Polariton condensation in tailored potential landscapes

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Exciton polaritons are an ideal system to study collective behavior of macroscopic coherent quantum states in a solid state environment as they fulfill a range of important prerequisites. The possibility to engineer polariton trapping potentials has triggered the interest in using polaritonic systems to simulate complex many-body phenomena, such as the physics of high-temperature superconductors, graphene, or frustrated spin lattices. We employ a technology that enables deep (several meV), potentially tunable trapping in any 2D geometry without affecting the favorable polariton characteristics. The traps are based on a locally elongated microcavity which can be formed by standard lithography [1, 2] We observe polariton condensation under non-resonant pumping in single traps and photonic crystal lattice arrays. In the latter structures, we observe pronounced energy bands, complete band gaps, and the spontaneous condensation at the M-point of the Brillouin zone. Furthermore, using spatially structured optical pumps potentials resulting from repulsive interactions between polaritons and excitons can be created, which are tunable and reconfigurable and can serve for various studies of physical phenomena of open, dissipative and intercative bosonic systems.

References

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