

Warm Dense Matter Experiments at LULI laboratory

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The behaviour and physical properties of warm dense matter is fundamental for various domains of physics among which planetary cores and Inertial Confinement Fusion. This extreme state of matter, at the frontier between condensed states and plasma physics is non trivial to simulate either theoretically, numerically or experimentally. In particular, on the experimental point of view, one key question, for planetary core physics, is to achieve high pressure and low temperature states^{1,2}. With lasers, it requires to follow a quasi isentropic compression far from usual shock states which produces too high temperatures. Also despite important progress obtained in the last decade on macroscopic characterization (e.g. equations of state^{3,4,5}, microscopic studies are today necessary to investigate WDM structure changes, phase transitions and to test common approximations used in detailed calculations⁶. In this talk, a review of latest development performed at LULI laboratory, in collaboration with Japanese scientists through joint projects (CNRS-JSPS), will be presented. In particular, I will discuss new opportunities to study telluric planets interiors using high energy lasers, with some impact on super-earths behaviour. Specific developments on isentropic compression techniques and related ab initio simulations will be exposed.

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[3] N. Ozaki et al., POP **16**, 062702 (2009)

[4] J. Eggert et al. PRL **100**, 124503 (2008)

[5] A. Benuzzi-Mounaix et al., POP **9**, 2466 (2002)

[6] V. Recoules et al., PRL **102**, 075002 (2009)