

THE ORBITRAP: A NEW MASS SPECTROMETER

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The Orbitrap is a new mass spectrometer based on a new type of mass analyzer invented by Makarov. Features of the Orbitrap at its present stage of development include high mass resolution (up to 150 000), large space charge capacity, high mass accuracy (2–5 ppm), a mass/charge range of at least 6000, and dynamic range greater than 1000

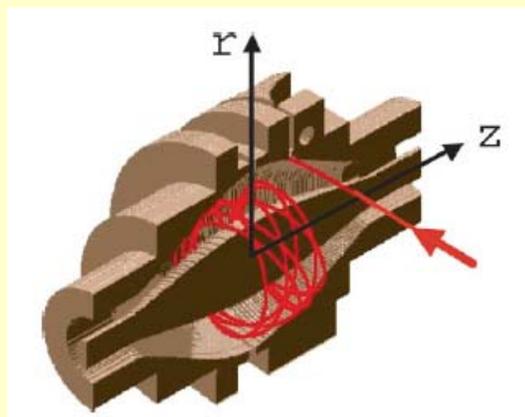


Figure 1. Cutaway view of the Orbitrap mass analyzer. Ions are injected at the point indicated by the red arrow with velocity perpendicular to the long axis of the Orbitrap (the z-axis). Injection at a point displaced from $z=0$ gives the ions potential energy in the z-direction. Ion injection at this point on the z-potential is analogous to pulling back a pendulum bob and then releasing it to oscillate. In this case, the frequency of motion is dependent on ion mass and independent of its velocity.

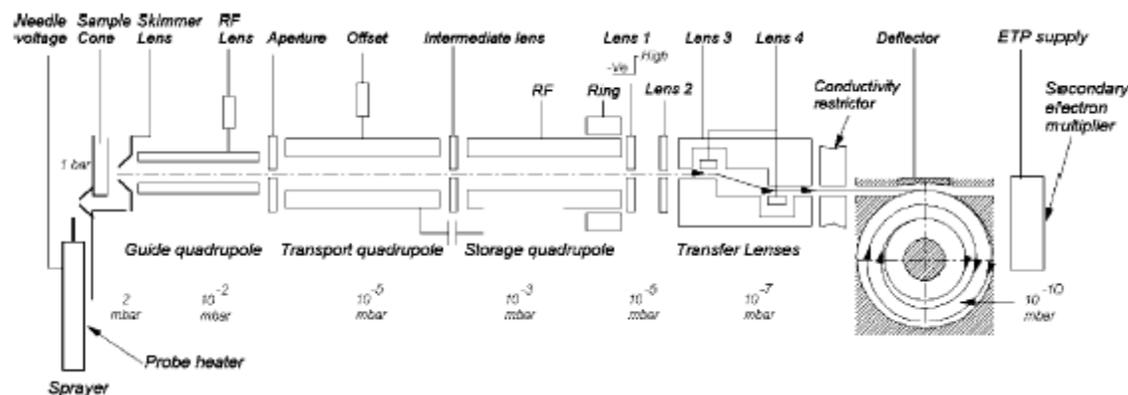


Figure 2. The experimental Orbitrap mass spectrometer. Ions are produced by the electrospray ion source at the extreme left. Ions then proceed through the source, collision quadrupole, selection quadrupole and then pass into the storage quadrupole. The storage quadrupole serves as an ion accumulator and buncher, allowing a pulsed mass analyzer such as the Orbitrap to be coupled to a continuous source like an electrospray ionization source. After accumulation and bunching in the storage quadrupole, the exit lens ('Lens 1') is pulsed low, the ion bunches traverse the ion transfer lens system and are injected into the Orbitrap mass analyzer (shown end-on).