Tailored Dynamic Thermodynamic Paths: Implications for Phase Transitions and Planetary Isentropes

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We will report a series of new dynamic compression experiments that can be tailored to reach previously inaccessible dynamic thermodynamic states beyond the principal Hugoniot and isentrope. In particular, we will discuss our progress on dynamic compression using prescribed impedance profile impactors in gas gun experiments. These impactors have been used in experiments demonstrating complex loading paths that include combination of shocks, quasi-isentropic compressions, controlled releases. The quasi-isentropic compression experiments last microseconds, and are capable of bridging the timescales of static experiments and current dynamic compression experiments. Using these techniques, we have carried out off-Hugoniot experiments on Al, Cu, and Ta. We also studied phase transitions in molten bismuth and water. We will also discuss the application of these techniques to study the timescale of phase transition and implications for experiments along the planetary isentropes.

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