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Unambiguous phonon mode assignment in multiferroic $BiFeO_3$ single crystals CHRISTIANNE BEEKMAN, University of Toronto, SANG-WOOK CHEONG, Rutgers University, KENNETH BURCH, University of Toronto — In Bismuth ferrite ($BiFeO_3$) antiferromagnetic and ferroelectric order parameters coexist at room temperature, making this material an excellent candidate for new functionalities, such as electrical control of magnetism. Despite extensive reports on Raman scattering experiments on single crystals and thin films, controversy still remains in the observation and assignment of the phonon mode symmetries. We present polarized micro-Raman spectroscopy of single crystals ($(1\ 0\ 0)_{cubic}$ surface) with uniform ferroelectric polarization. Careful examination of the Raman spectra upon crystal rotation enables us to unambiguously assign the (A_1, E_x and E_y) modes. We will show that ambiguity is easily introduced by slight misalignment of the crystal and that the crystal rotation is necessary to reach unambiguous mode assignment. Our method not only results in proper Raman mode assignment, which is necessary to describe the phonons critical for the multiferroic behavior, it also allows study of symmetry breaking and may provide a way to non-invasively check the ferroelectric polarization direction.

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