Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Measurements of electron-in-a-box level spectra in chemically-synthesized metal nanoparticles FERDINAND KUEMMETH, K.I. BOLOTIN, D.C. RALPH, Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, NY 14853 — We incorporate chemically-synthesized metal nanoparticles into a single electron transistor geometry such that tunneling spectroscopy can be used to measure the electron energy levels within a single nanoparticle at dilution refrigerator temperatures. This technique gives better control over the size and shape of the nanoparticle than previous studies of level spectra in metals. We use a monolayer of dithiols or propylamines as a self-assembled tunnel barrier on top of a back-gated pair of gold electrodes, separated by a nm-sized gap. Into the gap we trap gold nanospheres 5 to 15 nm in diameter from a citrate based colloid solution, with control provided by adjusting the pH. Previous experiments on gold nanoparticles found a wide range of g-factors for Zeeman splitting in an applied magnetic field, with some values inconsistent with expected orbital contributions. Our measurements clarify the relationship between g-factors and level spacing through systematic variation of the particle's size and composition.

Ferdinand Kuemmeth
Cornell University

Date submitted: 30 Nov 2005 Electronic form version 1.4