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Spectra of discrete electrons-in-a-box energy levels in chemically-formed Au and Pt nanoparticles. SU-FEI SHI, F. KUEMMETH, K.I. BOLOTIN, W. LI, D.C. RALPH, Cornell University — We report tunneling spectroscopy measurements of the discrete electron spectra of individual metal nanoparticles formed by chemical synthesis, so that they are well-defined in their composition, size, and shape. The spectra of 5-15 nm diameter gold particles exhibit as many as 40 resolvable electronic excited states for a fixed value of gate voltage. We find excellent agreement between the measured level statistics and random matrix predictions for the regime of strong spin-orbit coupling and ballistic transport. As a function of changing gate voltage, the energy-level spectra in the Au particles are not scrambled by the addition of electrons, indicating that in these particles the variation in the strength of electron-electron interactions between states is negligible. We have also succeeded in fabricating single-electron transistors from individual Pt nanoparticles and hope to present measurements of their discrete spectra. Pt, unlike Au, has a sufficiently strong exchange interaction that it is expected to exhibit non-zero values of the ground state spin in the form of "mesoscopic magnetism".

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