Dynamic Pathways in
Multidimensional Landscapes

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Ultrafast surface dynamics probed with time resolved photoemission at FLASH

Content :

Time resolved photoemission from core levels (trPES) at FELs is a tool for studying surface dynamics in real-time. Basis for this is the sensitivity of core-levels to their chemical environment. By probing their spectral evolution after an ultra-short excitation one can get insight on both, electronically caused excitations (fs- up to several-ps time-scales) as well as responses of the crystal lattice sub-ps to hundreds of ps).

In the present study we monitored the evolution of the 4f core levels of clean Ir(111) after an ultra-short (<120fs) optical excitation (800nm) by means of trPES at a photon energy of 198eV. The experiments were performed at the Free Electron Laser FLASH at the plane-grating monochromator beamline PG2. The setup allowed us to resolve temporal changes with a precision down to 1,1ps.

By analyzing the recorded data on a shot-to-shot basis we are able to fully characterize and control spectral shifts and broadening induced by X-ray and 800nm induced space-charge effects.

We observe a pump induced broadening in the surface component of the 4f lines which fully relaxes after 2ps. The early-component (<1,1ps) of this spectral broadening corresponds to the appearance of sidebands whereas a remaining excitation in the post-sideband time-scales (>1,1ps) can be explained by an increased electronic temperature.

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