

# SEMINAR: Dissipation as versatile resource for collective quantum dynamics

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15:00 to 16:00

Seminar Room

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The widespread belief is that quantum systems need to be protected from the environment as well as possible for quantum technology to fulfill its promise of revolutionizing computing, communication, and sensing. However, the advent of the Noisy Intermediate-Scale Quantum (NISQ) era forces us to investigate dissipation and decoherence and to find ways to utilize them effectively. This talk aims to provide examples where interactions with the environment play a pivotal role in generating and detecting collective quantum phenomena, inspiring new perspectives on harnessing environment interactions for advancing quantum technologies. Firstly, we will delve into the emerging field of topological quantum synchronization, a novel form of synchronization where topology and dissipation intertwine to protect synchronized dynamics against perturbation. Next, we will explore how carefully tailored interactions with the environment induce energy migration within small quantum spin networks characterized by a superradiant speed-up, demonstrating the potential for utilizing dissipation as a resource rather than a hindrance. Finally, if time permits, I will introduce a novel methodology for probing quantum criticality in non-equilibrium systems. This method circumvents the shortcomings of standard perturbative expansions, enabling a comprehensive and thermodynamically consistent understanding of critical phenomena in systems coupled to non-Markovian reservoirs.

**Hosted by:** Prof. Dr. Maciej Lewenstein