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**Magnetic and Structural Phase Diagram of  $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$**

SEVDA AVCI, DUCK-YOUNG CHUNG, STEPHAN ROSENKRANZ, JOHN-PAUL CASTELLAN, RAY OSBORN, Materials Science Division, Argonne National Laboratory, Illinois, USA, OMAR CHMAISSEM, Northern Illinois University and Argonne National Laboratory, Illinois, USA, MERCOURI KANATZIDIS, Northwestern University, Illinois, USA, EUGENE GOREMYCHKIN, AZIZ DAOUD-ALADINE, ISIS, Rutherford Appleton Laboratory, UK — It is well known that the partial substitution of Ba by K in  $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$  causes a steep suppression of both the antiferromagnetic and tetragonal-orthorhombic transitions, leading to the onset of superconductivity over a large substitution range peaking at 38 K for  $x = 0.4$ . We report high resolution neutron powder diffraction results, which show that the magnetic and structural transitions are coincident over the entire phase diagram, in contrast to  $\text{Ba}(\text{Fe}_{1-x}\text{Co}_x)_2\text{As}_2$ . Volume discontinuities show that the combined transitions are first-order. The superconducting phase diagram has been refined with greater precision and a narrow region of phase coexistence have been delineated.

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