# PHYSICS & ASTRONOMY SEMINAR

## "Bright and Stable Perovskite Electroluminescence by Differentiated Ion Motion"

***Presented by:***

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**Abstract:** Solution-processed metal halide perovskites with the chemical formula ABX3 have emerged as next-generation light-emitting materials. However, perovskite ion migration has been recently demonstrated to degrade the performance of metal halide perovskite devices. Our strategy involves producing differentiated ion motion within a device with a rational materials blend. This strategy involves selectively moving additive ions while restricting the transport of perovskite ions. This materials blend is also utilized to produce smooth, pinhole-free films with passivated traps and minimal defects. This selective ion motion provides a new pathway to utilize metal halide perovskites as emissive materials in light-emitting electrochemical cells (PeLEC). Light-emitting electrochemical cells (LECs) utilize ionic motion to generate electrical double layers for high carrier injection and potential doping effects to achieve efficient operation in single-layer devices. Recently, our group demonstrated bright and effectual PeLECs with simple single-layer architectures, leveraging a polyelectrolyte and a lithium ionic additive (LiPF6) to achieve devices with a high maximum luminance of >10000 cd m−2 and operation exceeding 100 hours over 800 cd m−2. To understand this improved performance among PeLECs, we characterized these perovskite thin films with photoluminescence (PL) spectroscopy, scanning electron microscopy (SEM), atomic force microscopy (AFM), X-ray photoelectron spectroscopy (XPS), and X-ray diffraction (XRD). These studies revealed that this optimal LiPF6 concentration improves electrical double layer formation, reduces the occurrence of voids, charge traps, and pinholes, and increases grain size and packing density. Electrochemical impedance spectroscopy with equivalent circuit modeling revealed that electrical double layer widths are minimized with an optimal LiPF6 concentration and inversely correlate with efficient performance. These results demonstrate that an optimal LiPF6 concentration improves stability and efficiency by improving double layer formation and retaining the perovskite structure.

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**Thursday, March 11, 2021**
**4:00 pm**
**PSLB 112**