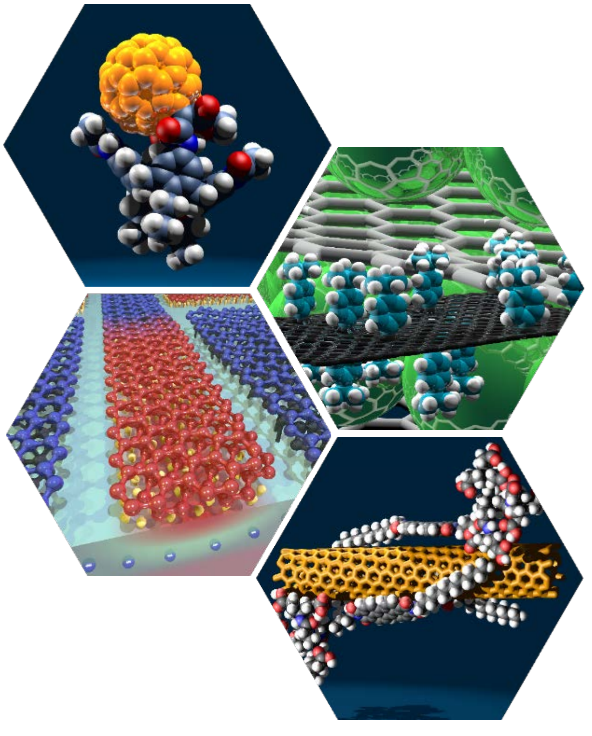
Seminar series of the Collaborative Research Centre (SFB) 953 «Synthetic Carbon Allotropes»



Controlling Excitons and Many-Body Interactions in 2D Semiconductors

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10:00 am

Lecture Hall F – Physikum
Staudtstraße 5

ABSTRACT: In monolayers of two-dimensional semiconductors, the reduced dimensionality and reduced dielectric screening lead to strong many-body interactions, which determine their electronic and optical properties. As a consequence, excitons have extraordinarily high binding energies and dominate the optical spectra. Higher-order excitonic states, such as excitons bound to free carriers (trions), biexcitons (four-body states) and charged biexcitons (five-praticle states) are also stable and give rise to new emission features. Here, we will describe recent advances in understanding these many-body states and their spin-valley configurations.
The weak screening within monolayered semiconductor systems also makes them sensitive to their dielectric environment. We have investigated this effect by measuring the optical bandgap and the band dispersion by optical and photoemission techniques. We find that the exciton binding energy is strongly reduced when highly screening layers, such as graphene, are placed adjacent to a TMDC monolayer. In addition to tuning the exciton binding energy, this approach also permits tuning of the quasiparticle band gap by several hundreds of meV. This new method thus opens the possibility of modifying the quasiparticle band structure of the material by engineering its dielectric environment.

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