

Seminar über Ultrafast Science and Technology

Referent: Dr. Johannes Haase, Paul Scherrer Institut, Villigen

Titel: Ultrafast biexcitonic signatures in single quantum dot pump-probe spectroscopy

II-VI semiconductor quantum dots with high confinement potentials and large Coulomb correlation energies provide promising systems for quantum optical experiments. In my talk, I will report on two-color femtosecond pump-probe measurements on a single self-assembled CdSe/ZnSe quantum dot. Recent developments in the sample design enable us to resonantly excite and spectro-temporally investigate simultaneously the trion line and the biexcitonic emission lines of a singly charged quantum dot. After hot exciton creation by the pump, for positive time delays the trion resonance exhibits an initial bleaching followed by stimulated emission, which occurs after relaxation to the ground state [1]. Additionally, negative pump-probe features emerge on the low-energy side of the trion line. We attribute those to an induced absorption into the biexcitonic states [2]. This picture is corroborated by matching transient absorption and photoluminescence emission lines.

[1] F. Sotier, T. Thomay, T. Hanke, J. Korger, S. Mahapatra, A. Frey, K. Brunner, R. Bratschitsch, and A. Leitenstorfer, Femtosecond few-fermion dynamics and deterministic single-photon gain in a quantum dot, *Nature Phys.* 5, 352-356 (2009).

[2] J. Huneke, I. D'Amico, P. Machnikowski, T. Thomay, R. Bratschitsch, A. Leitenstorfer, and T. Kuhn, Role of Coulomb correlations for femtosecond pump-probe signals obtained from a single quantum dot, *Phys. Rev. B* 84, 115320 (2011).

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