ICFO

JOURNAL CLUB: Many-Body Super- and Subradiance in Ordered Atomic Arrays

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14:00 to 15:00
Blue Lecture Room

When quantum emitters couple indistinguishably to light, they can synchronize into a collec tive light-matter system with radiative properties profoundly different from those of independent particles. To date, the resulting collective effects have largely been confined to point-like or homogeneous ensembles. Here, we open access to a qualitatively new collective regime by realizing geometrically ordered, spatially extended atom arrays with subwavelength spacing. This establishes a fundamentally new platform in which collective emission is no longer confined to a single Dicke mode but instead emerges from a ordered network of photon-mediated interactions. We find that 2D atom arrays undergo strong super and subradiant emission. Despite subwavelength spacing, we achieve site-resolved imaging and directly observe the build-up of spatial correlations, demonstrating the transformation of cooperative decay into a strongly correlated many-body pro cess. We observe extensive scaling of superradiance, uncover superradiant revivals, and reveal the ferromagnetic nature of superradiance and the antiferromagnetic nature of subradiance. Our results realize a novel programmable platform for exploring and utilizing dissipative many-body quantum physics, opening new possibilities for photon capture, storage, and atom-photon entanglement.

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