Magnetic ground state of pyrochlore oxide $Hg_2Os_2O_7$

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Results of ZF-/LF-μSR experiments on pyrochlore oxide $Hg_2Os_2O_7$ are reported. The Os^{5+} cations ($5d^3$) in $Hg_2Os_2O_7$ form a so-called pyrochlore lattice which has been intensively studied as a stage of the geometrical frustration. It is known that this compound exhibits a cusp-like peak of susceptibility at $\sim$88 K [1], which is very similar to the case of $Cd_2Os_2O_7$ [2, 3]. However, while metallic conductivity in $Hg_2Os_2O_7$ remains even at low temperatures down to 4 K, a metal-insulator (MI) transition occurs in the Cd compound below $T_{MI} =$ 225 K, at which the anomalous peak of susceptibility is seen. It has been turned out by μSR technique that the magnetic ground state of $Cd_2Os_2O_7$ is static *spin-density-wave* (SDW) like [4]. Nevertheless, the appearance of the static internal field at $T_m \simeq$150 K is markedly below T_{MI}, and fast spin fluctuation suggesting an existence of the magnetic frustration is seen just above T_m. This motivated us to investigate the magnetic ground state of $Hg_2Os_2O_7$.

Under zero external field, a muon spin precession was observed below 80K, together with a gradual depolarization suggesting a broad distribution of the internal field like a SDW state. By applying longitudinal fields up to 10 mT, the polarization of muon spin was recovered. The results clearly suggest that a static SDW-like internal field appears in $Hg_2Os_2O_7$ coincidentally with the magnetic transition inferred from macroscopic measurements [1], which is in contrast to the case of $Cd_2Os_2O_7$. However, it is noted that an approximately half part of the specimen remains non-magnetic at the lowest temperature of 2 K, which may relate to the metallic conductivity observed at low temperatures.

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