

P2.4004 Ion instability and off-axis equilibrium in a RF-sustained nonneutral plasma

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See full abstract here:

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Penning-Malmberg traps are known and extensively used as unique tools for long-term charged particles storage, precise manipulation and measurement of trapped samples, creation of high-quality bunched beams [1]. This array of opportunities results from decades of theoretical and experimental studies of the dynamical and equilibrium properties of nonneutral, magnetized plasmas as well as from an ever-increasing stretching of the concept, structure and operation of electro-magnetostatic traps themselves [2, 3]. In these terms, we have previously reported on experimental studies concerning the in-trap production of electron plasmas by background ionization due to a low-power radio-frequency (RF) excitation [4], an alternative way to the generation of electron samples to be used in studies of collective systems with interesting fluid analogues (e.g., fluid vortices and two-dimensional turbulence) [5, 6, 7].

Our previous measurements have led to the observation of stable states where a coherent vortex rotates around the longitudinal axis of the trap. This rotational motion (first diocotron mode) is resilient to typical perturbations and instability mechanisms (e.g., resistive-wall or ion-induced mode growth), which makes the control and manipulation of plasma properties unusually hard. In some cases the mode exhibits an amplitude modulation, accompanied by the periodic variation of the total number of electrons at the same modulation frequency [8, 9]. With a series of tailored experiments, we demonstrate how we can manipulate the vortex trajectory and simultaneously acquire key features (plasma charge, density profile, diocotron mode amplitude and frequency, temperature) finally leading us to a model of the off-axis equilibrium and stability.

References

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