## **Crystal Structure Characterization Using Optical Properties**

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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 ultra-fast (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. We have measured optical properties of various metals (Fe, Sn, Bi, and Al) at high pressures and temperatures. Preliminary analysis of these results will be reported. In particular, we will focus on changes in optical properties across phase boundaries: Fe ( $\alpha \rightarrow \epsilon$ ), Sn and Bi (solid  $\rightarrow$  liquid). Implications of these measurements on emissivities, temperature measurements and on phase diagrams will be explored. 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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