Muon spin rotation measured internal field in the magnetic ordered state of SrRuO₃

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We report results of investigation of the magnetically ordered state in SrRuO₃ single crystals and some comparable μSR data for the Sr₁₋ₓCaₓRuO₃ and Sr₀.₉(Na₀.₅La₀.₅)₀.₁RuO₃ polycrystalline samples. SrRuO₃ is an itinerant ferromagnet with $T_C \approx 163$ K, which crystallizes in the orthorhombically distorted perovskite structure. The ferromagnetic properties are tied to $d$ electrons in the band formed by overlapping Ru and O orbitals, the itinerant character of magnetism being well founded experimentally. For the SrRuO₃ crystals two branches of the internal field temperature dependence, corresponding to different frequencies of spontaneous precession of muon spins, are present at lower temperatures. Whereas the precession at lower frequency follows to the $T_C$, there is a rapid cut-off in the higher frequency branch observed at 110 K, within magnetically ordered phase. Asymmetry factors did not support spatial separation to magnetically non-equivalent volumes in the crystal. Two different frequencies would usually reflect nonequivalent muon stopping sites with corresponding muons experiencing different local field from neighboring local magnetic moments. We note a partial transfer of the magnetic moment toward the oxygen orbitals was found in [1]. After the neutron diffraction analysis we note the bond lengths did not reveal particular changes at $0 \leq T < T_C$ [2], and an anomalous flattening of the lattice parameters at low temperatures was associated with blocking of the RuO₆ octahedral tilt in magnetically ordered state [3]. There estimated volume magnetostriction seems anomalous at the similar temperature of approximately 110 K [3].

The spectra of polycrystalline samples, for small doping at Sr site, are consistently resolved with two frequency components in comparable range of temperatures.