3 PhD Student Positions at EPFL, Switzerland

The Laboratory of Nanostructures at Surfaces (LNS, https://www.epfl.ch/labs/lns/) headed by Prof. Harald Brune explores novel physical and chemical properties emerging from quantum effects in surface-supported nanostructures.

**Stacking 2D van der Waals homo- and hetero-structures**

(1 position)

2D materials are attracting a lot of interest due to their fascinating electronic and magnetic properties. The ability to stack these mono-atomic layers into heterostructures opens up yet novel properties, such as superconductivity in graphene, or graphene layers that are simply protected from oxidation by being sandwiched between hexagonal boron nitride layers. A key aspect is the cleanness of the stacking procedure, since adsorbates and contaminants strongly influence the properties of the stacked structure.

We recently succeeded in developing an ultra high vacuum compatible procedure for the transfer of adsorbate-free graphene layers onto a target surface [Merk et al., in preparation]. The present project focuses on the optimization of the developed procedure and on its extension to the stacking of different kinds of 2D materials. The structural, electronic and magnetic properties of these homo- and hetero-structures will be investigated by means of scanning tunneling microscopy, Raman spectroscopy, magneto optical Kerr effect, x-ray absorption spectroscopy, x-ray magnetic circular dichroism, and angle resolved ultraviolet photoelectron spectroscopy.

**Surface supported lanthanide complexes as bit prototypes for information storage**

(2 positions)

Recently, we realized surface-adsorbed single atom magnets [Donati et al., Science 2016; Baltic et al., Nano Lett. 2016], reaching therefore the ultimate size limit for classical and quantum magnetic information storage. However, the thermal stability of the magnetization, as well as the stability of the atoms towards surface diffusion, are limiting the use of these systems to T < 40 K. This projects seeks to find new systems that can be operated at higher temperatures.

A possible way to move forward is to use surface-supported lanthanide (Ln) complexes. In this project, we aim at realizing this new class of quantum magnets at surfaces, either prepared by *in-situ* ultra high vacuum deposition techniques or by *ex-situ* chemical synthesis and subsequent deposition onto the surfaces of interest. For example, recent theoretical calculations predict exceptionally high magnetic anisotropies in strongly axial LnO complexes adsorbed on hexagonal boron nitride. The structural and magnetic properties will be investigated by scanning tunneling microscopy and spectroscopy in our laboratory, as well as by x-ray absorption and x-ray magnetic circular dichroism at synchrotron facilities.

**Requirements**

Applicants should have an M.Sc. degree in Physics or equivalent, be highly motivated, and have experimental skills. Fluency in English, both written and spoken, is required.

The four-year positions, with a one-year probation period, are available starting from February 2022, the exact date being open to discussion.

**Application procedure**

Please send a letter motivating your preference for either project, an updated CV, transcript of records, as well as name and contact information of two references to Stefano Rusponi (e-mail) with subject line "Application for PhD student position at LNS".