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Room-Temperature Cavity QED with Single Quantum Dots and Plasmonic Nanocavities MATTHEW PELTON, University of Maryland, Baltimore County — Coupling a single emitter to a single mode of an optical cavity has the potential to enable optical nonlinearities at ultralow optical powers, opening up applications in all-optical classical and quantum information processing. These applications arise both in the strong-coupling (Rabi-splitting) regime and in the high-cooperativity (induced-transparency) regime, which both require coupling strengths to be large compared to decoherence rates of the emitter and of the cavity photons. In previous demonstrations using photonic cavities, the diffraction limit has placed a maximum on the coupling strength that can be obtained, so that cryogenic temperatures were required. Using plasmonic nanocavities overcomes this restriction, enabling strong-coupling and high-cooperativity regimes to be reached for single emitters at room temperatures. We have demonstrated these effects using single colloidal quantum dots in nanocavities formed between a metal nanoparticle and a metal film, or between a metal scanning-probe tip and a metal film. Current work is focused on developing assembly and fabrication methods for the high-yield production of assemblies with high coupling strengths.

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