

CM / AMO Seminar

Condensed Matter & Atomic Molecular Optical

Friday, July 13, 2018 / 705 Pupin Hall / 1:15 PM

****Special Day & Time****

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“Strong light-matter coupling and collective phenomena in quantum materials”

Collective phenomena originating from interactions between light and matter have become a major focus of interest spanning different fields of research. By allowing the creation of entangled quantum states of light and collective matter excitations, cavity quantum electrodynamics offers a fascinating platform in this context.

In this talk I will discuss how a cooperative effect between long-range correlations induced by the light-matter interaction and strong electron interactions intrinsic to quantum materials can lead to the stabilisation of coherent phases of light and matter.

By studying a simple model of interacting electrons coupled to a single mode cavity field I will show that a phase characterised by the simultaneous condensation of excitons and photon superradiance, the “superradiant excitonic insulator” (SXI) can be realised. Superradiance cannot be reached in the absence of electronic interactions. At the same time coupling with the cavity field promotes excitonic condensation in regimes of temperature and interaction where it cannot be stabilised in the absence of light-matter coupling. Therefore, the SXI intertwines excitonic condensation and superradiance in conditions where the two phases cannot be individually stabilised in the absence of such cooperative effect.

I will discuss probes to detect the SXI phase as photon spectra and optical conductivity of the hybrid light-matter system.