Crystal Structure Characterization Using High Pressure - Temperature Optical Properties\footnote{Work performed under the auspices of the U.S. DOE at the University of California/Lawrence Livermore National Laboratory under contract W-7405-ENG-48.} JEFFREY H. NGUYEN, J. REED PATTERSON, LORIN X. BENEDICT, JOHN E. KLEPEIS, NEIL C. HOLMES, Lawrence Livermore National Laboratory, H-DIV, PHYSICS & ADVANCED TECHNOLOGIES TEAM — Recent developments in tailored dynamic compression techniques have given us the ability to explore the dynamic phase space along prescribed thermodynamic paths. However, our ability to characterize the crystal structure under ultrafast (sub-ns) and extreme pressure-temperature conditions is lacking. Here, we will report a novel idea of using optical properties to characterize phase transitions and crystal structures under such conditions. Preliminary measurements on three phase transitions will be reported: Fe ($\alpha \rightarrow \varepsilon$), Sn and Bi (solid $\rightarrow$ liquid). Changes in complex optical constants across these phase transitions have been observed. We will discuss the implications of these observations in emissivities, temperature measurements and on phase diagrams such as iron. We will also discuss the possibility of using this technique to explore the differences between the dynamic and static phase diagrams.

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