

Control of Light at the Atomic Scale: Fundamentals and Applications

F. Javier García de Abajo

*ICFO-Institut de Ciències Fotoniques, The
Barcelona Institute of Science and Technology,
08860 Castelldefels (Barcelona), Spain
ICREA-Institució Catalana de Recerca i Estudis
Avançats, Passeig Lluís Companys 23, 08010
Barcelona, Spain*

javier.garciadeabajo@nanophotonics.es

Two-dimensional materials have been recently shown to host robust polaritonic modes, ranging from plasmons in highly doped graphene to excitations in transition metal dichalcogenides. The electromagnetic behavior of these modes can be well understood in terms of an effective surface conductivity, in which we can capture their strong dependence on temperature and external static electric and magnetic fields. Recent advances have also been produced in the synthesis of thin noble-metal films, which open new possibilities for exploring entirely new regimes of nanometallic plasmonics. In this talk, I will overview the general characteristics of the optical response of these materials, which we can understand in terms of simple theoretical descriptions. We will also cover more sophisticated descriptions, aiming at exploring genuinely quantum-mechanical effects. We will further overview recent advances in ultrafast optical response and nonlinear optics, as well as the potential application of these materials for light modulation, quantum-optics, and optical sensing.

This work has been supported in part by the Spanish MINECO (MAT2017-88492- R and SEV2015-0522), the ERC (Advanced Grant 789104- eNANO), the Catalan CERCA Program, and Fundació Privada Cellex.