

VII Leopoldo García-Colín Mexican Meeting on Mathematical and Experimental Physics



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LUCA CELARDO: Cooperative effects and long range interactions: from Superradiance to Cooperative Shielding

Friday, 21 February 2020 16:00 (30 minutes)

Cooperative effects are at the center of interest in many systems in physics such as cold atomic clouds, light harvesting systems, and trapped ions. Cooperative effects such as Superradiance and Supertransfer induce enhanced energy transport efficiency and robustness to noise. In the first part of the talk we will review the role of Superradiance/Superabsorption in light-harvesting systems. Design of efficient devices for photon sensing and light-harvesting based on Superabsorption will be discussed. At the heart of Superradiance lies the long range of the interactions mediated by the photon field between the molecules.

The second part of the talk will be devoted to discuss the interplay of cooperativity and noise in systems with long range interaction which can be implemented in ion trapped experiments. The main focus will be on 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 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.

[1] Superradiance Transition in Photosynthetic Light-Harvesting Complexes, G.L.Celardo, F. Borgonovi, V.I. Tsifrinovich, M. Merkli and G.P. Berman, *The Journal of Physical Chemistry C*, 116, 22105 (2012).

[2] Shielding and localization in the presence of long-range hopping, G. L. Celardo, R. Kaiser and F. Borgonovi, *Phys. Rev. B* 94, 144206 (2016).

[3] Cooperative Shielding in Many-Body Systems with Long-Range Interaction, L. Santos, F. Borgonovi and G.L.Celardo, *Phys. Rev. Lett.* 116, 250402 (2016).

Session Classification: SHORT TALKS

Track Classification: SYMPOSIUM ON SCATTERING, QUANTUM AND CLASSICAL TRANSPORT