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Demonstrating the Principle of an rf Paul Ion Trap ANDREW JOHNSON, JAMES RABCHUK, Western Illinois University — An rf ion trap uses a time-varying electric field to trap charged ions. This is useful in applications related to quantum computing and mass spectroscopy. There are several mechanical devices described in the literature which have attempted to provide illustrative demonstrations of the principle of rf ion traps, including a mechanically-rotating "saddle trap" and the vertically-driven, inverted pendulum[1,2]. Neither demonstration, however, successfully demonstrates BOTH the sinusoidal variation in the electric potential of the rf trap AND the parametric stability of the ions in the trap described by Mathieu's equation. We have modified a design of a one-dimensional ponderomotive trap[3] so that it satisfies both criteria for demonstrating the principle of an rf Paul trap. Our studies indicate that trapping stability is highly sensitive to fluxuations in the driving frequency. Results from the demonstration apparatus constructed by the authors will be presented. [1] Rueckner, W., et al., "Rotating saddle Paul trap," Am. J. Phys., 63 (2), February 1995. [2] Friedman, M.H., et al., "The inverted pendulum: A mechanical analogue of a quadrupole mass filter," Am. J. Phys., 50 (10), October 1982. [3] Johnson, A.K. and Rabchuk, J.A., "A One-Dimensional Ponderomotive Trap," ISAAPT 2007 spring meeting, WIU, March 30, 2007.

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