Im Auftrag der Dozenten
der Fakultät Physik
Der Dekan

Einladender: Prof. Mirko Cinchetti

KOLLOQUIUM PHYSIK

Thema: Measuring Electronic Structure in 4 Dimensions – a new Approach to Photoemission

Vortragender: Prof. Dr. Gerd Schönhense
Johannes Gutenberg-Universität Mainz

Ort: Hörsaalgebäude II
Hörsaal 2

16:30 Uhr

Kolloquiums-Kaffee ab 16:00 Uhr
im Raum P2-E0-414
(Alle sind herzlich eingeladen)
Measuring Electronic Structure in 4 Dimensions – a new Approach to Photoemission

Prof. Dr. Gerd Schönhense,
Johannes Gutenberg Universität-Mainz

The electronic structure of solids is a key element in materials research and –design. All transport and thermodynamical quantities of the electron system of a material depend on the Fermi surface and velocity $v_F$; band dispersions determine optical and semiconducting properties. The experimental method of choice is angular-resolved photoemission (ARPES), see e.g. [1]. A new approach to “multidimensional ARPES” (termed momentum microscopy) recently achieved orders of magnitude higher data throughput than conventional ARPES. High-resolution imaging of the Fourier plane of a cathode lens is combined with time-of-flight (ToF) energy recording, yielding maximal parallelization. The $(k_x,k_y)$-field of view exceeds the first Brillouin zone, the energy range comprises several eV. Tunable soft X-rays allow variation of $k_z$ (perpendicular to the surface) via direct transitions to free-electron-like final states. This combination of concepts from microscopy and spectroscopy yields the 4D spectral density function $\rho (E_B;k)$ (weighted by the photoemission cross section) with $\sim 10^8$ resolved data points. Fermi surface and velocity distribution $v_F(k_F)$, all band dispersions, electron or hole conductivity, effective mass and inner potential are obtained from $\rho$ by simple algorithms [2]. An imaging spin filter gives access to the spin texture [3].

[2] K.Medjanik et al., Nat. Mater. 10.1038/NMAT4875 (2017);