Abstract Submitted
for the OSF05 Meeting of
The American Physical Society

Charge and Debye length measurements in two-dimensional Debye clusters using thermal fluctuations W.L. THEISEN, T.E. SHERIDAN, Physics, Ohio Northern University — A two-dimensional Debye cluster is a system of n identical particles confined in a two-dimensional parabolic well and interacting through a screened Coulomb force (i.e., a Debye-Hückel or Yukawa potential) with a Debye length λ. In the strong-coupling regime, the particles exhibit small-amplitude motions about their equilibrium positions. These thermal oscillations are projected onto the center-of-mass and breathing modes to determine resonance curves from which the natural mode frequencies are found. The ratio of the breathing frequency to the center-of-mass frequency is then compared with theory to determine the Debye length and the average particle charge. Experiments were performed for $n = 3$ to 63 particles with 9 μm-diameter particles at a neutral argon pressure of 13.6 mtorr and for ≈ 9 W of rf power. The Debye length increases slightly and the absolute value of the charge decreases slightly as the number of particles increases.

T. E. Sheridan
Ohio Northern University

Date submitted: 22 Sep 2005 Electronic form version 1.4