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Electrostatic Trap for keV Ion Beams.*

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A reflecting ion beam electrostatic trap has been constructed and tested for the purpose of studying molecular ion physics. A trap of this type offers a large field-free region, wide mass range, and directionality that simplifies the detection of stored ions or breakup products. In our configuration, pulsed ions extracted from an ion source (5–10 μ s) are accelerated to keV energies and magnetically analyzed before injection into the trap. After the ions enter the trap, high-voltage electrostatic entrance and exit mirrors and einzel lenses (operated by fast switches), cause the ions to oscillate between the mirrors in nearly parallel trajectories. Neutralized ions, detected by a channelplate located beyond the exit mirror, indicate the time dependence of stored ions. Voltages and pulsed timing of the beam and trap are controlled by computer (38 parameters). The computer can quickly find the optimum trapping conditions in successive fills using the detected neutral yield. Thus far, numerous atomic and molecular ions (energy of 1.4 – 3.0 keV and mass < 100 amu) have been stored with a beam capture efficiency up to 20%. The pressure-limited storage lifetime is typically 2–5 sec at a pressure of 2×10^{-10} Torr.

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