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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Mobile optical excitations in 2D materials

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Photonic and plasmonic neuromorphic device concepts using photochromic molecules

Time: Thursday, 27.01.2022, 15:15

Place: The colloquium takes place online (ZOOM)

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Mobile optical excitations in 2D materials

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Transport of optical excitations in semiconducting solids plays a central role from both fundamental and technological perspectives. In systems with strong Coulomb interaction the propagation of optically injected carriers is dominated by excitons instead of free electrons or holes. This can affect both the overall energy landscape, interactions with the Fermi sea of free charges, and the mobility of the excitations. Here, I will present recent studies of exciton propagation in two-dimensional semiconductors monitored via time-resolved optical microscopy in systems free from the influence of disorder from local fluctuations of the dielectric environment. I will discuss linear and non-linear phenomena arising from interactions as well as illustrate how strain-induced potentials can be used to guide excitons in 1D/2D heterostructures. Finally, I will present temperature-dependent measurements of exciton diffusion challenging the established semi-classical description and indicating the role of quantum effects for exciton transport.

Photonic and plasmonic neuromorphic device concepts using photochromic molecules

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The employment of artificial neural networks (ANN), inspired by the biological nervous system, enables signal processes to elaborate solutions for specific issues. The high performance of such ANNs is achieved through the dynamic change of the synaptic weights by applying learning algorithms for self-optimization. Despite of the simple operations for each single elements in an ANN, a network with a huge amount of simulated elements consumes lots of computing capacity using the von Neumann architecture. To overcome this issue, neuromorphic devices facilitate the designing of hardware ANNs, which emulates the synaptic functions analogously. Here we demonstrate the viability of such devices using photonic/plasmonic functionalities in combination with the photochromic molecules.

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