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Ubiquitous electron-plasmon coupling in doped semiconductors
FABIO CARUSO, FELICIANO GIUSTINO, Department of Materials, University of Oxford — The interplay between electrons and bosonic excitations [as, e.g., phonons, collective charge-density fluctuations (plasmons), and magnons] is pervasive in matter and underlies an extremely broad spectrum of physical phenomena, as, for instance, current dissipation, superconductivity, hot-carrier thermalisation, and band structure replicas [1]. At variance with phonons, however, questions pertaining the strength of electron-plasmon coupling in solids are still awaiting further investigations. We developed and implemented a first-principles theory of electron-plasmon coupling based on many-body perturbation theory. Our first-principles calculations reveal that electron-plasmon coupling alters ubiquitously the dynamical and optical properties of semiconductors at high doping concentrations. This behaviour stems from the emergence of low-energy extrinsic plasmons which may couple electronic states in the vicinity of the Fermi energy. [1] F. Caruso, H. Lambert, and F. Giustino, Phys. Rev. Lett. **114**, 146404 (2015).

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