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Direct measurement of the spin gap in a quasi-one-dimensional clinopyroxene: $NaTiSi_2O_6$ HARLYN SILVERSTEIN, University of Manitoba, HAIDONG ZHOU, University of Tennessee-Knoxville, JOHAN VAN LIEROP, University of Manitoba, CHRISTOPHER WIEBE, University of Winnipeg — True inorganic Spin-Peierls materials are rare, but $NaTiSi_2O_6$ was at one time considered an ideal candidate due to it having well separated chains of edge-sharing TiO_6 octahedra. At low temperatures, this material undergoes a phase transition from $C2/c$ to $P\bar{1}$ symmetry, where trivalent Ti-Ti dimers begin to form within the chains. However, it was quickly realized with magnetic susceptibility that simple spin fluctuations do not progress to the point of enabling such a transition. Since then, considerable experimental and theoretical endeavours have been taken to find the true ground state of this system and explain how it manifests. Here, we employ the use of x-ray diffraction, neutron spectroscopy, and magnetic susceptibility to directly and simultaneously measure the symmetry loss, spin singlet-triple gap, and phonon modes. A gap of 53(3) meV was observed, fit to the magnetic susceptibility, and compared to previous theoretical models to unambiguously assign $NaTiSi_2O_6$ as having an orbital-assisted Spin-Peierls ground state.

Harlyn Silverstein
University of Manitoba

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