Abstract Submitted
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Experimental Study of a Pure Ion Plasma in a Linear Paul Trap Subject to Dipole and Quadrupole Perturbations to Study Magnetic Lattice Errors[1] MATTHEW TALLEY, Brigham Young University, ERIK GILSON, RONALD DAVIDSON, Princeton Plasma Physics Laboratory — The Paul Trap Simulator Experiment (PTSX) simulates the collective dynamics of a charged particle bunch traveling through a magnetic alternating-gradient particle accelerator. For example, PTSX is used to study the effect of random lattice errors caused by quadrupole magnets that are misaligned or vary in magnetic field strength. A pair of arbitrary function generators was used to apply a trapping voltage waveform for many lattice periods with a range of frequencies and with either a dipole or quadrupole spatial structure. Every 12th period, the amplitude was changed to create a perturbed waveform to stimulate the bunch. The duration of the perturbation was also varied to simulate different numbers of revolutions in the ring. The experimental results demonstrate the growth in the equivalent beam emittance that occurs due to the perturbation amplitude and duration. The data does not demonstrate a strictly monotonic decrease in charge but rather a periodic relationship that depends on the perturbation amplitude and duration. In the dipole and quadrupole experiments the data revealed a power-law relationship between these parameters. To explain this behavior, models based on the individual particle motion and the envelope equation were studied and will be presented with the data.

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