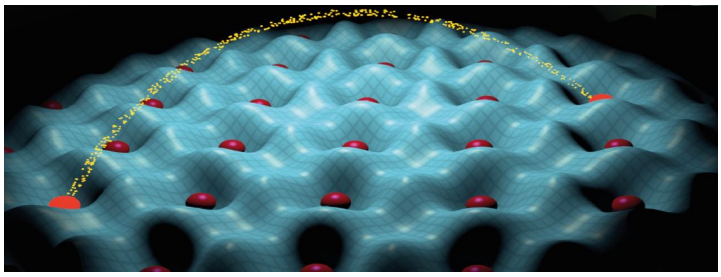

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”Semilocalization of disordered spins in cavity QED”

Monday, 17 June 2024 15:00 (1 hour)

Light-matter interactions are playing an increasingly crucial role in the understanding and engineering of new states of matter with relevance to the fields of quantum optics, solid state physics, chemistry and materials science. Experiments have shown that significant modifications of material properties and transport can occur in a cavity in the regime of collective strong light-matter coupling even without external irradiation –“in the dark”. In this colloquium-style talk we focus on disorder – a key feature of many materials –, in particular on general models for disordered spins coupled to the photon field of a cavity. We show that collective light matter interactions can dramatically alter the many-particle spin wavefunctions even in the limit of vanishingly small photon numbers: Subtle, permanent changes in the wavefunctions result from the combined effects of vacuum hybridization and long-range cavity-mediated couplings between the spins. A surprising, general, result is the realization of “semilocalization”, a famous and elusive effect in quantum physics, usually associated to critical states of Anderson-like transitions. We discuss implications for energy transport and novel quantum phases mediated by long-range couplings in molecular physics and quantum optical systems.

Presenter: PUPILLO, Guido (CNRS, Université de Strasbourg)