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S E M I N A R
on
Semiconductor Physics and Nanotechnology

Mo, 12.06.2023, 11:15 Uhr,

Seminar in person in the Physics lecture hall *or* via Zoom

"Gain, lasing and photocurrents of colloidal quantum dots"

Prof. Dr. Joachim R. Krenn

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Colloidal semiconducting quantum dots are efficient, stable and spectrally tunable emitters, but their optical gain is often limited by fast nonradiative processes. These processes can however be strongly suppressed in slab-shaped nanocrystals (nanoplatelets), due to relaxed exciton Coulomb interaction. We show that CdSe/CdS nanoplatelet ensembles can be shaped into simple sub-microscopic stripe waveguides that achieve lasing. We find a remarkably high gain factor of 1630 1/cm and look into the details of the laser emission above threshold [1]. Our results illustrate the feasibility of geometrically simple monolithic microscale nanoplatelet lasers for a variety of photonic applications.

Besides light emission, the full understanding of charge transport in quantum dots is key to their application in photovoltaics and light detection. We investigate photocurrents of colloidal PbS/perovskite quantum dots in nanoscale metal electrode gaps. By scanning photocurrent microscopy we evidence the strong localization and high reproducibility of photocurrent generation in the gap regions. With a consistent photocurrent/irradiance power law measured from only a few quantum dots over laser irradiances spanning five orders of magnitude, we demonstrate robust light/current coupling on the nanoscale [2].

In addition, ongoing work on colloidal quantum dots with conductive atomic force microscopy and ultrafast transient spectroscopy will be discussed.

[1] M. Belitsch, D.N. Dirin, M.V. Kovalenko, K. Pichler, S. Rotter, A. Ghalgaoui, H. Ditlbacher, A. Hohenau, J.R. Krenn, Gain and lasing from CdSe/CdS nanoplatelet stripe waveguides, Micro and Nano Engineering 17, 100167 (2022)

[2] D. Grimaldi, E. Kelderer, D.N. Dirin, M.V. Kovalenko, A. Hohenau, H. Ditlbacher, J.R. Krenn, Photoconductivity of PbS/perovskite quantum dots in gold nanogaps, Nanoscale Adv. 4, 3566 (2022)

Zoom – Link:

https://zoom.us/j/96375934537?pwd=RTlKTWhSdzRHU211YTY1bGFxTUtpZz09

Meeting-ID: 963 7593 4537

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