UCLA ENGINEERING
Chemical and Biomolecular Engineering

SEMINARS IN CHEMICAL AND BIOMOLECULAR ENGINEERING

Friday, February 23rd, 2018 | 10:00AM **Boelter Hall 3400**

Presented by:

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"Building a Brighter Future: Chemical and Photonic Design Principles for High Efficiency Solar Cells"

Although power from sunlight on the Earth's surface is both powerful and available, vastly exceeding both our annual power consumption and the total reserve power from all other known energy resources, solar energy only accounts for 1.8% of worldwide power generation. Transformative solar technologies with unprecedented efficiencies are required to make a more meaningful contribution. This presentation will discuss my recent work toward new chemical approaches to material processing and photonic design principles that dictate light propagation in materials, particularly within the context of improving solar energy conversion efficiency. First, this talk will describe a chemical solution to improve the current collection and efficiency of small (mm^2) GaAs solar cells, which are currently much less efficient (5% absolute difference) than larger (cm^2) cells owing to defect-heavy sidewalls. This facile passivation enables very efficient small cells for applications in flexible or concentrating panels. Additionally, this talk examines novel optical architectures for high efficiency (>40%) solar cell modules. We prototype a spectrum-splitting design optimized via ray tracing simulations; the resulting characterization shows an optical module that should correspond to a total conversion efficiency of 42%. Finally, I will discuss new nanophotonic approaches to improve renewable energy conversion. I will present examples of highly polarized emission and highly directional emission by tuning nanocrystal shape and local optical environment, which could yield more efficient optoelectronic devices for solar energy harvesting, lighting, and sensing applications. Through this program, we will explore novel device and photonic designs that represent a significant departure from current solar cell manufacturing techniques and show potential for much higher solar cell efficiencies, paving the way toward increased renewable energy generation.

Carissa Eisler is a postdoctoral fellow at Lawrence Berkeley National Laboratory and the University of California, Berkeley, working with Prof. A. Paul Alivisatos. She received her PhD in Chemical Engineering from the California Institute of Technology under the supervision of Prof. Harry A. Atwater, and her Bachelor's degree in Chemical Engineering (summa cum laude) from the University of California, Los Angeles. She is currently investigating the directionality properties of light-emitting nanocrystals as a means to create more efficient concentrators for solar energy applications. Her awards include the Energy Efficiency and Rewneable Energy (EERE) postdoctoral fellowship, the Everhart Distinguished Graduate Student Lecturer award, and the National Defense Science and Engineering Graduate (NDSEG) fellowship.