TECHNISCHE UNIVERSITÄT KAISERSLAUTERN

OPTIMAS light-spin-matter

Einladung zum Laser- und Quantenoptikseminar

Freitag, 09.11.2018, um 10:00 Uhr

Raum 46-387/388

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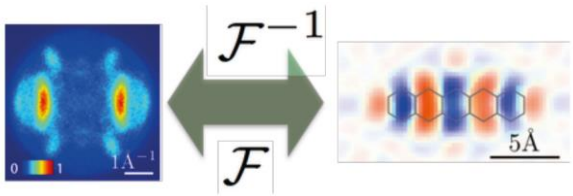
Coherence in time- and angle-resolved photoemission

Photoemission is fundamentally a coherent process. In most spectroscopic methods the measured quantity is an intensity though, *i. e.* the squared modulus of a complex amplitude. Some special techniques, however, are phase-sensitive and can provide additional information. RABBITT is an interferometric two-photon technique that enables the detection of electronic dynamics in the attosecond domain [1]. We extended this method to condensed matter and studied photoemission delays from noble metal surfaces [2,3]. Delays on the attosecond timescale can largely be attributed to transport and final state effects. The precise measurement of such delays requires a detailed understanding of the electromagnetic field distribution at the surface. We can use the same phasesensitive spectroscopy to probe electric fields at surfaces which will be demonstrated for cases of visible and THz radiation [4,5].

In photoelectron diffraction, the outgoing wave can be elastically scattered at neighboring atoms. The coherent interference of direct and scattered waves leads to an angular variation of the photoemission intensity. The technique is thus a sensitive structural probe and enables the elucidation of molecular adsorbate geometries [6]. In case of molecular valence levels as initial state, the state can be described as the coherent superposition of atomic wave functions. It was demonstrated that in some cases, the photoelectron momentum distribution is related to the initial state distribution through a Fourier transform [7]. We have extended phase-retrieval schemes from optics to photoemission holography to reconstruct molecular wavefunctions [8,9]. Finally, I will show how this technique allows for complete determination of both electronic structure and adsorbate geometry of a catalytically active macrocyclic molecule.



[1] P. M. Paul et al. *Science*, **292,** 1689 (2001).
[2] R. Locher et al. *Optica* **2**, 405 (2015).
[3] L. Kasmi et al. *Optica* **4**, 1492 (2017).
[4] M. Lucchini et al. *Phys. Rev. Lett.* **115**, 137401 (2015).
[5] K. Waltar et al. *Optics Express*, **26**, 8364 (2018)
[7] P. Puschnig et al. *Science,* **326**, 702, (2009).
[8] P. Kliuiev et al. *New J. Phys.* **18**, 093041 (2016).
[9] P. Kliuiev et al. *Phys. Rev. B.* **98**, 085426 (2018).

Der Gast wird betreut von JProf. Dr. B. Stadtmüller

GÄSTE SIND HERZLICH WILLKOMMEN!