Michigan State University
Science at the Edge
Engineering Seminar

February 20th, 2015
11:30 a.m., Room1400 Biomedical and Physical Sciences Building
Refreshments served at 11:15 a.m.

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The Future of Solar Energy after the Big Crash

Abstract

The precipitous crash of photovoltaic (PV) module prices over the last 5 years has made the dream of generating renewable electricity at a cost comparable to coal a potential reality, while also bankrupting much of the US solar industry. While PV module prices are close to meeting the goals set by the DOE's Sunshot program nearly *5 years early*, the costs related to the balance of systems, namely the costs associated with the land, mounting hardware, grid electronics, installation labor and permitting have remained stubbornly high. This dramatic shift of costs has transitioned the solar energy field from one focused on reducing module costs to one focused on increasing power efficiency beyond the Shockley-Queisser Limit (established over 40 years ago) and developing PV modules that can be directly into existing building infrastructure.

In this talk, I will provide an overview of the approaches we, and others, are pursing to both increase power efficiency and reduce balance of systems costs in order to make solar energy cost competitive with energy generated from fossil fuels. For example, by utilizing quantum confinement effects, more then one electron can be collected for each incident photon (i.e. over 100% quantum efficiency), thereby exceeding the long standing Shockley-Queisser limit. In addition, the discovery of perovskite materials has opened up a cost effective route to tandem cells with efficiencies exceeding 30%. Finally, wavelength-selectivity can be used to install PV modules directly into building windows or over agriculture crops or greenhouses to simultaneously grow food, generate electricity, and harness thermal energy. I will conclude by discussing the importance of developing models that accurately include thermal modeling with electrical and optical modeling to develop solar energy technologies that can efficiently utilize the entire solar energy spectrum.

Bio

Carter earned her BA from Kalamazoo College in Physics, Chemistry and Mathematics and her PhD from the University of Chicago in Physical Chemistry. She worked at AT&T Bell Laboratories as a postdoctoral fellow and IBM Almaden Research Center as a visiting researcher before joining the faculty at University of California Santa Cruz in 1995. As a Professor of Physics, Carter's research has focused on thin film optoelectronic devices, biophysics, and technologies for sustainability. She is the Chair of the American Physical Society Group for Energy Research, and has served on the boards of the UC Energy Institute and the California Solar Collaborative. At UCSC, she has served as Chair of Graduate Council, the Vice Chair of

the Committee of Planning and Budget and is currently the Associate Dean of Graduate Studies. Carter has also been actively involved with entrepreneurship, launching 3 start-up companies ranging from photovoltaic technologies to K-12 science education.

For further information please contact Prof. Richard Lunt, Department of Chemical Engineering and Materials Science at rlunt@egr.msu.edu

Persons with disabilities have the right to request and receive reasonable accommodation. Please call the Department of Chemical Engineering and Materials Science at 355-5135 at least one day prior to the seminar; requests received after this date will be met when possible.