High pressure μSR study on cobalt oxide spinel

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The magnetic nature of the Co_3O_4 spinel has been studied under pressure up to 13.4 kbar by means of zero field (ZF) and weak transversal field (wTF) μ^+SR using a polycrystalline sample. At ambient pressure, Co_3O_4 enters into an antiferromagnetic (AF) phase below 30 K, as evidenced by two distinct spontaneous muon-spin precessions in its ZF spectrum [1]. Figure 1 shows the temperature dependences of normalized initial wTF asymmetry ($A_{\rm TF}$) for Co_3O_4 under pressures of 1.0, 6.7 and 13.4 kbar. As T decreases from 40 K, $A_{\rm TF}(T)$ curve exhibits step-like decrease down to zero under all applied pressures, indicating that Co_3O_4 undergoes the AF transition with $T_{\rm N}$ of 30 K at 1.0 kbar, 31.5 K at 6.7 kbar and 33 K at 13.4 kbar, respectively. On the other hand, ZF measurements show that the frequency of spontaneous muon-spin precession is almost independent of pressure. Since only the Co^{2+} ions at the tetrahedral site in the Co_3O_4 spinel lattice are magnetic, the increase in $T_{\rm N}$ by pressure indicates that the AF interaction between the Co^{2+} ions at the tetrahedral site is enhanced by pressure through the decrease in the distance between the adjacent Co^{2+} ions.

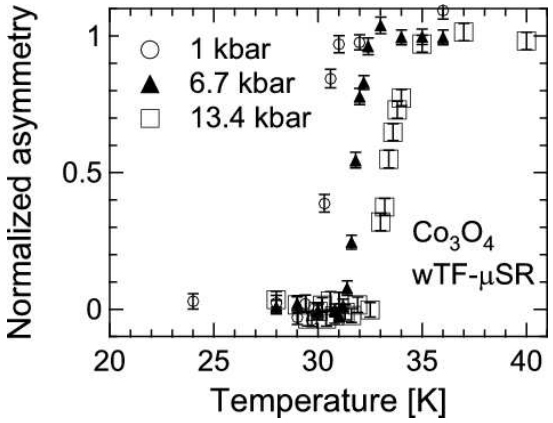

Fig. 1: T dependences of $A_{\rm TF}$ for Co_3O_4 under three different pressures.

[1] Y. Ikedo et al., Phys. Rev. B 75 (2007) 054424.