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**The impact of inversion and mirror reflection symmetry on Raman scattering of $T'$transition metal dichalcogenides**[1] JUN YAN, SHAO-YU CHEN, UMass Amherst, Department of Physics, CARL NAYLOR, UPenn, Department of Physics Astronomy, THOMAS GOLDSTEIN, UMass Amherst, Department of Physics, CHARLIE JOHNSON, UPenn, Department of Physics Astronomy, DHANDAPANI VENKATARAMAN, UMass Amherst, Department of Chemistry, ASHWIN RAMASUBRAMANIAM, UMass Amherst, Department of Mechanical Industrial Engineering — Distorted octahedral ($T'$) transition metal dichalcogenides (TMDCs) are topologically interesting material systems. Inversion-symmetry-broken bulk $T'$-TMDCs are predicted to be type II Weyl semimetals and inversion-symmetric monolayer (1L) $T'$-TMDCs are shown to be 2D topological insulators. In this talk, I will show that both the inversion symmetry and the mirror symmetry are important for understanding the lattice dynamics and Raman scattering of $T'$-TMDCs. The mirror plane that is perpendicular to the zigzag transition metal atomic chain classifies lattice vibrations into z-modes and m-modes where '$z$' stands for zigzag and '$m$' stands for mirror. Raman active $z$- and $m$- modes can be experimentally determined with light-polarization and crystal angle-resolved Raman tensor analysis. We report observation of all 9 even-parity zone-center phonons in 1L-$T'$-$MoTe_2$. In bulk $T'$-$MoTe_2$, we monitor inversion symmetry breaking with the shear lattice vibrations, which is important for supporting Weyl fermions.

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