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Inelastic neutron scattering of the frustrated quantum spin ladder BiCu2PO6

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Quantum spin ladders provide an exciting opportunity to study aspects of quantum critical phenomena and low-dimensional physics, serving as a bridge between 1 and 2 dimensional quantum systems [1]. BiCu2PO6 (BCPO) is a new spin 1 two-leg ladder system, with an energy scale of 2 exchange interactions in the range between the values found in cuprate ladders (˜100meV) and the metal-organic ladders (˜1meV). Quantum fluctuations prevent long-range order in the system, resulting in a disordered groundstate with gapped triplet excitations. Next-nearest-neighbour ex- change along the ladder direction introduces frustration in the system, which enhances quantum fluctuations and is thought to have a significant e□ect on magnon dispersion[2].
Inelastic Neutron Scattering (INS) experiments were conducted on BCPO, resulting in the ob- servation of magnon excitation branches incommensurate with the crystal lattice with a spin gap of Delta ˜ 1.8meV. Results from INS studies on the thermal Triple Axis Spectrometer (TAS) IN22 (ILL, Grenoble) suggest magnetic excitations extending up to 40meV, with dominant dispersion along the b and c axes; respectively the ladder leg and rung directions. High resolution studies on the cold neutron TAS instruments TASP (SINQ, PSI) and IN14 (ILL, Grenoble) near the gap minimum reveal multiple exciations with a strongly Q-dependent structure factor, which exhibit Zeeman splitting under applied field.
The collected results and preliminary analysis of the excitations across a range of reciprocal lattice vectors and applied field values will be presented and discussed.

[1] E. Dagotto and T. M. Rice, Science 271, 618 (1996).
[2] O. Mentre et al. Phys. Rev. B 80, 180413(R) (2009).

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