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NMR study on the Low field Antiferromagnetic Insulating State of the BETS based Field Induced Organic Superconductor

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The organic compound, λ-(BETS)2FeCl4, which is known as a field induced superconductor [1]. The field induced superconductivity was caused by the so-called "compensation" mechanism as experimentally confirmed by several experimental studies including our 77Se NMR study at high magnetic field [2]. On the other hand, the system exhibits a metal-insulator transition with magnetically ordering at lower field region [3]. The schematic temperature-field phase diagram is shown in the Fig. 1. The antiferromagnetic insulating state has been believed as a cooperation between conduction π spins on organic BETS molecule and localized ds spins on Fe3+ site. On the other hand, an idea which explains the antiferromagnetically ordering (AFO) insulating state has been proposed by the analysis of the specific heat measurement; p spins contribute to the AFO state but the localized d spins remain paramagnetically[4]. To detect p spin dynamics on the organic BETS site, 77Se and 13C NMR measurements at low field region (~<5 T) using a single crystal sample were performed.

Relatively narrower 77Se-NMR spectrum was observed at high temperature metallic state. The spectral width became broader at around 7 K and it broadened out at lower temperatures. This strongly suggests the existence of an antiferromagnetic interaction/fluctuation between conducting π spins.


Fig. 1 Schematic phase diagram