4.5: Quadrupole Ion Trap

Quadrupole Ion Trap. (1, 2, 3)

The Quadrupole ion storage trap mass spectrometer (QUISTOR) is a recently developed mass analyzer with some special capabilities. Several commercial instruments are available and this analyzer is becoming more popular. QUISTORs are very sensitive, relatively inexpensive, and scan fast enough for GC/MS exp eriments. The sensitivity of the QUISTOR results from trapping and then analyzing all the ions produced in the source. Since all the ions are detected, the S/N is high.

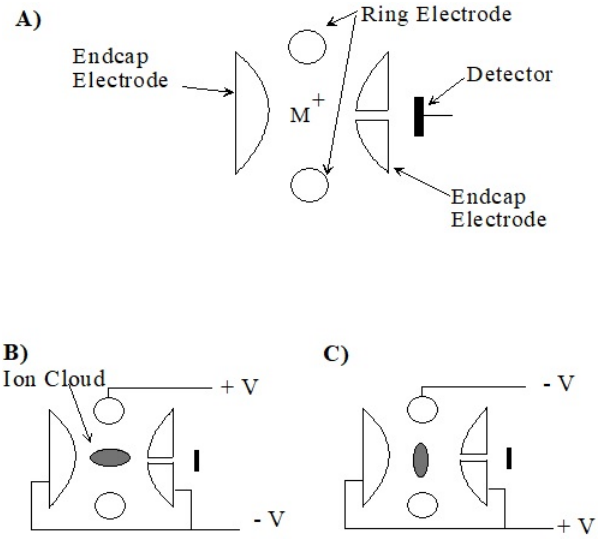

Figure 4.5.1: Quadrupole Ion Trap Mass Spectrometer. A) shows the major components. B) and C) ion response to the applied RF field.

The QUISTOR consists of a doughnut shaped ring electrode and two endcap electrodes. A cutaway view of this arrangement is shown in Figure 4.5.1. A combination of RF and DC voltages is applied to the electrodes to create a quadrup ole electric field similar to the electric field for the quadrupole mass analyzer. This electric field traps ions in a potential energy well at the center of the analyzer. The mass spectrum is acquired by scanning the RF and DC fields to destabilize low mass to charge ions. These destabilized ions are ejected through a hole in one endcap electrode and strike a detector. The mass spectrum is generated by scanning the fields so that ions of increasing m/z value are ejected from the cell and detected. The trap is then refilled with a new batch of ions to acquire the next mass spectrum. The mass resolution of the ion trap is increased by adding a small amount 0.1 Pa $\left(10^{-3}\right.$ torr $\left.\right)$ of Helium as a bath gas. Collisions between the analyte ions and the inert bath gas dampen the motion of the ions and increases the trapping efficiency of the analyzer.

References

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