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Real-time visualization of energy- and momentum-resolved carrier dynamics of spatially heterogeneous materials

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Abstract

Among a variety of methods for studying the ultrafast carrier dynamics in the solid-state materials, time-resolved photoemission electron microscopy (PEEM) has been regarded as a unique tool which can simultaneously achieve the femtosecond time resolution as well as non-diffraction-limited lateral spatial resolution, hence providing spatiotemporally resolved information on surfaces with structural heterogeneities [1]. When combined with an electron time-of-flight analyzer in the form of a delay-line detector [2], PEEM can be further extended to provide spectroscopic information. The consequent energy-resolved momentum-space images acquired at selected microscopic regions can be mapped, hence permitting the real-time visualization of the evolving photorelaxation dynamics of the band structure of solid-state materials. Here, preliminary spectromicroscopic results obtained from the time-resolved PEEM setup will be presented, and further on-going efforts to build a femtosecond megahertz-repetition-rate extreme ultraviolet radiation source will be introduced.

Keywords: Photoemission electron microscopy, Ultrafast carrier dynamics

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