Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Nodeless superconductivity in the stoichiometric superconductor LiFeAs HYUNSOO KIM, MAKARIY A. TANATAR, RUSLAN PROZOROV, Ames Laboratory, Ames, IA 50011, USA, YOO JANG SONG, YONG SEUNG KWON, Department of Physics, Sungkyunkwan University, Suwon, Gyeonggi-Do 440-746, Republic of Korea — The in- and out-of-plane London penetration depths were measured in single crystals of the intrinsic LiFeAs superconductor using a tunnel diode resonator (TDR) down to $0.03T_c$. This compound appears to be in the clean limit with a residual resistivity of $\rho_0 \approx 5$ $\mu\Omega$·cm and $RRR = 65$; it can be placed at a slightly overdoped value when compared to the charge-doped pnictides. The low-temperature region of the penetration depth, which is sensitive to the superconducting gap symmetry, is exponentially flat implying a nodeless gap. The superfluid density is well described by the self-consistent two-gap γ-model, where the larger gap is $\Delta_1/T_c \sim 2$ and the smaller gap is $\Delta_2/T_c \sim 1$. Together with the previous data, our results support the $s_\pm$ symmetry that evolves from nodeless to a nodal gap structure upon departure from optimal doping in Fe-based superconductors. We also conclude that pairbreaking scattering plays an important role in the deviations of the low-temperature behavior from exponential in $\lambda(T)$ of Fe-based compounds.

Hyunsoo Kim
Ames Laboratory, Ames, IA 50011, USA

Date submitted: 10 Nov 2010 Electronic form version 1.4