Max-Planck-Institut für Struktur und Dynamik der Materie

Max Planck Institute for the Structure and Dynamics of Matter

Thursday, July 7th 2016 – 14:00
MPSD Seminar, SR I-III (Blgd. 99)

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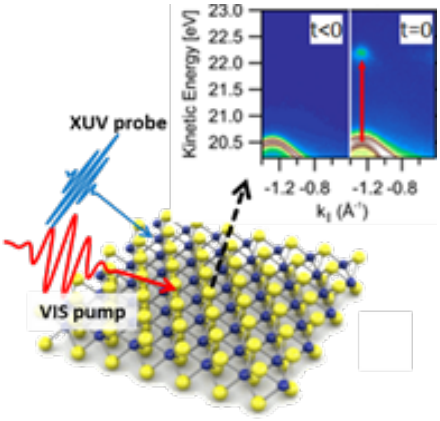
Electronic and Structural Dynamics in Solids: A Momentum-Resolved View on Microscopic Coupling and Correlation Phenomena

The coupling and mutual dependence of electronic and vibrational degrees of freedom is at the heart of microscopic as well as macroscopic phenomena in condensed matter. Ultrafast pump-probe techniques provide experimental access to these coupling and correlation effects by revealing the response of electrons and lattice to specific excitation of a material. We employ a set of complementary techniques: i) time- and angle-resolved photoelectron spectroscopy (trARPES) based on a 0.5 MHz laser [1] generating XUV pulses provides access to the spectral function and the dynamics of excited states throughout the Brillouin zone; ii) femtosecond electron diffraction (FED) [2] and optical spectroscopy are used to study phonon dynamics [3] and phase transitions [4]; and iii) electron point-projection microscopy allows for imaging of ultrafast carrier transport in nanostructures [5].

In particular, I will discuss electron and phonon dynamics in the semiconducting transition metal dichalcogenide WSe_2. We demonstrate mapping of the conduction band and the generation of spin- and pseudospin-polarized excited states in this centrosymmetric material [6]. A momentum-resolved view of the phonon dynamics is obtained from by FED.

[1] M. Puppin et al., Opt. Exp. 23 1491-1497 (2015).
[2] L. Waldecker et al., J. Appl. Phys. 117, 044903 (2015).
[3] L. Waldecker et al., Phys. Rev. X 6, 021003 (2016).
[4] L. Waldecker et al., Nature Materials 14, 991 (2015).
[5] M. Müller et al., Nature Communications 5, 5292 (2014).
M. Müller et al., ACS Photonics 3, 611 (2016).
[6] R. Bertoni et al., arXiv:1606.03218.



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