Abstract Submitted
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Two regimes in the decay behavior of ions from a linear r.f. Paul trap[1] JONATHAN KWOLEK, JAMES WELLS, University of Connecticut, DOUGLAS GOODMAN, Wentworth Institute of Technology, REINHOLD BLÜMEL, Wesleyan University, WINTHROP SMITH, University of Connecticut — A linear Paul trap (LPT) enables ions to be trapped for use in a variety of experiments. In many of these experiments, such as those measuring charge exchange or sympathetic cooling, the decay of ions from the trap is used to measure some quantity of interest. This decay is typically modeled as a single exponential. We have found that in cases where the trap is loaded to high numbers of ions, the ion decay is better described by a double exponential decay function [1]. We have experimentally examined the decay of ions from an LPT loaded by photoionization from a magneto-optical trap as a function of the q stability parameter of the Paul trap. The LPT is loaded to steady-state, then the loading is stopped and the number of trapped ions as a function of time is monitored to determine the decay. We present numerical simulations and experimental results that demonstrate two distinct regions in the decay. For high steady-state values, the trap exhibits a double-exponential behavior. However, if the trap is filled to a steady-state value below a threshold, the decay recovers the typical single-exponential behavior. This behavior should be universal to any Paul trap regardless of the geometry or species trapped.

[1] Goodman, et al. PRA **91**, 012709 (2015)

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