High Resolution Photoemission at BESSY

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Photoemission at BESSY

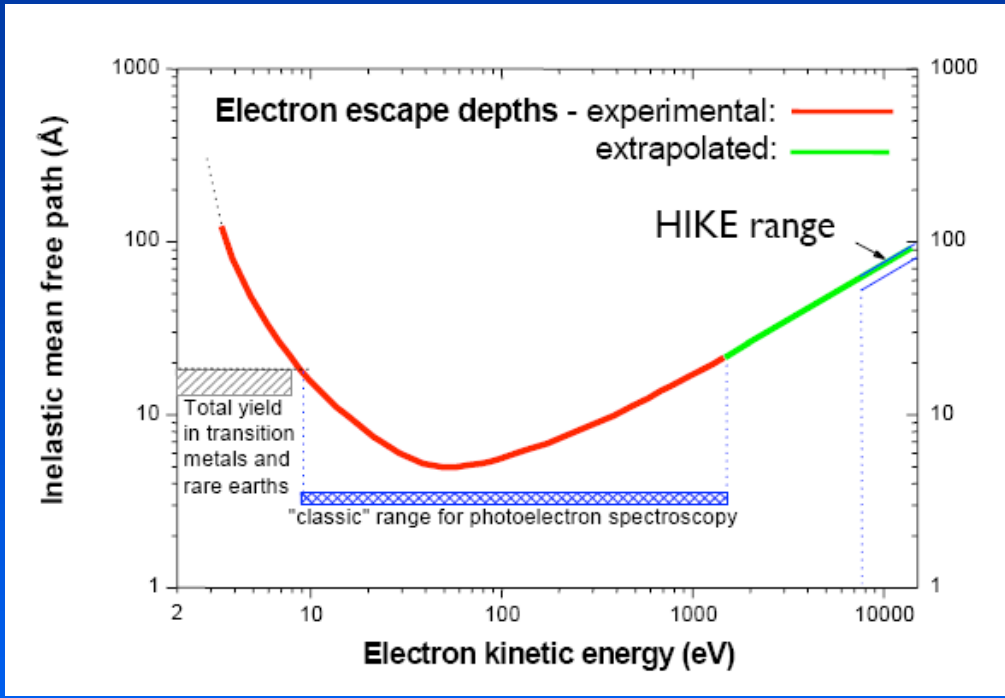
There are numereous photoemission experiments at BESSY

Focus to 2 new beamlines

1. **High kinetic energy PES: „HIKE“**

2. **Very high resolution ARPES: „1^3“ spectrometer**

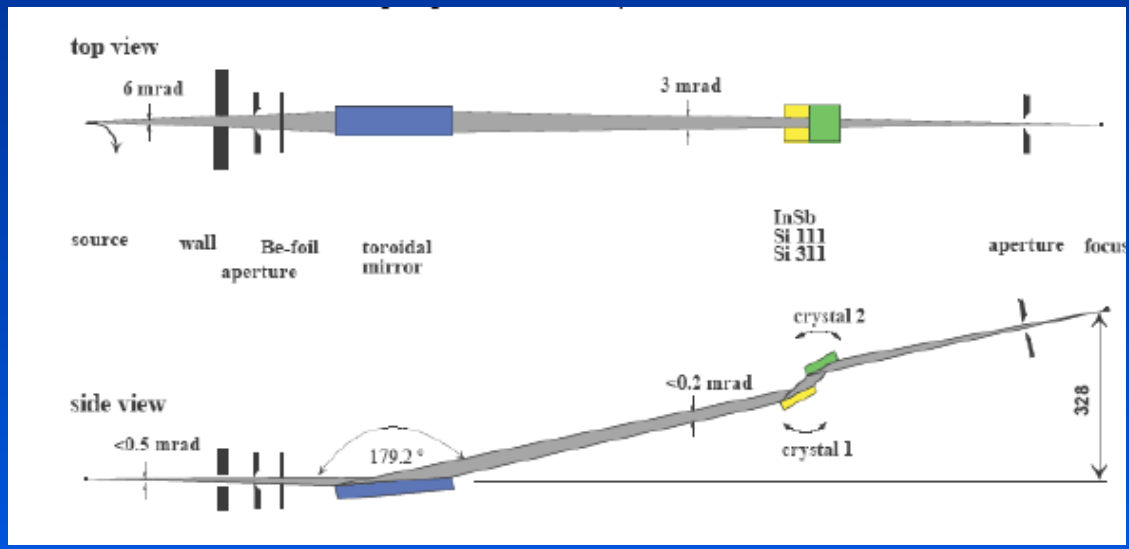
Goal: photoelectron spectroscopy with bulk sensitivity



Several experimental constraints:

- **Stability**
- **Resolution**
- **Intensity (cross section)**

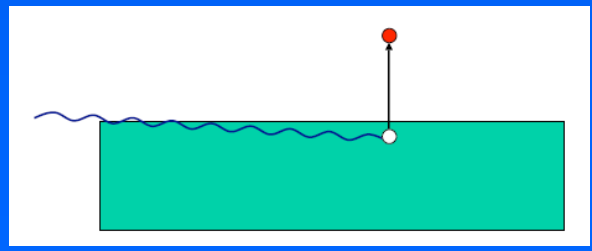
KMC I beam line at BESSY



Bending magnet

Double crystal monochromator: very high resolution in the backscattering mode

High brilliance



HIKE electron spectrometer

Scienta R4000 modified for analysing at kinetic energies from 0 to 10 KeV at high resolution

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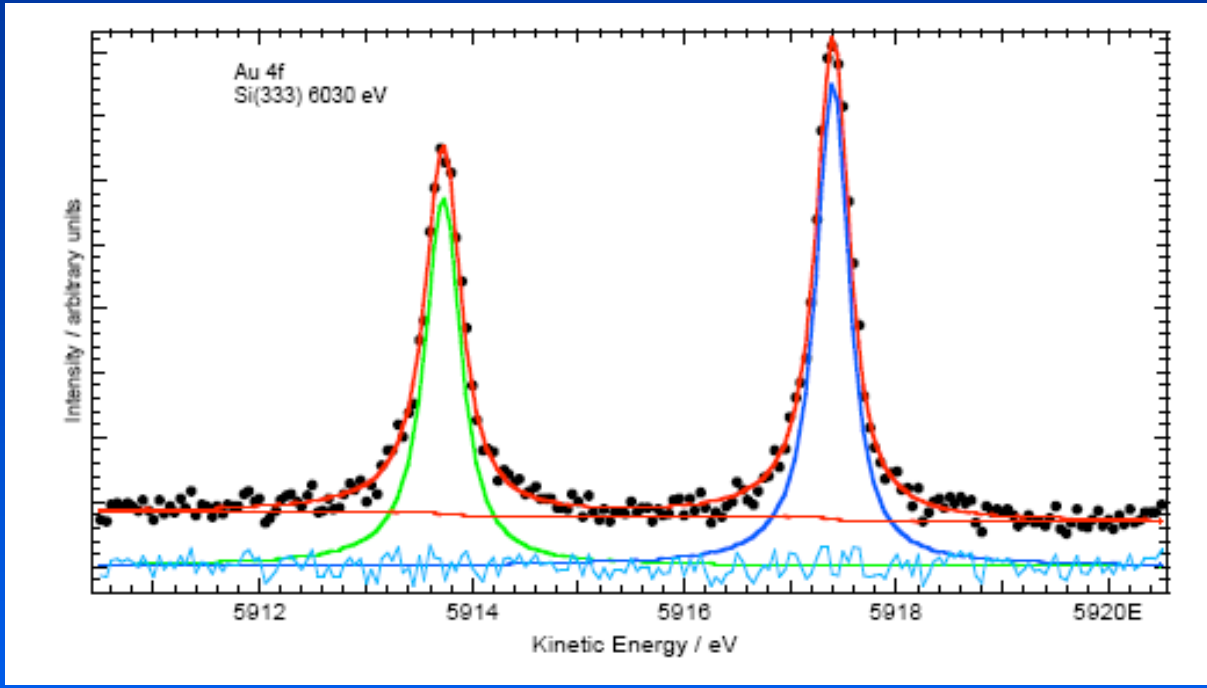
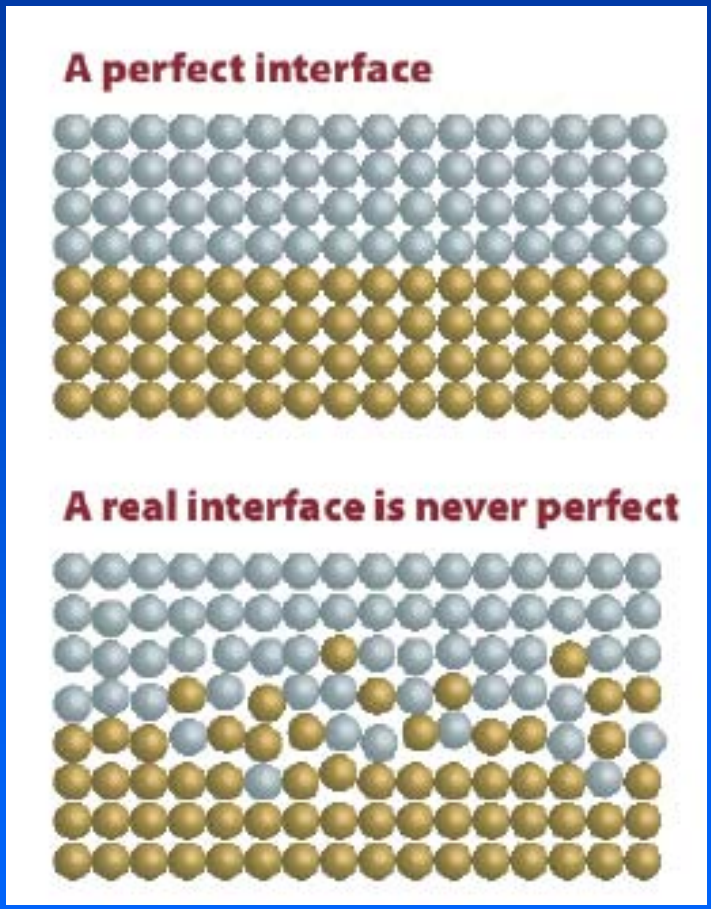
Current capabilities- Au 4f photoemission spectrum



Analyser resolution: 80 meV
Resolving power: 75 000

Photon resolution: 50 meV
Resolving power: 120 000

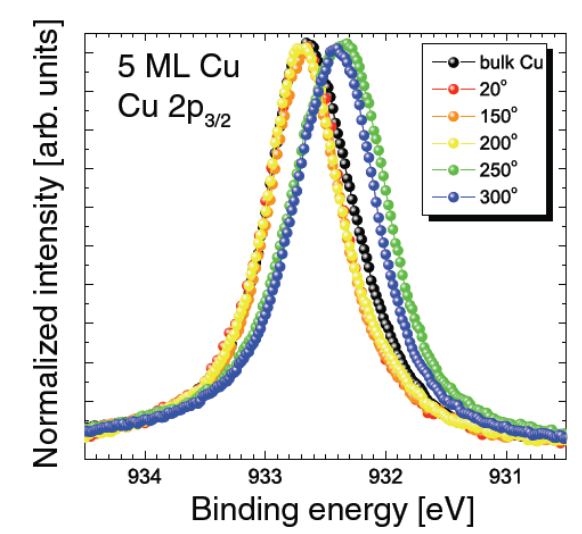
T-dependence of a Cu/Ni interface

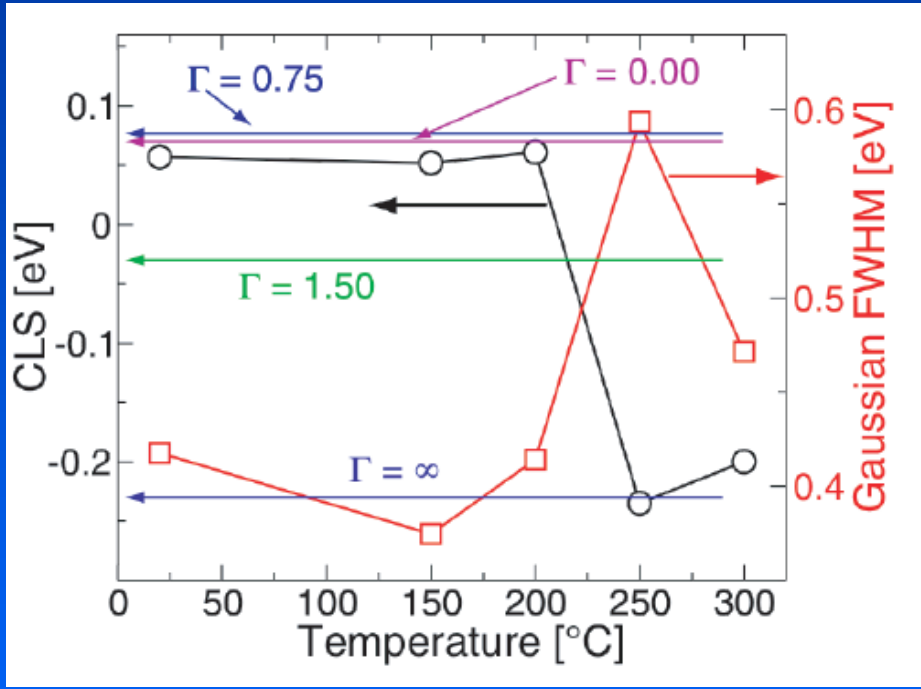


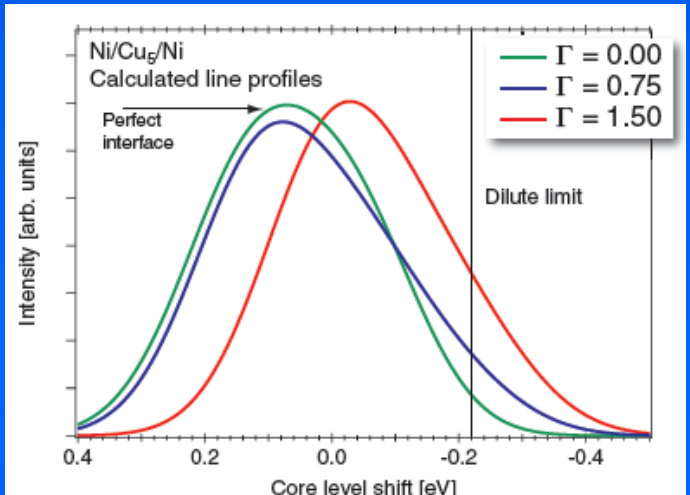
model system:
multilayer $(Cu_xNi_5)_n$ x = 2, 4, 5

E. Holmström et al. PRL 97, 266106 (2006)

Chemical shifts as a function of annealing T for $(Cu_xNi_5)_n$

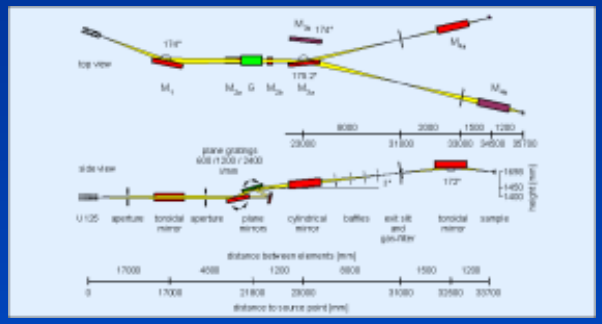




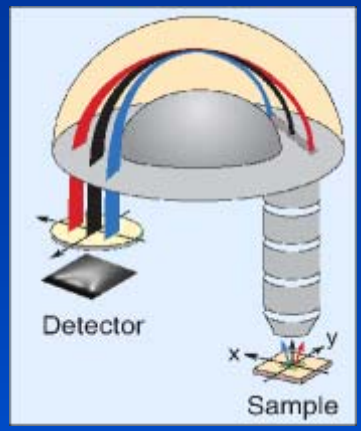


Theory DFT/CPA - Γ represents the quality of the interface

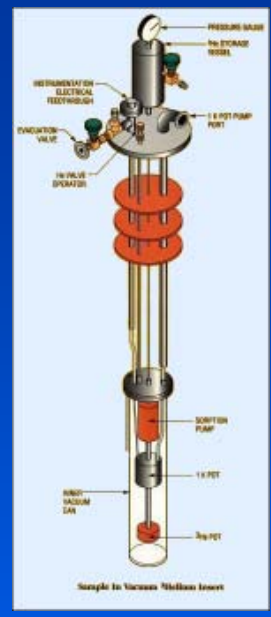
The „1^3“ ARPES Spectrometer



UE112



Scienta R4000



He3
Janis

ΔE < 1 meV

ΔE < 1 meV

T < 1K

1x1x1 = 1^3

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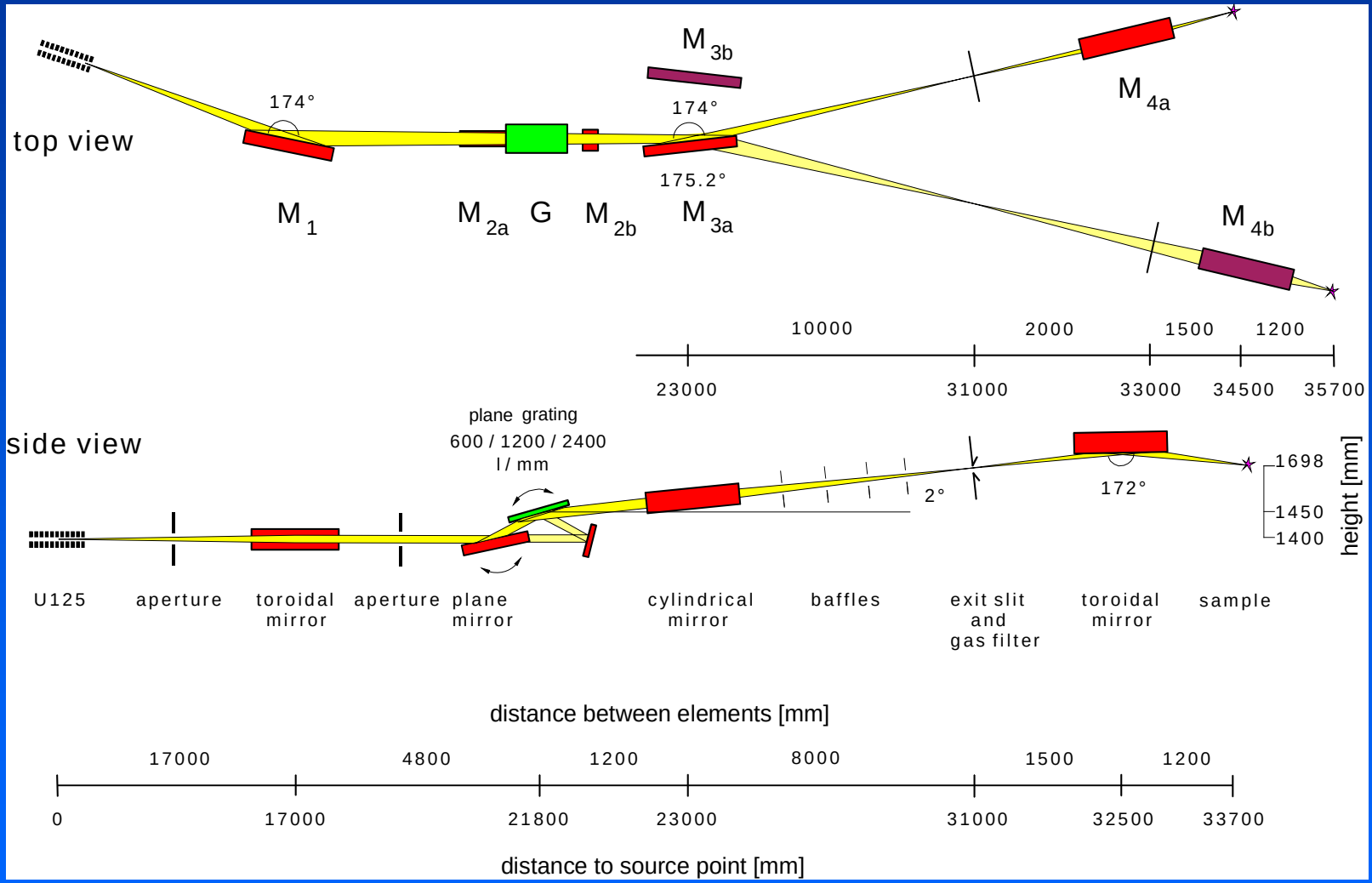
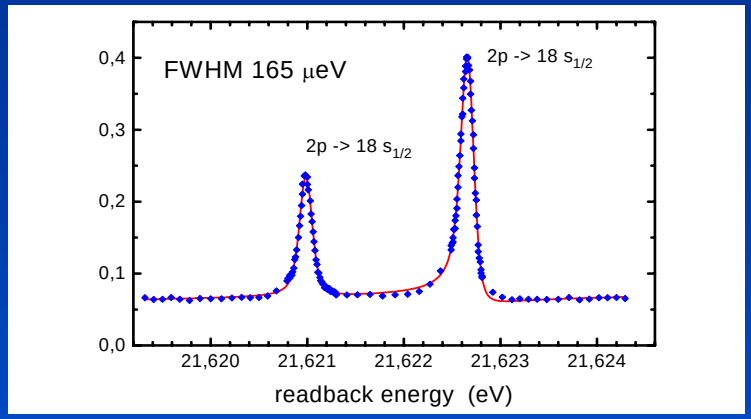
Optical Design of the Beamline



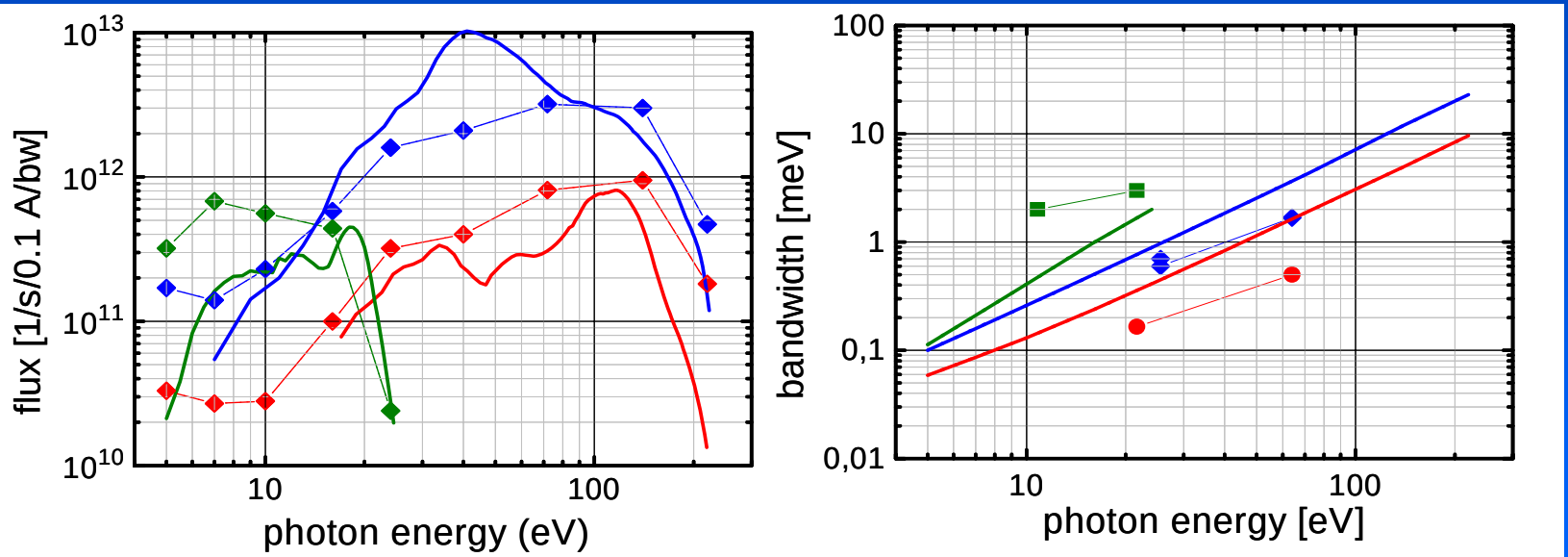
R. Follath et al.

Calculated Performance vs. Measured



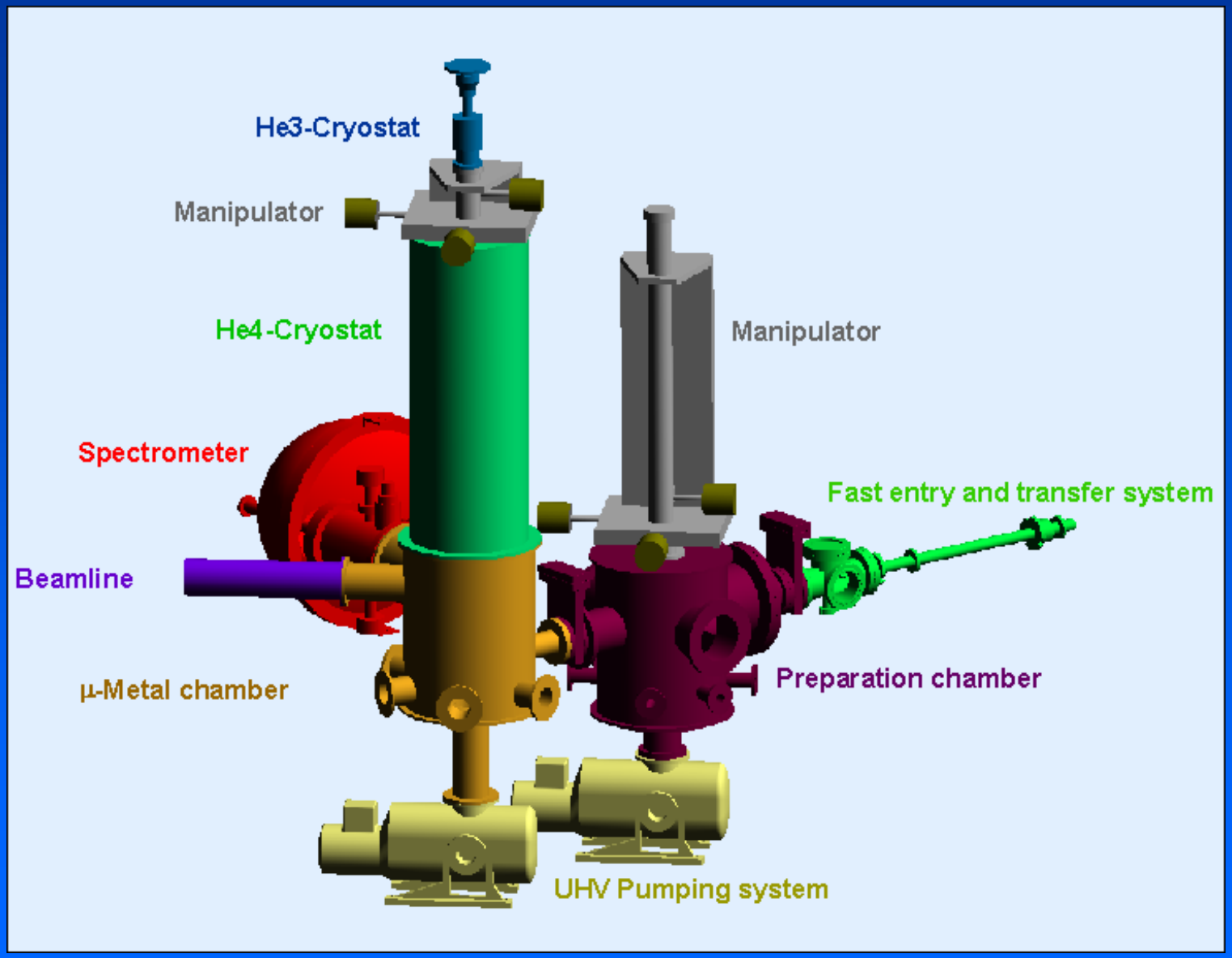
Neon 2p –> n s excitation at 21.6 eV

ΔE = 0.165 meV

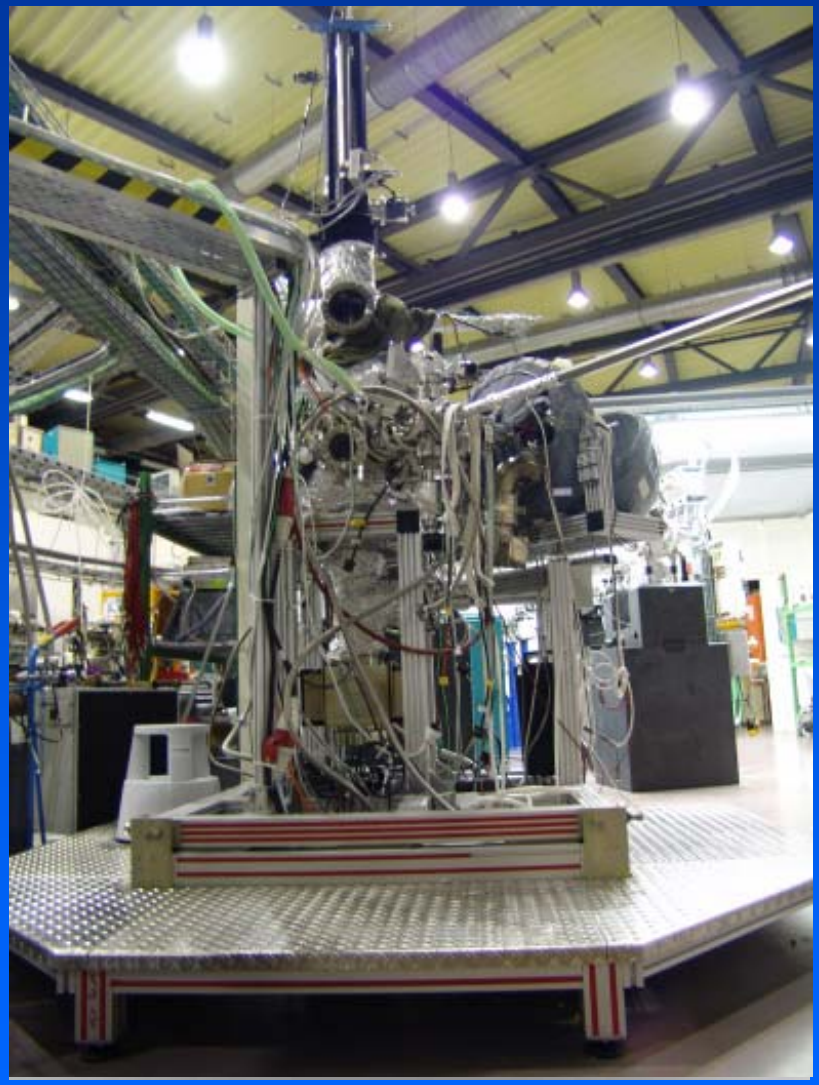


Resolving power 140 000 !
Variable polarization

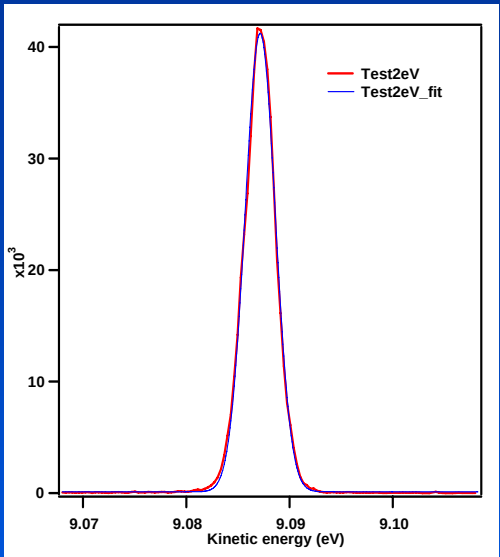
The Spectrometer and the Cryostat



The Spectrometer and the Cryostat

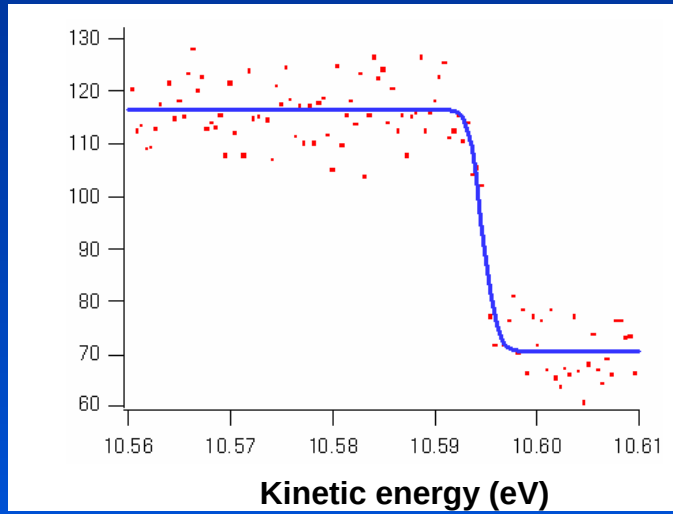


Energy resolution tests

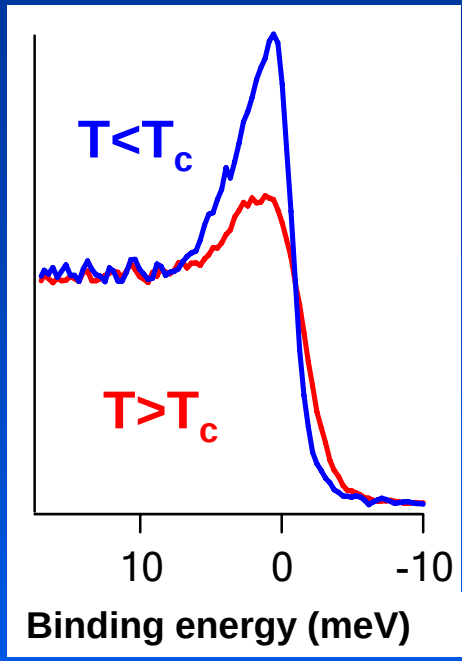


Xe
FWHM = 3.45 meV
Doppler = 3.25 meV
UV lamp = 1.2 meV

R4000 = i*0.316 meV !!!



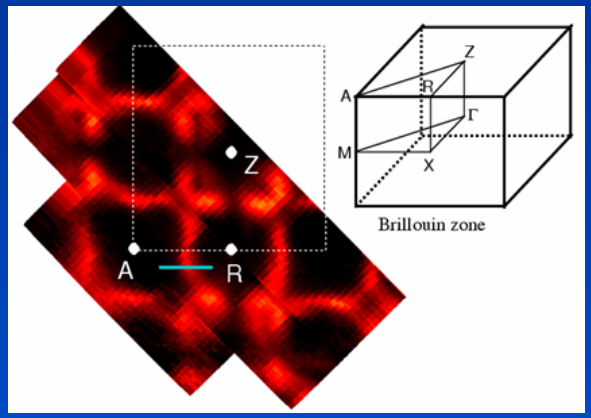
Ag polycrystal
T = 6K
PE = 2 eV / 0.1mm
FWHM = 1.3 meV

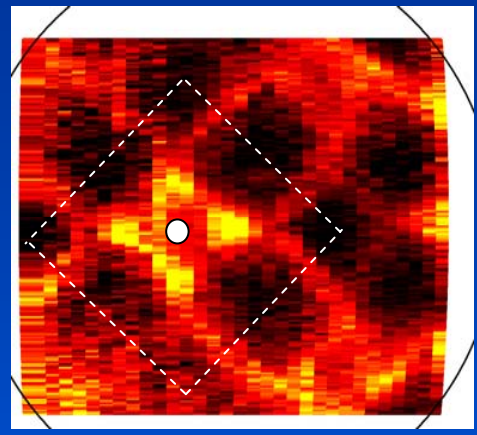


$NbSe_2$ single crystal
Tc=7.2K
Δ = 1 meV

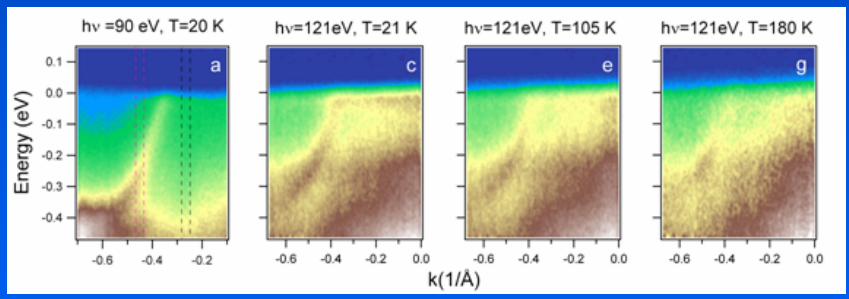
S. Borisenko et al.

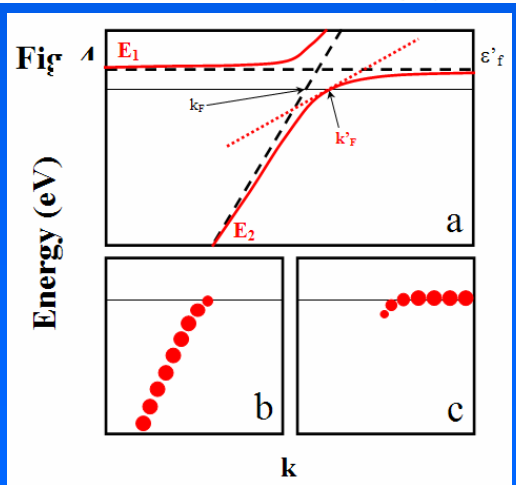
Heavy Fermion Systems $CeTIn_5$, T = Co, Rh, Ir

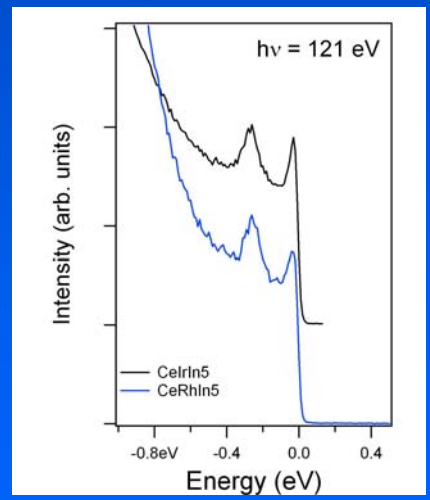




$CeRhIn_5$
$h\nu = 100$ eV

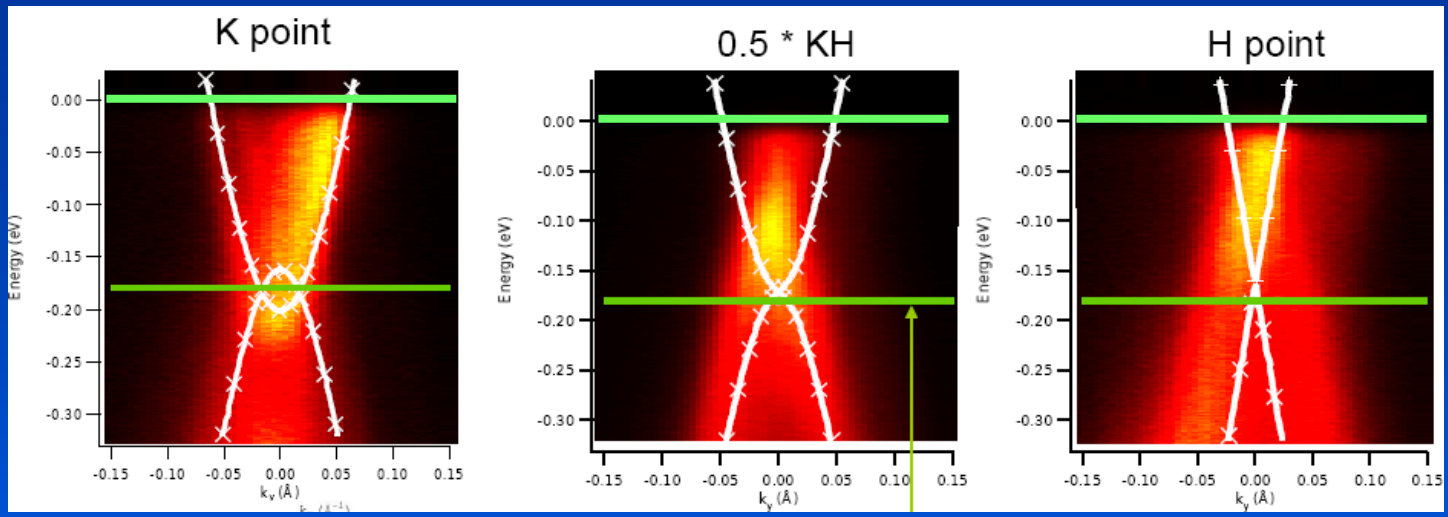


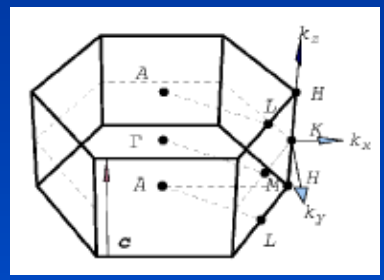


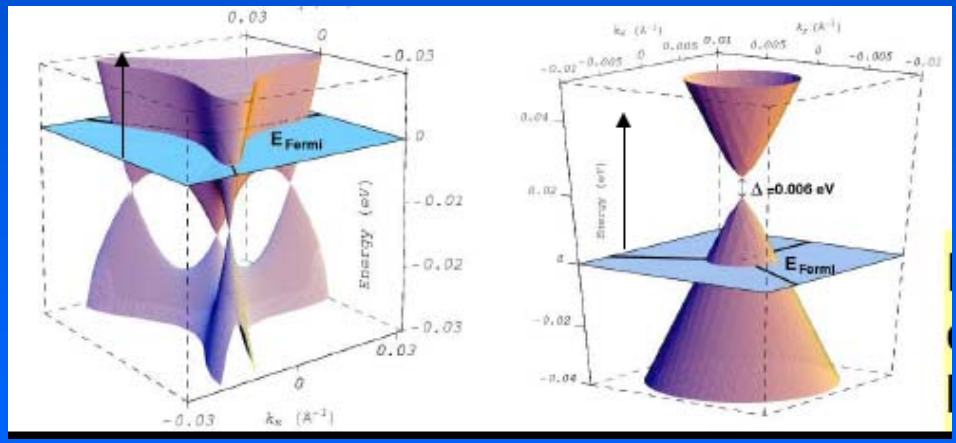


A. Koitzsch et al.

Semimetal to Metal Transition of Graphite Upon n-Doping

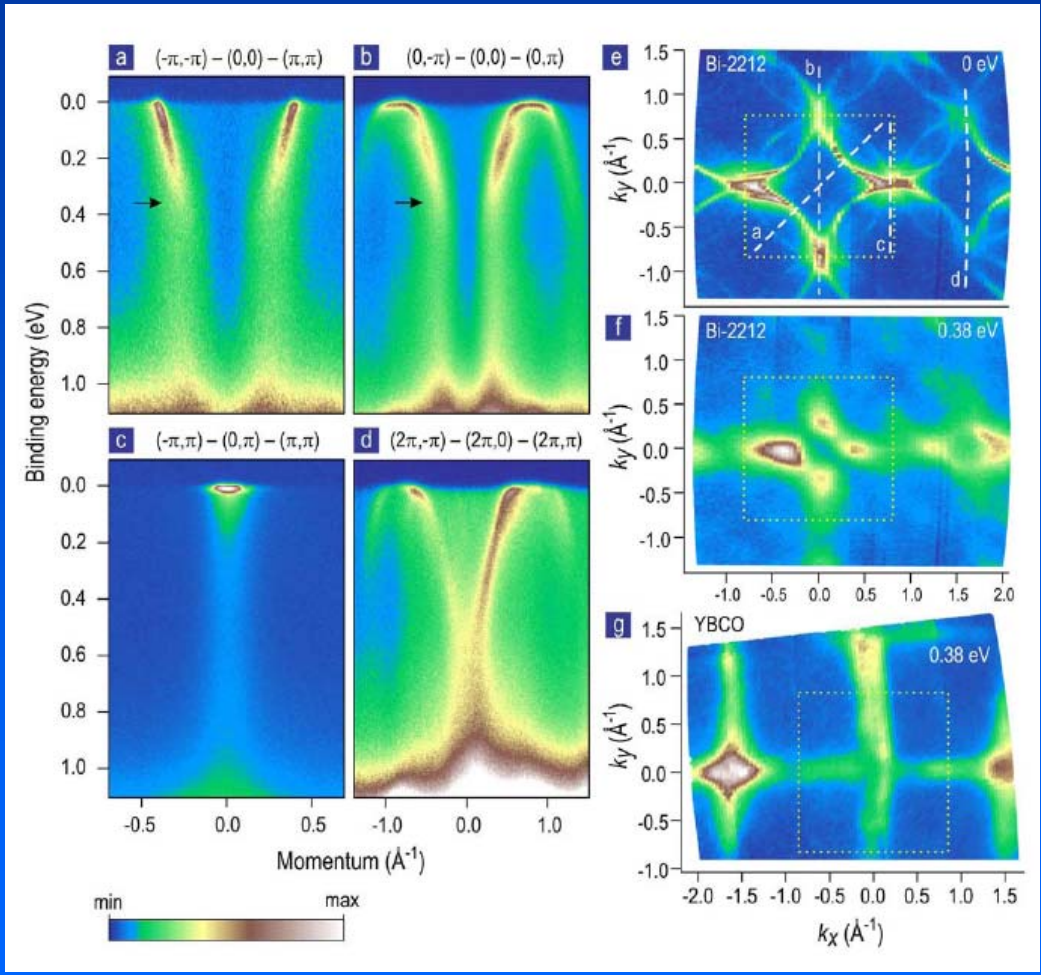






A. Grüneis, Th. Pichler at al.

„Waterfalls“ in High-Tc Superconductors



D.S. Inosov, A.A. Kordyuk et al. cond-mat

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