Short-range magnetic correlations in $Ba_3Yb(BO_3)_3$

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Quantum triangular-lattice antiferromagnets (QTLAFs) have attracted continuous interests of condensed matter researchers due to their intriguing low-temperature state originating from the combination of quantum fluctuations, low dimensionality, and geometrical frustrations. The title compound, $Ba_3Yb(BO_3)_3$, is one of such QTLAF candidates, and has been intensively studied recently [1]. It has almost ideal (though not perfect) triangular lattice structure. The bulk magnetic susceptibility, muSR, and specific-heat measurements all indicates absence of magnetic long-range order down to a few tenth of mili-Kelvin range, indicating possible quantum disordered state in this compound. To clarify the magnetic correlations in such disordered state, we have performed several neutron scattering experiments using 4G-GPTAS and C11-HER. Here, we will report the representative results obtained using 4G-GPTAS.

The single crystals of Ba3Yb(BO3)3 were obtained using the flux method. To reduce the high absorption of B, we used the isotope ^{11}B enriched starting material. The thin plate-like crystals were co-aligned on the Cu plates fixed using CYTOP. The sample assembly was then set to the cold tip of the dilution refrigerator, of which the base temperature was approximately 50 mK.

The elastic diffuse scattering was measured using 4G-GPTAS in the triple-axis mode with the collimations 40-80-80-80. Neutrons with energy of 14.7 meV were selected using pyrolytic graphite 002 reflections as monochromator and analyzer.

Figure 1 shows the neutron scattering intensity map obtained at the base temperature 50 mK. Due to the limited experimental time, only Q_K < 0.5 region could be measured, nonetheless, the map covers a few Brillouin zones, which may be sufficient for this initial scrutiny of magnetic correlation. It is noted that there is a ring of intensity appearing at Q ~ 2.5 Å^{-1}, which may be due to the powder impurity. Besides the ring feature, there is no sharp peaks in the map, clearly confirming the absence of the magnetic long-range order at the base temperature 50 mK. On the other hand, possible diffuse scattering appears at low Q regions below 1.0 Å^{-1}, which may have weak Q-directional dependence. Present statistics, however, is apparently not sufficient to conclude the existence of magnetic correlations, and hence, we are planning to run the similar experiment with larger sample together with focusing technique in future.

[1] R. Bag *et al.,* Phys. Rev. B **104**, L220403 (2021); C. Y. Jiang *et al.*, Phys. Rev. B **106**, 014409 (2022).

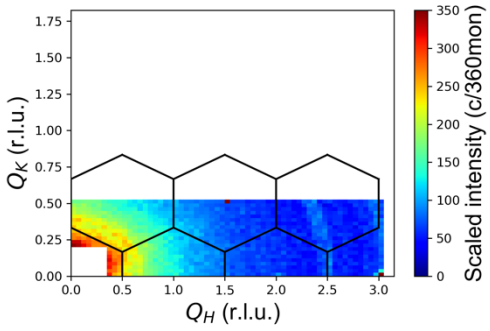

Fig. 1 Neutron scattering intensity map obtained at T ~ 0.05 K using 4G-GPTAS. The block lines indicate Brillouin zones in this hexagonal compound.