Halide Perovskite Semiconductors and Solar Cells

Hybrid organic inorganic semiconductors (HOIS) have witnessed a renaissance from the due to the performance of the halide perovskite HOIS in photovoltaic applications. Since the identification of HOIS for PV applications just under a decade ago the efficiencies have surpassed all other poly crystalline thin film technologies with record cell efficiencies in excess of 25%. This talk will provide an overview of NREL efforts, progress and challenges in halide perovskite solar cells with an emphasis on the role of the interface in device performance including stability. The importance of Pb as an enabling element in these materials and question regarding impact for the use of Pb based HOIS for terawatt scale PV will be discussed. An examination of different perovskite active layers and interfacial electronic structure of these remarkable materials will be presented and connected to basic question regarding stability. The extent to which other low dimensional HOIS system provide a unique avenue to modulate the interfaces and enable performance/stability will also be discuss. The discussion will then pivot to the larger opportunity for material functionality which lower dimensionality provides for applications beyond traditional PV. Specifically, the work within the NREL lead Center for Hybrid Organic Inorganic Semiconductors for Energy (CHOISE), US Department of Energy, Energy Frontier Research Center (EFRC) to exploit the hybrid aspects of these materials for spintronic functionality will be discussed. Characterization from a range of time resolved spectroscopy, structural, chemical and device level studies will be presented.

Department of Physics
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Theoretical and Applied Physics

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4:00 PM

Innovation Hall

Room E430

Refreshments will be available at

3:30 PM.

In E217

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Bio:

Dr. Berry is currently the team lead for the National Center for Photovoltaic's halide perovskite solar cell program. He is a graduate of the Penn State Department of Physics, receiving his PhD for work on spin physics of magnetic II-VI, III-V and metallic/semiconductor systems. After his PhD work he was awarded a National Research Council Fellowship at the National Institute of Standards and Technology (NIST/JILA), where he worked on the development and application of high-resolution spectroscopic techniques to solid-state electro-optical systems. Since joining NREL he has worked on a range of next generation photovoltaic materials and devices with an emphasis on relating basic interfacial properties to device level performance. He has worked on these issues in several EFRCs and is currently the co-lead of the spins thrust in the NREL CHOISE EFRC as well as PI participating in other CHOISE projects to connect basic science developments technological applications. He also leads research efforts across a number of basic and applied activities in HOIS materials including DOE's primary solar cell focused research efforts "De-risking halide perovskite solar cells".