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**Transport Properties of Gold Nanoparticle Arrays at Low Temperatures** T. TRAN, University of Chicago, I. BELOBORODOV, X.M. LIN, V. VINOKUR, Argonne National Laboratory, P. JIANG, W. KANG, H. JAEGER, University of Chicago — We investigated the effects of elastic and inelastic cotunneling on the electronic transport properties of Au monolayers and multilayers. Highly-ordered monolayers of dodecanethiol-ligated Au particles (6nm in diameter)[1] were assembled onto $Si_3N_4$ substrates with prefabricated electrodes. Multilayers were created by adding layers to the original monolayers[2]. Current-voltage (IV) measurements were performed with 50fA resolution down to 30mK. TEM images were taken posterior to all measurements. We found that transition from inelastic to elastic cotunneling occurred at T$\sim$5K. In the inelastic cotunneling regime, the IV curves were found to be nonlinear for $k_BT < eV/N < E_C$ and linear when $k_BT > eV/N$ where N is the number of grains across the electrode gap. In the elastic regime below 5K, the IV curves were found to be linear for $eV/N < (E_C\ \delta)^{1/2}$where $\delta$ is the level spacing and $E_C$ is the charging energy. As a consequence of cotunneling, Efros-Shklovskii variable-range-hopping-like conduction (VRH) was observed near zero bias. Above T$\sim$ 80-100K, transition from VRH to nearest-neighbor hopping took place.. X.M. Lin, *et.al.*, J. Nanoparticle Res. **2** 157 (2000). T.B. Tran, *et.al.*, Phys. Rev. Lett. **95** 076806 (2005),

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