Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

The metastable limit of isentropically compressed water D.H. DOLAN, Sandia National Laboratories , M.D. KNUDSON, Sandia National Laboratories, J.P. DAVIS, Sandia National Laboratories, C. DEENEY, Sandia National Laboratories, C. HALL, Sandia National Laboratories — Although freezing is normally a slow process, it can be observed on very short time scales using isentropic compression techniques. For isentropic compression beyond 2 GPa, liquid water becomes metastable with respect to the ice VII phase and can freeze on nanosecond time scales if heterogeneous nucleation sites are present [D.H. Dolan et al., J. Chem. Phys. **123**, 64702 (2005)]. Such nucleation sites are typically found on the surfaces of crystalline and amorphous silica windows used to compress a water sample; in the absence of such windows, water remains in a metastable liquid state for some time. Recent gas gun and Z machine experiments at Sandia National Laboratories suggest a sharp metastable limit for isentropically compressed water, beyond which the liquid phase rapidly transforms to a solid without the aid of a nucleating window. This rapid transition is expected because the liquid phase is increasingly unfavorable at high pressure, but has not been previously observed. Comparison of the new freezing observations with prior results reveals stark qualitative differences, suggesting that this newly observed freezing is very different from a heterogeneously nucleated transition.

Daniel Dolan
Sandia National Laboratories

Date submitted: 30 Nov 2005 Electronic form version 1.4