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Investigation of 1D to 2D phase transition in small dusty plasma
ANDREW L. MAGYAR, T.E. SHERIDAN, Ohio Northern University — We experimentally study a system of $n \leq 8$ microscopic dust particles floating in a plasma and confined in a two-dimensional biharmonic potential well as the well anisotropy is varied. When the well is highly anisotropic, the particles lie in a one-dimensional straight configuration. As the anisotropy is decreased, the system undergoes a 1D-2D zigzag transition. The well anisotropy is determined by measuring the center-of-mass frequencies from the particles' Brownian motion. The cluster is characterized by its root-mean-squared (rms) length and width. The transverse size of the cluster y_{rms} is used to characterize the 1D-2D transition. Near the critical point, we find that y_{rms} closely follows a power law, indicating that the transition can be viewed as a continuous phase transition from a 1D to a 2D state, even though the number of particles is small. A second structural transition to an "elliptical" state is also observed. The experimental results are in good agreement with a model for particles interacted through a Debye potential and confined in a biharmonic well.

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