**Density and velocity fluctuations and finite temperature effects in driven, vertically propagating dust acoustic waves**

Edward Thomas, Jr.,[1] and Robert L. Merlino[2]
(1) Physics Dept., Auburn University, Auburn, AL
(2) Dept. of Physics and Astronomy, The University of Iowa, Iowa City, IA

The theoretical and experimental identification of the dust acoustic wave is considered one of the early successes in dusty plasma studies. In the decade since its discovery, numerous papers have explored the linear and nonlinear features of this compressional wave mode in a dusty plasma. In spite of this vast body of theoretical work, new experimental observations continue to provide new insights into the behavior of these waves.

In this presentation, the results of a series of new experimental investigation of the dust acoustic wave are presented. Here, studies performed on dusty plasma experiments at Iowa's Dusty Plasma Device (DPD) and Auburn's 3D-Dusty Plasma Experiment (3DPX) are compared. In both systems, charge microparticles are suspended in argon dc glow discharge plasmas. The key feature of these studies is the use of a sinusoidally modulated anode dc current to actively control the frequency of the observed dust acoustic waves. This is a critical element of these experiments because it enables the measurement of the dispersion relation for the waves using video imaging techniques. Experimental measurements will be compared with a fluid model of dust behavior that includes neutral collisions and finite electric field effects. The experimental results will show that the common assumption of room temperature dust particles (i.e., equivalent to the ion or neutral temperature ~ 1/40 eV) is not consistent with the experimental measurements.

Finally, in experiments on the 3DPX device, stereoscopic particle image velocimetry (stereo-PIV) techniques will be used to obtain detailed information on the particle motion in the dust acoustic wavefronts. These measurements will be used to compare the spatial variation of the particle velocity against the density variations observed using imaging techniques. Furthermore, the distribution of velocities obtained using the stereo-PIV may give some insight into the thermal state of the charged microparticles.