Abstract Submitted
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Structure of Two-Dimensional Plasma Crystals in Anharmonic Penning Traps[1] D.H.E. DUBIN, UCSD — In several recent experiments charged particles have been trapped and cooled in two-dimensional (2D) crystalline configurations using a Penning trap. Usually in such traps the applied trap potential is harmonic (i.e. depending quadratically on position), and consequently the 2D crystal structure is nonuniform and riddled with defects. This poster derives a closed-form analytic expression for the density per unit area of the 2D crystal when an arbitrary anharmonic trap potential is employed, expressed as a multipole expansion. This expression is used to find the optimum potential, with a given number of multipoles, for trapping a plasma crystal with the most uniform possible density per unit area. Image charge effects are included to lowest order in (plasma size)/(electrode radius). Minimum energy states in such an optimized trap potential (including only quadrupole and octopole terms) are evaluated numerically and the resulting crystals are shown to be defect-free over the central region where the density is most nearly uniform. The poster also explores using an $l = 3$ rotating wall trap potential in order to produce near-perfect crystals with triangular boundaries and no defects.[2]

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[2]D.H.E. Dubin, Phys Rev A 88, 013403 (2013).

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