Max Born Institute

Institutskolloquium

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Max-Born-Saal

es spricht

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über

„Electron dynamics at metal and semiconductor surfaces"

Abstract

Carrier dynamics at surfaces is of both fundamental and technological importance. The underlying electron-transfer or scattering processes can be studied by following the electron dynamics after short-pulse laser excitation. Identification of the individual processes of carrier scattering, trapping and recombination requires a detailed knowledge of the surface electronic structure. The necessary comprehensive information of momentum, energy and lifetime of excited electrons can be obtained by means of angle-, energy-, and time-resolved two-photon photoemission spectroscopy.

Due to the coherent excitation the temporal evolution of the excited electronic states involves both population and quantum-phase decay. For a survey of these processes on a fundamental level Rydberg-like states in front of a Cu(001) surface serve as a model system. Scattering properties of the surface are modified by introducing steps or adsorbed atoms. That way interband and intraband scattering mechanisms are identified and their contributions to the total decay of the excited states is determined quantitatively.

Charge transfer on metal surfaces usually takes a few femtoseconds and is yet not accessible in combined synchrotron-laser experiments. To illustrate potential perspectives of pump-probe experiments with synchrotron radiation the second part of the talk concentrates on the Si(001) surface, where relaxation processes span from femto- to

nanoseconds. For the semiconductor surface the occupied and unoccupied dangling-bond states are accessed in one
experiment. Under sufficiently strong illumination the surface band bending is lifted. These ingredients allow to unravel carrier recombination and the underlying surface electronic structure. Recombination of hot carriers at the surface is ruled by picosecond relaxation of excited electron-hole pairs via phonon scattering, resulting in the formation of an exciton which lives for nanoseconds.

Interessenten sind herzlich eingeladen

Prof. W. Radloff