

Experiments to probe warm dense matter conditions for planetary science

P. M. Celliers¹

¹Lawrence Livermore National Laboratory

March 22, 2012

Abstract

In the last decade hundreds of extra-solar planets have been discovered. Our understanding of the formation, evolution and internal structure of these objects depends critically on accurate models of material properties at extreme pressures (≥ 10 TPa) and but modest temperatures (≤ 10000 K). These states are in the regime of so-called warm dense matter. Experiments to benchmark models of material properties in this regime are an important ingredient of this area of study. In parallel with the discoveries of exoplanets new experimental capabilities have emerged that enable the creation and probing of warm dense matter states. This review will survey the basic techniques used to create and probe warm dense matter states in the laboratory, and describe the progress in the development of these experimental capabilities. The review will include a selection of highlights from recent research.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.