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Plasmon-Induced Resonant Energy Transfer: a coherent dipole-dipole coupling mechanism ALAN D. BRISTOW, SCOTT K. CUSHING, JIANGTIAN LI, NIANQIANG WU, West Virginia University — Metal-insulator-semiconductor core-shell nanoparticles have been used to demonstrate a dipole-dipole coupling mechanism that is entirely dependent on the dephasing time of the localized plasmonic resonance [1]. Consequently, the short-time scale of the plasmons leads to broad energy uncertainty that allows for excitation of charge carriers in the semiconductor via stimulation of photons with energies below the energy band gap. In addition, this coherent energy transfer process overcomes interfacial losses often associated with direct charge transfer. This work explores the efficiency of the energy transfer process, the dipole-dipole coupling strength with dipole separation, shell thickness and plasmonic resonance overlap. We demonstrate limits where the coherent nature of the coupling is switched off and charge transfer processes can dominate. Experiments are performed using transient absorption spectroscopy. Results are compared to calculations using a quantum master equation. These nanostructures show strong potential for improving solar light-harvesting for power and fuel generation.
[1] J. Li *et al*, Nature Photonics **9**, 601 (2015).

Alan D. Bristow
West Virginia University

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