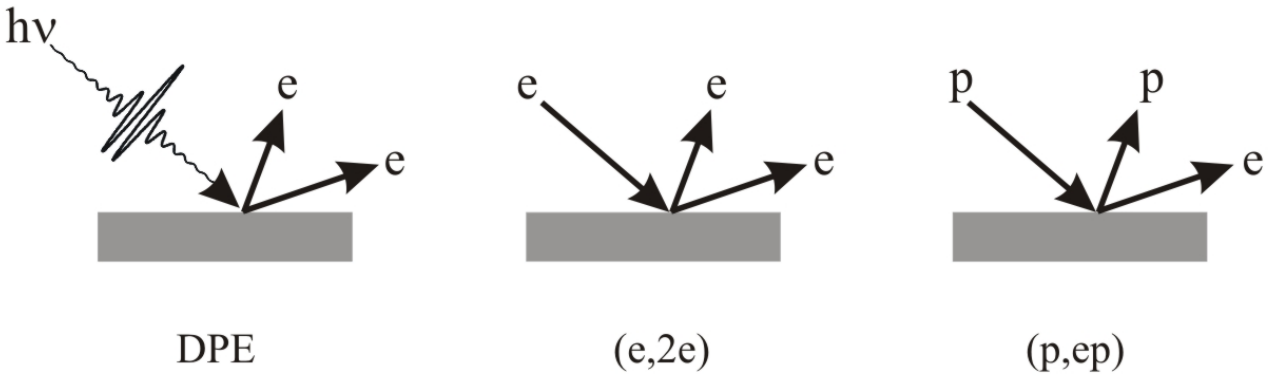
Energy relations in positron-electron pair emission

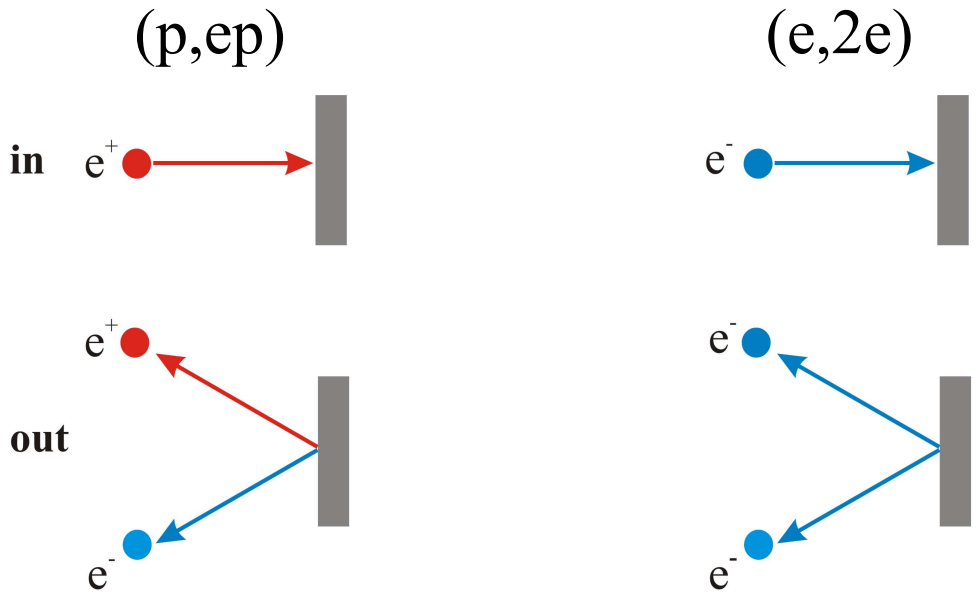
F. O. Schumann[1], I. Brandt[1], Z. Wei[1], and J. Kirschner[1,2]

[1]*Max-Planck-Institut Halle, Germany*
[2]*Martin-Luther Universität Halle, Germany*



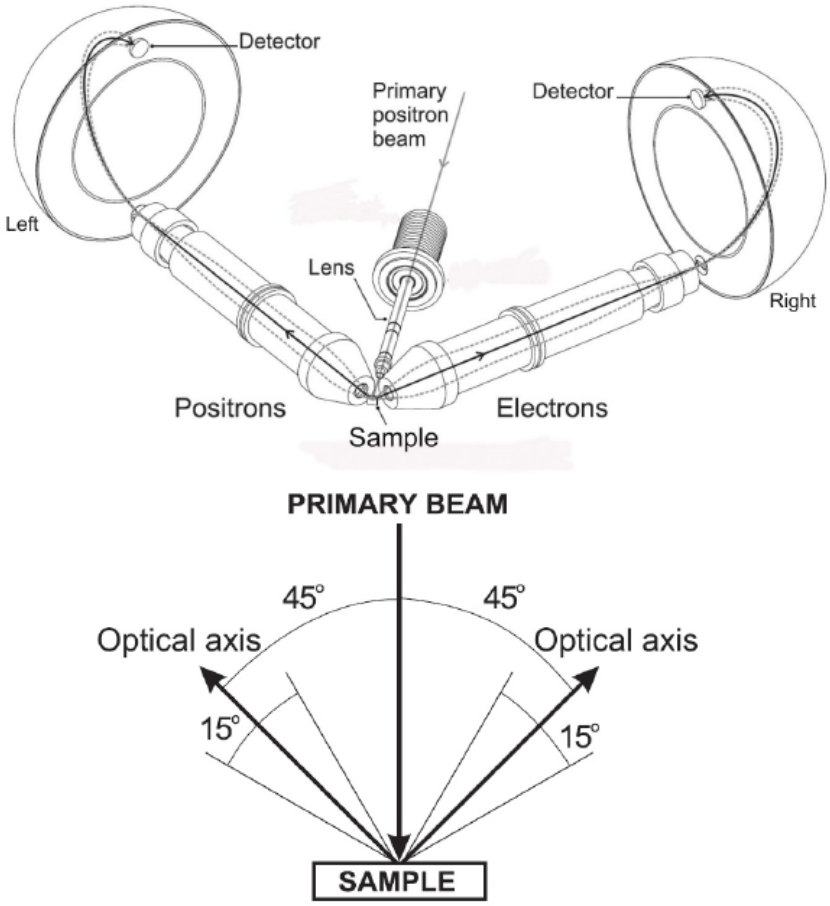
DPE (e,2e) (p,ep)

Detection symmetry



Detection symmetry is broken for distinguishable particles
⇒ asymmetry in energy distribution

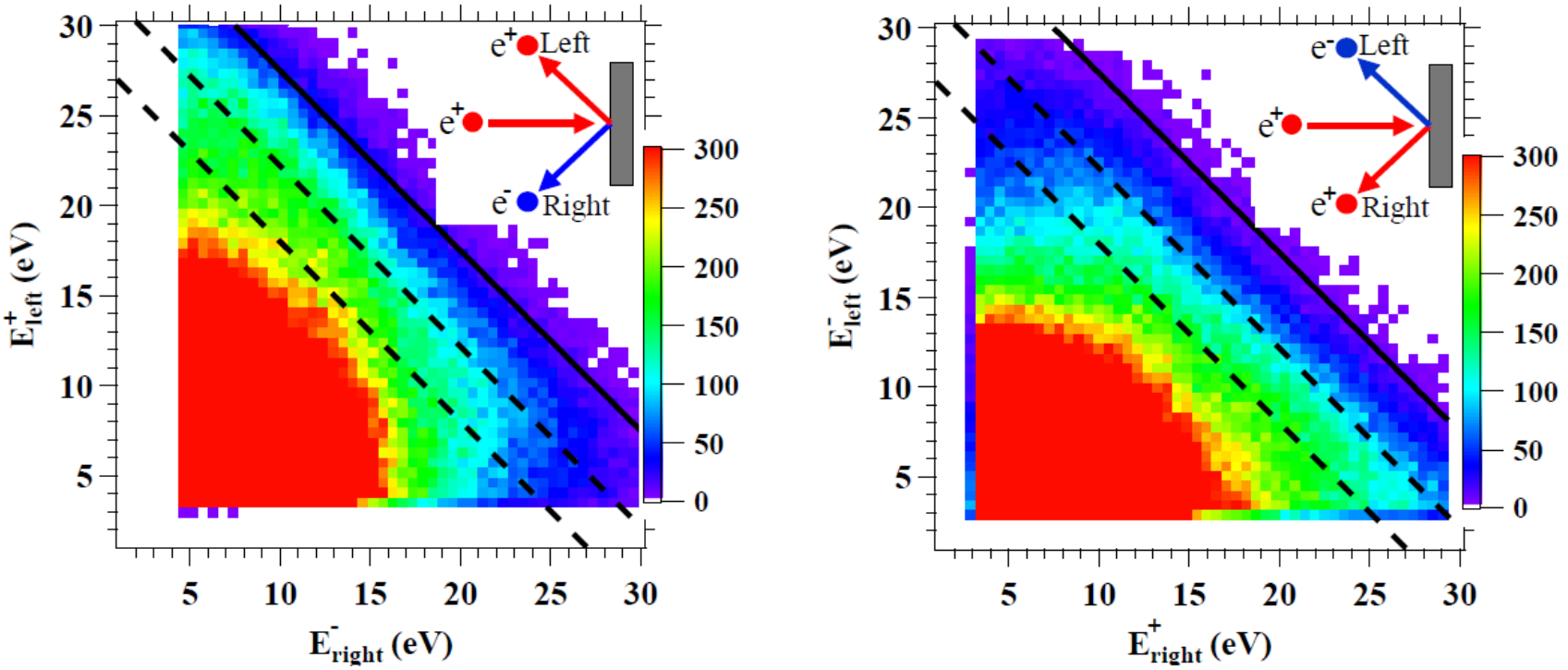
Coincidence spectrometer



- detection within 27 eV energy window
- $E_p \approx 40\text{-}60$ eV
- lab source 4×10^4 e^+/s on sample

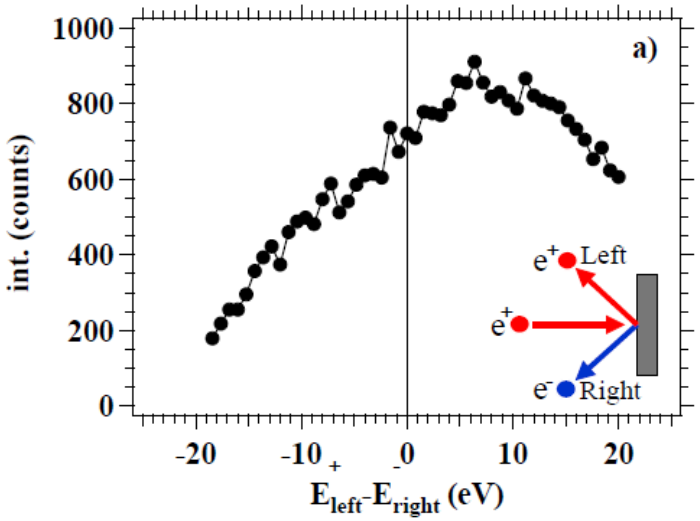
2D-Energy distribution from Ag(100)

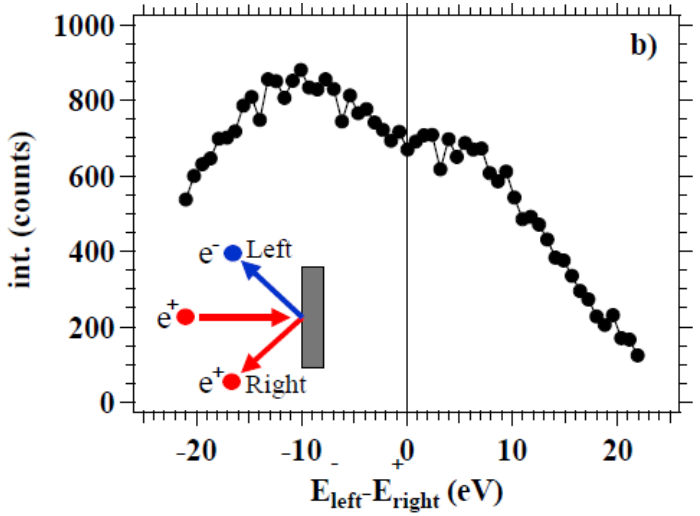
(p,ep) with E_p= 42 eV

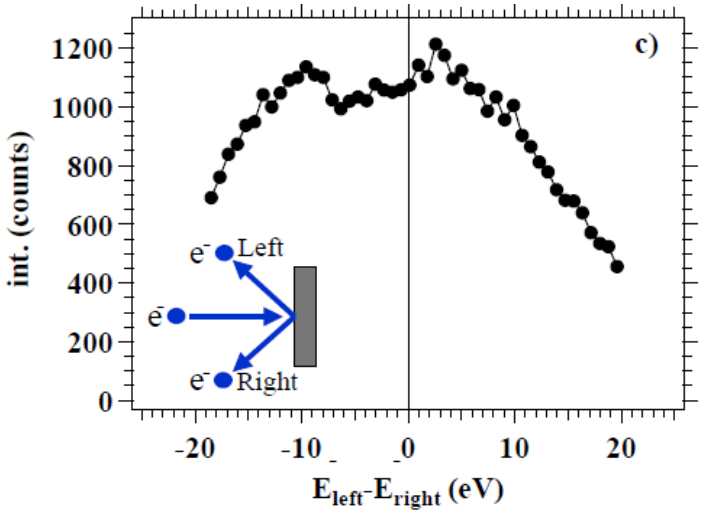


- the x-axis refers to the same spectrometer
- asymmetry in the 2D-Energy spectra

Intensity versus energy difference





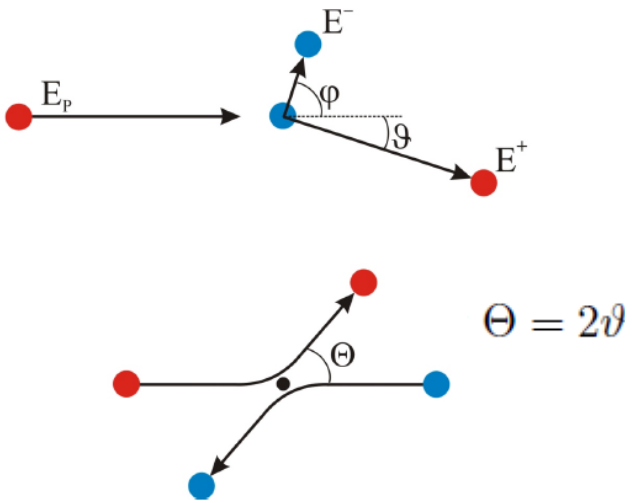


(e,2e) with E_p= 42 eV

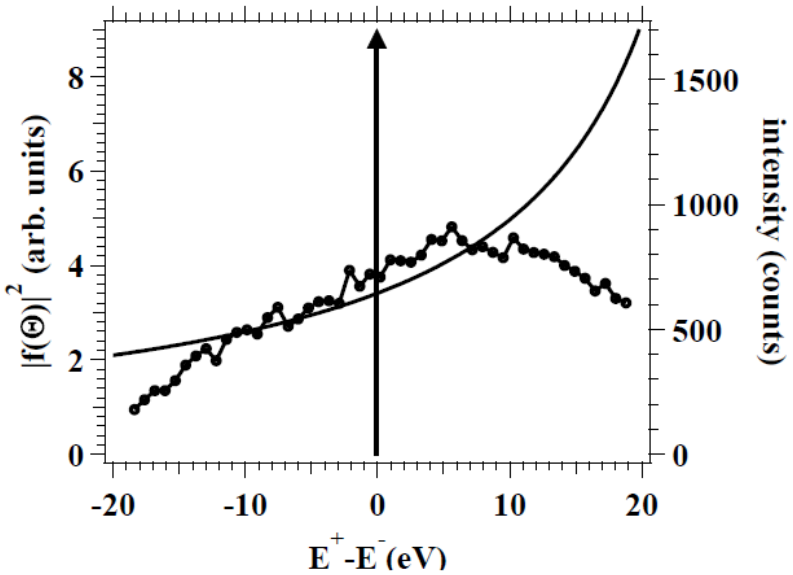
Instrumental asymmetry negligible

Positron has larger energy on average

Scattering model



$$\Theta = 2\vartheta$$

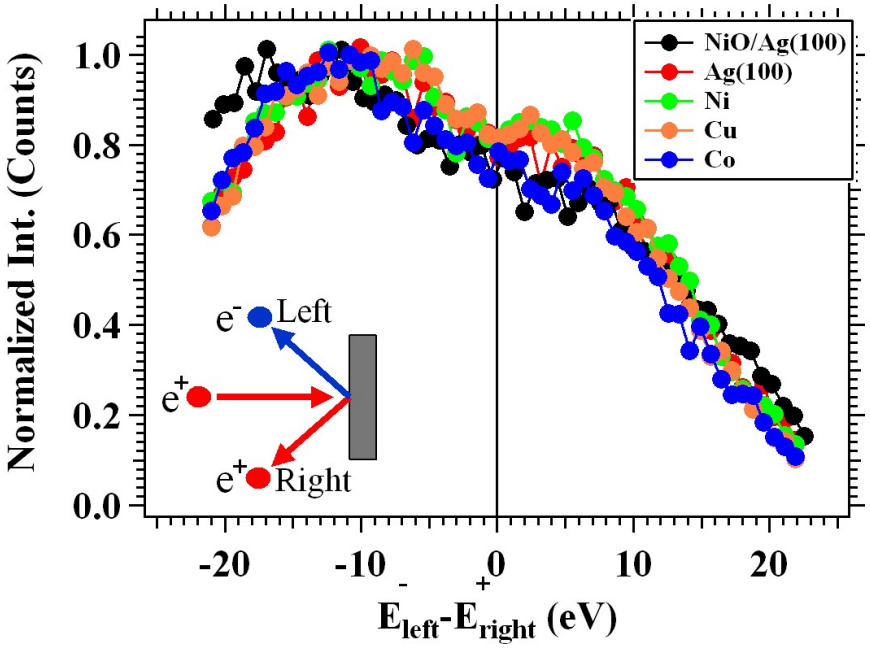


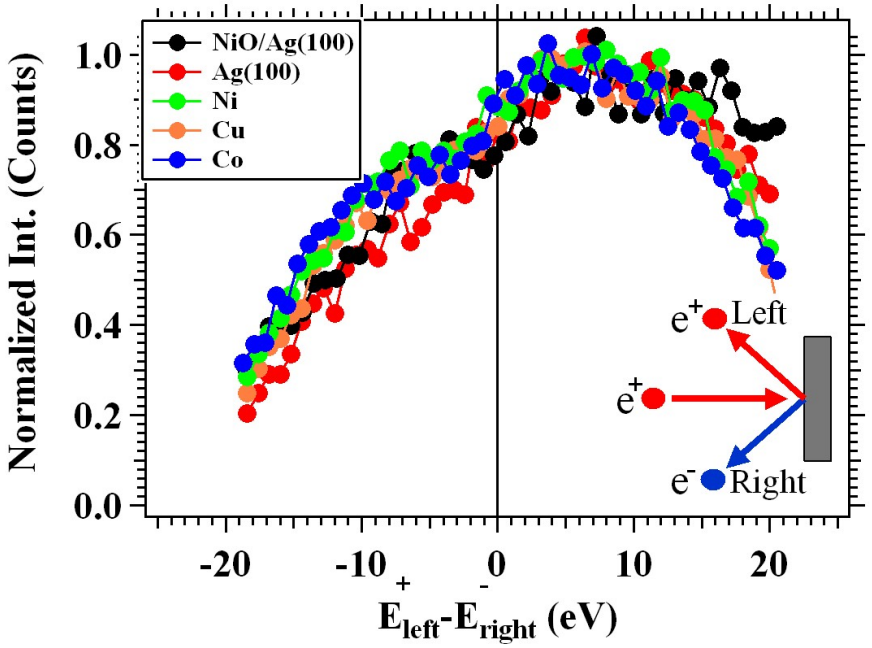
$$\Delta E = E^{+}(\vartheta) - E^{-}(\vartheta) = E_p \cdot cos(2\vartheta)$$

determine scattering amplitude f(Θ) ⇒ ΔE distribution

Screened Coulomb interaction
1st Born app

„Universal“ behavior





- slight differences between metals and NiO
- structural order plays no role

Summary

- Clear evidence of broken symmetry in detection
- Sharing curves show large variation
- "Universal" behaviour
- Simple model qualitatively explains findings

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