PHYSICS SEMINAR SERIES:

Surface and interface passivation for perovskite devices

Prof. Bin Chen

Northwestern University

Date:
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Time:
10:30 AM-11:50 AM

Location:
GRAN 13

About the speaker:

Bin Chen is currently a Research Assistant Professor in the Chemistry Department at Northwestern University. During his graduate studies, he focused on crystal growth of two-dimensional materials and studying defect behaviors in them. In 2018, he obtained his Ph.D. in materials science and engineering from Arizona State University. Prior to joining Northwestern, he worked as a postdoctoral researcher at the University of Toronto, where he conducted research on perovskite-based tandem solar cells and quantum dot photodetectors. His current research interests include exploring emerging semiconductors for applications in solar energy and infrared sensing.

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Abstract:

Metal halide perovskites have emerged as highly promising materials for photovoltaic (PV) applications. These materials have the potential to revolutionize the solar cell industry due to their low cost and high power conversion efficiency. In recent years, perovskite solar cells have made significant progress, with efficiencies reaching above 26%, approaching the performance of established silicon cells. The key to this rapid improvement lies in understanding and controlling the interfaces in perovskite devices. In this talk, I will focus on interface engineering in perovskite solar cells (e.g., energy alignment, doping, and carrier dynamics), including the construction of heterostructures of multi-dimensional perovskites. I will discuss surface passivation by synthesizing 2D perovskites atop 3D bulk perovskite. The precise control over the dimensionality of these quantum-confined 2D thin layers enables us to achieve efficient carrier transport across the interface while maintaining desirable trap passivation. I will also discuss field-effect passivation when the perovskite active layer is in contact with a carrier transport layer. Modulating the minority carrier population at the perovskite/C60 interface is critical for reducing interfacial recombination. Lastly, I will explore how we combine chemical and field-effect passivation to achieve optimal passivation. Adjusting interface conditions will be even more important as we move towards multi-junction device architecture in pursuit of higher efficiency.

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