Magnetic ordering in spin-orbit Mott insulator Ba_2IrO_4 probed by μSR

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The magnetic ground state of novel spin-orbit Mott insulator Ba_2IrO_4 has been investigated by muon-spin rotation/relaxation (μSR) technique. The amplitude of the zero-field μSR signal rapidly decays with decreasing temperature from 300 K to 240 K. We found that the signal oscillates due to the muon-spin precession below 240 K. It clearly indicates that there exists a coherent internal magnetic field induced by long-range ordered spins at low temperatures. It means that the magnetic ground state in Ba_2IrO_4 is an antiferromagnetic long-range ordered state.
The internal local field obtained from the precession frequency of the time spectra indicates that the effective magnetic moment of the iridium ions is estimated to be $|\mu| = 0.34(4)\ \mu_B$/Ir-atom. It is surprising that the moment size of the iridium ions is much smaller than the integer moment $1\mu_B$ expected in the case of $J_{\rm eff} = 1/2$. The moment reduction is probably attributed to a low-dimensional quantum spin fluctuation with large intra-plane antiferromagnetic correlation $|J|$.