Covered-gold-nanorod-dimer for optical and electrical hybrid applications

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Illuminated gapped-gold-nanorod dimers hold surface plasmon polaritons (SPPs) that can be engineered, by an appropriate choice of geometrical parameters, to enhance the electromagnetic field at the gap, allowing applications in molecular detection via surface-enhanced Raman spectroscopy (SERS) [1]. Envisioning hybrid devices in which the SERS spectroscopy of molecules in the gap is complemented by electrical measurements, it arises the question of designing efficient geometries to contact the nanorods without decreasing the enhancement factor (EF) of the nanoantenna, i.e., the figure of merit for SERS spectroscopy. We show [2] that covering with gold the far-from-the-gap areas of the dimer can produce enhancement factors larger than the best achieved in the uncovered dimer. This paves the way towards the use of these devices both for hybrid electrical and optical applications in sensing and detection of target molecules. Here, we explore the response of the system inside a cavity, a situation that can be useful for coupling the dimer´s plasmons to the cavity field enabling potential quantum applications.

References

[1] S. Li, M. L. Pedano, S.-H. Chang, C. A. Mirkin and G. C. Schatz, Nano Lett., 10(2010), 1722–1727.
[2] Iván A. Ramos, L. M. León Hilario, María L. Pedano, Andres A. Reynoso, RSC Adv.,11(2021), 9518-9527.

Figures

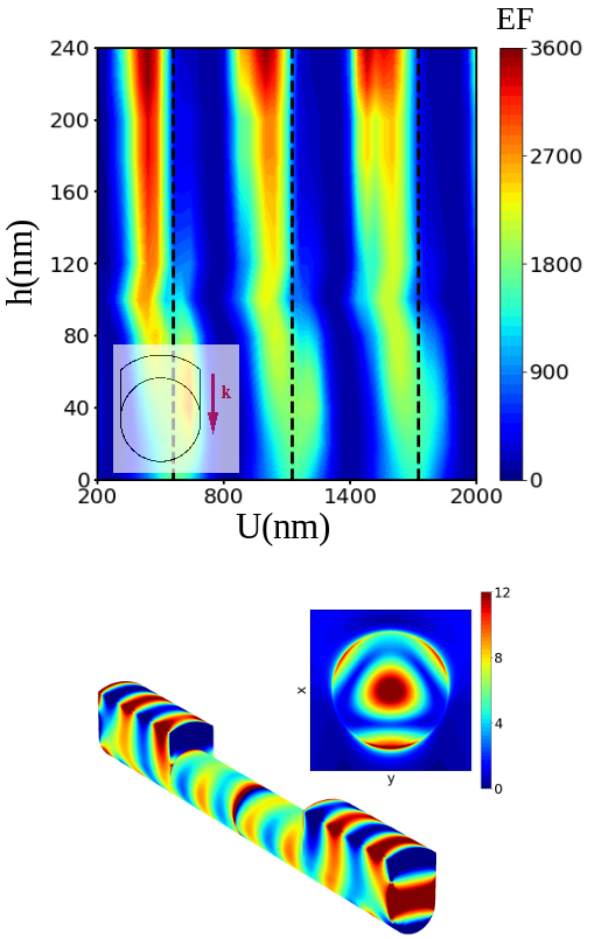

Figure 1: (top) Enhancement Factor in function of *U* and *h* lengths for a covered gold dimer of *C* = 1200nm. (bottom) Surface charge density of the dimer and |E| distribution in the x-y plane near the gap (2nm inside the gap).