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One-to-two dimensional transition in small Debye clusters T.E. SHERIDAN, K.D. WELLS[1], Ohio Northern University — We study the transition from one-dimensional to two-dimensional configurations of small clusters of monodisperse dust particles levitated in plasma. Particles are confined by a highly-anisotropic two-dimensional potential well in the Dusty ONU experimenT (DONUT). The well anisotropy, as determined by measuring the center-of-mass oscillation frequencies in the x and y directions using Brownian motion, is found to be $\omega_{0y}^2/\omega_{0x}^2 = 30.7$. For $n \leq 9$ particles, the cluster is in a linear, one-dimensional configuration. The addition of one more particle ($n = 10$) causes a zig-zag transition to a two-dimensional "barred-elliptical" configuration with an "elliptical" nucleus and linear tails. As more particles are added the nucleus grows and the tails decline until the cluster becomes an oval. These results are found to be in good agreement with Monte Carlo calculations of particle configurations. The Monte Carlo calculations show that in a linear configuration normal modes are either longitudinal or transverse, so that for low energies the cluster dynamics are one-dimensional.

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