WWU MÜNSTER

CENTER FOR MULTISCALE THEORY AND COMPUTATION

Physikalisches Institut — Institut für Festkörpertheorie

Integriertes Seminar

Aktuelle Probleme dimensionsreduzierter Festkörper

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Electronic Structure, Manybody Effects and Phonon-assisted Dynamics in Semiconductor Quantum Dots

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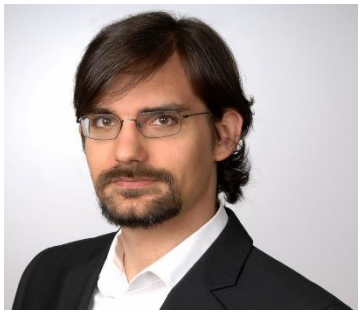

Quantum dots are key devices for quantum technologies. Because of their strong interaction with light, quantum dots can serve as single-photon sources or as emitters of entangled photon pairs. As novel fabrication techniques enable an unprecedented degree of control over the shapes and sizes of semiconductor nanostructures, there is a demand for tools to theoretically predict how changes in their geometry influence their electronic and optical properties.

Here, I present QNANO, an atomistic million-atom electronic structure simulation framework for semiconductors and 2D materials based on the tight-binding and configuration-interaction approach, and show how it can be used as a predictive tool to model the electronic and optical properties of excitonic complexes and multi-electron systems in nanowire quantum dots.

Moreover, I report on the ultrafast dynamics in laser-driven semiconductor quantum dots in optical microcavities as sources of non-classical light, where the non-perturbative coupling to phonons, simulated using a numerically exact real-time path-integral method, turns out to have both detrimental and beneficial aspects for applications.

Einladende: D. Reiter