

Ultrafast nanoscale dynamics probed by time-resolved electron imaging

Initiative: Lichtenberg - Professuren

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Laufzeit: 5 Jahre

Projekt-Website: <https://uol.de/und/>

Ultrafast processes on nanoscale dimensions are at the heart of such diverse applications as the efficient harvesting of light induced carriers in photovoltaics or the heat management in dense semiconductor devices. However, an experimental toolbox is lacking to map such phenomena on their intrinsic femto- and picosecond timescales, and on nanometer length scales. Recent developments in stroboscopic electron imaging offer a new avenue to solve this problem, by employing highly coherent femtosecond electron pulses in an electron microscope. The professorship aims at establishing ultrafast transmission electron microscopy as a versatile method for the real-space imaging of nanoscale energy conversion and transfer processes. Three well-defined model systems are identified, in which nano-focused electron pulses are utilized to spatio-temporally probe electronic, phononic and spin dynamics induced by tunable localized excitations. The model systems include near-field induced structural and electronic dynamics in excitonic materials, nanoscale spin currents coupled to terahertz fields, and optically-driven phonon wave packets. In combination with complementary ultrafast nano-optical approaches the professorship shall yield a detailed control of nanoscale processes in strongly inhomogeneous materials.

Projektbeteiligte

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Nanoscale mapping of ultrafast magnetization dynamics with femtosecond Lorentz microscopy

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