UNIVERSITÄT DUISBURG ESSEN

PHYSIK E=

Physikalisches Kolloquium

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Hörsaal MC 122

Electronic structure and properties of a few-layer black phosphorus

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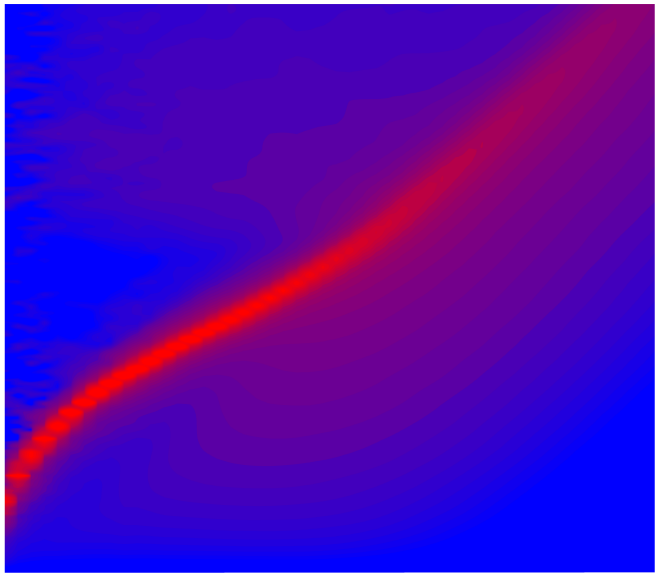

I will review some theoretical issues related to a newly discovered two-dimensional material, few-layer black phosphorus (for the case of single layer, also known as phosphorene).
This is a direct-gap semiconductor with a gap in Γ point changing from roughly 2 eV in single layer to 0.3 eV in the bulk, with anisotropic and essentially non-parabolic energy spectrum.
I will present tight-binding parametrization of electron energy spectrum and its application to large-scale simulations of optical and plasmonic properties.
At strong interlayer electric field (or potassium doping) electronic phase transition happens to semimetallic phase with anisotropic Dirac cones.
I will discuss consequences of this transition for plasmon spectra and quantum Hall effect.
I will also consider single- and two-phonon scattering processes and intrinsic limits on charge carrier mobility in single-layer black phosphorus which turn out to be much more restrictive than for graphene.