HL 53 Hybrid systems

Time: Friday 11:00–11:15 Room: BEY 154

HL 53.1 Fri 11:00 BEY 154

Electrical tuning of resonant energy transfer from semiconductor nanoantennae to single molecules — •Klaus Becker[1], John M. Lupton[1], Josef Müller[1], Andrey L. Rogach[1], Dmitri V. Talapin[2], Horst Weller[2], and Jochen Feldmann[1] — [1]Photonics and Optoelectronics Group, Physics Department and CeNS, Ludwig-Maximilians-Universität, Munich, Germany — [2]Institute of Physical Chemistry, University of Hamburg, Hamburg, Germany

Advances in technology often occur by bringing together different branches of materials science to form novel heterostructures or hybrid compounds. The combination of semiconductor nanoparticles and organic dye molecules constitutes a particularly powerful route to creating novel functional properties. The large absorption cross section of the nanocrystals provides an efficient route to concentrating excitation energy and funneling it to single dye molecules with much weaker absorption cross sections. By introducing a small number of nanoparticles into a film of dye acceptors, we show the feasibility of addressing single emitters in a large ensemble by resonant energy transfer, thus demonstrating the extremely high sensitivity of this approach. Such hybrid exciton coupling is complicated by the requirement of substantial spectral overlap between donor and acceptor. We employ the exceptional quantum confined Stark effect of rod-like heterostructure nanocrystals [1,2] to drive the particle in and out of resonance with a single absorbing molecule. This electrical control of energy transfer illustrates a novel single molecule switch.

[1] J. Mueller et al., Nano Letters 5, 2044 (2005). [2] J. Mueller et al., Phys. Rev. Lett. 93, 167402 (2004).