Seminář odd. 26
Tenkých vrstev a nanostruktur

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TÉMA

Low-temperature STM on molecules and atomically well-defined graphene structures

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In the first part of the talk, I will discuss our low-temperature STM experiments on molecules on hexagonal boron nitride (h-BN) on Ir(111). h-BN acts as ultrathin insulating layer for organic molecules, while simultaneously templating their self-assembly [1]. Tunneling spectroscopy experiments on cobalt phthalocyanine (CoPC) reveal narrow molecular resonances and indicate that the charge state of CoPC is periodically modulated by the h-BN moiré superstructure. Measurement of the local density of states (LDOS) of single molecules by scanning tunnelling spectroscopy (STS) is usually interpreted in terms of single-particle molecular orbitals. I will show that the simple single-particle picture fails qualitatively to account for the resonances in the tunneling spectra of dfferent charge states of CoPc molecules.Instead, these resonances can be understood as a series of many-body excitations of the ground state of the molecule [2]. This is the first experimental demonstration of such effects in a molecular system and our theoretical results show an accessible route beyond the simple single-particle picture in quantifying many-body states in molecules.

In the second part of the talk, I will discuss our experiments on using h-BN passivate and stabilize zigzag-oriented graphene edges. The electronic properties of graphene edges depend on their crystallographic orientation. The so-called zigzag (ZZ) edges haven been extensively explored theoretically and proposed for various electronic applications. However, their experimental study remains challenging due to the difficulty in realizing clean ZZ edges without disorder, reconstructions or the presence of chemical functional groups. We use the ZZ-terminated, atomically sharp interfaces between graphene and hexagonal boron nitride (BN) as experimentally realizable, chemically stable model systems for graphene ZZ edges [3]. Combining scanning tunnelling microscopy and numerical methods, we explore the structure of graphene/BN interfaces and show them to host localized electronic states similar to those on the pristine graphene ZZ edge.

References:

[1] F. Schulz et al. Templated Self-Assembly and Local Doping of Molecules on Epitaxial Hexagonal Boron Nitride, ACS Nano 7, 11121-11128 (2013)

[2] F. Schulz et al. Many-body transitions in a single molecule visualized by scanning tunneling microscopy, accepted..

[3] R. Drost et al. Electronic states at the graphene - hexagonal boron nitride zigzag interface, Nano Lett. 14, 5128 (2014).

odborný garant: *Ing. Pavel Jelínek, PhD.*