TRR 80 Seminar

Am Dienstag, den 12. Juli um 16:00 Uhr

spricht

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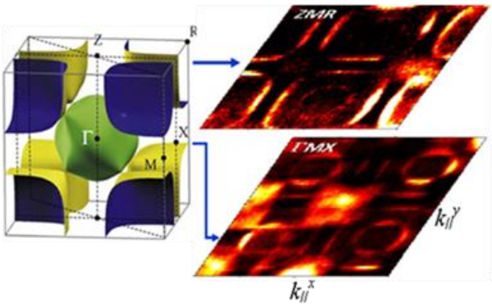
über das Thema

Soft-X-ray ARPES: k-resolved electronic structure of 3D materials, buried interfaces and impurities

ARPES is the unique tool to explore electronic structure of solid-state systems resolved in electron momentum **k**. Pushing this technique into the soft-X-ray energy range (SX-ARPES) extends its applications from surface physics towards 3D crystal systems, buried interfaces and impurity systems. These spectroscopic abilities results from enhancement of the photoelectron escape depth and a possibility of resonant photoexcitation delivering the elemental and chemical state specificity [1].

3D materials. The applications to 3D systems are based on sharp definition of surface-perpendicular momentum $k_\perp$ resulting from the enhanced photoelectron delocalization. An example is the perovskite $La_{1-x}Sr_xMnO_3$ where the experimental 3D Fermi surface reveals "shadow" contours, which manifest the rhombohedral structural distortion reducing the magnetoresistive T_c in interplay of the double-exchange itineracy and polaronic self-localization [2]. Other examples include polaronic physics in Ce-doped $CaMnO_3$, charge-density waves in VSe_2 resulting from 3D nesting of its Fermi surface, Weil fermions in TaAs and NbAs, etc.



Buried heterostructures. Our "drosophila" example is the buried $LaAlO_3/SrTiO_3$ interface embedding mobile 2D electron gas. Its signal can be accentuated using resonant SX-ARPES at the interface Ti^{3+} ions, which exposes the d_{xy}-, d_{yz}- and d_{xz}-derived subbands localized in the interface quantum well. Their intensity variations in **k**-space reveal the Fourier composition of their wavefunctions. The peak-dip-hump spectral function manifests strong polaronic coupling of interface electrons as the fundamental limit of their temperature-dependent mobility [3]. Manipulation by oxygen vacancies reduces the polaronic coupling, opening ways to increase the *i*nterfacial mobility. Further examples include multiferroic $BaTiO_3/La_{1-x}Sr_xMnO_3$ interfaces, EuO/Si spin injectors, GaN-based high electron mobility transistors and other buried systems in the heart of electronic and spintronic devices.

Buried impurities. Resonant SX-ARPES applied to the paradigm diluted magnetic semiconductor GaMnAs has identified the ferromagnetic Mn impurity band, and established its energy alignment and mechanism of hybridization with the host GaAs bands combining the previous *p-d* exchange and double-exchange models [4]. Other examples include InFeAs showing the ferromagnetism induced by doped highly mobile electron carriers, magnetic Mn impurities opening the Zeeman gap in the ferroelectric Rashba semiconductor GeTe, etc.

[1] V.N. Strocov *et al*, Synchr. Rad. News **27**, N2 (2014) 31
[2] L.L. Lev *et al*, Phys. Rev. Lett. **114** (2015)
[3] C. Cancellieri *et al*, Nature Comm. **7** (2016) 10386
[4] M. Kobayashi *et al*, Phys. Rev. **B** 89 (2014) 205204

Gäste sind herzlich willkommen!
Der Vortrag findet im Seminarraum S-288/Physik-Süd, Universität Augsburg statt.
Gastgeber: Prof. Dr. Thilo Kopp