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Ion Acoustic Modes in Warm Dense Matter NICHOLAS HARTLEY, Osaka University, GUILIO MONACO, University of Trento, THOMAS WHITE, Imperial College London, GIANLUCA GREGORI, University of Oxford, PETER GRAHAM, AWE, PLC, LUKE FLETCHER, SLAC National Accelerator Laboratory, KAREN APPEL, THOMAS TSCHENTSCHER, European XFEL, HAE JA LEE, BOB NAGLER, ERIC GALTIER, EDUARDO GRANADOS, PHILIP HEIMANN, ULF ZASTRAU, SLAC National Accelerator Laboratory, TILO DOEPPNER, Lawrence Berkeley National Laboratory, DIRK GERICKE, University of Warwick, SEBASTIEN LEPAPE, TAMMY MA, ART PAK, Lawrence Livermore National Laboratory, ANDREAS SCHROPP, SIEGFRIED GLENZER, JERRY HASTINGS, SLAC National Accelerator Laboratory — We present results that, for the first time, show scattering from ion acoustic modes in warm dense matter, representing an unprecedented level of energy resolution in the study of dense plasmas. The experiment was carried out at the LCLS facility in California on an aluminum sample at 7 g/cc and 5 eV. Using an X-ray probe at 8 keV, shifted peaks at $\pm$150 meV were observed. Although the energy shifts from interactions with the acoustic waves agree with predicted values from DFT-MD models, a central (elastic) peak was also observed, which did not appear in modelled spectra and may be due to the finite timescale of the simulation. Data fitting with a hydrodynamic form has proved able to match the observed spectrum, and provide measurements of some thermodynamic properties of the system, which mostly agree with predicted values. Suggest for further experiments to determine the cause of the disparity are also given.

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