January 31th, 2012 - 11:00 am

Seminar Room 108, DESY Bldg. 49

CFEL SCIENCE

Max Planck Research Department for Structural Dynamics

SEMINAR

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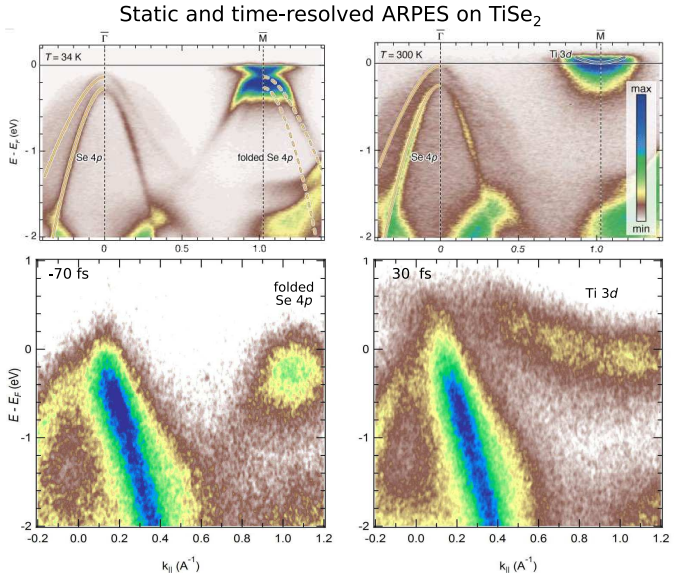
XUV Photoemission in the fs-regime

Angle Resolved Photo-Electron Spectroscopy (ARPES) has emerged as a leading technique in identifying static key properties of complex electron systems. In a pump-probe scheme using femtosecond light pulses this technique can be extended to monitor ultrafast transients in the electronic core levels and at particularly large momenta of the valence band structure. In this contribution I will present two different experimental setups for time-resolved photoemission spectroscopy using femtosecond XUV pulses. The relevant details and specification of the systems such as time- and energy resolution or XUV photon flux will be discussed.

Using this technique we can provide novel insights into the relative roles that the various factors play in charge-density wave (CDW) formation. Charge-density waves are broken-symmetry states of low-dimensional solids that are brought about by strong electron-phonon interaction. They are a classical paradigm of condensed matter physics. Yet, surprisingly, their microscopic origin in real materials is still poorly understood. Apparently, a more successful explanation has to take into account the delicate balance between several factors including not only electronic and phononic structure, but also electron-electron (electron-hole) and electronphonon interactions.

We will focus on three conspicuous CDWs within prominent members of the family of layered transition-metal dichalcogenides: the (2×2×2) CDW in the possible excitonic insulator 1T-$TiSe_2$ [1], the ($\sqrt{13}\times\sqrt{13}$) CDW in the Mott insulator 1T-TaS_2 [2] and the c($2\sqrt{3}\times4$)rect. CDW in the Peierls insulator Rb_xTaS_2 [3]. Our particular goal is to reveal the relative importance of electronic (excitonic) or phononic contributions to each CDW transition by relating measured break-down and equilibration dynamics of CDWinduced spectral features to typical elementary time scales in layered compounds.



[1] T. Rohwer et al. , Nature 471, 490 (2011)
[2] S. Hellmann et al. Phys. Rev. Lett. 105, 187401 (2010)
[3] K. Rossnagel et al. Phys. Rev. Lett. 95, 126403 (2005)

Host: Andrea Cavalleri, MPSD-CMD, CFEL