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Using Lasers to Achieve Extreme Material States on Ultra-fast Timescales JAMES HAWRELIAK, Washington State University — The vast majority of observable matter in our galaxy is much hotter and denser than the solids, liquids and gases we have on earth. Studying these extreme material states is complex and exciting. Exciting, because it tests the limits of scientific understanding of the phenomena by which atoms, ions and electrons interact and organize over a range of extreme conditions. Complex, because the study of materials in these conditions is multi-disciplinary. Dynamic compression provides a form of inertial confinement, where the pressure is applied as an impulse and the state is maintained while the pressure traverse the sample. Through dynamic compression some of the most extreme states of matter can be achieved. Recent experimental developments have coupled x-ray probes to shock wave pumps have started to build the bridge between the continuum level response of a material and the atomic phenomena that cause it. This talk will cover experiments where in situ probing with x-rays has looked at shock induced phase transitions in iron and defect formation in copper as well as material studies in the extreme states relevant to the cores of gas giants.

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