Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Numerical Modeling of Fluorescence Emission Energy Dispersion in Luminescent Solar Concentrator[1] LANFANG LI, XING SHENG, JOHN ROGERS, RALPH NUZZO, University of Illinois, Urbana — We present a numerical modeling method and the corresponding experimental results, to address fluorescence emission dispersion for applications such as luminescent solar concentrator and light emitting diode color correction. Previously established modeling methods utilized a statistic-thermodynamic theory (Kenard-Stepnov etc.) that required a thorough understanding of the free energy landscape of the fluorophores. Some more recent work used an empirical approximation of the measured emission energy dispersion profile without considering anti-Stokes shifting during absorption and emission. In this work we present a technique for modeling fluorescence absorption and emission that utilizes the experimentally measured spectrum and approximates the observable Frank-Condon vibronic states as a continuum and takes into account thermodynamic energy relaxation by allowing thermal fluctuations. This new approximation method relaxes the requirement for knowledge of the fluorophore system and reduces demand on computing resources while still capturing the essence of physical process. We present simulation results of the energy distribution of emitted photons and compare them with experimental results with good agreement in terms of peak red-shift and intensity attenuation in a luminescent solar concentrator.

[1]This work is supported by the DOE 'Light-Material Interactions in Energy Conversion' Energy Frontier Research Center under grant DE-SC0001293.

Lanfang Li
University of Illinois, Urbana

Date submitted: 28 Dec 2012 Electronic form version 1.4