



Warm Dense Matter (WMD) is matter at the transition from solid to plasma. The experiment reveals a transitional state in which electrons carry off energy while the nuclei remain undisturbed. Understanding WDM will aid in the understanding of astrophysics. Introduction Methods:

- What are the states of Warm Dense Matter?
- It is now known to be a quasi stable solid.
- of the stable state.

WDM has the density of a solid, but the energy of a plasma.



Characterizing Warm Dense Matter Ernest Irish, STAR program,

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Until recently WMD was thought to be rapidly expanding liquid.

- This experiment seeks to find the dielectric function from the duration



Results: - Data was collected from 3 targets: Cu, Al, and Au. - Change in phase is interpreted as motion of the lattice (nuclei). - Change in reflectivity is interpreted as motion of the electrons.

> • Experimental setup: Y Ping, et al., Warm dense matter created by isochoric laser heating, High Energy Density Phys. (2010), doi: 10.1016/j.hedp.2009.12.009 This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory. LLNL-POST-447-891

A pump laser pulse was fired into a piece of thin foil. Lower powered laser pulses were shined onto the area in and around the first laser strike, one pulse before and one pulse after. The frequency differences in the beams formed interference patterns that yield information on the energy of the electrons. In this experiment a rear laser was added to track the disturbance through the metal over time.



Experimental Setup.

Discussion:

In order to show the duration of the quasi steady state many shots of each energy would have to be taken. The series of shots has not yet been completed. It is anticipated that materials that hold the quasi steady sate longer will have higher dielectric functions.



Nuclear motion causes increased phase change.





Current

shot



Hole from previous shot

Au Foil Target



• Foil target photo, interferograms, phase change, and reflectivity charts: Y. Ping et al, unpublished