SFP 2011-0

Band-Edge Exciton Fine structure of Single CdSe/ZnS Nanocrystals

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This talk will report a spectroscopic study of highly photostable individual CdSe/ZnS nanocrystals. A striking feature in the low temperature emission spectra is the presence of two zero-phonon lines, which we attribute to the radiative recombinations from the two lowest excitonic levels as a consequence of a weak spin-flip rate between these two states [1, 2]. We also performed ultra-high resolution resonant photoluminescence excitation of the two lowest energy zero-phonon-lines of a single nanocrystal at 2K. This experiment sets a lower bound of 100ps for the optical coherence lifetime of the two lowest-energy bright and dark excitons over a time scale as long as 100ms [1].

In a second part of the talk, the effect of an applied magnetic field on single nanocrystals will be presented. Field-induced coupling between the bright and the dark excitonic states is directly observed in the low-temperature photoluminescence spectrum and decay [2]. This allows the determination of the angle between the nanocrystals *c* axis and the field. Orientation-dependent Zeeman splittings of the dark and bright sublevels are measured and provide the corresponding exciton Landé factors, as well as spin-flip relaxation rates between Zeeman sublevels.

Références

[1] L. Biadala, Y. Louyer, P. Tamarat and L. Lounis, “Direct observation of the two lowest exciton zero-phonon lines in single CdSe/ZnS nanocrystals”, Phys. Rev. Lett. **103**, 037404 (2009).

[2] Y. Louyer, L. Biadala, P. Tamarat and L. Lounis, “Spectroscopy of neutral and charged exciton states in single CdSe/ZnS nanocrystals”, Appl. Phys. Lett. **96**, 203111 (2010).

[3] L. Biadala, Y. Louyer, P. Tamarat and L. Lounis, “Direct observation of the two lowest exciton zero-phonon lines in single CdSe/ZnS nanocrystals”, Phys. Rev. Lett. **105**, 157402 (2010).