Strong light-matter coupling in nanoscale semiconductors for fast & tunable light-emitting devices

Initiative: Integration molekularer Komponenten in funktionale makroskopische Systeme (beendet, nur noch

Fortsetzungsanträge)

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Laufzeit: 3 Jahre

Exciton-polaritons are hybrid light-matter quasiparticles with mixed photonic (small effective mass) and excitonic (strong nonlinearities and fast relaxation) properties that form upon strong coupling of an excitonic transition to a cavity mode. The project focuses on the development of novel exciton-polariton light-emitting devices based on monochiral single-walled carbon nanotubes (SWNTs) and two-dimensional monolayered transition metal dichalcogenides (2D-TMDCs); two classes of semiconducting nanomaterials with high oscillator strength, high exciton binding energy and high charge carrier mobility that can be processed and assembled from solution. These nanomaterials will be integrated into light-emitting devices with unique properties, such as ultrashort emission pulses, narrow spectral linewidth and angle-independent and tunable emission from the visible to the near infrared. The hitherto uncharted physics of exciton-polaritons in these nanomaterials will be investigated using high-quality microcavities. In addition, the feasibility of polariton condensation at room temperature will be explored, which may lead to electrically pumped exciton-polariton lasers and other exciting phenomena.

Projektbeteiligte

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Spectroscopic near-infrared photodetectors enabled by strong light-matter coupling in (6,5) single-walled carbon nanotubes
Population of Exciton Polaritons via Luminescent sp^3 Defects in Single-Walled Carbon Nanotubes.
Trion-Polariton Formation in Single-Walled Carbon Nanotube Microcavities