Hybrid Inorganic/Organic Systems for Opto-Electronics

Collaborative Research Centre 951

Colloquium Announcement

of the Collaborative Research Centre 951
"Hybrid Inorganic/Organic Systems for Opto-Electronics"

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Max Planck Institute for Polymer Research, Mainz, Germany

Charge Transfer and Mobility in Novel (Hybrid) Materials

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Dynamic screening of quasiparticles in WS_2 monolayers

Time: Thursday, 28.04.2022, 15:15

Place: **IRIS Adlershof, Zum Großen Windkanal 2 Room 2'049 (Foyer)**

Meeting-ID: 615 2251 9123
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Charge Transfer and Mobility in Novel (Hybrid) Materials

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Many electro-optic devices, including solar cells, light-emitting diodes and photocatalysts rely on the interconversion of light and charges. Following their optical or electrical injection, the behavior of these charges determines the device efficiency. Key aspects of charge carrier dynamics are charge separation, charge mobility, and charge transfer across interfaces in hybrid systems. In my presentation, I will demonstrate how contact-free terahertz photoconductivity measurements can provide important insights into charge transfer and mobility in novel (hybrid) materials, including 2D materials, MXenes, and perovskites.

Dynamic screening of quasiparticles in WS_2 monolayers

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We unravel the influence of quasiparticle screening in the non-equilibrium exciton dynamics of monolayer WS_2 by femtosecond time-resolved reflectance contrast measurements and a simple, comprehensive model that provides a complete picture of the competing phenomena governing the exciton dynamics in WS_2 upon photoexcitation. Particularly, by tracking the evolution of the excited quasiparticle populations, those being excitons (exc) and quasi-free carriers (QFC), we unveil their specific impact on the renormalization of the quasi-free particle band gap, the exciton binding energy and the linewidth broadening. The remarkable conclusion is that, despite the many competing processes, the complex dynamics can be boiled down to a very simple and neat picture: the (effective) exciton screening solely reduces the exciton binding energy, while quasi-free carriers (effectively) only cause renormalization of the free carrier band gap. At the same time, linewidth broadening is dominated by QFC-exc and exc-exc scattering. Our model, thus, reduces the complex dynamics to the most essential elementary processes exemplarily for WS_2 monolayers.