PHOIBOS 150 2D-CCD Wide Angle Mode in 2PPE

Application Notes

Introduction

These notes describe the application of the angular resolving wide angle lens mode (WAM) in two-photon-photoemission spectroscopy (2PPE). Figure 1 shows the angular distribution of electrons emitted from a Ag sample in the WAM mode after transformation. An electron beam with 5000 eV kinetic energy and 100 µm spot size from a SPECS EQ 22/35 electron source is used to illuminate the sample. Secondary electrons passing a slit array (see figure 2) mounted in front of the sample are imaged in WAM on the CCD detector at 20 eV kinetic energy and 40 eV pass energy. As a result, a horizontal line pattern is observed in the detector image. The peaks show a FWHM of 0.3° - 0.5° due to the angular dispersion of the lens and the slit width of the test aperture. For the working distance of 40 mm used here, the total acceptance angle amounts to ± 14°. The total acceptance angle can be increased to ± 20° by decreasing the working distance to 20 mm.

CCD camera image (after transformation) I Line profile

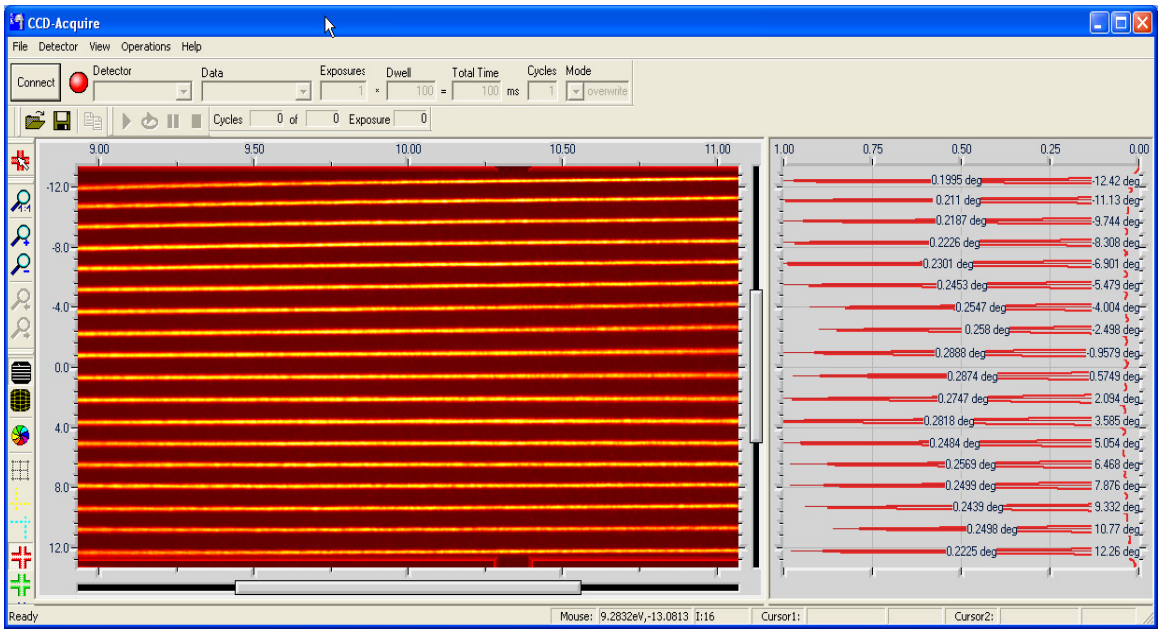

Figure 1: Angular distribution of electrons emitted from a Ag sample covered with a slit array.

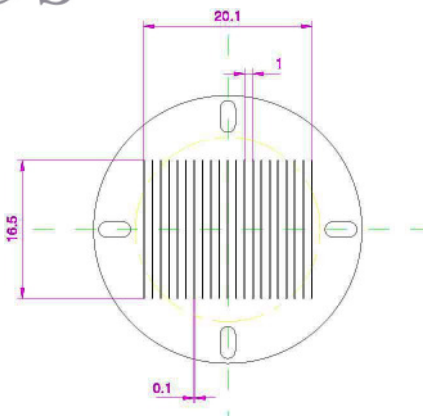

Figure 2: Slit array (dimensions in mm).

Using the WAM lens mode a clean Cu(100) surface has been investigated with 2PPE. Figure 3a shows the 2PPE signal of the image in potential states n=1,2 and 3 on a clean Cu(100) surface at 300 K. The surface has been analyzed using a PHOIBOS 150 analyzer equipped with a 2D-CCD detector. Frequency-trippled pulses from a Ti:sapphire laser system are used to excite the electrons, while the fundamental pulses photoemits them with a time delay of 130fs.
The relation between energy and emission angle for the first two image potential states is known from an independent measurement. Starting from the data shown above, emission angles can be calculated for each energy. In Figure 3b these emission angles are plotted versus the respective peak position to show the angular dispersion of analyzer.

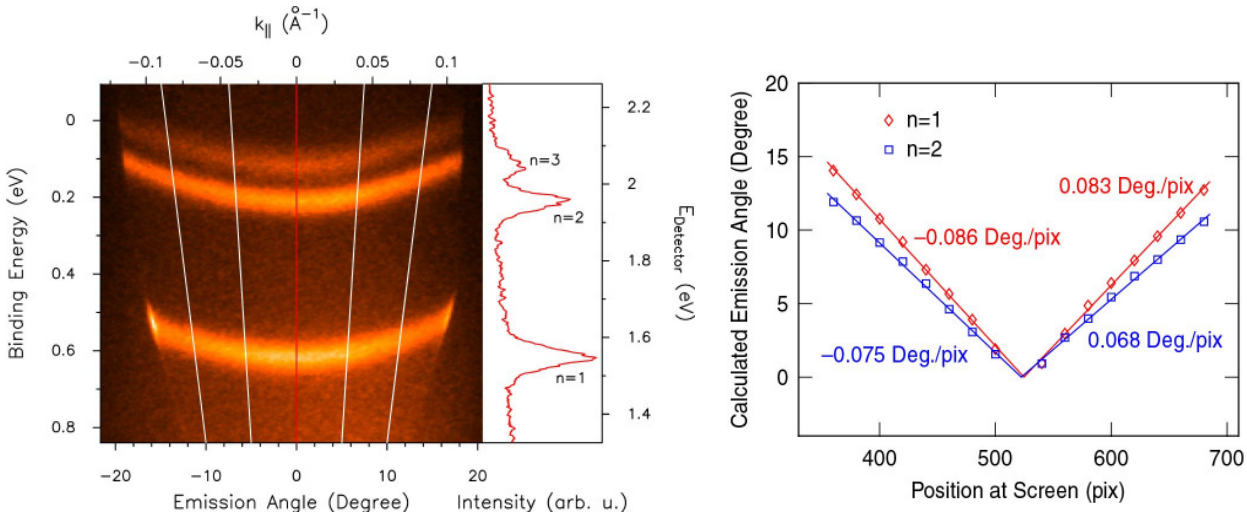

Figure 3: a) 2PPE signal of the image potential states from Cu(100) at 300 K. b) Relation between calculated emission angle and peak position. Data courtesy M. Rohleder, W. Berthold, J. Güdde and U. Höfer (Philipps-University Marburg, Germany).

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