Manley et al. (1) report neutron time-of-flight scattering measurements of the low-frequency lattice dynamics in the relaxor ferroelectric \( \text{Pb}[(\text{Mg}_{1/3}\text{Nb}_{2/3})_{1-x}\text{Ti}_x]\text{O}_3 \) with \( x = 0.30 \) using neutron scattering methods. Manley et al. argue that this splitting occurs because these phonons hybridize with local, harmonic lattice vibrations associated with polar nanoregions. We show that splitting is absent when the measurement is made using a different neutron wavelength, and we suggest an alternative interpretation.

Manley et al. (1) report neutron time-of-flight scattering measurements of the low-frequency lattice dynamics in the relaxor ferroelectric \( \text{Pb}[(\text{Mg}_{1/3}\text{Nb}_{2/3})_{1-x}\text{Ti}_x]\text{O}_3 \) with \( x = 0.30 \) above the Curie temperature \( T_C \) (\( \sim 405 \) K), their data are consistent with a single transverse acoustic (TA) phonon branch measured at wave vectors \( Q = (2 + H, H - 2, 0) \) for 0.0 rlu (reciprocal lattice units) \(< H < 0.4 \) rlu. Below \( T_C \), they observed a narrow dip in intensity located near the peak of the TA phonon line shape for \( H = 0.25 \) rlu. This was interpreted as evidence that the TA phonon branch had split into two branches that exhibit anticrossing behavior.

We measured the neutron inelastic scattering from a 10-cm\(^3\) single crystal of PMN-xPT with nominally identical composition (\( x = 0.29 \)) below \( T_C \) for \( H = 0.25 \) rlu, i.e., at a constant wave vector \( Q = (2.25, -1.75, 0) \). These data were obtained using the National Institute of Standards and Technology (NIST) BT7 triple-axis spectrometer, which selects the incident and final neutron energies via Bragg diffraction rather than time of flight, but instead of collecting data with a fixed incident neutron energy of \( E_i = 25 \) meV as performed in (1), we used a commonly used fixed final neutron energy \( E_f = 14.7 \) meV. Our data, as shown in Fig. 1 (top), show no evidence of this splitting. A least-squares fit to a single damped harmonic oscillator describes the TA phonon extremely well.

This result raises the question of why the TA phonon splitting is not observed above \( T_C \). The following three questions remain: (i) Why does this feature vanish above \( T_C \)? (ii) Why is it observed in the (110) Brillouin zone? (iii) Why is it affected by an external electric field? The answers are (i) primary extinction (4), (ii) ghostons exist in all zones (2), and (iii) electric fields strongly affect PMN-xPT Bragg intensities (5).

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of observing ghostons because the strict constraint imposed by energy conservation is much easier to satisfy (6).

We have shown that the purported TA phonon splitting depends on the choice of neutron energy. We can account for this anomaly quantitatively using an inelastic double-scattering model. Thus, we believe that the TA phonon splitting reported by Manley et al. (1) is spurious.

MATERIALS AND METHODS

We studied an 80-g single crystal of PMN-\(x\)PT with nominal Ti content \(x = 0.29\). The crystal was cut with \(\{100\}\) faces and dimensions of 17.8 mm by 23 mm by 24.3 mm. The crystal was loaded into an aluminum sample can in the (HK0) scattering plane with \(\{100\}\) parallel to the 17.8-mm dimension and mounted inside a closed-cycle \(^4\)He refrigerator. Data on the NIST BT7 triple-axis spectrometer were measured at constant wave vector \(Q\) by varying the incident neutron energy while holding the final neutron energy \(E_f\) fixed at 14.7 meV. Horizontal beam collimations of 120"–80"–80"–120" were used. A neutron velocity selector located before the monochromator eliminated higher-order neutrons from the incident beam; a highly oriented pyrolytic graphite filter was placed in the scattered beam. Similar measurements were carried out on the NIST BT4 triple-axis spectrometer using a fixed final neutron energy of 13.7 meV and no velocity selector. We calibrated the BT7 wavelengths and scattering angles using an alumina standard and aligned the analyzers using vanadium, which is an incoherent scatterer.

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Acknowledgments: P.M.G. acknowledges useful communications with Michael E. Manley.

Funding: The authors acknowledge that they received no funding in support of this work.
Author contributions: P.M.G. conceived experiments. P.M.G., C.S., and G.X. performed neutron scattering measurements on BT4. P.M.G., Z.X., and D.P. performed those on BT7. P.M.G. analyzed all scattering data. P.M.G., L.H., and C.A.G. performed ghoston model calculations. X.L. and H.L. grew the single crystals. P.M.G. wrote the manuscript with input from all authors.

Competing interests: The authors declare that they have no competing interests. Data and materials availability: All data needed to evaluate the conclusions in the paper are present in the paper. Additional data related to this Technical Comment may be requested from the corresponding author.

Citation: P. M. Gehring, Z. Xu, C. Stock, G. Xu, D. Parshall, L. Harriger, C. A. Gehring, X. Li, H. Luo, Comment on “Giant electromechanical coupling of relaxor ferroelectrics controlled by polar nanoregion vibrations”. Sci. Adv. 5, eaar5066 (2019).