La$_{0.5-x}$Na$_{0.5+x}$Fe$_2$As$_2$: electron and hole doping in the spacing layer JIAQIANG YAN, University of Tennessee, S. NANDI, Julich Centre for Neutron Science JCNS, B. SALES, D. MANDRUS, Oak Ridge National Laboratory — The electron-hole asymmetry in the phase diagram of iron-based superconductors is well illustrated in doped BaFe$_2$As$_2$ by comparing hole-doped Ba$_{1-x}$K$_x$Fe$_2$As$_2$ and electron doped BaFe$_{2-x}$Co$_x$As$_2$, mainly due to the availability of high quality single crystals which enable systematic studies using various probes. In Ba$_{1-x}$K$_x$Fe$_2$As$_2$, K-doping takes place at the spacing layer while FeAs layers remain intact. In contrast, Co substitution in BaFe$_{2-x}$Co$_x$As$_2$ disturbs the contiguity of the [FeAs$_4$] tetrahedra and interferes with superconductivity in the FeAs layers. This effect coming from substitution at different crystallographic sites has been suggested to contribute to the electron-hole asymmetry. In this talk, I will present the magnetic and structural transitions of La$_{0.5-x}$Na$_{0.5+x}$Fe$_2$As$_2$. Our results show that La$_{0.5-x}$Na$_{0.5+x}$Fe$_2$As$_2$, or even compounds with other rare earth and alkali ions in the spacing layer, provides a new material platform for the study of iron-based superconductors. The material could be tuned from electron-doped to hole-doped by varying the ratio between the alkali metal and rare earth ions.

Jiaqiang Yan
University of Tennessee

Date submitted: 14 Nov 2014