Characterizing solid density plasmas relevant to white dwarf envelope using XRTS at EuXFEL

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White dwarfs, the final evolutionary stage for most main sequence stars, are integral to astrophysics as both "standard candles" for measuring cosmological distances and "cosmochronometers" for dating stellar populations. Hot DQ white dwarfs, characterized by carbon-rich envelopes, contrast with those having hydrogen or helium compositions. Modeling of such celestial objects provides stringent tests of white dwarf models and a detailed picture of the outcome of the late stages of stellar evolution. However, the high-energy-density states that exist in white dwarfs are extremely difficult to characterize in the laboratory, so theoretical predictions are largely untested. Here we report the latest experiment conducted at the European X-Ray Free-Electron Laser (EuXFEL), which utilized a drive laser with an intensity of 10^{16} to 10^{17} W/cm^2 to isochorically heat Polypropylene (PP) targets into the warm dense matter (WDM) region, simulating the peculiar environment of white dwarf envelopes. By employing X-ray Thomson scattering (XRTS), we probed the resultant plasmas, enabling a comprehensive examination of ionization, electron density and temperature while simultaneously testing the degree of equilibration achieved within the plasma during the short timescales.