Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Superconductivity and antiferromagnetism in $\mathbf{Fe(Se_{1-x}Te_x)_{0.82}}$
E.K. VEHSTEDT, M.H. FANG, B. QIAN, T.J. LIU, Tulane University, L. SPINU, H.M. PHAM, University of New Orleans, W. BAO, M.R. FITZSIMMONS, M. ZHERNENKOV, Los Alamos, Y. QIU, Q. HUANG, M.A. GREEN, P. ZAJDEL, NIST, J. YANG, Zhejiang University, Y. LIU, Pennsylvania State University, Z.Q. MAO, Tulane University — The search for unconventional superconductors has been reenergized by the discovery of T_c up to 56 K in FeAs type materials [1]. Revelation of the binary superconductor FeSe, $T_c \approx 8$ K [2], prompted our investigation of the phase diagram and the evolution of superconductivity and magnetism in the ternary $Fe(Se_{1-x}Te_x)_{0.82}$ ($0 \leq x \leq 1.0$) system. We discovered a new superconducting phase with $T_{c,max} = 14$ K for $0.3 < x < 1.0$. End member $FeTe_{0.82}$ is non-superconducting and exhibits incommensurate antiferromagnetic (AFM) order. The AFM order contains both linear and spiral components, propagating diagonally in the Fe tetragonal lattice, in contrast with the commensurate AFM order in FeAs-based superconductors. Superconductivity occurs when the long-range AFM order evolves into short-range correlations with the isovalent substitution of Se for Te. These findings strongly suggest that superconductivity in this system is associated with magnetic correlations, and thus may be unconventional in nature.
[1] A. Cho, Science **320**, 870 (2008).
[2] F. C. Hsu *et al.*, Proc. Natl. Acad. Sci. USA. **105**, 14262 (2008).

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Date submitted: 21 Nov 2008 Electronic form version 1.4