Physikalisches Kolloquium

Universität Konstanz

Di 31.01.17
15:15 Uhr
14:45 Uhr, Kaffee/Tee
R 513

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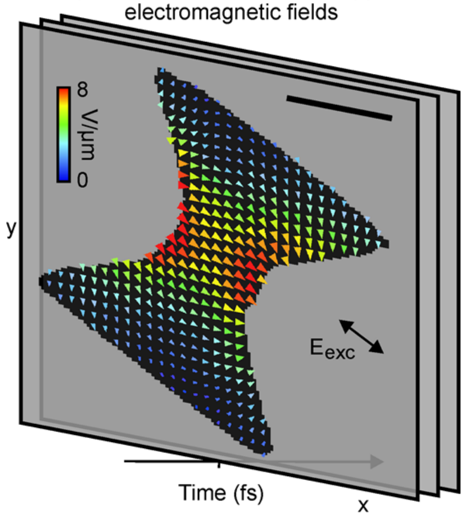
Understanding Structure and Function by seeing Atoms and Electrons in Motion

All processes in materials, nanostructures and devices are on a fundamental level defined by electronic and atomic motion from initial to final conformations. Our unique approach for a direct, real-space visualization is pump-probe electron diffraction and microscopy [1] with optical-cycle-controlled single-electron wavepackets [2-4]. We achieve simultaneously sub-atomic and sub-light-cycle resolution [4], which allows resolving almost any light-matter interaction or transport phenomenon on fundamental length and time scales. We report on graphite, graphene, carbon nanotubes, strongly correlated materials [5], organic molecular switches, metamaterials [6] and attosecond dynamics in silicon [7]. We conclude with an outlook on how atomic-scale imaging in space and time can help understanding fundamental and complex materials of almost arbitrary complexity and size.



[1] P. Baum, "On the physics of ultrashort single-electron pulses for time-resolved microscopy and diffraction", Chem. Phys. 423, 55-61 (2013).
[2].F. O. Kirchner, A. Gliserin, F. Krausz, P. Baum, "Laser streaking of free electrons at 25 keV", Nature Photonics 8, 52-57 (2014).
[3].A. Gliserin, M. Walbran, F. Krausz, P. Baum, "Sub-phonon-period compression of electron pulses for atomic diffraction", Nature Comm. 6, 8723 (2015).
[4]C. Kealhofer, W. Schneider, D. Ehberger, A. Ryabov, F. Krausz, P. Baum, "All-optical control and metrology of electron pulses", Science 352, 429 (2016).
[5]P. Baum, D.-S. Yang, A. H. Zewail, "4D Visualization of Transitional Structures in Phase Transformations by Electron Diffraction", Science 318, 788 (2007).
[6].A. Ryabov and P. Baum, "Electron microscopy of electromagnetic waveforms", Science 353, 374 (2016).
7.Y. Morimoto and P. Baum, "Attosecond electron diffraction", submitted (2016).