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Manipulating coupling between a single semiconductor quantum dot and single gold nanoparticle¹ FARBOD SHAFIEI, DANIEL RATCHFORD, SUENNE KIM, XIAOQIN LI, Department of Physics, University of Texas at Austin, STEPHEN GRAY, Chemistry Division and Center for Nanoscale Materials, Argonne National Laboratory — We report the manipulation of coupling in a simple model system, a single semiconductor quantum dot (QD) near a single metallic nanoparticle, and study the resulting changes in QD photoluminescence (PL) dynamics. We used atomic force microscopy nanomanipulation to controllably push a Au NP proximal to a CdSe/ZnS QD. We observed gradual and reversible changes in the QD PL lifetime and blinking dynamics. In some cases, the total lifetime reduced from 30 ns to well below 1 ns. This decrease is accompanied by the disappearance of blinking behavior as the nonradiative energy transfer from QD to the Au NP becomes the dominant decay channel. In comparison to previous studies, our experiments report changes in the PL dynamics of the same QD, therefore, eliminating the ambiguity of variable properties of individual QDs.

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