SHOCK17-2017-020023

Abstract for an Invited Paper
for the SHOCK17 Meeting of
the American Physical Society

Using Sandias Z Machine and Density Functional Theory Simulations to Understand Planetary Materials

SETH ROOT, Sandia National Laboratories

The use of Z, NIF, and Omega have produced many breakthrough results in high pressure physics. One area that has greatly benefited from these facilities is the planetary sciences. The high pressure behavior of planetary materials has implications for numerous geophysical and planetary processes. The continuing discovery of exosolar super-Earths demonstrates the need for accurate equation of state data to better inform our models of their interior structures. Planetary collision processes, such as the moon-forming giant impact, require understanding planetary materials over a wide-range of pressures and temperatures. Using Z, we examined the shock compression response of some common planetary materials: MgO, Mg_2SiO_4, and Fe_2O_3 (hematite). We compare the experimental shock compression measurements with density functional theory (DFT) based quantum molecular dynamics (QMD) simulations. The combination of experiment and theory provides clearer understanding of planetary materials properties at extreme conditions. Sandia National Laboratories is a multi-mission laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energys National Nuclear Security Administration under contract DE-AC04-94AL85000.