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Photoluminescence of Giant Quantum Dots Coupled With Waveguide Modes of Plasmonic Gap Bar Nanoantennas FENG WANG, HUE-MINH NGUYEN, NILADRI KARAN, YAGNASENI GHOSH, CHRIS SHEEHAN, JENNIFER HOLLINGSWORTH, HAN HTOON, CINT, Los Alamos National Lab — We designed a plasmonic gap bar nanoantenna, which is in resonances with the emission band of silica-coated giant-CdSe/CdS quantum dots. This antenna is composed of two parallel gold nano-bars with 40 nm gap fabricated on top of a 20 nm thick gold film and glass substrate. Utilizing two-step e-beam lithography process, we have fabricated this antenna and integrated the single silica-coated giant quantum dots into the gap. The enhanced emission rate and emission polarization have been studied for quantum dots placed at different positions along the gap bar antennas. The use of silica shell suppressed the energy transfer quenching from giant quantum dots to metal. Therefore, the detected lifetime shortening by a factor of 8 is purely resulted from the enhancement of decay rate. Experimental measurements also show that the photoluminescence intensity with polarization perpendicular to the bar can be 9 times stronger than along the bar, leading to a linear polarization degree of 0.8. Strong modulation of emission spectra has also been observed. Numerical simulations indicate that the strong linear polarization and the spectral modulation could be due to the emission coupling with the plasmonic waveguide modes.

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