Tunable Polariton Rabi Oscillation in Phase-Changing Perovskite Microcavities

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Abstract: Exciton-polaritons are composite quasiparticles hybridized between excitons and photons, which are very promising to develop quantum information devices such as entangled photon pair sources and polariton qubit devices by utilizing the fascinating properties of strong nonlinearity, Bose-Einstein condensation, and superfluidity. Organic–inorganic hybrid lead halide perovskites have attracted much interest in cavity quantum electrodynamics due to their excellent excitonic properties, including strong exciton binding energy and high oscillation strength. Here, tunable Rabi oscillation of exciton-polaritons in the lead halide perovskite microcavity is demonstrated, which experiences a phase transition between orthorhombic, tetragonal, and cubic phases by varying the temperature. Over the phase transition, the Rabi frequency is probed by tracing the dispersion relation of the exciton-polaritons using Fourier plane spectroscopy. Due to the emergence of ferroelectricity in the tetragonal phase of the perovskites, the Rabi splitting can be tuned by ≈20%, while the corresponding exciton oscillator strength is varied by ≈44% [1]. These results provide insight into novel functionalities of polariton devices by utilizing ferroic semiconductors, which can facilitate the development of tunable quantum devices.

References:

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