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Transport in ultrathin gold films decorated with magnetic Gd atoms MICOL ALEMANI, ERIK HELGREN, ADDISON HUGEL, FRANCES HELLMAN, Physics Department, University of California, Berkeley, 366 Le Conte, Berkeley, CA, 94720 — We have performed four-probe transport measurements of ultrathin Au films decorated with Gd ad-atoms. The samples were prepared by quench condensation, i.e., sequential evaporation on a cryogenically cooled substrate under UHV conditions while monitoring the film thickness and resistance. Electrically continuous Au films at thickness of about 2 mono-layers of material are grown on an amorphous Ge wetting layer. The quench condensation method provides a sensitive control on the sample growth process, allowing us to tune the morphological and electrical configuration of the system. The ultrathin gold films develop from an insulating to a metallic state as a function of film thickness. The temperature dependence of the Au conductivity for different thickness is studied. It evolves from hopping transport for the insulating films, to a ln T dependence for thicker films. For gold films in the insulating regime we found a decreasing resistance by adding Gd. This is in agreement with a decreasing tunneling barrier height between metallic atoms. The Gd magnetic moments are randomly oriented for isolated atoms. This magnetic disorder leads to scattering of the charge carriers and a reduced conductivity compared to nonmagnetic materials.

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