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Structural role of the pressure-dependent charge-density-wave to superconductor transition in $ZrTe_3$: an inelastic light scattering study[1]

YEWON GIM, SAM GLEASON, TAYLOR BYRUM, ASTHA SETHI, Department of Physics and Frederick Seitz Materials Research Laboratory, University of Illinois, Urbana, Illinois 61801, USA, C. PETROVIC, Condensed Matter Physics and Materials Science Department, Brookhaven National Laboratory, Upton, New York 11973, USA, S.L. COOPER, Department of Physics and Frederick Seitz Materials Research Laboratory, University of Illinois, Urbana, Illinois 61801, USA — One of the most exciting areas of condensed matter research involves the study of how superconductivity evolves from magnetic- or charge-ordered phases in strongly correlated systems. We present a Raman scattering study of the temperature- and pressure-induced structural changes leading to the transition between charge-density wave (CDW) and superconducting phase regimes in $ZrTe_3$. We show that the internal deformation modes associated with the Te-Te chains–which support the CDW in this material–exhibit anomalous linewidth changes as a function of temperature, indicating strong electron-phonon coupling associated with these modes. Additionally, the pressure-dependence of these modes suggests that dissociation of the Te-Te chain bonds may be responsible for the suppression of the CDW phase as a function of pressure. These studies provide insight into the structural changes responsible for CDW collapse in this material.

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