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Electron transport of n-type semiconductor nanocrystal thin films DONG YU, CONGJUN WANG, BRIAN WEHRENBERG, PHILIPPE GUYOT-SIONNEST, JAMES FRANK INSTITUTE, UNIVERSITY OF CHICAGO TEAM — The conductivity of thin films of n-type colloidal CdSe nanocrystals increases by up to 12 orders of magnitude as the occupation of the first two electronic shells 1Se and 1Pe increases, either by potassium or electrochemical doping. *[D. Yu, C. Wang, P. Guyot-Sionnest, Science 300, 1277 (2003)]* In the low electrical field regime, the conductivity follows $\sigma \sim \exp(-(T^*/T)^{1/2})$ in the temperature range 10K<T<120K. At higher electrical field, the conductivity becomes strongly field dependent. At 4K, the conductance increases by eight orders of magnitude over one decade of bias. At extremely high field conductivity becomes temperature independent, where $\sigma \sim \exp(-(E^*/E)^{1/2})$. The conduction behavior follows Efros & Shklovskii's variable range hopping model with Coulomb gap very well and the parameters determined by experiment agree well with the theoretical prediction. *[D. Yu, C. Wang, B. Wehrenberg, P. Guyot-Sionnest, Phys. Rev. Lett. 92, 216802 (2004)]* Our current interest is to dope magnetic impurities like Mn^{2+} inside the NCs. The doped magnetic spins provide strong local magnetic field and large magnetoresistive effect is expected.

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