INVITATION

Department of Condensed Matter Physics

Is pleased to invite you to the lecture

Charge, orbital and magnetic orders at the $YBa_2Cu_3O_7/Nd_{1-x}(Ca,Sr)_xMnO_3$ interface

by

prof. Christian Bernhard

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I will present x-ray absorption spectroscopy (XAS) and resonant x-ray inelastic scattering (RIXS) studies at the Cu-L_3 edge of PLD-grown heterostructures that contain alternating layers of the cuprate high T_c superconductor $YBa_2Cu_3O_7$ (YBCO) and the manganite $Nd_{1-x}(Ca,Sr)_xMnO_3$ (NCSMO). The latter material is an insulator with a CE-type antiferromagnetic and charge/orbital order that competes with a ferromagnetic phase that is weakly conducting [1].

In the first part, I will provide evidence that the phase competition in the manganite layers has a strong impact on copper charge density wave (Cu-CDW) order in the superconducting YBCO layers. In particular, I will show that a Cu-CDW with a wave vector of q≈0.33 r.l.u. can be strongly enhanced as compared to that in bulk YBCO and that an entirely new kind of Cu-CDW (with a much larger period and correlation length) can be induced in the interfacial CuO_2 layers [2].

In the second part, I show that the RIXS technique can be used to distinguish between two magnon modes that arise from the CuO_2 layers that are either right at the interface or further away from it [3]. The analysis of the dispersion of these magnon modes indicates a suppression of the in-plane AF exchange interaction from J≈130 meV in the bulk-like CuO_2 layers to J≈70 meV in the interfacial ones. Moreover, we observe an anomalous momentum dependence of the intensity of the interfacial magnon which suggests that the antiferromagnetic order at the interface is accompanied by an orbital order. Notably, the combined AF and orbital order gives rise to a so-called "altermagnetic" state in the interfacial CuO_2 layer that can enable unique superconducting proximity effects and new spintronic applications [3].

References

1 R. Gaina *et al.*, Phys. Rev. **B 104**, 174513 (2021).
2 R. Gaina *et al.*, npjQM **6**, 12 (2021).
3 S. Sarkar *et al.*, *PNAS Nexus*, pgae100, https://doi.org/10.1093/pnasnexus/pgae100

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Time: **11:00**

Venue: **Lecture room F1, Building 6, Faculty of Science, Kotlářská 2, Brno**

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