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Anomalous Transport and Possible Phase Transition in Palladium Nanojunction[1] GAVIN D. SCOTT, Rice University, Department of Physics & Astronomy, JUAN J. PALACIOS, Universidad de Alicante, Departamento de Fisica Aplicada, DOUGLAS NATELSON, Rice University, Department of Physics & Astronomy, Department of Computer and Electrical Engineering — Many phenomena in condensed matter are thought to result from competition between different ordered phases. Palladium is a paramagnetic metal close to both ferromagnetism and superconductivity, and is therefore a potentially interesting material to consider. Structuring matter on the nanometer scale is one means of modifying relevant physical energy scales, with nanoscale confinement already known to favor locally modified magnetic interactions. We present transport measurements in electromigrated palladium break junction devices showing the emergence at low temperatures of anomalous sharp features in the differential conductance. These features appear symmetrically in applied bias and exhibit a temperature dependence of their characteristic voltages reminiscent of a mean field phase transition. The systematic variation of these voltages with zero-bias conductance, together with density functional theory calculations illustrating the relationship between the magnetization of Pd and atomic coordination, suggest that the features may result from the onset of spontaneous magnetization in the nanojunction electrodes. We propose that the characteristic conductance features are related to inelastic tunneling involving magnetic excitations.

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