Abstract Submitted
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Charge Transport in Semiconductor Nanocrystal Solids DMITRI TALAPIN, ELENA SHEVCHENKO, JONG SOO LEE, The Molecular Foundry, Lawrence Berkeley National Laboratory, Berkeley, CA, JEFFREY URBAN, DAVID MITZI, CHRISTOPHER MURRAY, IBM T. J. Watson Research Center, Yorktown Heights, NY — Self-assembly of chemically-synthesized nanocrystals can yield complex long-range ordered structures which can be used as model systems for studying transport phenomena in low-dimensional materials [1]. Treatment of close-packed PbSe nanocrystal arrays with hydrazine enhanced exchange coupling between the nanocrystals and improved conductance by more than ten orders of magnitude compared to native nanocrystal films [2]. The conductivity of PbSe nanocrystal solids can be switched between n- and p-type transports by controlling the saturation of electronic states at nanocrystal surfaces. Nanocrystal arrays form the n- and p-channels of field-effect transistors with electron and hole mobilities of 2.5 $cm^2V^{-1}s^{-1}$ and 0.3 $cm^2V^{-1}s^{-1}$, respectively, and current modulation I_{on}/I_{off} $\sim 10^3$-10^4. The field-effect mobility in PbSe nanocrystal arrays is higher than the mobility of organic transistors while the easy switch between n- and p-transport allows realization of complimentary circuits and p-n junctions for nanocrystal-based solar cells and thermoelectric devices. [1] E. V. Shevchenko, D. V. Talapin, N. A. Kotov, S. O'Brien, C. B. Murray. *Nature* **439**, 55 (2006). [2] D. V. Talapin, C. B. Murray. *Science* **310**, 86 (2005).

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