

**NANO-SEMINÁŘ**  
**a seminář projektu NANO-CENT**  
**čtvrtek, 18. 4. 2024, 14.00,**  
**posluchárna F2, MFF UK, Ke Karlovu 5**

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**Noncontact Atomic Force Microscopy: From imaging  
atoms to manipulating single electrons**

Noncontact atomic force microscopy (nc-AFM) has recently proven to be a powerful tool for characterizing surfaces of complex materials.<sup>1</sup> In this talk I will first discuss the capabilities of achieving atomic resolution and chemical identification of surface atoms, using a challenging system of copper oxide thin films. Copper oxides play a key role in catalysis of small organic molecules, and they form a plethora of structures with a-priori unknown configurations and stoichiometry. Here the system is resolved by a combination of nc-AFM and theoretical methods based on a combination of density functional theory and machine learning.

The second part of the talk will focus on possibilities of investigating electrons self-trapped in the crystal lattice, so called polarons.<sup>2</sup> Such charge carriers can move to adjacent lattice positions, provided they are given certain activation energy. Polarons play a key role in many applications and materials properties, such as electrical conductivity, optical properties, catalysis and photocatalysis, and they stand behind exotic properties such as colossal magnetoresistance or high-temperature superconductivity. The successful imaging of polarons in hematite Fe<sub>2</sub>O<sub>3</sub> and SrTiO<sub>3</sub> will be shown, and the new possibilities offered by this technique will be discussed.

References:

- [1] Giessibl, F. J. The qPlus sensor, a powerful core for the atomic force microscope. Rev. Sci. Instr. 90, 011101 (2019).
- [2] Franchini, C., Reticcioli, M., Setvin, M. & Diebold, U. Polarons in Materials. Nature Reviews Materials 6, 560-586 (2021).

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