Supporting Information

Gap-Plasmon Enhanced Gold Nanoparticle Photoluminescence

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Scattering Spectrum from Different Gold Nanoparticles

Dark-field scattering spectra were collected for several particles on the Al_2O_3 coated Au film. To demonstrate the consistency of the plasmon resonant response of these supported particles, Figure S1 shows the scattering spectra of three randomly selected particles. In this and all following graphs the left panel shows the particle (NP1) used in the main manuscript. Note that the particles show maximum scattering at a wavelength of 658 ± 11 nm. Small spectral differences are present, possibly related to small variations in the local environment at the particle-substrate junction.

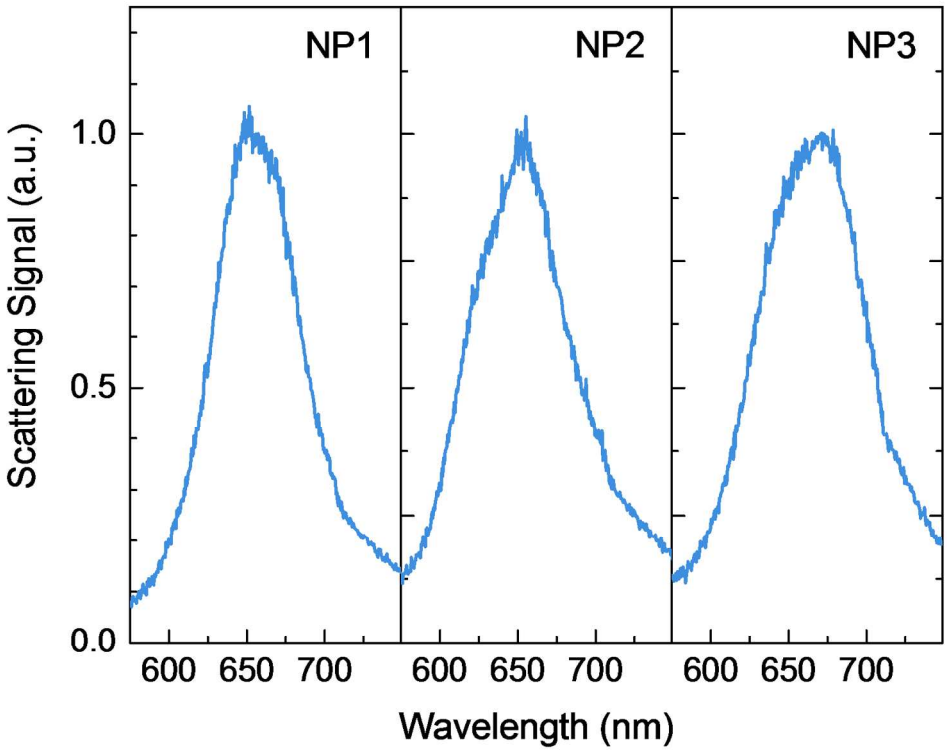

Figure S1. Measured single nanoparticle scattering spectra of three different gold nanoparticles on an Al_2O_3 coated Au film on glass.

Spectral Shape of the Particle-related Photoluminescence

The photoluminescence (PL) spectra from Au nanoparticles on an Al_2O_3 coated gold film as shown in Fig. 3 in the main manuscript appear to have a different spectral shape depending on the excitation wavelength. This apparent difference is largely an artifact due to the different relative contribution of the PL background originating from the gold film. To highlight this fact, Figure S2 shows the collected spectra, corrected for the film PL background. These spectra thus correspond to the term (I_{NP}-I_{film}) in Eq. 2 and represent the added PL signal due to the presence of the particle in the excitation spot. Note that at energies more than ~80 meV below the excitation energy the added PL signal has a similar spectral shape for all measurements.

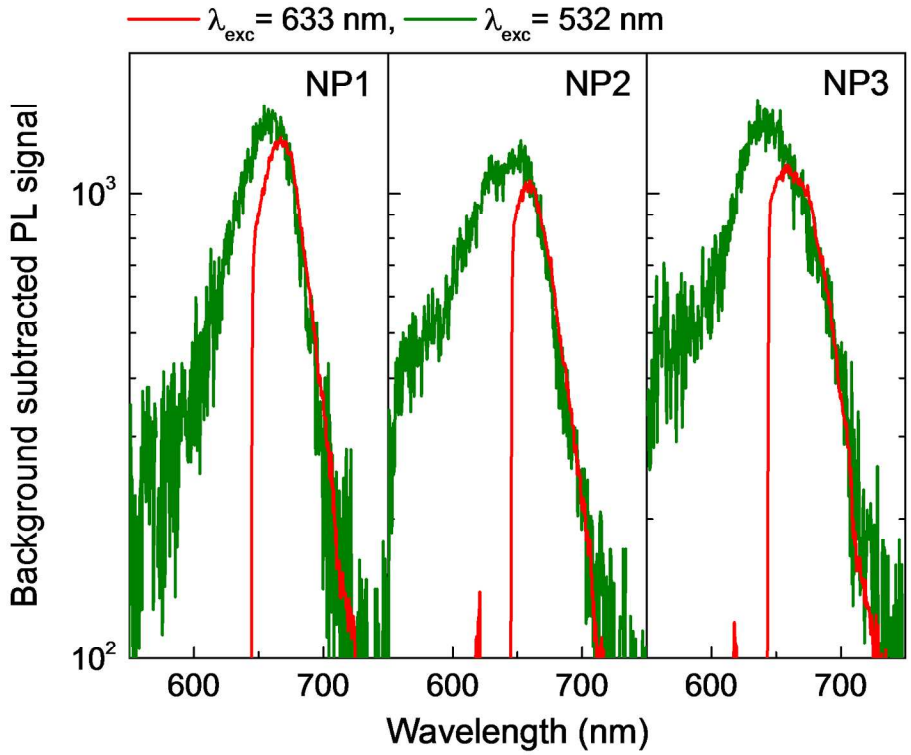

Figure S2. Background subtracted photoluminescence from three gold nanoparticles showing a small offset between the peak positions of the 532 nm and 633 nm excited NP-mediated photoluminescence spectra. The spectra under 532 nm excitation were scaled to facilitate comparison with the 633 nm excited spectra.

Photoluminescence Enhancement Spectrum from Different Gold Nanoparticles

The analysis presented in the main manuscript was repeated for additional nanoparticles in order to test the reproducibility of the results. Figure S3 shows the obtained PL enhancement factors for the two excitation wavelengths used with a scaled scattering spectrum of the corresponding particle overlaid on each curve. Note that the peak position of the enhancement consistently appears identical for both excitation wavelengths, that the magnitude of the enhancement is consistent within 7% and 20% for 633 nm and 532 nm excitation, respectively, and that the location and spectral shape of the scattering peak closely matches the enhancement peak shape.

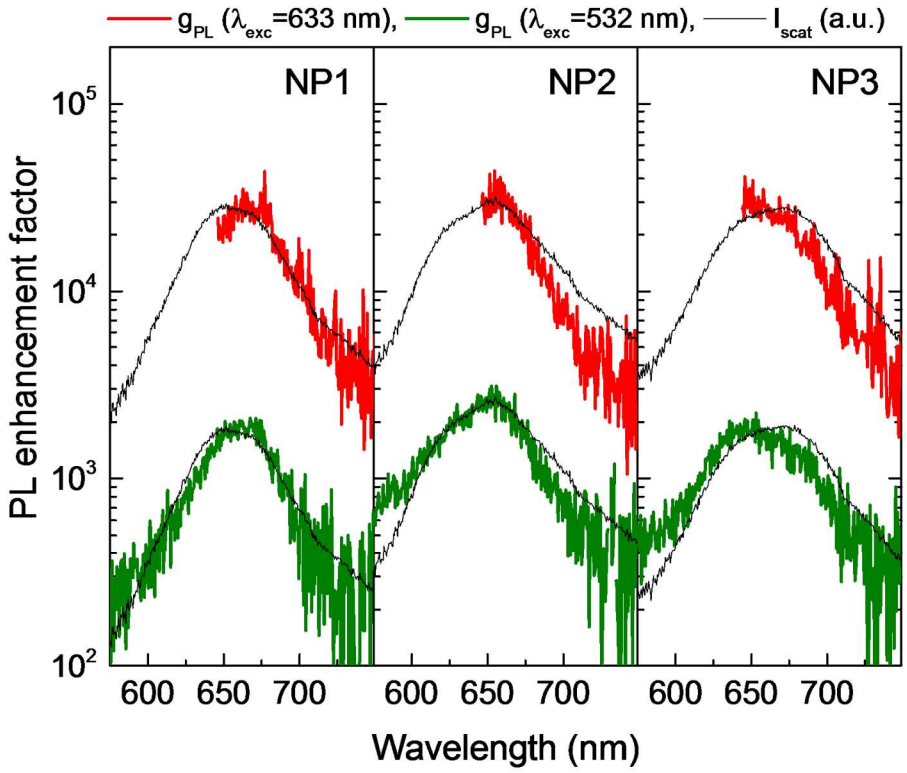

Figure S3. Photoluminescence enhancement spectra at 532 nm and 633 nm excitation from three different gold nanoparticles on a gold film. The scattering spectrum of these particles are scaled and overlaid to facilitate comparison between scattering and photoluminescence enhancement spectra.