Orbital selective quasi-particle interference and Cooper pairing in FeSe

Brian M. Andersen
Niels Bohr Institute, University of Copenhagen, Juliane Maries Vej 30, Copenhagen 2100, Denmark

Email: bma@nbi.ku.dk

Iron-based superconductors have been extensively studied both experimentally and theoretically over the last decade, with great progress in our understanding of these materials. Recent focus on FeSe has been centered on the connection between nematicity and superconductivity, and the possibility of enhancing T_c in monolayers on STO, or by pressure. In this talk, I will focus on recent experiments mapping out the detailed spectroscopic features of FeSe by the group of J. C. Seamus Davis at Cornell University.[1,2] I will explain the recent evidence for orbital selective superconducting pairing, and the direct detection of orbital selective quasiparticles by quasi-particle interference. This highlights the correlated nature of FeSe, more specifically its Hund's metal nature with coexisting orbital-dependent coherent and incoherent low-energy states. I then proceed to discuss the theoretical modelling of these phenomena and the implications for our understanding of the origin of superconductivity in FeSe in particular, and in the iron-based superconductors in general. [3]

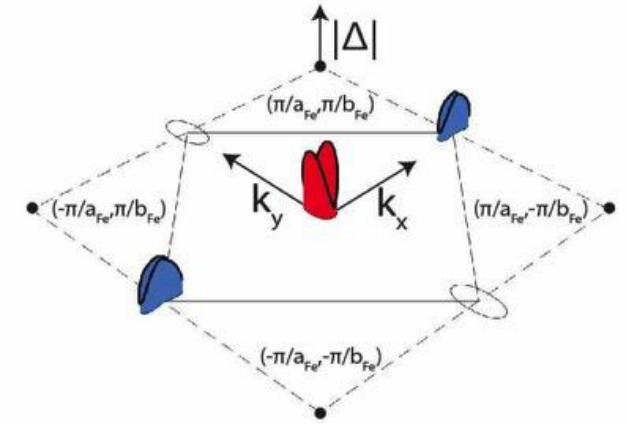

Figure. Superconducting gap structure extracted from quasi-particle interference, and modelled quantitatively by orbital selective spin-fluctuation theory. The red/blue "inverted bishop's hats" illustrate the superconducting gap in momentum space.

References

[1] Sprau, P. O., Kostin, A., Kreisel, A., Böhmer, A. E., Taufour, V., Canfield, P. C., Hirschfeld P. J., Andersen, B. M. & Davis, J. S. Discovery of orbital-selective Cooper pairing in FeSe. 2017 *Science*, ***357*** 75-80.
[2] Kostin, A., Sprau, P. O., Kreisel, A., Böhmer, A. E., Taufour, V., Canfield, P. C., Hirschfeld, P. J., Andersen, B. M., & Davis, J. S. 2018 Preprint.
[3] Kreisel A., Andersen, B. M., Sprau, P. O., Kostin, A., Davis, J. S., Hirschfeld, P. J. Orbital selective pairing and gap structures of iron-based superconductors. 2017 *Phys. Rev. B* **95**, 174504.