Single-component Plasma Compression with Application to Positron Plasmas*

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The application of a rotating electric field to plasmas confined in Penning-Malmberg traps [i.e., the so-called "rotating wall" (RW) technique] has been used extensively to radially compress and increase the confinement of single-component electron, positron, and ion plasmas [1]. We describe here the results of experiments demonstrating a robust operating regime in which compressed, torque-balanced steady states can be achieved over a broad range of RW frequencies without the need to tune to a plasma mode [2]. The current experiments are done on electron plasmas. Plasmas can be driven into a regime in which the transport is roughly independent of density. The RW heating is balanced by cyclotron cooling in a 5T magnetic field. A key result is the discovery that the plasma density increases until the central $E \times B$ rotation frequency matches the frequency of the applied RW field. An emerging physical model of the resulting torque-balanced steady states will be discussed. The implications of these results for the ultimate limits on single-component positron plasma confinement and cold, bright beam formation will also be discussed.

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1. See, for example, C. M. Surko and R. G. Greaves, Phys. Plasmas **11**, 2333 (2004); and references therein.
2. J. R. Danielson and C. M. Surko, Phys. Rev. Lett. **94**, 035001 (2005).