



BIG energy seminar series

Addressing the scale and complexity of the global energy challenge.



“Pathways to a New Efficiency Regime for Organic Photovoltaics: The Science and Engineering of Plastic Solar Cells”

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Astronomy – University of Denver***

Date: Thursday April 4th 3:30

Location: ECCR 155

Abstract:

The field of Organic Photovoltaics (OPVs – aka “plastic solar cells”) has garnered a tremendous amount of attention in laboratories around the world in recent years due to its promise of low-cost, high-throughput fabrication of photovoltaic modules from earth-abundant materials. The result has been the development of materials and device architectures capable of power conversion efficiencies of up to 12% at the laboratory scale, leading to significant industrial interest. However, if OPV is to be viable as a large-scale renewable energy technology in the highly competitive photovoltaics arena, it will have to make significant and rapid progress to yield efficiencies closer to 20%. This talk will begin with a brief overview of the existing state-of-the-art in the field in terms of molecular materials, device architectures, and issues involved in industrial production of modules. It will then discuss the device physics of OPVs, in particular focusing on the role of electronic defects and dark carriers on the electric field distributions and carrier dynamics of prototypical devices. Potential pathways to engineering devices with higher efficiencies will then be highlighted, namely how electric field poling of the organic materials during their deposition can lead to better molecular alignment and hence improved charge transport properties. Finally, attempts at realizing a novel concept known as “energy pooling”, whereby the energies of multiple excitons are added together to form a highly excited state, will be discussed..

Biosketch:

Sean Shaheen is an Associate Professor in the Department of Physics and Astronomy at the University Denver and an affiliate with the National Renewable Energy Laboratory (NREL). He obtained his B.S. in physics at Carnegie Mellon University in 1991 and a Ph.D. in physics at the University of Arizona in 1999. He then went on to do postdoc at the University of Linz, Austria, where he worked on the topic of organic photovoltaics as a Lise Meitner Postdoctoral Fellow. Following his postdoc he was employed as a Scientist and then Senior Scientist in the National Center for Photovoltaics at NREL, where he was instrumental in establishing the organic photovoltaics laboratory there. He has worked in the field of organic electronics for close to twenty years and made early contributions to the advancement of their device efficiencies. He has over 70 publications and several book chapters and edited works in the area. Other topics in organic electronics that he is interested in include their application to neuromorphic circuitry and engineering and their use as environmentally-benign electronic devices. Beyond organic electronics, he and his group and collaborators are working on emerging research in biocomplexity and have initiated efforts on topics such as the dynamics of cyanobacterial colony growth (for biofuel applications) and information processing and transforms of biological data series. Shaheen is a Scialog Fellow of the Research Corporation for Science Advancement.

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