Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Measuring charge transport in nanopatterned PbS colloidal quantum dots using charge sensing NIRAT RAY, NEAL E. STALEY, DARCY D. WANGER, MOUNGI G. BAWENDI, MARC A. KASTNER, Massachusetts Inst of Tech-MIT — Colloidal quantum dots (CQDs) can self-assemble from solution into close-packed arrays, where the motion of electrons is expected to be correlated due to long-range coulomb interactions. In order to study electron transport in these arrays, measurement of conductance around zero bias is required. Devices fabricated using CQDs, however, tend to be highly resistive (owing to large tunnel barriers from the organic ligands), and techniques to increase the conductance, such as annealing, often lead to large scale cracking. We nanopattern PbS CQDs, using electron beam lithography and a liftoff process, adjacent to a charge sensor. The patterning process helps to eliminate cracking, and improve packing of the dots. By performing a time resolved measurement of charge through the dots, using the sensor, we are able to measure conductance values as low as $10^{-19}\,\Omega^{-1}$ with a voltage bias of just 100mV. Our technique also allows us to map out the current voltage characteristics, even at low temperatures where the current becomes immeasurably small. We present the first transport measurements, near zero bias, on nanopatterned PbS quantum dots.

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Date submitted: 15 Nov 2013 Electronic form version 1.4