

Materials on the nanoscale: small is different

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Scope of the seminar course is the presentation and discussion of some main differences encountered in nanoscaled materials compared to their bulk counterparts.

The seminar course will first shortly address fundamental concepts of electron and phonon physics. In course of this the density of states and temperature-dependence of specific heat of materials of different dimensionality, the temperature-dependence of scattering cross-sections (electron-defect, phonon-defect, electron-phonon, spin etc.). Within this framework, the basic operation of a few characterisation techniques comprising scanning- and transmission-electron microscopy, Raman scattering, scanning-force microscopy (STM and AFM) and electronic transport in general will be discussed.

The capabilities of the experimental techniques will be demonstrated on several examples comprising optics with electrons in graphene, transport and Raman in functionalised graphene, and diameter-dependent electrical transport and charge-injection in quasi-1D silver and germanium nanowires. The presented results will demonstrate the (in part subtle) qualitative difference of the physical properties of nanoscaled materials compared to their bulk form.

Target audience: B.Sc. higher semesters and M.Sc. students