Abstract Submitted
for the DAMOP16 Meeting of
The American Physical Society

Universal, non-monotonic structure in the saturation curves of a linear Paul trap[1] JAMES WELLS, JONATHAN KWOLEK, University of Connecticut, DOUGLAS GOODMAN, Wentworth Institute of Technology, REINHOLD BLMEL, Wesleyan University, WINTHROP SMITH, University of Connecticut — A common technique to measure ion-atom collision rates in a hybrid trap if the ions have no optical transitions (e.g. alkalis) is to monitor the fluorescence of the neutrals in the presence of a saturated linear Paul trap (LPT) [1]. We present numerical simulations, analytical calculations, and experimental results that show that the steady-state ion capacity of an LPT, N_s, exhibits nonlinear, nonmonotonic behavior as a function of ion loading rate, Λ [2]. The steady state as a function of loading rate, $N_s(\Lambda)$, shows four distinct regions. In Region I, at the lowest Λ, $N_s(\Lambda)$ increases monotonically. Then, $N_s(\Lambda)$ reaches a plateau in Region II, before decreasing to a local minimum in Region III. Finally, in Region IV, $N_s(\Lambda)$ once again increases monotonically. This behavior appears universal to any Paul trap, regardless of geometry or species trapped. We examine this behavior experimentally as a function of the q stability parameter of the Paul trap and simulate numerically the effect of the particular trap geometry on the onset of each of the four regions.
[1] Goodman, et al. PRA **91**, 012709 (2015) and Lee, et al. PRA **87**, 052701 (2013)
[2] Blümel, et al. PRA **92**, 063402 (2015)

[1]Funding from NSF grant PHY-1307874.

James Wells
University of Connecticut

Date submitted: 27 Jan 2016

Electronic form version 1.4