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Frontier WDM experimental research on advanced light sources PATRICK RENAUDIN, CEA-DAM-DIF, F-91297 Arpajon, France, PATRICK AUDEBERT, LULI, Ecole Polytechnique, UMR 7605, F-91128 Palaiseau, France — Investigations of matter properties in extreme conditions have attracted numerous experimental and theoretical studies motivated by the wide range of application where these conditions are found. An accurate description of the regime of interest here, i.e., warm dense matter (WDM), is of importance for the study of planetary objects, inertial confinement fusion or basic properties of heated solids. In the temperature and density ranges of several eV and near solid density, matter is difficult to describe theoretically as WDM is strongly coupled, partially disordered and degenerate. This provides the motivation to experimentally create and accurately diagnose matter in this regime. Generating a uniform high energy density sample in laboratory requires: (i) transfer of energy to the matter in a time short compared to its hydrodynamic expansion duration; (ii) optimized heating efficiency to reach high temperatures (several eVs); and, (iii) creating a temperature and density gradient-free heated material for extracting accurate information on its properties. Due to short duration (100 fs), high brightness (few 10^{12} photons/pulse) and large penetration depth (up to tens of μm) hard x-ray free-electron laser opens unique opportunity to obtain a deeper insight into the formation and nature of WDM.

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