Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Comparison of carrier multiplication yields in the PbX salts[1]
JAYSON STEWART, LAZARO PADILHA, JEFFREY PIETRYGA, Los Alamos National Laboratory, AARON MIDGETT, JOSEPH LUTHER, MATTHEW BEARD, ARTHUR NOZIK, National Renewable Energy Laboratory, VICTOR KLIMOV, Los Alamos National Laboratory — In this talk I will present recent results of a collaborative effort investigating the quantum efficiency of carrier multiplication (CM) of the lead salt nanocrystals: PbS, PbSe and PbTe. These materials are promising candidates for exploring generation-III photovoltaic concepts that rely on carrier multiplication, the process in which a single photon generates more than one electron-hole pair. Despite the many apparent similarities of these materials in their bulk form, we find that these compounds exhibit strikingly different CM yields in their nanocrystalline form. We suggest that the difference in CM yields in these nanomaterials is the consequence of different competing relaxation rates, such as phonon emission. Indeed, we estimate the rate of energy dissipation due to phonon emission mediated by a polar Frohlich-type interaction for these three materials and find excellent qualitative agreement with the data. This approach could prove useful for predicting future materials to investigate for increasingly high CM yields.

[1]Center for Advanced Solar Photophysics

Jayson Stewart
Los Alamos National Laboratory

Date submitted: 11 Nov 2011 Electronic form version 1.4