Partial Breakdown of the Field-induced Superconductivity by Dynamical Spin Reversal

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The discovery of field-induced superconductivity (FISC) in λ-$(BETS)_2FeCl_4$ has attracted considerable interests since the application of a sufficiently strong magnetic field usually destroys the superconducting state [1]. The origin of FISC can be explained by the Jaccarino-Peter compensation effect where the internal field, created by the Fe (III) moments, is compensated by the external field. Hence, Zeeman effect, that normally destroys the superconductivity, is suppressed under this condition [2]. To have more detailed microscopic information of the FISC state, we have employed ESR on λ-$(BETS)_2Fe_{0.6}Ga_{0.4}Cl_4$. Simultaneous transport measurement was performed to confirm the FISC state. Surprisingly, electron paramgnetic resonance (EPR) is still observed in the FISC phase. This suggests that the paramagnetic and superconducting domains coexist in the system. Moreover, when the EPR transition occurs, we have observed a change in the resistance, which indicates that the FISC phase is partly destroyed by the change of the spin states. The temperature dependence of simultaneous measurements will be presented, and the ground state as well as the breakdown mechanism will be discussed.

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