CFEL SCIENCE

SEMINAR

9th December 2015 - 2:00 p.m.

CFEL-bldg. 99, seminar room IV

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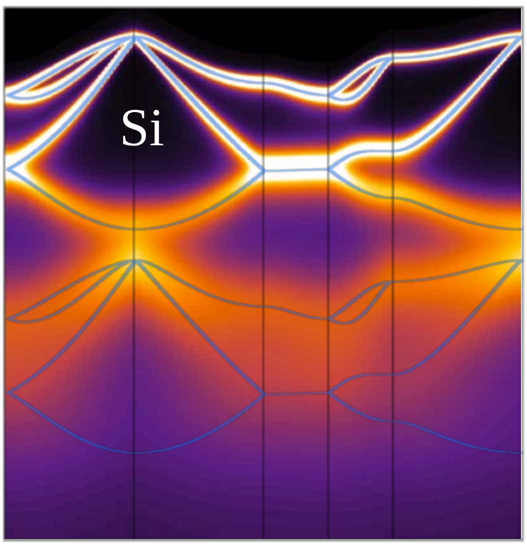
Ubiquitous electron-plasmon interaction in semiconductors

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 thermalization, etc. At variance with electron-phonon coupling, however, questions pertaining the strength of electron-plasmon coupling and its spectral signatures in photoemission experiments are still awaiting further investigations. These problems may be addressed through the development a first-principle theory of electron-plasmon interaction based on many-body perturbation theory. I will illustrate that electron-plasmon interaction in semiconductors lead to the emergence of plasmonic polaron bands, that is, broadened replicas of the full valence band-structure shifted by the plasmon energy (see Figure). Additionally, our first-principles calculations reveal strong electron-plasmon coupling in degenerate (highly-doped) semiconductors. In these materials, due to the emergence of low-energy extrinsic plasmons, electron-plasmon interaction may couple electronic states in the vicinity of the Fermi energy, altering ubiquitously dynamical and optical properties.



Host: Angel Rubio – MPSD-CFEL Theory Department