Order-disorder transition and quantum magnetic oscillations in the vortex state of strong type-II superconductors

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Magnetic quantum oscillations, usually exploited for mapping the Fermi surface of metals, appear in the mixed state with reduced intensity as compared to the normal state signal. Understanding of this phenomenon should help to reveal the nature of superconductivity in high magnetic fields, which is yet to be clarified even for conventional superconductors. Here, we present results of μSR, dHvA, and SQUID magnetization measurements on boro-carbide superconductors, which show remarkable correlation between an order-disorder transition of the vortex lattice, observed in the μSR measurements, and enhanced additional damping of dHvA oscillations in the peak-effect region. It is, therefore, concluded that an important mechanism of additional damping of dHvA oscillations in the superconducting state should be associated with enhanced scattering of quasi-particles by the pair-potential in disordered vortex lattices.