Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Carrier Dynamics in Colloidal Graphene Quantum Dots CHENG SUN, Michigan State University, XIN YAN, LIANG-SHI LI, Indiana University, JOHN A. MCGUIRE, Michigan State University — We describe carrier dynamics for single and multiple excitons in colloidal graphene quantum dots (GQDs). Strong confinement and corresponding size-tunable electronic structure make GQDs potentially useful sensitizers in photovoltaic devices. We have studied the optical response of GQDs consisting of 132 and 168 sp^2 hybridized carbon atoms dissolved in toluene with HOMO-LUMO transitions of 1.4-1.6 eV. From measurements of ultrafast ($\sim$100 fs) transient absorption over nanosecond timescales, we extract the single-photon absorption cross-section and observe carrier-induced Stark shifts of the order of 0.1 eV indicating strong carrier-carrier interactions, as expected for the relatively weak screening of a two-dimensional nanostructure. Multiexcitons are observed to decay nonradiatively on $\sim$1 to 20 ps timescales, while single excitons display dynamics on multiple timescales due to carrier cooling, singlet-to-triplet intersystem crossing, and, on nanosecond to microsecond timescales, radiative recombination.

John McGuire
Michigan State University

Date submitted: 19 Nov 2010 Electronic form version 1.4