# Spectroscopy of single II-VI quantum dots using single-mode optical fibers

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Over many years of intense studies of semiconductor quantum dots (QDs) the progress in their understanding was coupled to the development of a variety of suitable experimental techniques. E.g., non-resonant photoluminescence measurements reveal a discreet character of the energy spectrum while single photon correlations prove non-poissonian character of the photoluminescence and indistinguishability of the emitted photons. Experimental realization of such measurements is done using two approaches: free-beam and fiber-based optical systems, each of them having their respective pros and cons. In general, the free-space approach is less demanding and allows for spatial imaging of the sample onto a CCD camera. On the other hand, the fiber-based approach leads to more robust and modular structure of the experimental setup. Using single-mode (SM) fibers is also an invaluable when mode-matching is required, e.g., in Hong-Ou-Mandel correlation experiments.

Setups based on single-mode optical fibers are most commonly used in the studies of III-V QDs, which emit in the near-infrared part of the spectrum. Employing this approach to II-VI QDs presents a number of practical difficulties, involving much higher attenuation in the optical fibers and limited availability of the aspheric optics optimized for the range of 500-600nm.

In our work we apply the SM-fiber-based approach to CdSe/ZnSe QDs doped with single magnetic ions. We analyze the theoretical and practical efficiency of the coupling of the QD photoluminescence to the SM fiber using two different cryogenic microscope objectives - a Cassagrein-type reflector and a high-NA aspheric lens. We demonstrate the usability of such arrangement by utilizing it in high-resolution photoluminescence measurements and Hanburry-Brown-Twiss correlations and discussing the prospect of Hong-Ou-Mandel experiment.