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Experimental and Theoretical Studies of Electrostatic Confinement on the Intense Neutron Source (INS-e) Device

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Abstract

Theoretical works by Barnes and Nebel [1,2] have suggested that a tiny oscillating ion cloud may undergo a self-similar collapse in a harmonic oscillator potential formed by a uniform electron background. By tuning the external radio-frequency (rf) electric fields to this naturally occurring mode, it is then possible to heat the ions to obtain very high densities and temperatures simultaneously during the collapse phase of the oscillation through adiabatic compression. However, a major uncertainty in this oscillating plasma scheme is the dynamics and stability of the background electrons in the virtual cathode. Here we describe an Inertial Electrostatic Confinement (IEC) device at Los Alamos National Laboratory that is being used to test the electron dynamics in a virtual cathode and will subsequently be used to verify this heating and compression scheme. Results from the device operation will be presented including the formation of deep potential wells and bifurcations in the potential equilibria. A simple model is used to explain this bifurcation.

[1.] R. A. Nebel, D. C. Barnes, *Fusion Technology* **38**, 28 (1998)
[2.] D. C. Barnes, R. A. Nebel, *Phys. Plasmas* **5**, 2498 (1998)