Dipartimento di Scienze
Sezione di Nanoscienze

Seminari di Sezione

12 giugno 2018 ore 14:30

Aula C, via della Vasca Navale 84

Info: simonetta.tuti@uniroma3.it, francesco.offi@uniroma3.it

Lanthanide single-atom magnets

Luca Persichetti

Dipartimento di Scienze, Università Roma Tre

For decades, the smallest known systems showing slow relaxation behavior have been polynuclear and mononuclear metal-organic complexes, so-called single-molecule magnets (SMM) [1]. Beyond SMM, the ultimate limit of magnet size shrinkage is an isolated magnetic atom on a nonmagnetic substrate. However, since the report of giant magnetic anisotropy in individual magnetic atoms on surfaces [2], the observation of magnetic remanence in single adatoms has remained an elusive goal, since the coupling- i.e. energy and angular momentum exchange, of the magnetic moment to the environment occurred on a timescale in the pico- to microsecond range, i.e. much faster compared to magnetization loop measurements [3]. The key to stabilize the single magnetic moment of an adatom is therefore to develop a viable route for minimizing the coupling with the surrounding electronic/crystalline environment. We have recently achieved this goal for diverse combinations of magnetic atoms/ substrate. For different lanthanide atoms on ultra-thin insulating layers, we measured a magnetic lifetime of > 1000 s within a wide temperature range of several tens of K [4]. Slow magnetic relaxation is also observed on 2D templates, including graphene and transitional-metal dichalcogenides. Starting from the description of the experimental results, I will present the main physical ingredients which play a role in achieving long magnetic lifetime in individual adatoms on surfaces, such as phonon bottleneck and weak coupling to the electronic and vibrational degrees of freedom of the substrate ensured by crystal-field- and time-reversal symmetry.

[1] Nature **365**, 141 (1993).
[2] Science **300**, 1130 (2003).
[3] Phys. Rev. B **96**, 224418 (2017).
[4] Science **352**, 318 (2016).