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$La_{0.5-x}Na_{0.5+x}Fe_2As_2$: 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 $BaFe_2As_2$ by comparing hole-doped $Ba_{1-x}K_xFe_2As_2$ and electron doped $BaFe_{2-x}Co_xAs_2$, mainly due to the availability of high quality single crystals which enable systematic studies using various probes. In $Ba_{1-x}K_xFe_2As_2$, K-doping takes place at the spacing layer while FeAs layers remain intact. In contrast, Co substitution in $BaFe_{2-x}Co_xAs_2$ 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 $La_{0.5-x}Na_{0.5+x}Fe_2As_2$. Our results show that $La_{0.5-x}Na_{0.5+x}Fe_2As_2$, 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.

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