Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Shock Hugoniot Calculations of Dense Liquid Helium[1] BURKHARD MILITZER, Carnegie Institution of Washington — By combining two first-principles computer simulation techniques, path integral Monte Carlo and density functional molecular dynamics, the properties of dense liquid helium are studied. From the equation of state we derive the shock Hugoniot curves. Results at low pressures agree well with gas gun experiments. For higher pressures, we predict that helium is compressible to more than five times its initial density. This behavior is in contrast to hydrogen, for which we predicted a maximum compression ratio of only 4.25. In the case of helium, the conditions for 5-fold compression are attainable with existing shock facilities. Studying this material will enable us to verify new experimental and theoretical techniques, and may help us to understand the existing controversy in the experimental shock results for deuterium. The characterization of dense liquid hydrogen and helium allows us to build models describing the interior of Giant Planets and answer fundamental questions of their evolution.

[1]Supported by NASA's PGG program (NNH04ZSS001N).

Burkhard Militzer
Carnegie Institution of Washington

Date submitted: 02 Dec 2005 Electronic form version 1.4