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TÉMA

Transport through single magnetic molecules

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We have developed several techniques to fabricate single-molecule devices, in which a single molecule bridges the gap between two electrodes. Devices include (gated) mechanical controlled break junctions [1], junctions made with a self-breaking electromigration technique [2] and room-temperature stable molecular transistors formed by electroburning few-layer graphene [3]. Often a third gate electrode is present [4] that allows the modification of charge transport independently from the source/drain electrodes thereby realizing a transistor in which the electric current through the molecule probes its properties. Using these different techniques, a wide variety of (magnetic) molecules is studied including mono-radicals, bi-and tri-radicals, single-molecule magnets (SMMs) and spin-crossover compounds.
In this talk I will concentrate on the family of radicals and the spin-crossover compounds. Concerning the latter, I will show how the low-spin to high-spin transition can be triggered by an electric field when introducing dipole moments on the molecule or by mechanical stretching [5]. Spin-state dependent conductance switching is also studied with graphene electrodes and shown to occur well below the critical temperature for crystals of the same molecules. Calculations suggest that switching at the single-molecule level can be induced by small perturbations to the ligand distance in the molecular junction. All-organic mono-radicals can be viewed as model systems for spin-1/2 physics including the observation of Shiba states when connected to superconducting electrodes [6]. Furthermore, molecular distortions may also play an important role in spin-spin interactions of the bi- and triradical systems; the understanding of these distortions is essential when considering these units as quantum information devices [7].

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