Spin-lattice coupling in the spinel GeCo2O4

Normal spinels AM_2O_4 crystallize in the cubic space group Fd-3m at room temperature. The magnetic ions *M* form a pyrochlore sublattice, consisting of a network of corner-sharing tetrahedra prone to magnetic frustration. Complex magnetic ground states arise in these spinel compounds from a strong competition between magnetic interactions beyond the third neighbor [1-5]. In this talk, we focus on $GeCo_2O_4$, which orders at T_N = 23 K into a complex antiferromagnetic structure characterized by the propagation vector $\boldsymbol{k}$ = (½ ½ ½) [3-5]. The magnetic ordering is accompanied by a cubic to tetragonal structural transition [3,4], which partly releases the magnetic frustration through magneto-structural effects. Moreover, elastic constant studies using ultrasound velocity measurements reported acoustic anomalies (in particular, in the *C44* elastic constant related to the transverse acoustic phonons) at the magnetic transition, possibly associated to the structural distortion, thus suggesting a coupling between the magnetic excitations and the acoustic phonons [6].

In this context, we have studied in detail the dynamics in $GeCo_2O_4$ and particularly focused on the coupling between spin and lattice degrees of freedom in the dynamical regime. We have performed inelastic neutron scattering on IN5 [10], which shows an interesting excitation spectrum around the Brillouin zone center, with acoustic phonons crossing gapped spin waves. Such crossing may hide the presence of hybrid excitations as previously evidenced in the hexagonal multiferroic $YMnO_3$ [7-9]. We have tested this hypothesis and used longitudinal polarization analysis on THALES and IN20 in order to separate the nuclear and magnetic contributions to the inelastic neutron scattering cross section in $GeCo_2O_4$. The presence of a novel mode was evidenced in the nuclear scattering. It follows the dispersion of a magnon and disappears above T_N, suggesting a spin-lattice hybrid excitation. However, the intrinsic nature of this mode remains unclear and will be discussed in this talk.

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