Quantum Dots Placed in the Gap of Plasmonic Nanoparticle Dimers

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Coupling single photon emitters to plasmonic nanostructures yields an attractive platform for the detailed study of strong light-matter interaction. In our work we aim at the lithographically controlled combination of (single) colloidal quantum dots and silver nanoparticles. Therefore, first, we tailor triangle dimers in a bow-tie geometry by electron beam lithography. In a second lithography step we fabricate a polymer mask for quantum dot deposition in the bow-tie gap. On one hand, this configuration places the quantum dot in a plasmonic hotspot due to the (polarization dependent) high field enhancement. Besides the triangle geometry the size of the gap offers an additional lever to tune the optical response of the system (figure). On the other hand, we aim at contacting the quantum dots electrically with the gold particles which are in turn connected to electrodes turning the system into a photoconductive device. Ultimately, we envisage at investigating the feasibility and performance of a single-quantum-dot photodetector.

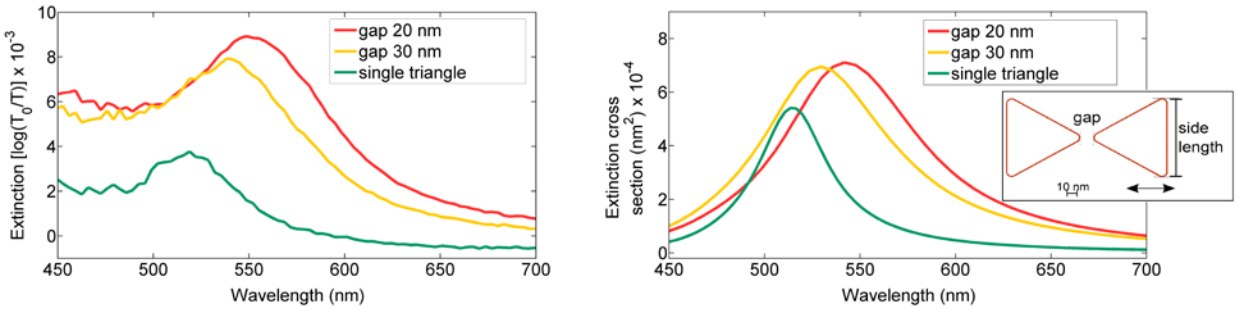

Figure. *Measured (left) and simulated (right) extinction spectra of silver triangle dimers with side lengths 80-70-70 nm, 40 nm height and gap dimensions as indicated. The polarization direction is given by the double arrow in the inset.*