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Texture in the superconducting order parameter of CeCoIn₅

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To uncover the new high superconducting phase which was discovered recently in quasi two dimensional heavy fermion CeCoIn₅ with extremely large Pauli paramagnetic susceptibility, we have performed ultrasound and NMR measurements. Ultrasound velocity measurements of the unconventional superconductor CeCoIn₅ reveal an unusual structural transformation of the flux line lattice (FLL) in the vicinity of the upper critical field. The transition field coincides with that at which heat capacity measurements reveals a second order phase transition. The lowering of the sound velocity at the transition is consistent with the collapse of the FLL tilt modulus and a crossover to quasi two-dimensional FLL pinning. The NMR spectrum exhibits a dramatic change below $T^*(H)$ which well coincides with the position of reported anomalies in specific heat and ultrasound velocity. These results provides a strong evidence that the high field state is the Fulde-Ferrel-Larkin-Ovchinnikov phase, in which the order parameter is spatially modulated and has planar nodes aligned perpendicular to the vortices.

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