SPECIAL SEMINAR

Cooperative effects in quantum transport: Cooperative Shielding

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Cooperative effects in quantum systems are at the center of interest in many systems in physics such as cold atomic clouds, light harvesting systems, trapped ions and strongly correlated materials. Cooperative quantum effects are at the heart of Superradiance and Supertransfer showing enhance energy transport efficiency and a robustness to noise.

In the first part of the talk we will review the role of cooperativity in different physical systems, focusing on the role of long range interaction in determining cooperative behaviours.

The second part of the talk will be devoted to discuss the interplay of cooperativity and noise in systems with long range interaction (many body spin systems and tight binding models). The main focus will be on a novel cooperative effects which we named Cooperative Shielding.

Contrary to the common expectation that long-range interaction should necessarily induce an instantaneous spread of information in the thermodynamic limit, we show that, as the system size increases, the dynamics can actually become more confined into invariant subspaces. In such subspaces, the dynamics is determined by an emergent Hamiltonian which contains only short range interactions. This implies that the dynamics is effectively shielded from long-range interaction, that is, it occurs as if that interaction was absent. Shielding is a cooperative effect, because the time over which it is effective diverges with system size. This shielding phenomenon can be related to the quantum Zeno effect. The latter refers to the confinement of the dynamics into invariant subspaces of a system under “continuous measurement". This implies that long-range interaction plays a role similar to a measuring apparatus.