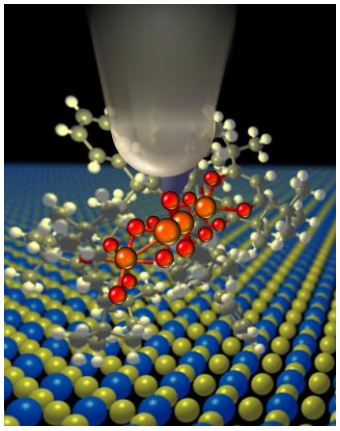
PHYSICS AND ASTRONOMY
SEMINAR

Dr. J.A.J. Burgess

Max Planck Institute for the Structure and Dynamics of Matter, Hamburg, Germany
Max Planck Institute for Solid State Research, Stuttgart, Germany

"Controlling Exchange Coupling at the Atomic and Molecular Scale"

Abstract



Control of quantum spins is a critical step in the pursuit of spin-based quantum computation. Scanning Tunnelling Microscopy (STM) plays an important role in discovering and evaluating new spin systems. This role can be surprisingly flexible when applying complex tip interactions, particularly when using a magnetic tip. Usually, potential perturbative influences of the tip on the sample are treated with great concern in STM experiments. Striving for the idealized scenario of a non-invasive measurement provides cleaner and more easily interpreted results, however turning the tables on tip interactions can provide access to new experiments not possible by any other means.

Two sets of experiments will be discussed exemplifying the exploitation of tip interactions in STM research focused on atomic scale spin systems. Both experiments tune magnetic exchange interactions, but in extremely different fashions. In the first experiment, individual Fe4 single magnetic molecules are probed electrically. Strong tip interactions are inherent in the measurement and create a challenging experimental scenario. Once overcome, however, these tip effects reveal that compression of individual molecules can lead to enhanced intramolecular exchange [1]. In the second set of experiments, nanomagnets are assembled on a surface using atomic manipulation to create arrays of coupled transition metal atoms. Using a magnetic tip and time-resolved STM, the excitation and relaxation of these structures can be measured. Moreover, the magnetic tip can be used to apply an exchange bias to a single atom within the structure [2]. This enables tuning of magnetic dynamics even within fully compensated antiferromagnetic structures which have no response to applied field.

Thursday September 15th, 2016
1:30 p.m.
Clearihue Building
Room A311