Two-dimensional materials have been recently shown to host robust polaritonic modes, ranging from plasmons in highly doped graphene to excitons 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. 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 quantum-optics and optical sensing.

Javier García de Abajo received his PhD from the University of the Basque Country in 1993 and then visited Berkeley National Lab for three years. He was a Research Professor at the Spanish CSIC and in 2013 moved to ICFO-Institut de Ciencies Fotoniques (Barcelona) as an ICREA Research Professor and Group Leader. He is Fellow of both the American Physical Society and the Optical Society of America. García de Abajo has co-authored 300+ articles cited 24,000+ times with a h index of 75 (Oct 2018 WoK data), including contributions on different aspects of surface science, nanophotonics, and electron microscope spectroscopies.