

Coexistence of Ferromagnetism and Superconductivity in ErRh_4B_4 Single Crystals

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High resolution measurements of the dynamic magnetic susceptibility by using tunnel-diode resonator are reported for the ferromagnetic, re-entrant superconductor, ErRh_4B_4 . Detailed investigation of a very narrow, ≈ 0.3 K, coexisting temperature interval reveals unusual, temperature-asymmetric on warming and cooling and magnetically anisotropic, behavior. The superconducting phase appears via a series of discontinuous steps upon warming from the ferromagnetic normal phase. To the contrary, the ferromagnetic phase develops via a gradual transition upon cooling from the superconducting phase. None of the existing models of the coexistence of ferromagnetism and superconductivity explain our results. We suggest a new scenario in which the observed jumps are associated with the local magnetic field inhomogeneity and physics similar to supercooling phenomena in type-I superconductors.¹

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