O 53: Poster Wednesday: Spins and Magnetism

Time: Wednesday 18:00–20:00 Location: P4

O 53.1 Wed 18:00 P4

Ferroelectric BaTiO3 (001): Atomic-level characterization and polarization by combined STM/AFM — •Llorenç Albons Caldentey[1], Dominik Wrana[1], Igor Sokolović[2], Aji Alexander[1], and Martin Setvin[1] — [1]Department of Surface and Plasma Science, Faculty of Mathematics and Physics, Charles University, 180 00 Prague 8, Czech Republic — [2]Institute of Applied Physics, TU Wien, 1040 Vienna, Austria

Perovskites attract strong interest thanks to their catalytic properties, efficient electron-hole separation in light harvesting, or the frequent occurrence of ferroelectricity. In this work we show that BaTiO3 single crystals can be cleaved along the (001) plane to obtain flat surfaces with domains of either BaO or TiO2 termination. Using low temperature (4K) qPlus nc-AFM we have characterized the surface atomic structure and studied the tip-induced ferroelectric polarization of the material. The impact of ferroelectric poling on adsorbed species is discussed.

O 53.2 Wed 18:00 P4

DFT based analysis of surface reactions of stainless steels through degradation in aqueous media — •Vahid Jamebozorgi — Bielefeld University and Bielefeld University of applied science

Stainless steels (SSs) are widely used in industry due to their outstanding mechanical and physical properties plus their durability in corrosive media. The corrosion resistance of SSs is caused by the formation of a thin passive layer which mainly consists of chromium oxides. However, the passive layer makes SSs more vulnerable to localized corrosion including pitting corrosion. Pitting corrosion occurs when the passive layer interacts locally with bond-forming atoms and molecules dissolved in the aqueous media, e.g. halides or hydroxide. However, the process of bond formation, erosion of the passive layer, and consequently the degradation of SSs is still not completely understood. Amongst other parameters, the adsorption energy and work function seem to play a key role in pitting corrosion. The experimental determination of the work function is challenging since the surface texture, crystal defects and impurities can increase or decrease work function value significantly. Here, we show how density-functional theory (DFT) computation techniques can be used to obtain adsorption energies and work function values for different crystallographic orientations on the surfaces of Fe, Cr and Ni. As a result we will provide insight into the degradation mechanisms of SSs surfaces in aqueous media.

O 53.3 Wed 18:00 P4

Thermally-induced magnetic order from glassiness in elemental neodymium — •Benjamin Verlhac[1], Lorena Niggli[1], Anders Bergman[2], Umut Kamber[1], Andrey Bagrov[1,2], Diana Iuşan[2], Lars Nordström[2], Mikhail I. Katsnelson[1], Daniel Wegner[1], Olle Eriksson[2,3], and Alexander A. Khajetoorians[1] — [1]Institute for Molecules and Materials, Radboud University, Nijmegen, The Netherlands — [2]Department of Physics and Astronomy, Uppsala University, Uppsala, Sweden — [3]School of Science and Technology, Örebro University, SE-701 82 Örebro, Sweden

In thermodynamic systems, temperature is synonymous with disorder as phase transitions between order to disorder occur when temperature is increased. Recently, the first example of a spin-Q glass was found in elemental neodymium between 30mK and 4K(1). This phase originated from magnetic frustration within the dhcp lattice of neodymium. In this study, we show by means of spin-polarized scanning tunneling microscopy that neodymium undergoes an unusual magnetic transition, where long range multi-Q order emerges from the spin-Q glass phase as temperature is increased from 5 K to 15 K(2). We also developed a new analysis method, which analyzes the experimental data and extracts the phase transition temperature. These findings are supported by atomistic spin dynamics simulations, in which the phase transition is qualitatively explained by destroying spin frustration due to various exchange contributions of the different sublattices.

(1) Kamber, U. et al., *Science* **368** (2020)
(2) Verlhac, B. et al., arXiv:2109.04815

O 53.4 Wed 18:00 P4

Yu-Shiba-Rusinov states of Mn on Pb(110) — •Bharti Mahendru, Martina Trahms, Gaël Reecht, and Katharina J. Franke — Fachbereich Physik, Freie Universität Berlin, Arnimallee 14, 14195 Berlin, Germany

Unpaired electron spins exchange coupled to a superconductor give rise to bound states inside the superconducting energy gap and are called Yu-Shiba-Rusinov (YSR) states. Previously, it has been shown that the crystal-field splits singly-occupied d levels of Mn atoms on Pb surfaces, which leads to distinct YSR states inheriting the symmetry of the spin-carrying orbital [1,2].

Here we investigate single atoms and chains of Mn on a Pb(110) surface using scanning tunneling microscopy and spectroscopy. We find different adsorption sites of the individual Mn atoms and chains, which can be distinguished by different YSR states. Some of the Mn sites show a bistability in the presence of the STM tip, while some of the YSR states are also influenced by the tip position.

[1] Michael Ruby, et al., Phys. Rev. Lett. 117, 186801, 2016
[2] Michael Ruby, et al., Phys. Rev. Lett. 120, 156803, 2018

O 53.5 Wed 18:00 P4

Imaging fast magnetization dynamics by Lorentz microscopy with event-based electron detectors — •Alexander Schröder, Christopher Rathje, Xinlai Xing, and Sascha Schäfer — Institute of Physics, University of Oldenburg, Germany

In recent years, ultrafast transmission electron microscopy (UTEM) [1] has successfully enabled the imaging of ultrafast dynamics on the nanoscale by utilizing femtosecond electron pulses in an optical-pump/electron-probe approach. In a potentially more flexible approach, instead of femtosecond electron pulses, a continuous electron beam could be used to map the optically induced dynamics provided sufficiently fast, event-based electron detectors are employed.

Here, we present Lorenz microscopy of nanoscale magnetic dynamics observed with a Timepix3 hybrid pixel electron detector. In particular, we study the distortion of magnetic vortices triggered by femtosecond optical pulses, accessing reversible processes on time scales ranging from nanoseconds to milliseconds.

[1] A. Feist et al., Ultramicroscopy 176, 63 (2017).