Progress in Two-plate Ion Trap Mass Analyzers

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We report on a new method for building ion trap mass analyzers. The electric fields for trapping and analysis are made between two lithographically patterned plates. Potentials are established on each plate in such a way as to produce the appropriate potential distribution between the plates. This design has been used to produce three ion traps: a quadrupolar (Paul) trap, a toroidal rap, and a combination-in-space of the quadrupolar and toroidal traps. In each design, the potential distributions are established using sets of concentric ring electrodes patterned on each plate. Each ring is set to a different RF amplitude using a capacitive voltage divider. The electric field shape, including higher-order multipoles, can be modified by changing the RF amplitudes on one or more of the rings. As a result, this approach has great flexibility in terms of the type and shape of electric field that can be produced. The quadrupole trap is operated using 700 V RF at 1.1 MHz, and uses axial modulation for ion ejection. This trap has so far demonstrated good mass resolution (typically 500-700), mass range (50-400), and tandem capabilities. The two-plate approach can be used to make rugged, miniaturized mass analyzers for handheld and portable applications.