Oral PhD

Kondo Physics in 4f metals: Gadolinium nanocontacts

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The study of electron transport in conducting materials at the nanoscale can be carried out by using Scanning Tunneling Microscope (STM) and Mechanically Controllable Break Junction techniques (MCBJ) [1]. At such scales, Kondo effect vanishes the magnetic properties of the 3d transition metals Fe, Co and Ni [2]. The 4f rare earth metals are an interesting aim of study because of their strong magnetic properties among other things. At our laboratories we have measured gadolinium with both STM and MCBJ techniques. In the spectroscopy measurements of this material we perceive a set of features that could be related to its magnetic properties. The interplay between the $4f^7$ and $5d^1$ orbitals from Gd drives us to pose the mechanisms that are involved in the electronic transport properties of these systems.

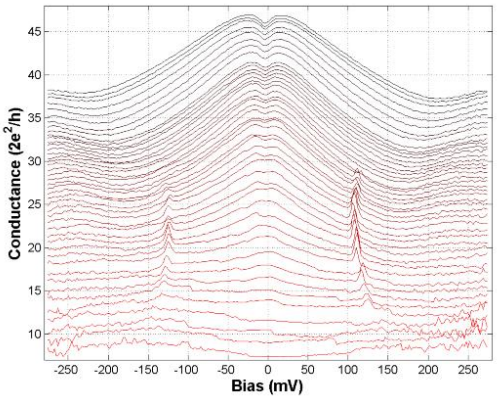

Figure 1. Gd>Gd measurements taken using STM at cryogenic conditions and at zero applied magnetic field. Different distance between tip and sample for every color curve.

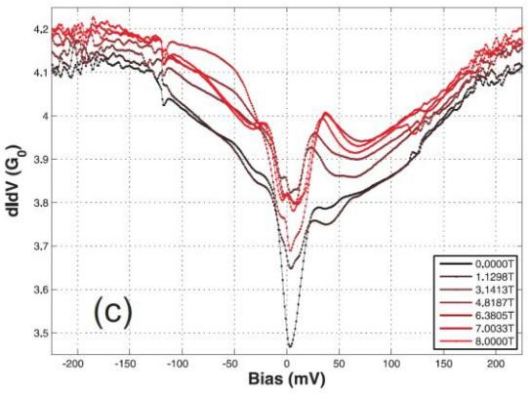

Figure 2. Gd>Gd measurements taken using MCBJ at cryogenic conditions. Different values of the applied magnetic field for every color curve. Splitting of the Kondo resonance peak increases with magnetic field.

References

[1] N. Agraït, A. Levy-Yeyati, J.M. van Ruitenbeek. Phys. Rep. 377 (2003), 81.
[2] M. R. Calvo et al., Nature 458 (7242) (2009), 1150-1153.