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How dimensionality and shape anisotropy in perovskite nanocrystals promotes next generation energy materials

Assistant Professor Yehonadav Bekenstein

Department of Materials Science and Engineering & The Solid State Institute
Technion-Israel Institute of Technology

Abstract

New materials pose new challenges. Lead-halide perovskites have emerged as important optoelectronic materials with excellent efficiencies in photovoltaic, light-emitting applications and as good quantum emitters with highly coherent emission. These physical properties stand in contrast with recent experimental observations of high dynamic disorder, room temperature structural transformation, and questionable material stability.

For improving our understanding, I will argue in favor of studying these materials at the limit of smallest crystals we can make.

I will show how through synthetic control of perovskite cesium lead halide nanocrystal's shape; we control quantum confinement of excitons with atomic precision and anisotropic emission. By control of composition and structural phase transformations we learn of the thermodynamic nature of this crystal system.

In the case of 2D plates we observe increased excitonic interaction and increased absorption coefficient. In the case of nanowires, we show that the broken symmetry manifests in polarized emission which enables fabrication of highly functional films through 3D printing. In addition, by changing the anion composition facile band gap tunability at room temperature throughout the visible spectrum is achieved.

This synthetic versatility, position colloidal perovskites as a unique model system for the study of charge dynamics and thermodynamic transformations at the nanoscale. These lessons are important in the context of understanding and designing loss-less next generation materials for energy conversion applications.

ההרצאה תתקיים ביום רביעי, ה-22.5.19 בשעה 12:30
באודיטוריום המכון למצב מוצק, קומת כניסה
The lecture will take place on Wednesday, 22.5.19 at 12:30
at the Solid State Institute auditorium, entrance floor

Host: Assistant Professor Yoav Sagi