Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Symmetry imposed line nodes in the superconducting gap of KFe_2As_2 HYUNSOO KIM, MAKARIY A. TANATAR, YONG LIU, THOMAS A. LOGRASSO, RUSLAN PROZOROV, Ames Laboratory, Ames, IA, USA, CHENGLIN ZHANG, PENGCHENG DAI, Rice University, Houston, TX, USA — The variation with temperature of the London penetration depth, $\Delta\lambda(T)$, was measured in single crystals of $K_{1-x}Na_xFe_2As_2$ ($x = 0,\ 0.07$) by using a tunnel diode resonator down to 50 mK. Electrical resistivity measurements on the same samples show that isoelectronic Na-substitution significantly increases residual resistivity ρ_0 (from 0.2 to 1 $\mu\Omega$), without changing the shape of $\rho(T)$, and changes T_c from 3.6 K to 2.9 K for $x = 0$ and 0.07 samples. In both pure and doped compounds, the penetration depth follows the power-law function, $\Delta\lambda(T) = AT^n$ below $0.3\,T_c$ with $n \approx 1.5$ and 2.0 for $x = 0$ and 0.07 samples, respectively. This behavior is consistent with presence of line nodes in the superconducting gap with moderate scattering for $x = 0$ evolving into dirty limit for $x = 0.07$. The normalized superfluid density, $\rho_s = \lambda^2(0)/\lambda^2(T)$ was calculated with $\lambda(0) = 200$ nm and 500 nm for $x = 0$ and $x = 0.07$, respectively. Detailed investigation of the calculated ρ_s strongly supports the existence of symmetry imposed line nodes in KFe_2As_2 superconductor and is consistent with thermal conductivity data that concluded $d-$wave pairing in this compound.

Hyunsoo Kim
Ames Laboratory, Ames, IA, USA

Date submitted: 14 Nov 2013 Electronic form version 1.4