Low temperature Raman study of the spin ladder compound $BiCu_2PO_6$

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Recently, quantum antiferromagnets with an intrinsically disordered ("spin liquid") ground state have attracted great interest [1]. $BiCu_2PO_6$ shows such a structure where the Cu spins form two-leg zigzag ladders providing a valuable model of quantum magnets. From a recent study details on the growth of undoped and Zn-doped single crystals, the structure, and the magnetic properties were published $Bi(Cu_{1-x}Zn_x)_2PO_6$ [2]. It was shown that the magnetic susceptibility χ(T) passes through a broad maximum around 60K confirming the formation of a spin singlet ground state.
In this study, we investigate the low temperature micro-Raman spectra of the $BiCu_2PO_6$ single crystals. A detailed assignment of the observed bands is suggested based on the selection rules, the spectral evolution with temperature, and lattice dynamic calculations. Phonon modifications at low temperatures indicate a coupling of the lattice with the antiferromagnetic state. The Raman results are compared with the findings from other experimental methods and theoretical calculations.

[1]E. Dagotto and T.M. Rice, Science 271, 618 (1996)
[2]S. Wang et al, Journal of Crystal Growth, 313, 51-55 (2010), F. Casola et al, Phys. Rev. Lett. 105, 067203 (2010)