Kondo effect and magnetic exchange inversion in neutral and stable organic radical single molecule break junctions

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Abstract

Organic radicals are neutral, purely organic molecules exhibiting an intrinsic magnetic moment due to the presence of an unpaired electron in the molecule in its ground state. This property, added to the low spin-orbit coupling makes organic radicals good candidates for molecular spintronics insofar as the radical character is stable in solid state electronic devices.

We show that the magnetism of the PTM radical molecule, in the shape of a Kondo anomaly is preserved in two- and three-terminal solid-state devices, regardless of mechanical and electrostatic changes. Indeed, our results demonstrate that the Kondo anomaly is robust under electrodes displacement and changes of the electrostatic environment, pointing to a localized orbital in the radical as the source of magnetism. Strong support to this picture is provided by density functional calculations and measurements of the corresponding nonradical specie [1].

We further study polyradical molecules, where several unpaired spins are coupled via exchange in a single high-spin purely organic molecule. We show that the local environment can induce a sign reversal of the exchange interaction, from ferro to antiferro, inducing a change in the magnetic ground state [2].

References

[1] R. Frisenda et al., Nano Lett., **15** (2015) 3109–3114.
[2] R. Gaudenzi et al., Accepted in Nano Letters 2016.

Figures

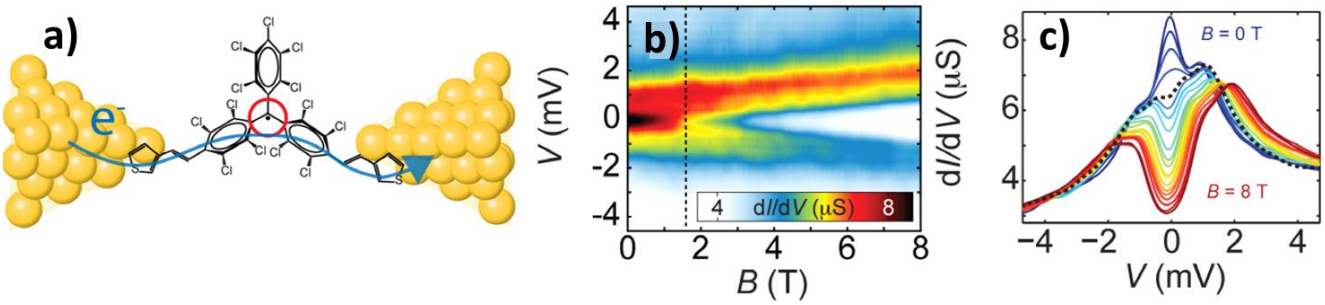

Figure 1. (a) Schematics of an organic radical molecular junction. (b) dI/dV color plot showing the zero-bias resonance splitting in magnetic field. (c) Magnetic spectra of (b).