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Plasmon-enhanced energy transfer for improved upconversion of infrared radiation in doped-lanthanide nanocrystals QI SUN, Univ of Colorado - Boulder, HARIDAS MUNDOOR, Department of Physics, University of Colorado Boulder, JOSEP RIBOT, VIVEK SINGH, Department of Chemical and Biological Engineering, University of Colorado Boulder, IVAN SMALYUKH, Department of Physics, University of Colorado Boulder, PRASHANT NAGPAL, Department of Chemical and Biological Engineering, University of Colorado Boulder — Upconversion of infrared radiation into visible light has been investigated for applications in biological imaging and photovoltaics. However, low conversion efficiency due to small absorption cross-section for infrared light (Yb^{3+}), and slow rate of energy transfer (to Er^{3+} states) has prevented application of upconversion photoluminescence (UPL) for diffuse sunlight or imaging tissue samples. Here, we utilize resonant surface plasmon polaritons (SPP) waves to enhance UPL in doped-lanthanide nanocrystals. Our analysis indicates that SPP waves not only enhance the electromagnetic field, and hence weak Purcell effect, but also increases the rate of resonant energy transfer from Yb^{3+} to Er^{3+} ions by 6 fold. While we do observe strong metal mediated quenching (14 fold) of green fluorescence on flat metal surfaces, the nanostructured metal is resonant in the infrared, and hence enhances the nanocrystal UPL. This strong columbic effect on energy transfer can have important implications for other fluorescent and excitonic systems too.

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