Advance in Momentum Microscopy with NanoESCA MARIS

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Since its introduction in 2005, the energy-filtered photoelectron microscope NanoESCA [1,2] has been used for various application including work-function mapping, imaging XPS and in the last years more prominently for imaging the reciprocal space, i.e., momentum microscopy or orbital tomography (e.g., at the NanoESCA at synchrotron Elettra, Trieste [3]).

The latest revision of the analyzer, called NanoESCA MARIS, has a new microscope lens. It was designed to achieve a better angular / momentum resolution while keeping the same good real space resolution < 35 nm from its predecessor. In momentum space mode, the instrument achieves a resolution of 0.005 $Å^{-1}$. We will show the performance on the Rashba split surface state of a Au (111) single crystal (Fig. 1,b).

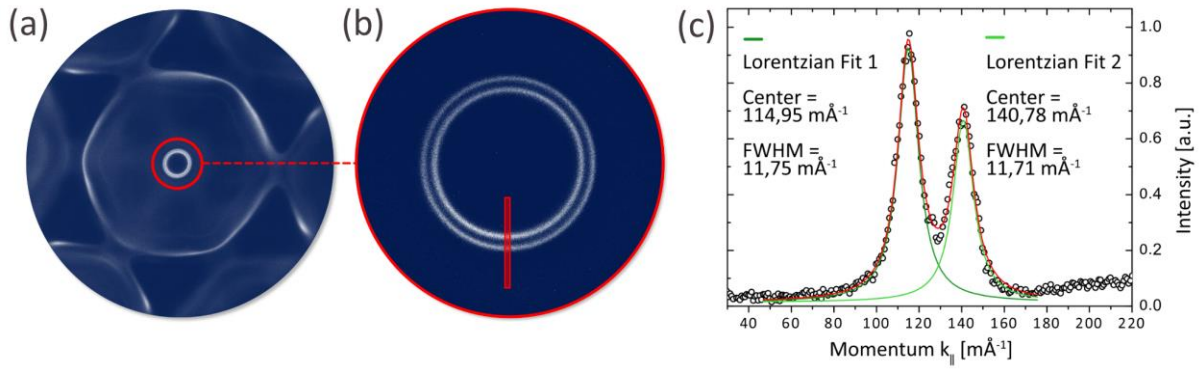

Figure 1: (a) Momentum Space Microscopy Image of a Au (111) single crystal at the Fermi level, showing more than one Brillouin zone (room temperature, 50 meV instrumental energy resolution). (b) Zoom onto the Rashba split surface state of Au (111). This image was taken at a sample stage temperature of 45 K. The instrumental energy resolution was evaluated to be < 24 meV by fitting the Fermi edge and subtracting the thermal broadening. The line profiles of the bands were fitted with Lorentzian peak functions. The natural broadening of the bands are significantly bigger than the Gaussian broadening of the instrumental resolution.

In addition, new working modes, like off-axis zoom, double dispersive imaging mode and an energy dispersion snapshot mode were introduced with the new analyzer and will be presented. Developments in the Imaging Spin Filter for NanoESCA [4] will be discussed.

References

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[3] M. Wießner et al., Nature Comm. **5** (2014) 4156
[4] M. Escher et al., Ultramicroscopy **253** (2023) 113814