Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Optimizing Solar Conversion Efficiency Using Semiconductor Nanocrystals RANDY ELLINGSON, KELLY KNUTSEN, QING SONG, JUSTIN JOHNSON, MATT LAW, WYATT METZGER, JOSEPH LUTHER, KATHRINE GERTH, MARK HANNA, MATT BEARD, ARTHUR NOZIK, National Renewable Energy Laboratory — The increasing need for large quantities of CO_2-free energy sources may be partially met through the development of novel highly-efficient solar photoconversion approaches. The efficient generation of multiple excitons following absorption of a single photon in semiconductor nanocrystals (NCs) represents one possible route towards inexpensive, high-efficiency solar cells. The multiple exciton state, which has been observed for absorption of a single photon with energy above twice the NC effective bandgap in various colloidal semiconductors, can be detected through the Auger recombination signature in the decay of the charge carrier population. Exciton population decays can be measured by studying the time-dependence of either intra- or inter-band photoinduced absorption, or via the decay of photoluminescence for emissive samples. We report on work in our laboratory to study multiple exciton generation, and its potential for solar energy conversion applications, in various lead-salt as well as Si and Ge NCs.

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Date submitted: 21 Nov 2006 Electronic form version 1.4