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Breathing oscillation of elliptical Debye cluster K.D. WELLS, M.J. GAREE, A.C. HERRICK, T.E. SHERIDAN, Ohio Northern University — An elliptical Debye cluster is a system of n identical particles confined in a two-dimensional anisotropic potential well and interacting through a shielded Coulomb potential. A model for this system has been developed which has three parameters: the number of particles, the well ellipticity, and the Debye shielding parameter. From numerical solutions of the model, we find as the ellipticity increases from circular to highly elliptical that the breathing mode persists and that the breathing frequency increases. For highly elliptical clusters, the breathing mode consists of particle motions predominantly in the direction of the minor axis of the ellipse. An elliptical cluster with $n = 49$ monodisperse microspheres was studied in the Dusty O.N.U. experimenT (D.ONU.T). The anisotropic parabolic well was created using a rectangular aperture (17.5 mm $\times$ 30.2 mm) placed on the lower electrode of an rf discharge. Plasma was created using $\approx$ 11 W of rf power for 18 mtorr of argon. The well ellipticity was determined by measuring the center-of-mass frequencies along the major and minor axes of the resulting elliptical cluster using both driven and thermally-excited oscillations. These two methods give results that are in good agreement. Cluster parameters were determined by measuring the frequency of the breathing mode and comparing with numerical eigenmode solutions of the model. The measured Debye shielding parameter was ≈ 2. The measured cluster temperature was 400 K.

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