Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Phase separation and magnetic order in K-doped iron selenide superconductor XI CHEN, WEI LI, HAO DING, PENG DENG, KAI CHANG, CANLI SONG, Tsinghua University, KE HE, LILI WANG, XUCUN MA, Chinese Academy of Sciences, JIANG-PING HU, Purdue University, QI-KUN XUE, Tsinghua University —
The newly discovered alkali-doped iron selenide superconductors exhibit unique characters that are absent in other iron-based superconductors, such as anti-ferromagnetically ordered insulating phases, extremely high Neel transition temperatures, and the presence of Fe vacancies and ordering. We have grown high-quality $K_xFe_{2-y}Se_2$ thin films on graphene by molecular beam epitaxy and measured their atomic and electronic structures by low-temperature scanning tunneling microscopy. We demonstrate that a typical $K_xFe_{2-y}Se_2$ sample contains two distinct phases: an insulating phase with well-defined $\sqrt{5} \times \sqrt{5}$ order of Fe vacancies, and a superconducting KFe_2Se_2 phase containing no Fe vacancies. An individual Fe vacancy can locally destroy superconductivity in a similar way as a magnetic impurity in conventional superconductors. The measurement of magnetic field dependence of the Fe-vacancy-induced bound states reveals a magnetically-related bipartite order in the tetragonal iron lattice. These findings elucidate the existing controversies on this new superconductor and provide atomistic information on the interplay between magnetism and superconductivity in iron-based superconductors.

Xi Chen
Tsinghua University

Date submitted: 07 Dec 2011 Electronic form version 1.4