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Breakdown of phase-locked states and limit of the upper critical field controlled by interband scattering in two-gap superconductors.
ALEXANDER GUREVICH, National High Magnetic Field Laboratory, Tallahassee, FL 32310, USA — The effect of weak interband scattering on the maximum upper critical field H_{c2} , which can be achieved in a two-band superconductor by increasing intraband impurity scattering is considered. Using the two-gap Usadel equations, we show how weak interband scattering provides the crossover from the orbitally limited to the paramagnetically limited H_{c2} , both in bulk samples and thin films. The results are applied to describe high H_{c2} values in carbon-doped MgB₂ films. It is shown that interband scattering produces mixed gradient terms $\propto \text{Re}(\Pi^* \Psi_\sigma^* \Pi \Psi_\pi)$ in the free energy, where $\Pi = \nabla + 2\pi A/\phi_0$, and $\Psi_\sigma = \Delta_\sigma \exp(i\theta_\sigma)$ and $\Psi_\pi = \Delta_\pi \exp(i\theta_\pi)$ are intraband order parameters. The mixed gradient coupling can provide parametric excitation of the plasmon Leggett mode or large-amplitude interband phase textures by ac currents.

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