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Overview of Experimental and Theoretical Studies of the Periodically Oscillating Plasma Sphere (POPS) RICHARD NEBEL, JAEYOUNG PARK, EVSTATI EVSTATIEV, ALBERTO MAROCCHINO, GIOVANNI LAPENTA, LUIS CHACON, Los Alamos National Laboratory — Theoretical work has suggested that a tiny oscillating ion cloud may undergo a self-similar collapse that can result in the periodic and simultaneous attainment of ultra-high densities and temperatures. A remarkable feature of these oscillations is that they stay in local thermodynamic equilibrium (lte) at all times independent of the collisionality of the system (i.e. they are exact solutions of the Vlasov equation for Maxwellian distribution functions). In recent experimental work on the INS-e device at LANL we have observed the POPS oscillations by resonantly driving the plasma at the POPS frequency. Ongoing theoretical work is focused in two areas: multidimensional kinetic simulations of the stability of the virtual cathode and space charge neutralization during the ion collapse phase of the POPS oscillation. POPS simulation results indicate that significant gains in plasma compression can be achieved by properly programming the electron distribution function at the boundary. Two dimensional kinetic simulations indicate that the virtual cathode stability to electron-electron two-stream modes is similar to the 1-D result.

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