

TT 8: Topical Talk Wulfhekel (joint session O/TT)

Time: Monday 9:30–10:15

Location: TRE/PHYS

Topical Talk

TT 8.1 Mon 9:30 TRE/PHYS

Vortices, inter-band coupling and inelastic QPI in two band superconductors — •WULF WULFHEKEL — Physikalisches Institut, Karlsruhe Institute of Technology

The majority of superconductors have more than one Fermi surface, on which the electrons pair below the critical temperature, yet their behavior can be well described by a single-band Bardeen-Cooper-Schrieffer theory. This is mostly due to interband scattering, especially in superconductors in the dirty limit, rigidly linking the pairing amplitude of the bands. We here lift this constrain and study the behavior of the ultra-pure two-band superconductor Pb. We show that at low temperatures, it is neither of type I nor type II and superconducting

vortices of arbitrary flux quanta can be formed. We show that on the non-spherical Fermi surfaces, a modified index theory is needed for the description of in gap states in vortices. Further, the two condensates are only weakly coupled and can be individually manipulated. By studying stacking fault tetrahedra, we demonstrate local tuning of interband coupling ranging from weak to strong and the modification of the superconducting order parameters from two well separated gaps to one merged gap around defects. The experiments critically test the theory of multiband superconductors and give a route to access a wide range of predicted quantum effects in these systems. Finally, we demonstrate that quasi particle interference is also possible in the inelastic tunneling channel enabling the imaging of standing phonons with STM.