



Colloquium Announcement

of the Collaborative Research Centre 951
"Hybrid Inorganic/Organic Systems for Opto-Electronics"

Ulrich Höfer

Fachbereich Physik, Philipps-Universität Marburg, Germany

Ultrafast spectroscopy of electron transport at surfaces and internal interfaces

Katharina Franke

Department of Physics, Freie Universität Berlin, Germany

Scanning tunneling spectroscopy of organic molecules on single-layer MoS₂ on Au(111)

Time: Thursday, 28.11.2019, 15:15

Place: Erwin-Schrödinger-Zentrum, Rudower Chaussee 26,
Room 0`119.

Collaborative Research Centre 951
Department of Physics
Humboldt-Universität zu Berlin

Email: sfb951@physik.hu-berlin.de
Tel.: +49 30 2093 66380
www.physik.hu-berlin.de/sfb951



Partners



Ultrafast spectroscopy of electron transport at surfaces and internal interfaces

Ulrich Höfer

Fachbereich Physik, Philipps-Universität Marburg, Renthof 5, 35032 Marburg

Time-resolved photoelectron spectroscopy, a method that combines femtosecond pump-probe techniques with angle-resolved photoelectron spectroscopy (ARPES), can be used to perform measurements of electron transport at interfaces in a contact-free fashion and with femtosecond time-resolution. In a first example, I will discuss results obtained for well-defined model systems of organic/metal contacts. The experiments show that interface-specific electronic states efficiently mediate the electron transfer between metals and organic semiconductors. In a second example, I will discuss Dirac surface states of topological insulators. We induce electrical currents in these states with strong THz transients and directly access their dynamics in momentum space with subcycle time resolution. As a result of spin-momentum locking, the accelerated spin-polarized electrons reach ballistic mean free paths of several hundreds of nanometers. Topological insulators are thus promising materials for future lightwave-driven electronics operating at THz clock rates.

Scanning tunneling spectroscopy of organic molecules on single-layer MoS₂ on Au(111)

Nils Krane, Gaël Reecht, Christian Lotze,
Katharina Franke

Department of Physics, Freie Universität Berlin

Adsorption of organic molecules on metal surfaces typically leads to strong hybridization of the frontier molecular orbitals with the substrate electronic bands. This results in broad energy levels reflecting the ultrashort lifetime of excited molecular states in tunneling experiments. A monolayer of MoS₂ is direct-bandgap semiconductor. Here, we show that single-layer MoS₂ on Au(111) acts as an efficient decoupling layer for organic molecules. The decoupling efficiency is superior to frequently employed ionic layers such as NaCl, or to graphene. Molecular resonances within the semiconducting band gap of MoS₂ exhibit widths of only a few meV. This exquisite energy resolution allows to study vibrational excitations within the individual molecules. Details in the set of vibronic resonances on thienothiophene-based molecules allow for their rotamer identification. The spatial intensity distribution along the molecule further reveals that the simple Franck-Condon picture is insufficient for a complete understanding of the excitation mechanism.

Furthermore, we study the STM-induced H-abstraction reaction of phthalocyanines on a monolayer of MoS₂ on Au(111). The inert nature of MoS₂ favors the stabilization of an extended π radical, in contrast to the same reaction on a metallic substrate, where the radical state is quenched by charge transfer.