The Vortex Lattice of KFe$_2$As$_2$ CHARLOTTE BOWELL, University of Cambridge, HAZUKI FURUKAWA, Ochanomizu University, EDWARD FORGAN, ALASTAIR CAMERON, RICHARD HESLOP, University of Birmingham, KUNIHIRO KIHOU, C.H. LEE, HIROSHI EISAKI, AIST, Tokyo, TAKU SAITO, HIDETO FUKAZAWA, YOH KOHORI, Chiba University, ROBERT CUBITT, Institut Laue Langevin — Small angle neutron scattering (SANS) studies of the vortex lattice in the FeAs-based superconductors are currently being hindered by the strong vortex pinning that seems almost omnipresent in these materials. An investigation of Ba(Fe$_{0.93}$Co$_{0.07}$)$_2$As$_2$ [1] gave only a ring of diffraction intensity, not well-defined Bragg peaks, showing a disordered vortex structure. It is likely that local inhomogeneities in these doped compounds are responsible for the significant vortex pinning.

KFe$_2$As$_2$ belongs to the 122 class of pnictide superconductors and is intrinsically superconducting (with a $T_c$ of 3.8 K), allowing high quality crystals to be grown that exhibit extremely low vortex lattice pinning. Our SANS measurements of KFe$_2$As$_2$ are the first to observe sharp Bragg peaks from a well-ordered vortex lattice. It is now the underlying physics, not pinning, that controls the vortex structure. We present the vortex lattice structure observed as a function of temperature and field, and discuss what the temperature dependence of the diffracted intensity implies for the superconducting order parameter. [1] M.R. Eskildsen et al. Phys. Rev. B 79, 100501(R) (2009)

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