Anisotropic Energy Gaps of Iron-based Superconductivity from Intraband Quasiparticle Interference in LiFeAs


Atomic-scale visualization of electron pairing in iron superconductors finds evidences supporting magnetic pairing theory that could lead to new improved superconductors.
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If strong electron-electron interactions between neighboring Fe atoms mediate the Cooper pairing in iron-pnictide superconductors, then specific and distinct anisotropic superconducting energy gaps $\Delta_i(k)$ should appear on the different electronic bands $i$. Here we introduce intra-band Bogoliubov quasiparticle scattering interference (QPI) techniques for determination of $\Delta_i(k)$ in such materials, focusing on LiFeAs. We identify the three hole-like bands assigned previously as $\gamma$, $\alpha_2$, and $\alpha_1$, and we determine the anisotropy, magnitude and relative orientations of their $\Delta_i(k)$. These measurements will advance quantitative theoretical analysis of the mechanism of cooper pairing in iron-based superconductivity.