Abstract Submitted
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Debye-Waller Temperature Measurement of Shock Compressed Solids[1] ANDREW HIGGINBOTHAM, ASHLEY POOLE, University of York, ANDREW COMLEY, EMMA FLOYD, JOHN FOSTER, AWE PLC, CAROLINE LUMSDON, University of York, DAVID MCGONEGLE, University of Oxford, ANTHONY MEADOWCROFT, STEVE ROTHMAN, AWE PLC, JUSTIN WARK, University of Oxford — The accurate measurement of temperature during laser compression of solids remains a significant barrier to full determination of material response during high strain-rate deformation. Given the importance of such experiments in fields as diverse as physics, inertial confinement fusion efforts, and the search for new metastable materials, a solution to this elusive element of equation of state is increasingly pressing. This is compounded by the ever-increasing body of work which makes use of off-Hugoniot compression to reach novel states as the Rankine-Hugoniot relations can no longer be relied upon to constrain P-T conditions. We present work conducted on the UKs Orion laser aimed at investigating the potential for utilising the Debye-Waller effect present in x-ray diffraction signals to infer temperature. This approach has the advantage that it is fully complementary to existing structural diagnostics, simply making use of hitherto (often) neglected intensity information within the pattern. We will show experimental results and supporting molecular dynamics simulations and discuss the potential for this technique to be employed more widely in laser plasma and free electron laser environments.

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