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Talk Fabrizio Minganti: Chaos in open quantum systems

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Chaos in open quantum systems

Quantum technologies represent a frontier of both fundamental and applied research. Far from being ideal closed systems, quantum devices are open, interact with their environment experiencing dissipation, and require error correction strategies to reliably perform quantum algorithms [1]. In these systems, the interplay between dissipative and Hamiltonian evolution leads to states and phenomena distinct from those observed in equilibrium condensed matter physics, including chaos [2,3,4]. During this talk, I will briefly discuss open and monitored quantum systems, chaos, and its relation to quantum devices. I will highlight some peculiar features, from the effect of measurement backaction [3] to thermalization phenomena [4]. I will showcase some of the recent experimental demonstrations of our theoretical predictions [5,6].

[1] Google Quantum AI and Collaborators, Quantum error correction below the surface code threshold, arXiv:2408.13687v1 (2024).
[2] D. Dahan, G. Arwas, and E. Grosfeld, Classical and quantum chaos in chirally-driven, dissipative Bose-Hubbard systems. npj Quantum Inf 8, 14 (2022).
[3] F. Ferrari, L. Gravina, D. Eeltink, P. Scarlino, V. Savona, and FM, Transient and steady-state quantum chaos in driven-dissipative bosonic systems, arXiv 2305.15479 (2023).
[4] F. Ferrari, FM, C. Aron, V. Savona, Chaos and spatial prethermalization in driven-dissipative bosonic chains, arXiv:2409.12225 (2024).
[5] L. P. Peyruchat, F. Ferrari, FM, and P. Scarlino, Signature of dissipative quantum chaos in coupled nonlinear driven resonators, in preparation.
[6] L. Peyruchat, FM, M. Scigliuzzo, F. Ferrari, V. Jouanny, F. Nori, V. Savona, and Pasquale Scarlino, Landau-Zener without a Qubit: Unveiling Multiphoton Interference, Synthetic Floquet Dimensions, and Dissipative Quantum Chaos, arXiv:2404.10051 (2024).