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Calculations of strong coupling between a single quantum dot and a plasmonic nanoresonator XIAOHUA WU, JASON MONTGOMERY, STEPHEN GRAY, MATTHEW PELTON, Center for Nanoscale Materials, Argonne National Laboratory — Quantum-mechanical strong coupling between an optical cavity and a single solid-state emitter offers a robust, scalable platform for quantum information processing. Several experiments have demonstrated strong coupling between single quantum dots and dielectric microcavities. Although plasmonic cavities, composed of metal nanostructures, have fast loss rates compared to dielectric cavities, they also have much smaller mode volumes, and therefore stronger dot-cavity coupling strengths; they thus have the potential to serve as a fully nanoscale system with controllable strong coupling. In this work, we present simulation results for a quantum dot between two silver nanoparticles. Although the calculated absorption cross-section shows a double-peak structure only in the strong-coupling regime, the scattering spectrum can show two peaks even in the weak-coupling regime. Since scattering dominates the extinction spectra that are typically measured, this has important implications for experimental verification of strong coupling.

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