Keynote

Designer nanomagnets

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Several groups in the world are able to fabricate artificial nanomagnets assembling atoms one by one on top of a surface, using scanning tunnelling microscopes. Apparently minor differences in the structure, chemical composition and surface orientation of these systems lead to dramatic changes in their electronic and magnetic properties. For instance, when deposited on the same surface (Cu(100) coated with a monolayer of Cu_2N), a linear array of 6 Mn atoms [1] deposited along a N rich row, behaves like a quantum spin liquid with strong quantum spin fluctuations whereas a linear array of 6 atoms of Fe behaves like a classical antiferromagnet [2] with two stable Neel states that can be used to store digital information at low temperatures. In contrast, when deposited on the exactly the same surface, an array of 6 Fe atoms along a Cu rich direction couple ferromagnetically [3].

In this talk I will discuss two topics, in connection with these fascinating systems. First, I will discuss our theoretical understanding of the rules that govern these very different magnetic properties, including the interplay between exchange interaction, Kondo coupling and magnetic anisotropy [4]. Second [3], I will discuss the theoretical background [3] that made it possible to obtain, for the first time, an atomic-scale resolution image of spin wave modes in these systems. Understanding these artificial nanomagnets and being able to probe their spin excitations with atomic resolution should pave the way towards their rational design, resulting in a new class of systems, designer nanomagnets.

References

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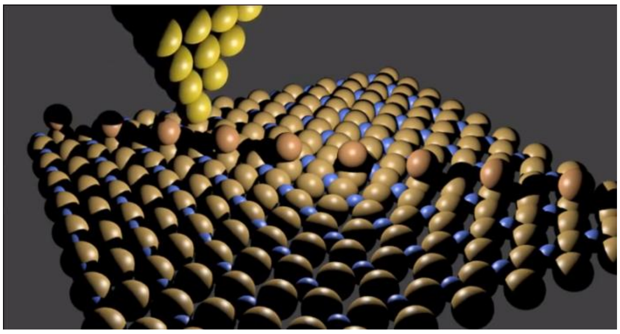
[3] A. Spinelli, B. Bryant, F. Delgado, J. Fernández-Rossier, A. F. Otte, Nature Materials 13, (2014) 782.

[4] J. Oberg, R. Calvo, F. Delgado, D. Jacob, M. Moro, D. Serrate, J. Fernández-Rossier, C. F. Hirjibehedin, Nature Nanotechnology 9, (2014) 64.



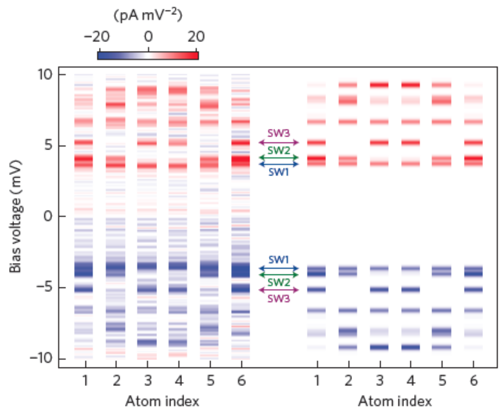


Figure 1. **Top panel**: Art image of magnetic adatoms on Cu_2N surface, probed with the STM tip.
Bottom panel: From reference [], color maps (left, experiment, right theory) of d^2I/dV^2 curves as a function of bias voltage (vertical axis) for each atom (horizontal axis) on a chain of N=6 Fe ferromagnetically coupled atoms.