

Mass Analyzers III

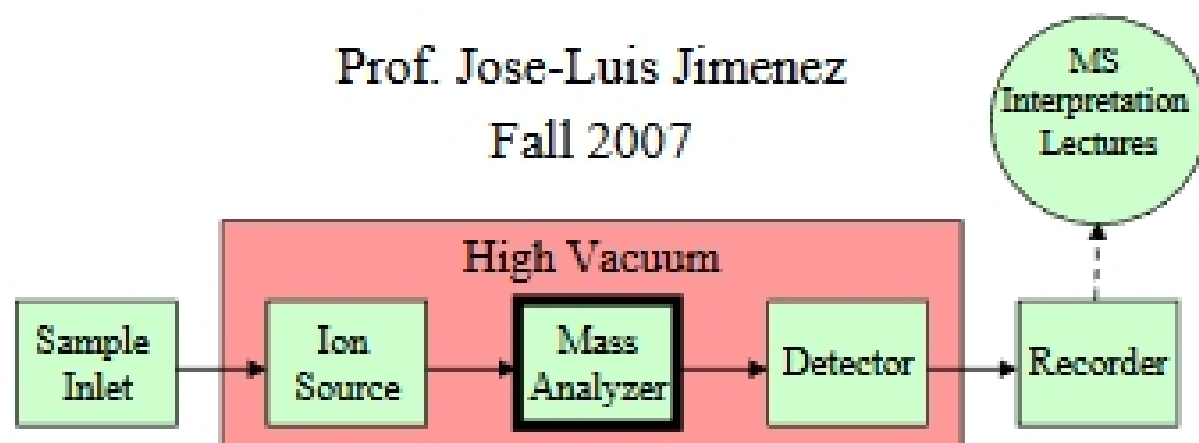
Sector, FTICR, Orbitrap

CU- Boulder

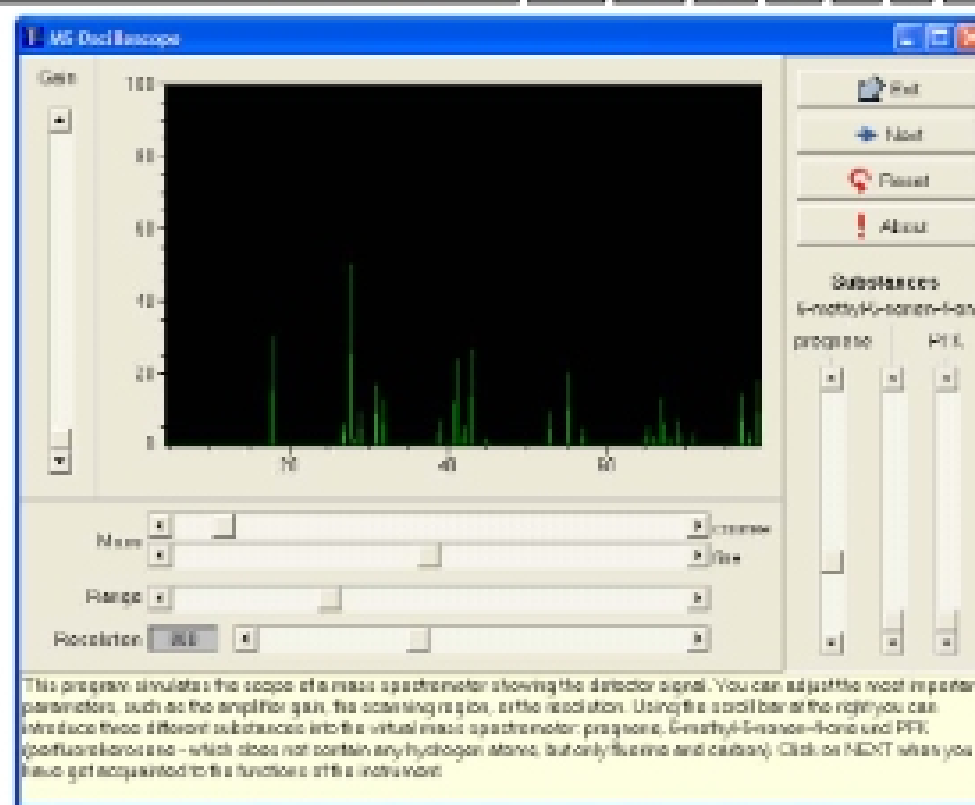
CHEM 5181: Mass Spectrometry & Chromatography

Prof. Jose-Luis Jimenez

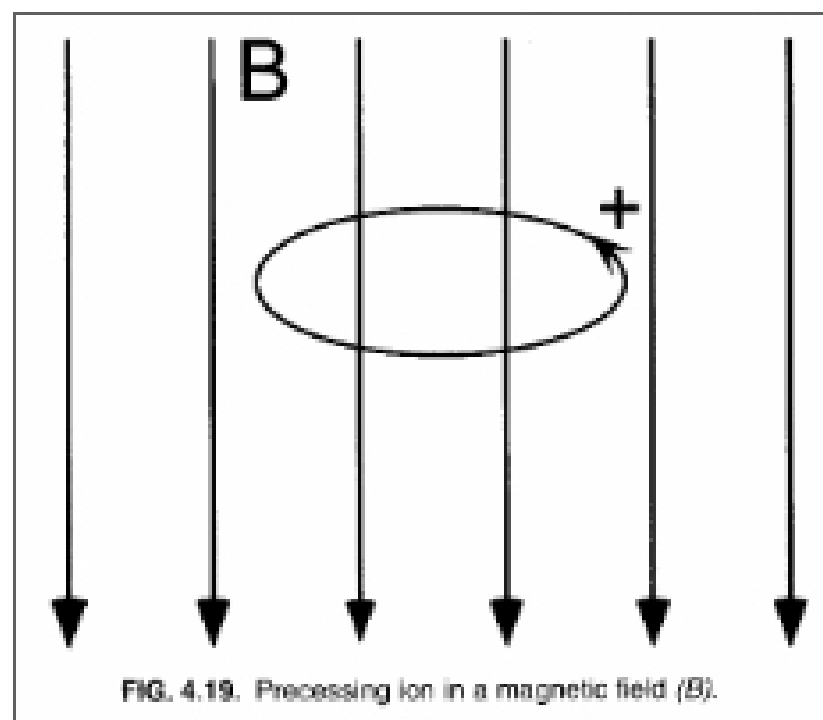
Fall 2007



MS Oscilloscope



An Ion in an Uniform Magnetic Field



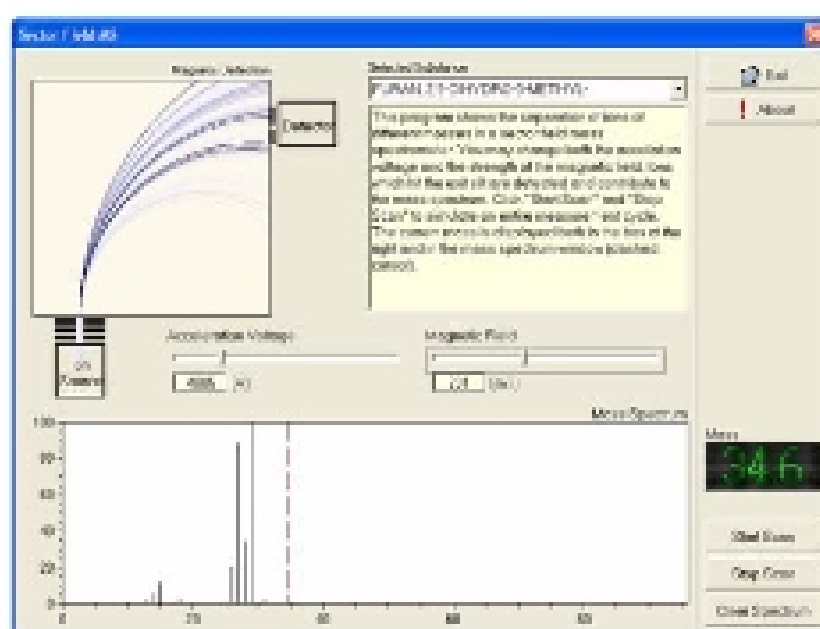
From
Watson

FIG. 4.19. Precessing ion in a magnetic field (B).

- Q: what determines the radius of rotation?

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Simulation of Magnetic Sector MS



- Clicker Q
- With $V_s = 4000$ V and $B = 200$ mT, we select m/z 35.
- What m/z will we select if we double both V_s and B ?
 - A. m/z 35
 - B. m/z 17.5
 - C. m/z 70
 - D. m/z 350
 - E. All of the above

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Magnetic Sector Analyzer

- Ion kinetic energy when leaving source:
- Action of the magnetic field:
- Trajectory of ion is determined by equilibration of magnetic force and centripetal acceleration:
- Ions with the same momentum (mv) have the same R . This is a **momentum analyzer**.
- Taking into account the kinetic energy of the ions:

$$E_k = \frac{mv^2}{2} = qV_s$$

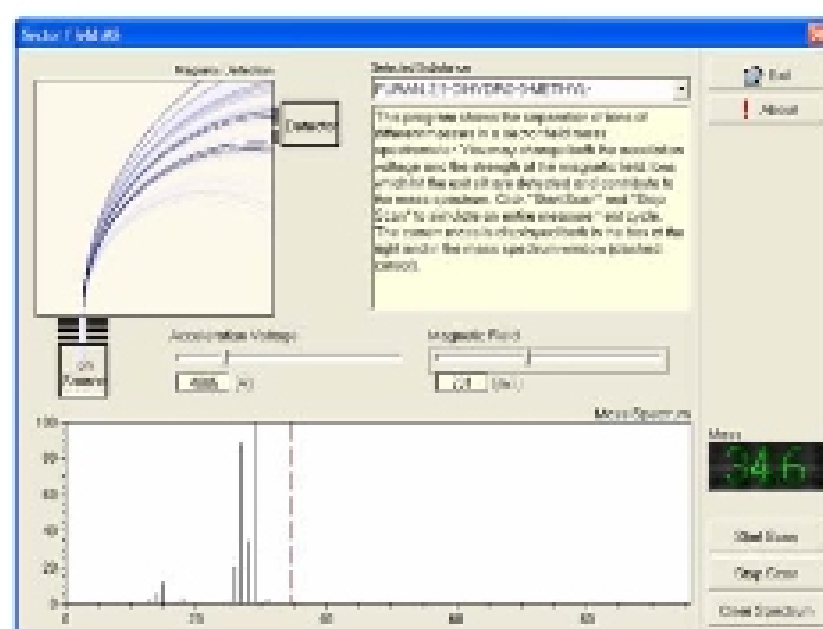
$$\vec{F}_M = q\vec{v} \times \vec{B}$$

$$qvB = \frac{mv^2}{R} = m\omega^2 R$$

$$R = \frac{mv}{qB}$$

$$\frac{m}{q} = \frac{R^2 B^2}{2V_s}$$

Simulation of Magnetic Sector MS



- Clicker Q
- With $V_s = 4000$ V and $B = 200$ mT, we select m/z 35.
- What m/z will we select if we double V_s and halve B ?
 - m/z 4
 - m/z 17.5
 - m/z 35
 - m/z 70
 - m/z 140