Invited

Optoelectronics in plasmonic nanogaps

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Plasmonic particles separated by subnanometric distances (Figure 1a) allows to investigate ultra-fast and ultra-confined optoelectronic effects that emerge due to the influence of the electrons tunneling through the gap on the optical response [1]. The tunneling can completely modify the modal structure of the resonant system (Figure 1b) and it strongly quenches the near fields (Figure1c). We discuss both the fundamental physical phenomena behind this behavior as also its relevance to possible applications such as spectroscopy and light generation by non-linear processes[2]. Of special interest is the identification of these processes in experiments, which have only reached the required level of control in the last years [3]. We are able to satisfactorily analyze different experimental measurements [4] using a Quantum Corrected Model (QCM [5], Figure 1a), which we developed to treat large systems. The QCM also allows revealing the influence of the gap morphology on the experimental signature of the charge transfer and exploring the relative weight on the response of non-local and quantum effects.

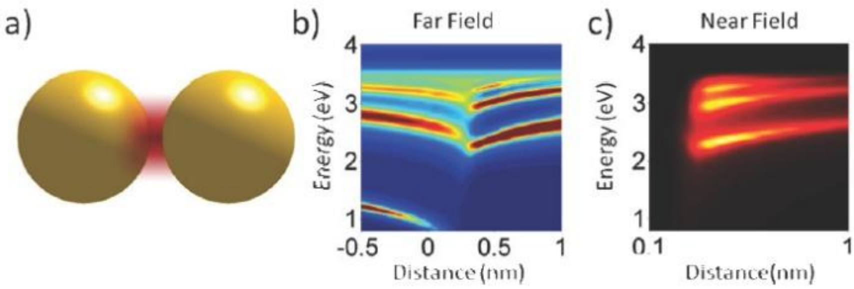

Figure 1. Quantum effects for a plasmonic dimer. a) An effective medium is inserted in the ultra-narrow gap to implement the QCM. (b-c) Extinction and (c) Near Field enhancement at the gap for a dimer of 25nm radius silver spheres as a function of separation distance and energy. The onset of the quantum regime near 0.35nm distance is characterized by a gradual change of the nature of the modes in (b) and the quenching of the near fields in (c).

References

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