

Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Overview of Warm Dense Matter Experiments at LCLS ERIC

GALTIER, SLAC - Natl Accelerator Lab, ANNA LEVY, Sorbonne Universits, UPMC, CNRS, INSP, GARETH WILLIAMS, GoLP/IPFN-Laboratorio Associado, IST, LUKE FLETCHER, SLAC - Natl Accelerator Lab, FABIEN DORCHIES, JRME GAUDIN, Universit de Bordeaux, CNRS, CEA, CELIA, PHILIPP SPERLING, SLAC - Natl Accelerator Lab — Warm Dense Matter (WDM) is found in numerous astrophysical systems, from giant planets to brown dwarves or cool dense stars. Being this intermediate regime where condensed matter or plasma theories do not apply, it can be produced in all laser-induced plasma experiments on Earth. As a consequence, understanding its properties is fundamental and the whole community is investigating this extreme state of matter. With the advent of the 4th generation of light sources, namely the Free Electron Lasers (FELs), a new way of producing and diagnosing WDM becomes available. In 2009, the Linac Coherent Light Source (LCLS) at SLAC was the first FEL to produce X-ray photons to be used by the user community. Since then, various experiments took place at LCLS to produce and measure specific physical properties of WDM. In this talk, we will present an overview of key experiments performed at LCLS to study WDM. The LCLS has been used in a variety of configuration: as the main heating mechanism, as a probe or both at the same time. When used as a probe, high power lasers have been used to shock matter and excite it into the WDM regime. Finally, we will describe exciting perspectives on the WDM research, as the LCLS-II will become available in about 5 years.

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Date submitted: 06 Nov 2015

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