An EJS Simulation of a Mass Spectrometer

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Ion Motion in EM trap

Newton's 2nd law of motion

$$F = ma,$$

Lorentz force

$$F = q[E + (v \times B)],$$

Ion Acceleration

$$\frac{dv}{dt} = \frac{q}{m}[E + (v \times B)].$$

ODE Form:

$$\frac{dv_x}{dt} = \frac{q}{m}[E_x + (v_y B_z - v_z B_y)]$$
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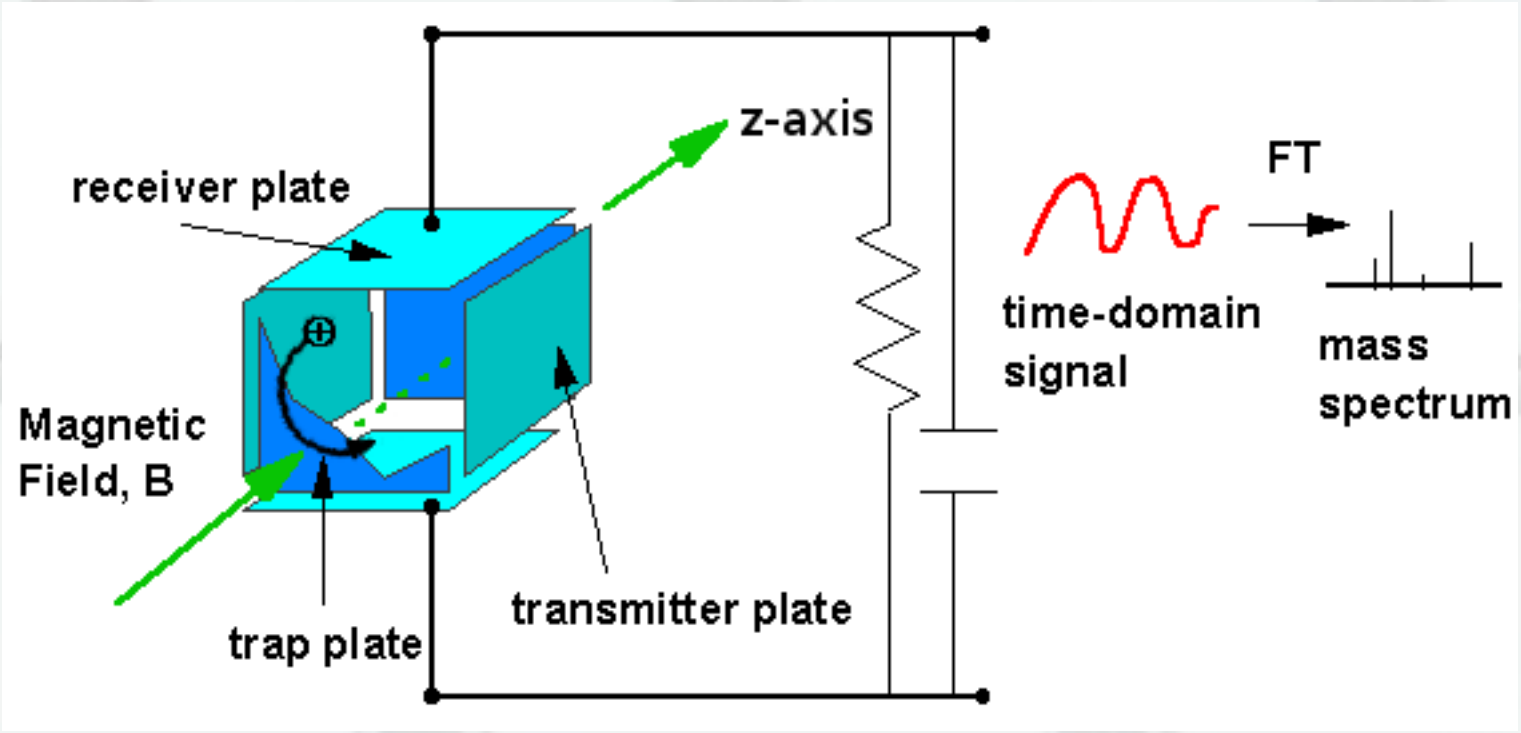
$$\frac{dv_z}{dt} = \frac{q}{m}[E_z + (v_x B_y - v_y B_x)]$$

Ion trap schematic



http://www.chem.ucsb.edu/~devries/groupsite/labicr.htm

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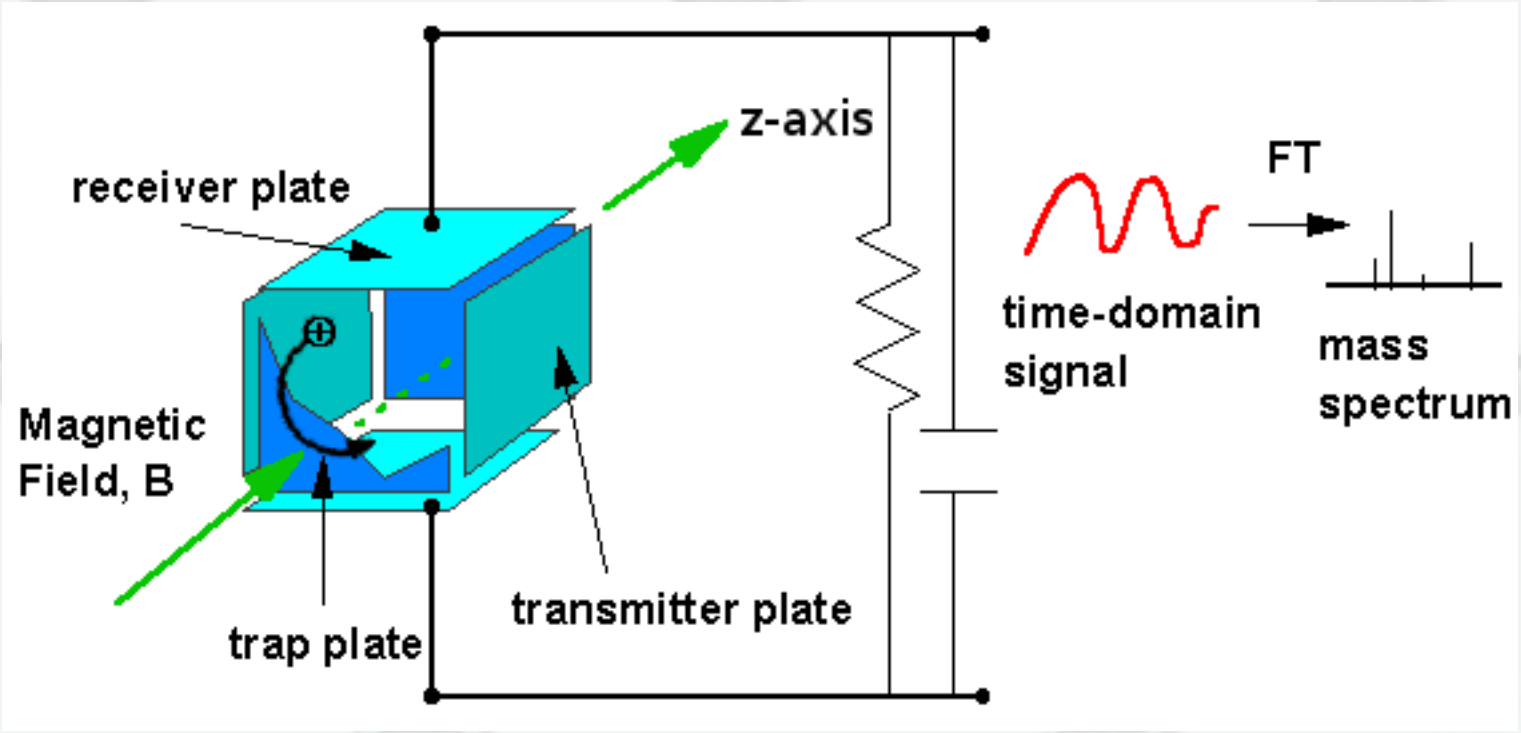

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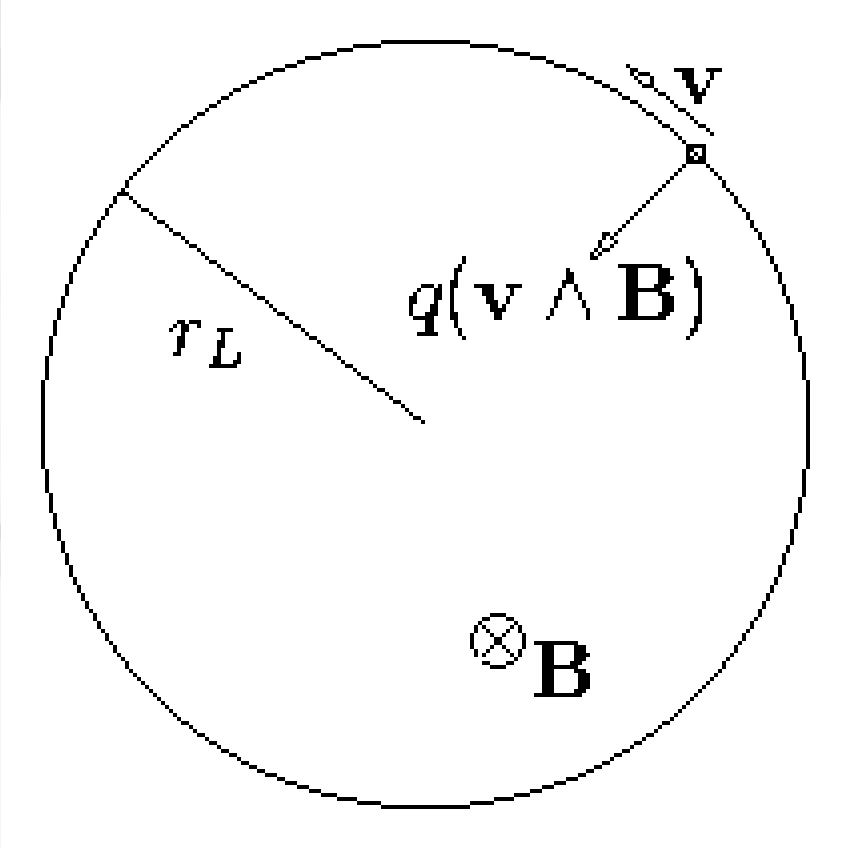
Cyclotron motion



Cyclotron equation

$$\omega_c = \frac{qB_0}{m}$$

- Same m/q = Same frequency
- Independent of initial velocity

Show 'em

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- Anuj Shah
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References

[1] A. G. Marshall and F. R. Verdun, *Fourier Transforms in NMR, Optical, and Mass Spectrometry.* Elsevier Science, 1990.

Questions