement establishing exponentially fast in time. Interestingly, these dynamics defy thermalization, as dynamical long-range entanglement can appear for Hamiltonians whose equilibrium phase diagram lacks any form of long-range order. In fact we argue that long-range interacting systems can exhibit systematic violations of the eigenstate thermalization hypothesis, with entanglement dynamics being the direct consequence of this violation.

Benoît Zumer (University of Freiburg)

A theoretical description of classical and quantum phenomena associated with three Rydberg atoms in a circular trap

Our work deals with the classical and quantum dynamics of three interacting particles modeling three Rydberg atoms in a circular trap. This is a novel, experimentally feasible system of trapped particles displaying a striking classical-quantum correspondence [1,2]. First, we study the classical dynamics of the system. It exhibits a classical mixed phase space, that is to say that it comprises both ergodic regions and non-ergodic islands. Then, we construct the system and compare it with integrable and non-integrable systems with the same symmetry group. Then we identify periodic trajectories in the system and calculate their Lyapunov exponent. We identify the appearance of bifurcations in this system, discuss their stability and analyse the impact of symmetries on them. Then, we turn to the quantum mechanics. We initiate the study of the quantum eigenstates which we sort in terms of the discrete symmetries of the system. We numerically calculate the quantum eigenstates of the system and show that some of them are scarred by a classically unstable periodic trajectory, in the vicinity of which the classical analog exhibits chaos. The few-body scar we consider is stabilized by quantum mechanics, and we analyze it along the lines of the original quantum scarring mechanism.

[1] D. J. Papoular and B. Zumer, Phys. Rev. A **107**, 022217 (2023)
[2] D. J. Papoular and B. Zumer, Phys. Rev. A **110**, 012230 (2024)

Hernan B. Xavier (SISSA & ICTP Trieste)

Anomalous transport in chiral systems

I discuss chiral transport at infinite temperature in narrow ribbons with a symmetry-protected Dirac band touching, focusing on a triangular ladder geometry. In this regime, charge dynamics decompose into counter-propagating modes that become spatially resolved in the presence of magnetic flux. Interactions preserving the Dirac structure give rise to anomalous behavior, including charge superdiffusion and signatures of an emergent axial charge. These results highlight the role of multi-mode dynamics and quasi-local conserved quantities in shaping anomalous transport. The framework is directly relevant to cold-atom experiments and suggests possible extensions toward higher-dimensional transport.

[1] C. Muzzi, D. S. Bhakuni, M. Dalmonte, L. Zadnik, and H. B. Xavier, *accepted for publication in Phys. Rev. B* (2026)
[2] H. B. Xavier, D. S. Bhakuni, and L. Zadnik, *in preparation*

Mao Tian Tan (University of Ljubljana)

Logarithmic growth of operator entanglement in a clean non-integrable circuit

We study semi-ergodic dual-unitary quantum circuits in which correlations are ergodic along one light ray and non-ergodic along the other. Focusing on finite systems and long-time dynamics, we show that the Heisenberg evolution of a local operator is confined to a restricted subspace and can be mapped to an effective picture of a single qutrit scattering sequentially with a bath of qubits. Despite being non-integrable and disorder-free, the model exhibits at most logarithmic growth of operator entanglement, providing a rare example of slow entanglement growth outside integrable or localized settings. The dynamics further display intermediate behavior between chaotic and integrable systems, including a bimodal operator size distribution. At late times, autocorrelations can be described in terms of products of SO(3) matrices, leading to a random-matrix prediction.

David Horváth (University of Birmingham)

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Márton Kormos (BME Budapest)

Observing quantum criticality at finite temperature through nonanalytic correlation times

I will report recent results on the finite temperature dynamical correlation functions of the magnetization operator in the quantum Ising spin chain. First I will present our findings in the Ising quantum field theory describing the scaling limit of the spin chain. We derived a new closed form expression for the correlation length for space-like separations that has some unusual properties: it is a non-analytic function of both the space-time direction and the temperature, and its temperature dependence is non-monotonic. I will then turn to the spin chain, where using methods based on hydrodynamic fluctuations I will show that the correlation length of the order parameter shows similar non-analytic behavior as the magnetic field, space-time direction, and temperature are varied. As a function of the magnetic field, the non-analyticity occurs at a value that continuously approach that of the zero-temperature quantum critical point as the velocity is decreased and reach it within the light cone, where we obtain a new, temperature-independent logarithmic divergence characterizing the collective dynamics. Thus, collective effects induced by quantum fluctuations persist in the dynamics of local observables even at finite temperature.

[1] https://arxiv.org/abs/2406.05100
[2] SciPost Phys. 17, 162 (2024)
[3] https://arxiv.org/abs/2602.00794

Friedrich Hübner (ENS Paris)

Systematic approach to solvability in brickwork circuits

Solvable circuits, such as dual unitary circuits and their extensions, have arisen as paradigmatic examples of tractable chaotic non-equilibrium dynamics, both in classical and quantum systems. These correspond to local algebraic relations which allow for calculation of observables due to a simplification of the corresponding tensor network. However, so far these relations are not exhaustive, and it is not clear what their limitations are. We fill this gap by providing a sufficient and necessary local condition under which a circuit is solvable (by this we mean that its influence matrix can be written as a translation invariant MPS). The result is based on a version of the fundamental theorem of MPS with open boundary conditions. We then apply these conditions to study the simplest case: factorized initial state and Markovian bath. For this case we classify all solvable classical circuits (with local dimension 2 and 3) and all solvable quantum circuits with local dimension 2.

Pasquale Calabrese (SISSA Trieste)

Probing entanglement and symmetries in random states: from theory to experiment

Random quantum states sampled from uniform distributions provide a powerful theoretical framework for capturing the universal properties of complex quantum many-body systems. Remarkably, such states encode key features relevant to a wide range of phenomena, from thermalization and quantum chaos to aspects of black hole physics and information scrambling. In this talk, I will present analytical methods to compute entanglement and symmetry-related quantities in ensembles of random quantum states. These results allow for a systematic understanding of the statistical structure of entanglement and the role of symmetries in many-body systems. I will also discuss the broader physical implications of these findings, highlighting their relevance to both black hole theory and many-body physics. Finally, I will report on recent experimental measurements performed on a superconducting quantum processor, where quantities such as entanglement entropies, moments of the partial transpose, and entanglement asymmetry have been directly accessed. These experiments demonstrate how theoretical predictions for random states can be tested in controlled quantum platforms, opening new avenues for probing entanglement in complex quantum systems.

Paul Fendley (University of Oxford)

XYZ integrability the easy way

I will describe a simple derivation of the integrability of the XYZ chain with nary an elliptic function in sight. The key is to write the strong zero mode in terms of a matrix-product operator. It then becomes easy to generalise this operator to yield a sequence of charges commuting with the XYZ Hamiltonian with periodic boundary conditions or an arbitrary boundary magnetic field. A straightforward extension yields integrable impurity interactions including a generalisation of the Kondo problem with a gapped bulk. Time permitting I will describe new work on how this matrix-product operator allows one to find exact "scar" eigenstates for at least some XYZ couplings.

Michele Mazzoni (University of Bologna)

Generalized hydrodynamics of free fermions under extensive-charge monitoring

We study transport dynamics of free fermions subject to the external monitoring of a conserved charge over an extensive region. Focusing on bipartition protocols, we consider monitoring the total particle number over half of the system, and study the profiles of local charges and currents at hydrodynamic scales. While the Lindbladian describing the averaged dynamics is non-local, we show that the profiles can be understood in terms of localized impurities. We present a general framework based on the generalized hydrodynamics (GHD) picture, allowing for a hybrid numerical-analytic solution of the quench dynamics at hydrodynamic scales. We illustrate our approach for domain-wall initial states, showing that monitoring leads to discontinuities in the profiles that become more pronounced as the rate increases and that lead to the absence of transport in the Zeno limit of infinite monitoring rates. Our GHD framework could be naturally extended to interacting systems, paving the way for a systematic study of transport of integrable models subject to extensive-charge measurements.

Mikhail Zvonarev (LPTMS Saclay)

Motion without dissipation in one dimension

According to Landau, kinematic constraints imply energy and momentum dissipation for any macroscopic object moving through one-dimensional quantum fluid. We discuss the dynamics of a microscopic quantum impurity in a fluid and demonstrate that such an impurity can propagate without any friction. Notably, theoretical arguments are consistent with results of a recent experiment dealing with single impurity atom dynamics in a strongly interacting one-dimensional ultracold gas of Cs atoms.

Pavel Kos (University of Ljubljana)

Mixed state deep thermalization.

We introduce the notion of the mixed state projected ensemble (MSPE), a collection of mixed states describing a local region of a quantum many-body system, conditioned upon incomplete measurements of the complementary region. This constitutes a generalization of the pure state projected ensemble in which measurements are assumed ideal and complete, and which has been shown to tend towards limiting pure state distributions depending only on symmetries of the system, thus representing a new kind of universality in quantum equilibration dubbed deep thermalization. We study the MSPE generated by solvable (1+1)D dual-unitary quantum circuit evolution, and identify the limiting mixed state distributions which emerge at late times depending on the size of the incomplete measurement, which we assume to be lossy, finding that they correspond to certain random density matrix ensembles known in the literature. We also derive the rate of the emergence of such universality. Furthermore, we uncover a sharp transition in the ensemble's capacity to teleport quantum information: the fidelity switches from zero to maximal when the number of lost measurement outcomes matches the number of teleported degrees of freedom. These results provide a framework for observing deep thermalization and sampling random matrix ensembles in realistic, lossy quantum simulators.

[1] Xie-Hang Yu, Wen Wei Ho, Pavel Kos, Phys. Rev. Lett. **135**, 260402 (2025)

Maksym Serbyn (IST Austria, Klosterneuburg)

New regimes of nonergodic dynamics: from quantum scars to solitons

The description of many-particle systems in statistical mechanics rests on the assumption of ergodicity, which is the ability of a system to explore all allowed configurations in phase space. In quantum many-body systems, statistical mechanics predicts the equilibration of a highly excited non-equilibrium state towards a featureless thermal state. In my talk, I will discuss the phenomenon of weak ergodicity breaking—the absence of thermalization for a few special initial conditions, related to the existence of non-thermal eigenstates known as quantum many-body scars. I will focus on understanding of scars via periodic trajectories and will demonstrate their occurrence in Hamiltonian and Floquet models. Finally, I will demonstrate the existence of ballistic excitations at high energy in PXP model and other systems, pointing to new hitherto unexplored regimes of nonergodic dynamics.

Kristian Knakkergaard Nielsen (University of Copenhagen)

Symmetry-protected non-ergodic dynamics

Understanding mechanisms for the breakdown of thermalisation in closed quantum systems is a central problem in quantum many-body physics. We demonstrate strong non-ergodic behaviour in the XX model on coupled chains, where domain-wall initial states retain an inhomogeneous magnetisation profile for arbitrarily long times. We find that this effect arises due to exponentially many zero modes protected by chiral symmetry. Using an analysis based on the Lanczos algorithm, we identify a localisation transition in the thermodynamic limit at a critical coupling between the chains. We further show that antiferromagnetic defects in the initial state and symmetry-breaking perturbations restore slow thermalisation, whereas it remains robust for symmetry-conserving perturbations. These results establish that degenerate, symmetry-protected subspaces can give rise to thermodynamically stable non-ergodic dynamics in experimentally accessible quantum systems.

Lorenzo Gotta (University of Geneva)

Enhancing entanglement asymmetry in fragmented quantum systems

Entanglement asymmetry provides a quantitative measure of symmetry breaking in many-body quantum states. Focusing on inhomogeneous U(1) charges, such as dipole and multipole moments, we show that the typical asymmetry is bounded by a universal fraction of its maximal value. Multipole charges naturally arise in systems with Hilbert-space fragmentation, where the dynamics splits into exponentially many disconnected sectors. Using the commutant algebra formalism, we generalize entanglement asymmetry to account for fragmentation. While the asymmetry grows logarithmically for conventional symmetries, it can scale extensively in fragmented systems and distinguish classical from quantum fragmentation. We derive general upper bounds for the asymmetry and identify states that saturate them. To study the typical behavior of the asymmetry, we consider the ensemble of random matrix product states. By identifying the bond dimension with an effective time parameter, we qualitatively reproduce recent results on asymmetry dynamics in random quantum circuits, suggesting a universal behavior for the asymmetry of U(1) charges in local ergodic systems.

Arthur Hutsalyuk (SISSA Trieste)

Spectral Decimation of Quantum Many-Body Hamiltonians

We develop a systematic theory of spectral decimation for quantum many-body Hamiltonians and show that it provides a quantitative probe of emergent symmetries in statistically mixed spectra. Building on an analytical description of statistical mixtures, we derive an explicit expression for the size of a characteristic symmetry sector (CSS), defined as the largest subsequence of levels exhibiting non-Poissonian correlations. The CSS dimension is shown to be the size-biased average of the underlying symmetry sectors, establishing a direct link between spectral statistics and Hilbert-space structure. We apply this framework to two paradigmatic settings: Hilbert-space fragmentation and disorder-induced many-body localization (MBL). In fragmented systems, the CSS reproduces the mixture prediction and isolates correlated subsectors even when the full spectrum appears nearly Poissonian. In the disordered Heisenberg chain, spectral decimation reveals the gradual emergence of integrability through a shrinking CSS, whose statistics exhibit signatures consistent with local integrals of motion. We introduce a characteristic symmetry entropy (CSE) as a finite-size scaling observable and extract, within accessible system sizes, the crossover exponents. Our results establish spectral decimation as a controlled, unbiased and computationally inexpensive diagnostic of hidden structure in many-body spectra, capable of distinguishing between chaotic dynamics, statistical mixtures, and emergent integrability.

Jean-Yves Desaules (IST Austria, Klosterneuburg)

Slow thermalisation but fast transport: the U(1) lattice gauge theory as a unique paradigm of ergodicity breaking

Recent advances in quantum simulators have brought a renewed interest in lattice gauge theories (LGTs), thanks to the prospect of investigating the standard model in tabletop experiments. Beyond their connection to high-energy physics, LGTs are also relevant for the study of thermalisation in constrained quantum many-body systems due to the unusual restrictions imposed by gauge symmetries. The most famous example is the PXP model, which is equivalent to a spin-1/2 regularisation of the U(1) LGT. This model hosts multiple unexpected phenomena such as quantum many-body scars - specific infinite-temperature states that evade thermalisation - and superdiffusive transport of energy despite being non-integrable. In this talk, I will review the results for this model and show that they actually hold for all regularisations of the U(1) LGT. Perhaps even more intriguingly, I will demonstrate through numerical results that energy transport becomes faster as the system gets more constrained, making the U(1) LGT an ideal test bed for studying the effects of kinetic constraints on thermalisation.

Riccardo Senese (SISSA Trieste)

Universal freezing transitions of dipole-conserving chains

Qudit chains subject to finite-range interactions that conserve a global charge and its dipole moment are a paradigmatic setup hosting Hilbert space fragmentation (HSF), where the phenomenon was originally identified. However, many of the results established in these models have primarily relied on numerical evidence. This includes the observation that these systems exhibit a phase transition between strongly and weakly fragmented phases as the charge filling is varied. By means of a novel analytical approach, I will locate this phase transition point and show that it is independent of the on-site Hilbert space dimension. To this end, I will analytically prove the presence of strong HSF at fillings below the critical one, and show that in this phase, typical eigenstates at any energy density possess area-law entanglement scaling, altough rare eigenstates that feature non-area-law scaling exist. Finally, building on these same analytic techniques, I will present large-scale numerical evidence of weak fragmentation above the critical point.

Lev Vidmar (IJS Ljubljana)

Fading ergodicity

Recent decades of research contributed significantly to our understanding how an interacting quantum system, evolving in isolation from environment, approaches a thermal equilibrium. The process in which the expectation values of observables after a long time approach predictions from the thermal Gibbs ensembles is called thermalization, and the state of the system is referred to as being ergodic. The mechanism of thermalization is today understood via the eigenstate thermalization hypothesis, which states that all eigenstates of a Hamiltonian are already thermal. I will discuss counterexamples to thermalization. In particular, I will comment on our recent proposal of the regime of ”fading ergodicity”, which acts as a precursor of the ergodicity breaking phase transition.

Stefano Scopa (ENS Paris)

Large deviations of current in noisy many-body quantum systems: classical emergence and quantum corrections

I discuss transport in boundary-driven quantum many-body systems subject to stochastic noise, characterized via the full fluctuation statistics of density and current. In simple models with nearest-neighbor hopping, I show that, at large scales, these statistics coincide with those of classical diffusive systems, such as exclusion and inclusion processes, in a strong, realization-wise sense. At the same time, I identify subleading corrections that encode genuine quantum effects and thus quantify deviations from classical behavior. These results provide a microscopic route to macroscopic fluctuation theory in noisy quantum systems.

Mikhail Feigel’man (IJS & Nanocenter CENN, Ljubljana)

Evidence for a two-dimensional quantum glass state at high temperatures

Disorder in quantum many-body systems can drive transitions between ergodic and non-ergodic phases, yet the nature—and even the existence—of these transitions remains intensely debated. Using a two-dimensional array of superconducting qubits, we study an interacting spin model at finite temperature in a disordered landscape, tracking dynamics both in real space and in Hilbert space. Over a broad disorder range, we observe an intermediate non-ergodic regime with glass-like characteristics: physical observables become broadly distributed and some, but not all, degrees of freedom are effectively frozen. The Hilbert-space return probability shows slow power-law decay, consistent with finite-temperature quantum glassiness. In the same regime, we detect the onset of a finite Edwards-Anderson order parameter and the disappearance of spin diffusion. By contrast, at lower disorder, spin transport persists with a nonzero diffusion coefficient. We furthermore track wave-function statistics across the critical point, showing an evolution from the Porter-Thomas distribution in the ergodic phase to power-law scaling in the glassy phase. Our results show that there is a transition out of the ergodic phase in two-dimensional systems that does not coincide with the localization transition.

Hosho Katsura (University of Tokyo)

Algebraic construction of quantum many-body scars

The eigenstate thermalization hypothesis (ETH) provides a theoretical framework for understanding how isolated quantum many-body systems reach thermal equilibrium. Recent experimental and theoretical studies have shown, however, that certain non-integrable systems can host atypical eigenstates that evade thermalization. These special states are called quantum many-body scars (QMBS), offering concrete examples of strong ETH violation. In this talk, I will first provide a pedagogical review of the algebraic methods used to construct such scar states. While obtaining exact eigenstates is usually restricted to integrable models, I will show how a tower of QMBS can be built in non-integrable systems by repeatedly acting with a certain creation operator on a simple parent state. I will then present our recent results based on algebraic techniques such as restricted spectrum generating algebras and integrable boundary states. These methods allow us to construct a variety of models hosting exact QMBS in both one and higher dimensions. I will also mention the concept of asymptotic QMBS, which extends the notion of QMBS. If time permits, I will discuss a possible realization of such models using Rydberg atom quantum simulators.

Rafał Świętek (University of Göttingen)

Mechanism of eigenstate thermalization breakdown

Establishing a common framework for ergodicity-breaking transitions has many potential applications and provides insight into the nature of non-ergodic phases. In this work, we show that the softening of fluctuations within the recently established fading ergodicity framework can be derived directly from the emergence of the Fermi Golden Rule (FGR), ultimately classifying fading ergodicity as manifestation of FGR physics in quantum many-body systems. We show that this framework identifies the width of the local density of states and the fractal nature of eigenstates in the unperturbed basis as building blocks for fading ergodicity. Furthermore, we argue that our theory can be also applied to integrability-breaking transitions, where the critical point drifts exponentially with system size to a singular point, providing a common framework for ergodicity breaking in RMT models and integrability-breaking in local Hamiltonians.

Berislav Buča (LPTMS Saclay)

Non-stationary quantum many-body dynamics

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David Villaseñor (CAMTP Maribor)

Mixed eigenstates in spin-boson systems with one-photon and two-photon interactions

In this talk, we explore the mixed phase space of spin-boson systems, which commonly shift from regular to fully chaotic behavior as specific control parameters are varied. We analyze the characteristics of mixed eigenstates in these systems, comparing one-photon interactions with two-photon interactions. Additionally, we propose a generalized definition of the phase-space overlap index to accurately identify genuine mixed eigenstates. Our findings support the principle of uniform semiclassical condensation (PUSC) of quasiprobability functions in spin-boson systems and highlight fundamental differences that emerge when considering two-photon processes as opposed to one-photon processes.