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Imaging pnictide superconductors close to magnetic instabilities via scanning tunneling spectroscopy

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Quasiparticle interference and vortex imaging have both been shown to be powerful tools to investigate pnictide superconductors. Here I will review efforts in the 122 based materials and in the recently discovered family of 1144 materials, particularly in pure and Ni-doped CaFe_4As_4 . These materials show the highest T_c among stoichiometric pnictide superconductors (35 K). We show that they are two-gap, sign-changing superconductors [1,2] and are located at optimal doping. Quasiparticle interference shows the opening of a superconducting gap in the hole bands around the zone center. Ni doping reduces T_c and induces a magnetic transition where a unique hedgehog magnetic order has been proposed [3]. I will discuss the impact of Ni doping on the electronic bandstructure. I will also present the most relevant features of a new high magnetic fields laboratory for local imaging techniques that we are now setting up.

[1] K. Cho, A. Fente et al., Phys. Rev. B **95**, 100502(R) 2017.

[2] A. Fente et al., Phys. Rev. B **97**, 134501 (2018).

[3] W.R. Meier et al., npj Quantum Materials **3**, 5 (2018).