Polariton Condensate Lattices: A Novel Quantum Simulator Platform

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Exciton-polaritons, are mixed light-matter quasiparticles resulting from the strong coupling of photons confined in a microcavity and quantum well excitons. Being bosons, polaritons can condense into macroscopically coherent many-body state and have thus emerged as prime candidates for the study of non-equilibrium systems of interacting bosons. Our recent studies, exploit non-equilibrium nature of polariton condensates, showing that polariton condensates can spontaneously magnetize [1], and how their spin can be controlled both optically and electrically[2]. Direct coupling of polaritons to leaking microcavity photons provides on-the-fly information of all characteristics of the polariton condensates such as energy, momentum, spin, and their phase. We employ spatially patterned external laser excitation to create arbitrary potential landscapes for polaritons and demonstrate ferromagnetic and antiferromagnetic coupling between neighbouring condensates[3]. Furthermore, using such techniques, polariton condensates can now be imprinted into arbitrary two dimensional lattices with tunable intra[4]- and inter-site interactions providing exciting opportunities for devising novel and versatile quantum simulation platforms[5].

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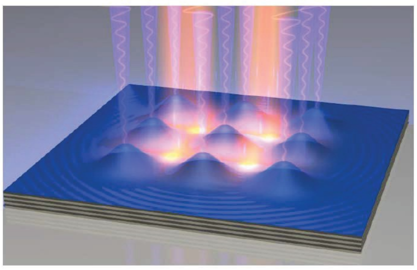

Figure 1: Optically controlled magnetized polariton lattices.