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Multiple vortex phases in the heavy fermion superconductor $CeCoIn_5$ A. D. BIANCHI, Z. FISK, Dept. Phys. & Astro., UC Irvine, Irvine, CA, USA, M. KENZELMANN, J. MESOT, J. KOHLBRECHER, M. ZOLLIKER, LNS, PSI & ETHZ, Switzerland, L. DEBEER-SCHMITT, M. R. ESKILDSEN, Dept. of Physics, University of Notre Dame, Notre Dame, IN, USA, J. S. WHITE, E. M. FORGAN, School of Phys. and Astro., U. of Birmingham, Birmingham, UK, R. MOVSHOVICH, E. D. BAUER, J. L. SARRAO, MPA-10, LANL, Los Alamos, NM, USA, C. PETROVIC, Cond. Matt. Phys., BNL, Upton, NY 11973, USA —
We report the entire HT-phase diagram of the vortex lattice (VL) in $CeCoIn_5$ for fields applied along the crystallographic c-axis. At the upper critical field H_{c2} of about 5 T and 50 mK, we observe a distorted hexagonal flux lattice, which first gives way to a rhombic lattice at 4.3 T and then to a square lattice at 3.3 T, before entering the previously reported flux lattices at lower fields. The distorted hexagonal phase extends to lower fields and higher temperatures than the H-T-phase space that was previously assigned to a inhomogeneous FFLO state by magnetization and NMR measurements. Surprisingly, we also observed an increase of the flux lattice form factor as a function of increasing field in the rhombic phase, in constrast to the flux lattice in most superconductors. We will discuss the relevance of these results for the presence of the FFLO and magnetic phases.

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