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Multiple shock reverberation compression of dense Ne up to the warm dense regime: Evaluating the theoretical models QI-FENG CHEN, National Key Laboratory of Shock Wave and Detonation Physics, Institute of Fluid Physics, CAEP, JUN TANG, Institute of Fluid Physics, CAEP, YUN-JUN GU, JUN ZHENG, CHENG-JUN LI, YU-FENG WANG, ZHI-GUO LI, National Key Laboratory of Shock Wave and Detonation Physics, Institute of Fluid Physics, CAEP — Knowledge of thermodynamic properties of materials in warm dense matter (WDM) regime is especially important for understanding many high-energy density physics processes and phenomena, such as the interior structure of the earth, inertial confinement fusion, and the formation and evolution of gaseous giants. Neon is the primary constituent of planetary and stellar atmospheres. Its thermodynamic properties in WDM region are vital to construct the inner structure of these astrophysics objects and understand their formation and evolution. In this work, multiple shock reverberation compression experiments are designed and performed to determine the equation of state of neon ranging from the initial dense gas up to the warm dense regime where the pressure is up to 120 GPa and the temperature is up to above 20000 K. The wide region experimental data are used to evaluate the available theoretical models. It is found that, for neon below 1.1g/cm^3, within the framework of density functional theory molecular dynamics, a van der Waals correction is meaningful. Under high pressure and temperature, results from the self-consistent fluid variational theory model are sensitive to the potential parameter. The new observations on neon under megabar pressure and 10^4 K temperature enrich the understanding on properties of warm dense matter and have potential applications in revealing the formation and evolution of gaseous giants or mega-Earths.

Qi-Feng Chen
Institute of Fluid Physics, CAEP

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