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ULTRAFAST DYNAMICS OF EXCITED STATES AND LIGHT INDUCED PROCESSES AT SURFACES

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Electronic excitations at surfaces can induce a rich variety of processes, includingchemical reactions at surfaces, coherent lattice excitations (phonons) or ultrafasstructural transitions of solids. These photoinduced processes occur on ultrafas(femto- to picosecond) timescales and are accompanied by pronounced changes othe electronic structure and occupation of electronic states. Recent advances infemtosecond time-resolved spectroscopy allow direct probing of the underlying
fundamental steps and provide a mechanistic understanding of transfer of energyfrom the electronic system into nuclear motions.
In this talk, I will discuss two different experimental approaches to probe such transient electronic structure changes on ultrafast timescales employing time- and angleresolved photoelectron spectroscopy (trARPES) and time-resolved resonant inelastic
x-ray scattering (trRIXS). XUV based trARPES at 500 kHz repetition rate opens the
perspective of excited state band mapping throughout the complete Brillouin zoneand monitoring collective phonon dynamics through their influence on the electronicband structure. In particular, we investigate in detail the dynamics of the photoinduced phase transition of quasi-1D metal nanowires on In/Si(111) as prototypicalexample for order-order structural transition. On the other hand, experiments at the
X-ray free electron laser LCLS performed with trRIXS provide direct insight into
chemical bond formation in ultrafast surface reactions. These studies allow newinsights into dynamics and details of the potential energy landscape.