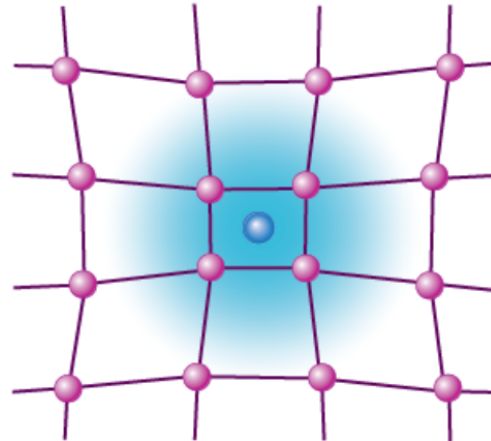


Solid State Theory

Solid state theory is an extremely interesting playground for studying the effects of quantum mechanics. Moreover, the corresponding effects are directly accessible by experiment and often provide the basis for technological applications. Starting point of the lecture is the description of electronic states in solids and an introduction to the theoretical tools which allow for the calculation of the electron dynamics in these systems. The coupling between electrons via the Coulomb interaction leads to the phenomenon of plasmon excitations which are discussed in two- and three-dimensional materials. Also the coupling between electrons and lattice vibrations, giving rise to polaron states and the influence of disorder are part of the lecture.

Winter term: 4+2 SWS, 6 CP



Polaron formation due to the coupling between electron (blue) and lattice.

Content:

- Electronic states in solids, band theory
- Methods of Band Structure Calculation
- Linear response theory, application to collective excitations in solids: plasmons, optical conductivity, dielectric function
- Transport: Boltzmann equation and applications, scattering rates, impurities
- Elastic properties of solids

Literature:

- R. M. Martin, Electronic structure: Theory and practical methods
- O. Madelung: Introduction to Solid-State Theory
- G. D. Mahan, Many Particle Physics