Azadi Ka Amrit Mahotsav

Bose Colloquium

S. N. Bose National Centre for Basic Sciences

(An Autonomous Research Institute established under DST, GOI

Title:

Microscopic dynamics of propagating and localized excitations across interfaces analyzed by femtosecond solid state spectroscopy

Abstract:

An excited electron propagates in condensed matter with its momentum **k** at an energy E(**k**) and experiences elastic and inelastic scattering processes, which lead to electronic relaxation and energy transfer to microscopic excitations of the lattice and spin systems. Experiments employing femtosecond time-resolved photoelectron spectroscopy exploited so far very successfully the surface sensitivity of the method and probed such scattering processes locally at or near the surface in the time domain. Here, we report on experimental results which analyze the non-local dynamics of excited electrons in two-photon photoemission (2PPE) and demonstrate sensitivity to buried media. In these experiments one photon excites in Au/Fe/MgO(001) heterostructures electrons in Fe. Electron propagation through the layer stack to the Au surface is detected in 2PPE in back side pump front side probe experiments in a time-of-flight like scheme. We observe pronounced differences between front and back side pumping of the heterostructure which are attributed to electron transport contributions through the layer stack. Furthermore, competition of e-e with e-ph scattering will be discussed in [Fe/MgO]n heterostructures. Pump-probe experiments of element specific spectroscopy in combination with electron diffraction provide here unprecedented insights regarding the mechanism of energy transfer across interfaces and emphasize the importance of coupling hot electrons to non-thermalized interface phonons. Extension of these experimental tools to address effects of strong electron correlation and spin-dependent dynamics across interfaces will be discussed.

This work was funded by the Deutsche Forschungsgemeinschaft through the Collaborative Research Center CRC 1242.

11 March, 2022

4.00 PM

Webinar Link

YouTube Link

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