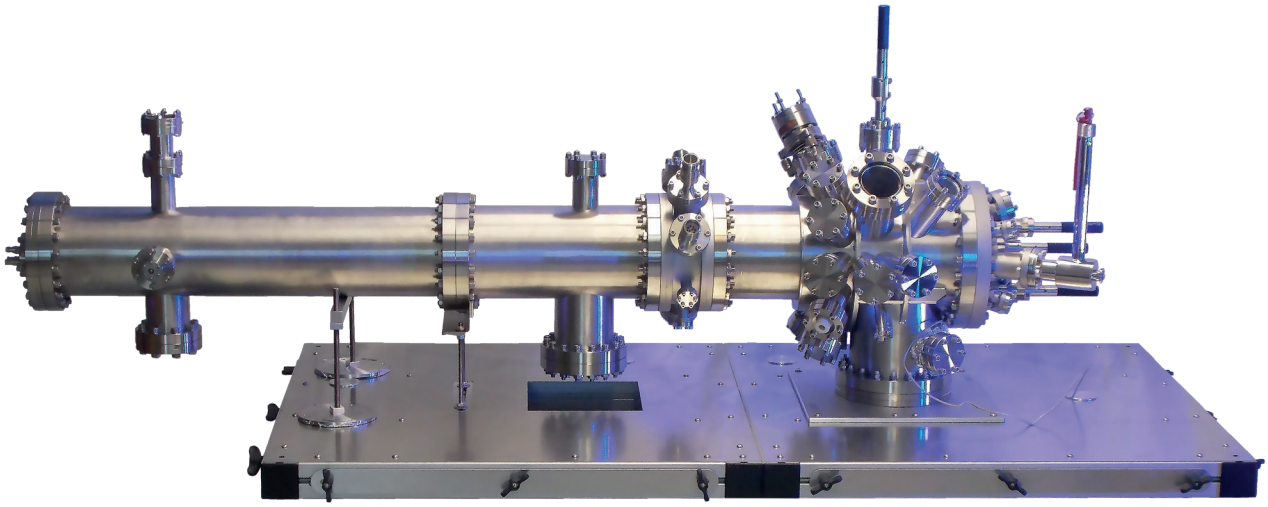
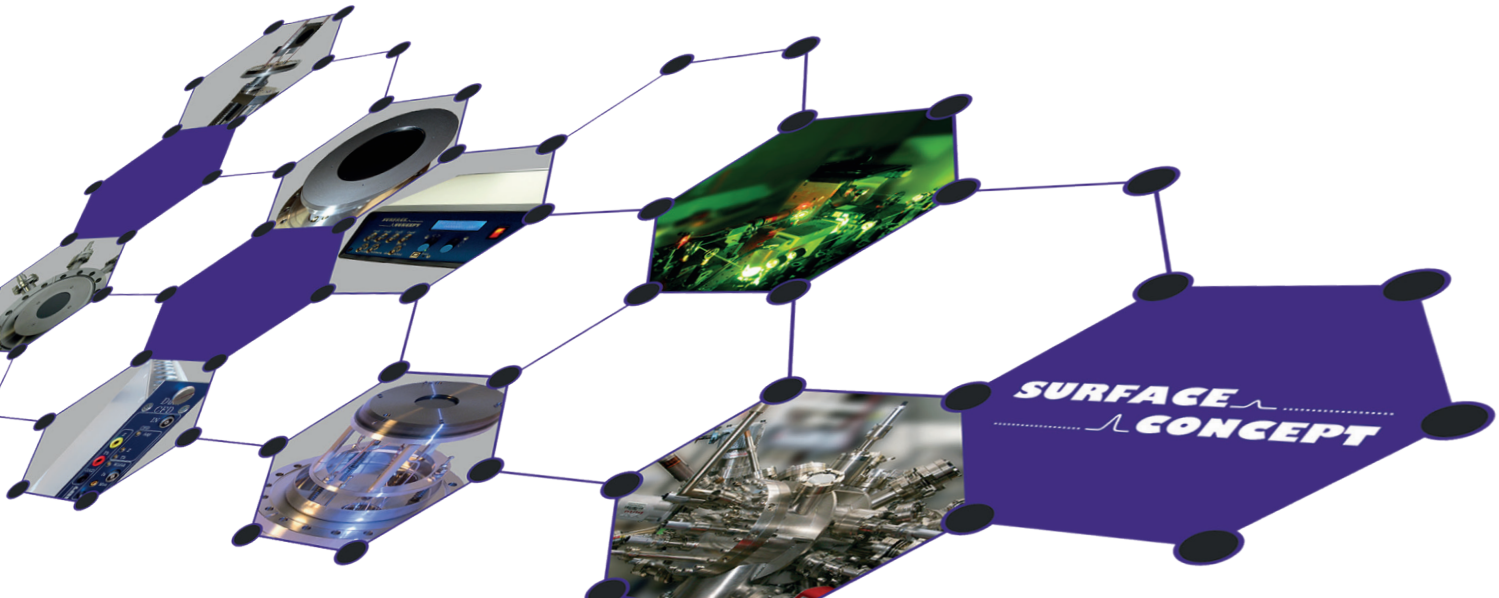
Time-Of-Flight Momentum Microscope with Spin Imaging Option

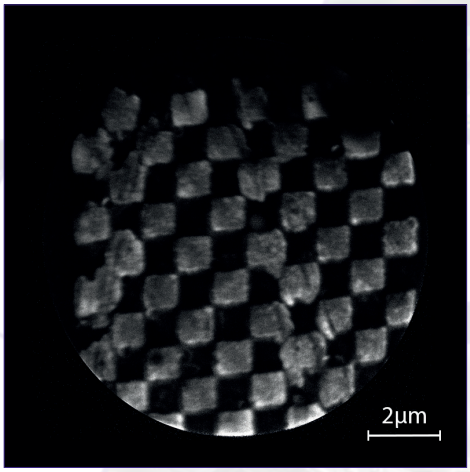




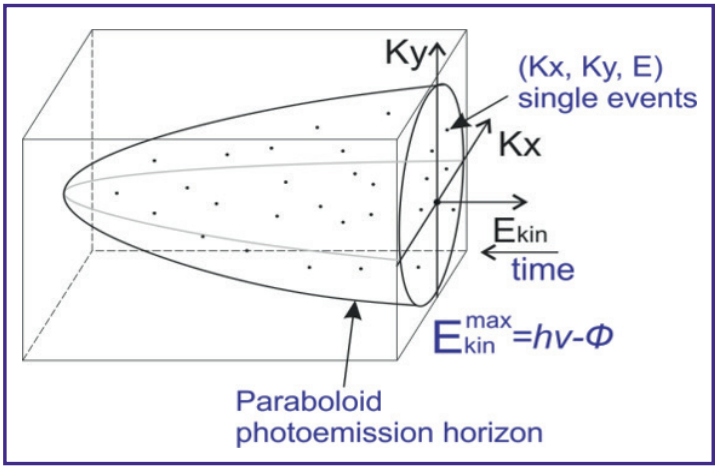
Momentum Microscopy and Spectroscopy System

The patented Time-Of-Flight Momentum Microscope images the full emission hemisphere ($2\pi k^2$) k-space out of a selectable real space sample area down to a diameter of <1 µm, a novel type of ARPES.

- Momentum resolution <0,01 $Å^{-1}$
- Momentum resolved range up to +- 3 $Å^{-1}$
- Small area ARPES <1 µm
- Spatial resolution <50 nm
- Real space field of view 11 - 1000 µm
- Energy resolution <20 meV (17 meV shown)
- Simultaneously focused energy range up to 10 eV
- Piezo driven contrast aperture 3 aperture sizes + 200 mesh
- Piezo driven field aperture 9 aperture sizes + 200 mesh
- All Piezo driven apertures x/y adjustable
- Motorized manipulator 6 axis (Hexapod)
- L-He cooled sample stage available
- Temperature range <15 K - 400 K (<9 K shown)
- Parallel spin imaging available

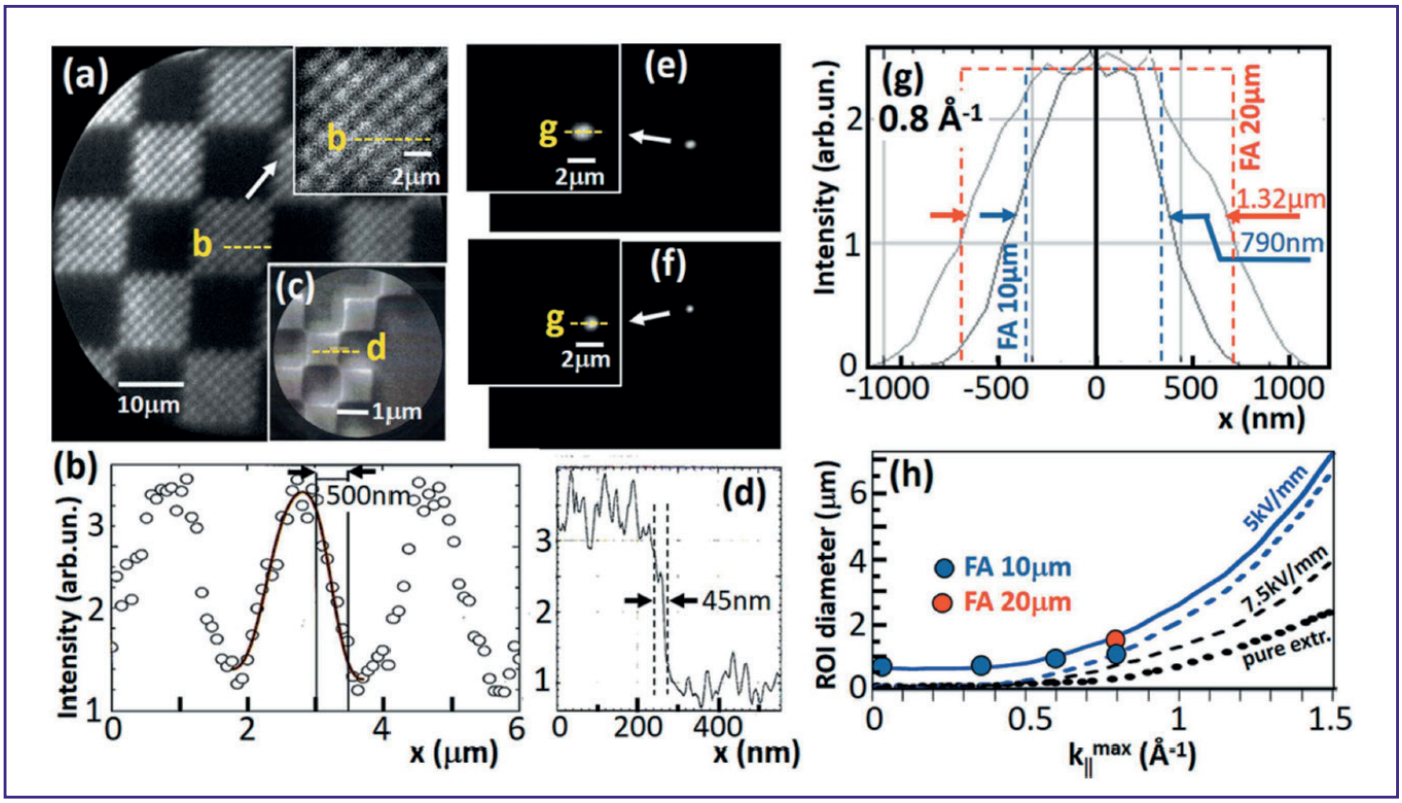


Real space image of 1 $µm^2$ squares of Au on Si (Chessy). Even imperfections on the sample surface such as scratches and contaminations are visible.



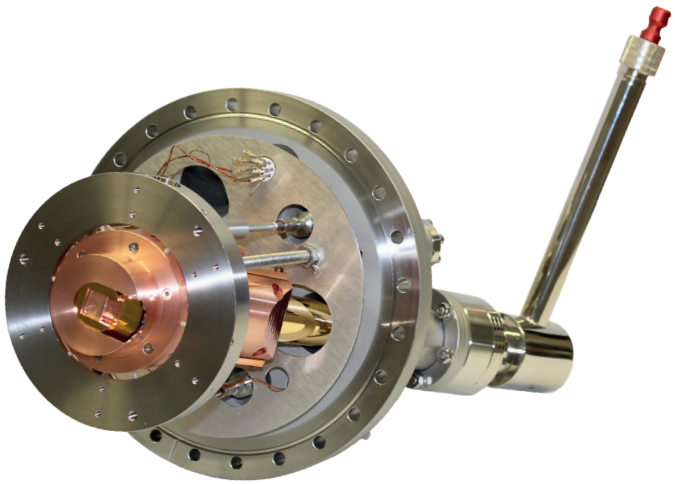
The user can access the full space of the photoemission paraboloid from work function cut-off to Fermi edge during one measurement (verified for excitation energies up to 21.7 eV). The optics directly image the angular distribution in k_x and k_y (isogonic), no further transformation is necessary.

Sub-Micron Areas in Real Space are now accessible for ARPES

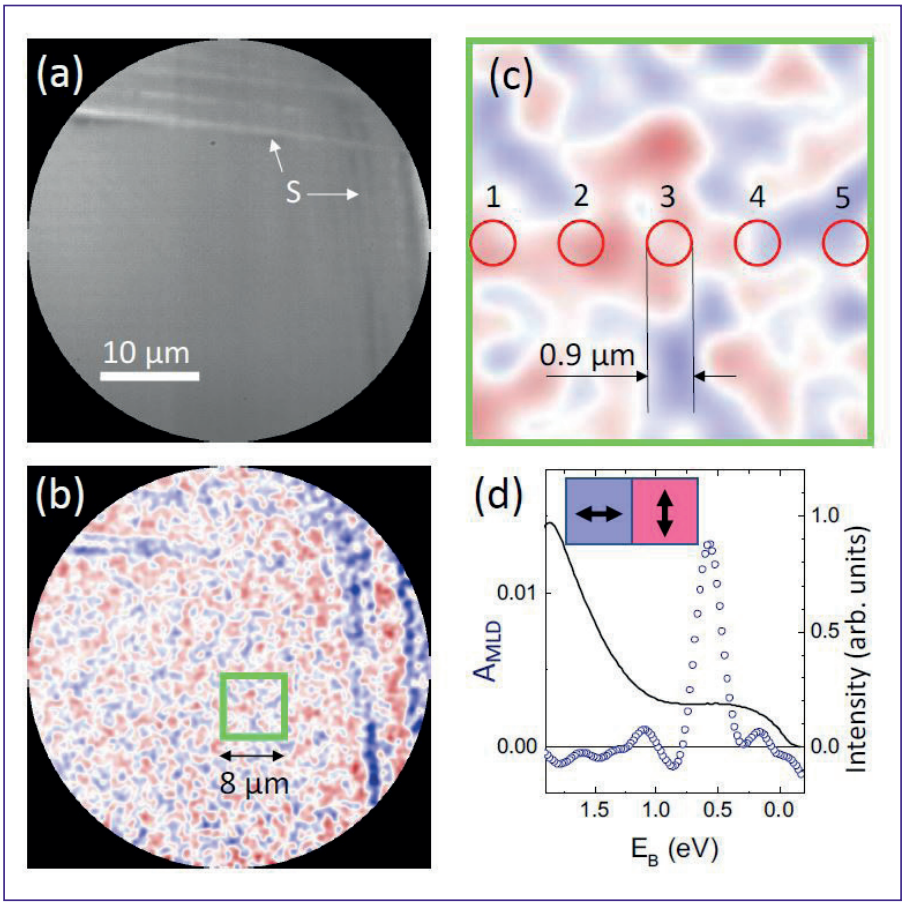


Small-area momentum microscopy using small field apertures. Results taken for an Au checkerboard structure ('Chessy', Plano GmbH) with fully open field aperture (a) and apertures of 20 µm (e) and 10 µm (f). (c) Resolution limit in PEEM mode. (b, d, g) Line scans along the dashed lines in (a, c, e and f). Dashed square profiles in (g) denote the widths expected for an ideal, aberration-free lens. (a, b, e – g) Measured at the Fermi edge of the Au structure at E_{kin} = 2.5 eV, corresponding to k^{max} = 0.8 Å^{-1}. (h) ROI diameter as a function of k^{max} as measured for field apertures of 20 µm (red dot) and 10 µm (blue dots) and as calculated for the full lens optics at field E = 5 kV mm^{-1} in the small-aperture limit (dashed blue curve) and for a 10 µm aperture (full blue curve). For comparison, the small-aperture limits for E = 7.5 kV mm^{-1} and for the pure extractor field of 5 kV mm^{-1} are also shown [all curves from C. Tusche et al., Ultramicroscopy 159, 520-529 (2015)].

[G. Schönhense et al., J. Synchr. Radiation 28, 1891 (2021)]



Resolving Micro-Sized Antiferromagnetic Domains in Mn_2Au



(a) PEEM image of the Mn_2Au(100) sample surface obtained with 6.4 eV photon energy. Scratches (S) on the otherwise homogeneous surface serve for position determination. (b) Magnetic linear dichroism (MLD) image for the area as in (a) with color (red/blue) coded asymmetry AMLD = $(I_p - I_s)/(I_p + I_s)$ (E_B = 0.6 eV, p- and s-polarized light). (c) Magnified image from the green square indicated in (b). The five numbered circles define the regions of interest selected by the field aperture that are used for momentum microscopy. (d) Intensity (black line) and MLD asymmetry, AMLD, (circles) vs. E_B

[H. J. Elmers et al., arXiv:2110.12186 (2021)]

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