TcSUH BI-WEEKLY PI WEBINAR

Friday, October 16, 2020 – 12:00 p.m. to 1:00 p.m.

Join Zoom Meeting

https://uofh.zoom.us/j/845619943?pwd=QlZvYUV6M2dxNDkvNWxBd3F2YzdJZz09

Meeting ID: 845 619 943
Passcode: 016104

Origin of Luminescent Centers and Edge States in Low-dimensional Lead Halide Perovskites

Prof. Jiming Bao

Department of Electrical and Computer Engineering, University of Houston; TcSUH PI

ABSTRACT: With only a few deep-level defect states having a high formation energy and dominance of shallow carrier non-trapping defects, the defect-tolerant electronic and optical properties of lead halide perovskites have made them appealing materials for high-efficiency, low-cost, solar cells and light-emitting devices. As such, recent observations of apparently deep-level and highly luminescent states in low-dimensional perovskites have attracted enormous attention as well as intensive debates. The observed green emission in 2D $CsPb_2Br_5$ and 0D Cs_4PbBr_6 poses an enigma over whether it is originated from intrinsic point defects or simply from highly luminescent $CsPbBr_3$ nanocrystals embedded in the otherwise transparent wide bandgap semiconductors. The nature of deep-level edge emission in 2D Ruddlesden-Popper perovskites is also not well understood. In this talk, I will analyze the experimental evidences that support the opposing interpretations and discuss challenges and root causes for the controversy. I will then present experimental approaches that can better correlate property with structure of a material and help resolve the controversies. Using combined Raman-photoluminescence under hydrostatic pressure in a diamond anvil cell, we prove that $CsPbBr_3$ nanocrystals are responsible for the bright green emissions in both 2D $CsPb_2Br_5$ and 0D Cs_4PbBr_6. Finally, I will show how we identify 3D perovskite as luminescent center for the edge emission in 2D R-P perovskites.

BRIEF BIO: Dr. Bao is interested in developing and understanding new nanomaterials and then exploring their novel applications in energy, optoelectronics and sensing. Dr. Bao graduated from Zhejiang University with B.S. and M.S. in Physics in 1992 and 1995, respectively. He obtained his Ph.D. in Applied Physics in 2003 from the University of Michigan under Roberto Merlin; he then did post-doctoral research in Federico Capasso's group at Harvard University before joining the University of Houston in 2008 as an assistant professor. Dr. Bao is a Fellow of the Optical Society of America (OSA) and American Physical Society (APS).