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PHOTONIK SEMINAR

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Metamaterial cavity quantum electrodynamics

Strong light-matter interaction in a resonant cavity is at the core of quantum electrodynamics (cavity QED) research. It has profound interest for fundamental quantum optics, information processing and the realization of ultrahigh-resolution sensors. While the strong coupling regime of cavity QED was initially explored with atoms, it was later realized with a range of solid-state material systems, involving, for instance, interband (excitonic) or inter-subband transitions in quantum wells, superconducting circuit, spin resonances in magnetic materials and molecular vibrational transitions in polymers.
In this presentation, I will discuss the strong interaction between cavity photons and plasmonic quasi-particles of metamaterials (MMs). By engineering the types of MMs and cavities, we investigate strong interaction of many quasi-particles in the cavity. By 'switching-off' the MM resonance, we trace the ultrafast switching dynamics of polariton modes, and observes instantaneous parametric optical gain of the coupled system. In addition, we also realize the coherent coupling of MM cavity with the electronic transitions of dopants in Si. The measured Rabi splitting is about 0.4 THz. By optimizing the Q-factor of MM, one could enter the strong coupling regime.

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Seminarraum 387 (CBEG02) - Institut für Photonik
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