Triplet superconductivity near a saturation field

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We investigate triplet superconductivity induced by transverse fluctuations in an Ising ferromagnet under high transverse magnetic fields. We introduce a toy model for ferromagnetic superconductor URhGe [1,2] and examine its triplet superconductivity on the basis of Scharnberg-Klemm theory[3] for the determination of the upper critical field H_{c2} and the transition temperature T_c.

URhGe [2] shows ferromagnetism and superconductivity inside the ferromagnetic state. When applying magnetic fields (// b-axis) perpendicular to the direction of the spontaneous magnetic moments (// c-axis), in addition to the superconductivity surviving below 2 T, another superconductivity appears at higher fields between $\sim$ 9 to 14 T. The high-field superconductivity is considered to be one mediated by spin-flip fluctuations of the ferromagnetic moments, while no theoretical investigations have been done so far.

The purpose of this work is to clarify the nature of the high-field superconductivity in URhGe. On the basis of BCS-type model where interactions between electrons are assumed to be magnon-exchange one constructed via a spin-wave approximation in an XXZ model under transverse fields. Applying the Scharnberg-Klemm theory to the present model, we find that its d vector of the triplet superconductivity varies as the field increases and shows an interesting variation near the saturation field where the localized ferromagnetic moment is fully polarized in the transverse direction. The superconducting "dome" in the temperature and the magnetic field plane shows peculiar shape and the T_c is strongly enhanced near the saturation field, which is qualitatively consistent with the experimental results [1,2]. We discuss the origin of the d vector variations near the saturation field in details.

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