Anomalous magnetic state in UPt_3 at very low temperature

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The unconventional superconductivity in heavy fermion systems is attracting much interest. Among many compounds, UPt_3 presents a reasonably convincing case for such superconductivity. It exhibits three distinct superconducting phases with two phase transitions. Furthermore, it is suggested that an odd-parity superconducting state is realized[1]. In neutron scattering experiments, broad magnetic Bragg peaks have been observed below 5 K, which suggests the occurrence of antiferromagnetic (AF) phase. A certain relation between the multiple superconductivity and AF order has been pointed out, and the AF ordering is presumed to play a crucial role for the multiple superconductivity. However, no significant change has been detected in the other experiments. This fact imply that the AF order may not be static. In recent neutron experiment, the narrowing of the AF Bragg peak below 50 mK was observed[2], from which they suggest that a quasistatic AF long range order is realized below 20 mK. Such an AF state is also suggested by a sudden decrease of magnetization below 20 mK [3].

In our previous ZF-μSR measurement down to 20 mK, we observed no significant change in the muon spin relaxation rate [4]. This fact does not support the presence of static AF order. Recently, we have extended ZF-μSR measurement down to 8 mK to investigate the anomalous magnetic state over the very low temperature region. In our ZF-μSR, there is no significant change in the muon spin relaxation rate down to 8 mK. The result suggests the absence of static or quasistatic magnetic order over the relevant temperature range. Possible magnetic state will be discussed.

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