Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Anisotropic Energy-Gaps of Iron-based Superconductivity from Intra-band Quasiparticle Interference in LiFeAs
ANDREAS W. ROST, University of St Andrews / Cornell University, MILAN P. ALLAN, CMPMS Department, Brookhaven National Laboratory, ANDREW P. MACKENZIE, University of St Andrews, YANG XIE, J.C. DAVIS, Cornell University, K. KIHOU, C.-H. LEE, A. IYO, H. EISAKI, Institute of Advanced Industrial Science and Technology, Tsukuba, T.-M. CHUANG, Institute of Physics, Academica Sinica, Nankang, Taipei — Cooper pairing in the iron-based high-T_C superconductors is thought to occur due to the projection of the antiferromagnetic interactions between neighboring iron atoms onto the complex momentum-space electronic structure. A key consequence is that distinct anisotropic energy gaps $\Delta_i(k)$ with specific relative orientations should occur on the different electronic bands i. However, the high-precision spectroscopy required to demonstrate anisotropy of the energy gaps, and to determine the relationship between the $\Delta_i(k)$ on different bands, has not been achieved. Here we introduce intra-band Bogoliubov quasiparticle scattering interference (QPI) to iron-based superconductor studies, focusing specifically on LiFeAs. This approach provides direct spectroscopic confirmation of multiple anisotropic energy gaps on different bands. We identify the QPI signatures of the three hole-like bands assigned by photoemission studies to be γ, α_2 and α_1. Then, by introducing a new QPI technique, we determine the magnitude and relative orientations of the anisotropic $\Delta_i(k)$. Intra-band Bogoliubov QPI therefore yields the spectroscopic information required to identify the mechanism of superconductivity in iron-based superconductors.

Andreas W. Rost
University of St Andrews / Cornell University

Date submitted: 13 Dec 2011 Electronic form version 1.4