

# Übungen zur Oberflächenphysik

## Blatt 3 – 2.04.2014

### 1) Photon Polarization of Synchrotron Radiation

Consider the case of synchrotron radiation from a bending magnet source on a storage ring filled with electrons. Now assume that the ring was operated with positrons instead of electrons with the particle trajectory remaining the same (this can indeed be done and has been tried at some synchrotron radiation facilities). Does the polarization of the emitted radiation change or remain the same?

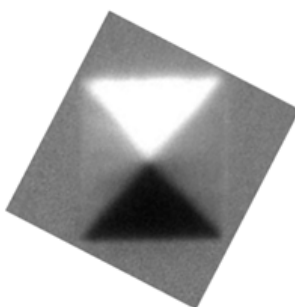
### 2) X-ray absorption: transmission mode and total electron yield modes

What are the differences between both modes?

### 3) Origin of XMCD image

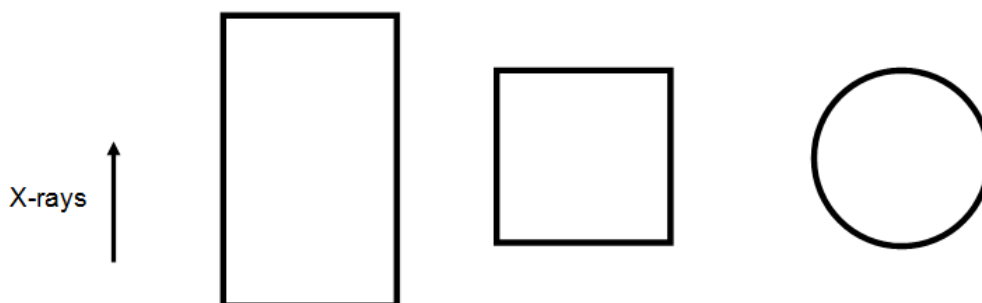
Shown is an XMCD image taken with a photon-energy of 780 eV (Co  $L_3$  edge).

- Give a brief explanation of the XMCD effect (e.g. two step model) for 3d transition metals like Co
- How this leads to a contrast in the image?



### 4) Magnetic domains in structures

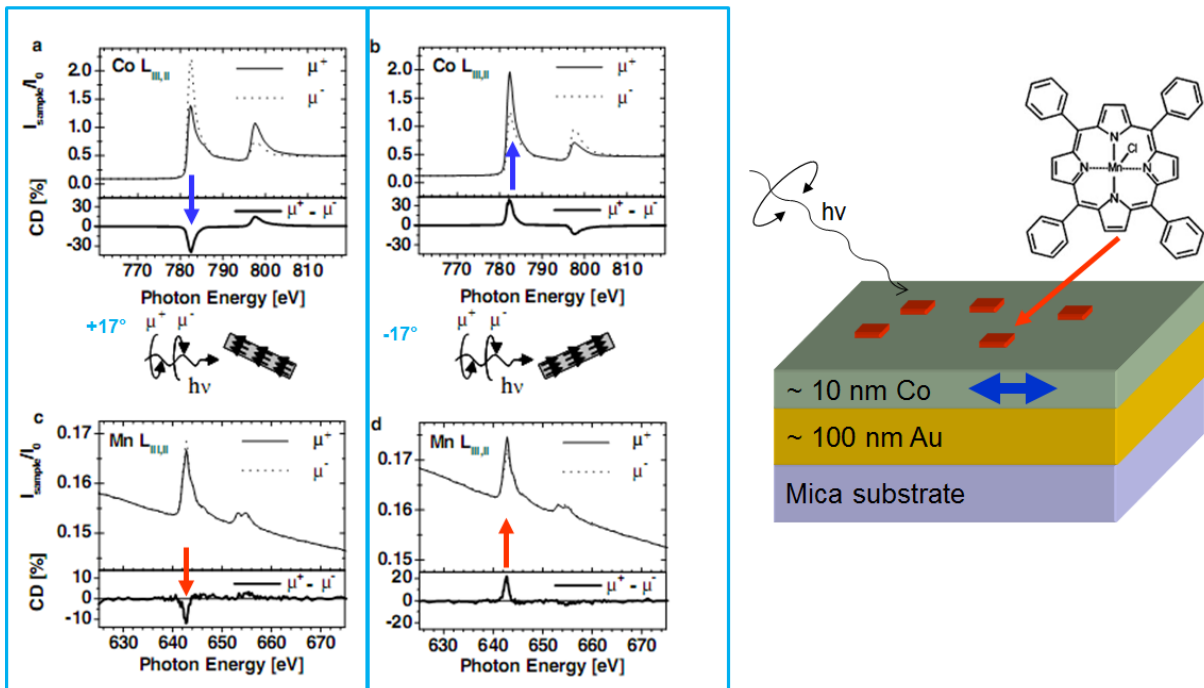
Draw the ground state configuration of these structures, i.e. the orientation of the magnetic domains and the contrast in a XMCD image.



## 5) XMCD spectra

Thin Cobalt film (10 nm) was grown on Au/mica substrate. Afterwards the external magnetic field parallel to the surface was switched on to assure single-domain magnetization along the easy axis (see blue arrow in sketch). Then organic molecules with Mn core were deposited on such prepared surface. XMCD spectra were measured.

Is there any magnetic interaction between molecule and substrate? If yes, what kind?

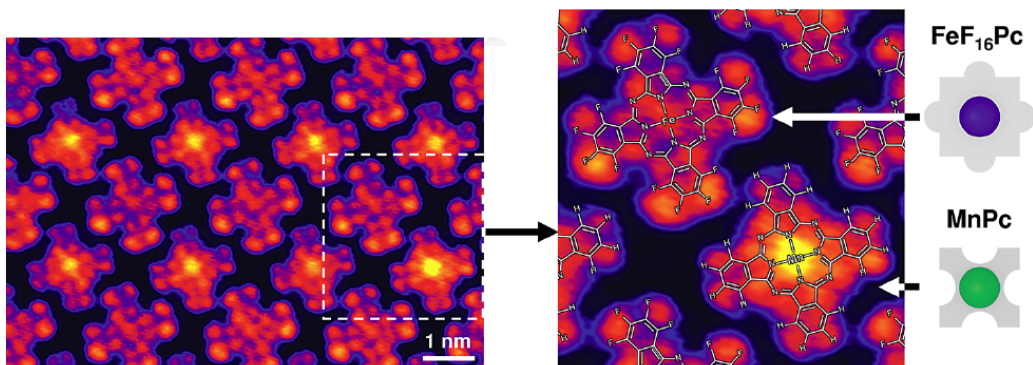


## 6) XMCD spectra

Two phthalocyanines derivatives (see scheme below) were deposited on oxygen reconstructed cobalt. Oxygen reconstruction enabled self-assembly of the molecules in a chessboard arrangement.

Look at the STM image presented below:

- a) What type of interactions between these molecules enabled their spontaneous arrangement in chessboard structure?



Look at the XMCD spectra presented below,

- Is there any magnetic interaction between MnPc and substrate? If yes, what kind?
- Is there any magnetic interaction between FeF<sub>16</sub>Pc and substrate? If yes, what kind?
- What happens after dosing of NH<sub>3</sub>?
- What happens after annealing to 300 K, which result in desorption of NH<sub>3</sub>?

