Novel 2D spin system and its interaction with conduction electrons

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We study the interaction of a dilute 2D spin system with conduction electrons in a metallic host via low-temperature transport measurements. A novel molecular fabrication method is presented, in which the 2D spin system is formed by self-assembly of spin-1/2 paramagnetic molecules on an Au film. This method offers great tunability of the nature and density (and hence coupling) of the spins, while avoiding undesired clustering of magnetic impurities often suffered from in alternative methods. The insertion of the paramagnetic molecules leads to a 2D Kondo impurity system with enhanced spin scattering near and above the Kondo temperature. This gives rise to a logarithmic resistivity increase at low temperatures. Mixed monolayers of paramagnetic and nonmagnetic molecules have been used to systematically vary the spin concentration. Our experimental results are very well described by Hamann's expression (D.R. Hamann, Phys. Rev. **158**, 570 (1967)) for the Kondo resistivity correction. The additional spin scattering also leads to a reduced phase coherence length as demonstrated by weak (anti)localization measurements. We discuss the relevance of this model system for further study of spin phenomena that lie at the very heart of solid-state physics: the Kondo effect, RKKY interaction and spin glasses.