Abstract Submitted
for the DPP08 Meeting of
The American Physical Society

Superheating of a Dusty Plasma Crystal[1] JOHN GOREE, YAN FENG, BIN LIU, The Univ. of Iowa — In a laboratory dusty plasma, highly-charged micron-size particles of solid matter are immersed in a weakly-ionized gas, where they are confined indefinitely by ambipolar electric potentials. Individual particles move a few mm/s, and are imaged using video micrography. Due to their large mutual Coulomb repulsion, particles self-organize in a solid, which we melt, by applying laser heating. Applying the heating suddenly, we observe solid superheating, a basic physical phenomenon which until now has been observed only in a handful of experiments with metals. A superheated solid has the structure of a solid, but a temperature higher than the melting point. In metals, solid superheating is short-lived because it is rapidly followed by melting. In our experiment, thanks to the long time scales for the massive charged particles to move, our superheated solid lasts about 0.25 sec before melting ensues. We make time-resolved observations of particle motion and defect development during this rapid heating, in a way that is impossible in experiments with metals. A hysteresis diagram reveals the solid superheating.

[1]Supported by DOE and NASA

John Goree
The Univ. of Iowa

Date submitted: 29 Aug 2008 Electronic form version 1.4