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Characterization and 2D FT electronic spectra of colloidal PbSe nanocrystals[1] DMITRY BARANOV, SAMUEL PARK, BYUNGMOON CHO, DAVID JONAS, University of Colorado Boulder — In the last decade, colloidal lead selenide nanocrystals (PbSe NCs) have been actively studied by ultrafast laser spectroscopy techniques due to interesting electronic structure and rich carrier dynamics. Theoretical studies of small PbSe NCs by Zunger group predicted intervalley splitting of the electron and hole ground states which are degenerate in the bulk. Recent theoretical work by Goupalov group predicted that magnitude of the splitting depends on the structure of NC's core and presence of surface shell. These predictions and abundant reports of sample to sample variation in observed photophysics of PbSe NCs point towards the need for a better relation of sample's structure and composition to results of spectroscopic measurements. In this work, we investigate well-defined colloidal PbSe NCs by 2D FT electronic spectroscopy in the short-wave infrared region. Samples of oleate-capped PbSe colloidal NCs (3.3 nm average diameter, 1.09 eV band gap) have uniform shapes with a size distribution varying by less than half of bulk PbSe lattice constant. Studied samples of PbSe NCs were prepared following a protocol which has been reported to produce Pb-rich NCs, suitable for testing predictions about the intervalley splitting.

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