From nanocrystals to two-dimensional metal halide perovskite microcrystals: Heterostructures, optical properties and photonic functionality

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Low-dimensional metal-halide perovskites emerged as highly interesting materials for optoelectronics and light emission. In these materials the semiconductor octahedra are sandwiched in between comparatively large organic molecules and feature several highly attractive properties: the nanoscale dimensions of the layered structure lead to strong quantum and dielectric confinement, which for example results in strongly bound excitons. And a huge variety of molecules is available (or can be designed) to form the organic phase of the low-dimensional MHP, which provides an extensive toolbox to tailor their structural, mechanical, and optoelectronic properties.

In my talk I will review different semiconductor nanomaterial architectures and their respective advantages. Then I will discuss our recent progress in fabrication of single microcrystals of such low-dimensional perovskites, where we developed a microcrystal growth process based on dissolution and recrystallization that allows to fabricate 2D-MHP microcrystals with perfect rectangular shape. These microcrystals are single crystalline, with clean surfaces, and can function as photonic cavities.