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Quantum effects in active linear and non-linear plasmonics. GARIKOITZ AGUIRREGABIRIA, JAVIER AIZPURUA, ANDREY K. KAZANSKY, PEDRO MIGUEL ECHENIQUE, Material Physics Center CSIC-UPV/EHU and Donostia International Physics Center DIPC, Paseo Manuel de Lardizabal 5 20018, Donostia-San Sebastin, Spain, MARIO ZAPATA, Departamento de Fisca, Universidad de los Andes, Bogot D.C., Colombia, PETER NORDLANDER, Department of Physics, MS61, Laboratory for Nanophotonics, Rice University, Houston, Texas 77005, USA, DANA CODRUTA MARINICA, ANDREI G. BORISSOV, Institut des Sciences Molculaires d'Orsay - UMR 8214, CNRS-Universit Paris Sud, Batiment 351, 91405 Orsay Cedex, France — The unique properties of localized surface plasmons have turned plasmonic nanoparticles into a suitable platform for novel and more efficient optoelectronic processes. Therefore, the development of practical approaches to actively control the plasmon excitations is a major fundamental and practical challenge. Using Time Dependent Density Functional Theory we explore the possibility of all electrical control of the optical properties of different plasmonic systems such as isolated nanoparticles as well as nanoparticle dimers, and core-shell nanoparticles with sub nm gaps. We demonstrate that for plasmonic systems with narrow gaps, the quantum regime owing to the electron tunneling offers the possibility of fast and reversible control of the plasmon resonances, by application of an external dc bias. Along with all-electrical control of the linear response, we also show that the external polarizing DC field can be used to actively control high-harmonic generation from plasmonic nanoparticles.

Material Physics Center CSIC-UPV/EHU and Donostia International Physics Center DIPC, Paseo Manuel de L

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