

Mass Spectroscopy

ChaoYang Cheng

October 2015

1 Basic Principle

The physics principle behind mass spectroscopy is that a charged particle passing through a magnetic field is deflected along a circular path on a radius that is proportional to the mass to charge ratio.

$$\text{Charge ratio} = \frac{m}{e}$$

In an electron impact mass spectrometer, a high energy beam of electrons is used to displace an electron from the organic molecule to form a radical cation known as the molecular ion. If the molecular ion is too unstable then it can fragment to give other smaller ions.

The collection of ions is then focused into a beam and accelerated into the magnetic field and deflected along circular paths according to the masses of the ions. By adjusting the magnetic field, the ions can be focused on the detector and recorded.

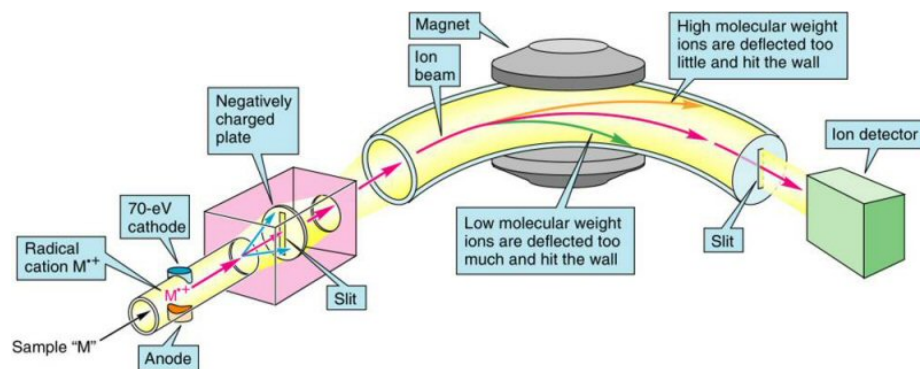


Figure 1: Mass Spectroscopy

2 Relevant Formula

Newton's Second law:

$$F = ma$$

Lorentz force law:

$$F = Q(E + v \times B)$$

Mass spectroscopy:

$$\frac{\text{mass}}{\text{charge}} = \frac{m}{e} = \frac{B^2 r^2}{2V}$$

B = magnetic field strength

r = radius of the analyzer tube

V = voltage (accelerator plate)

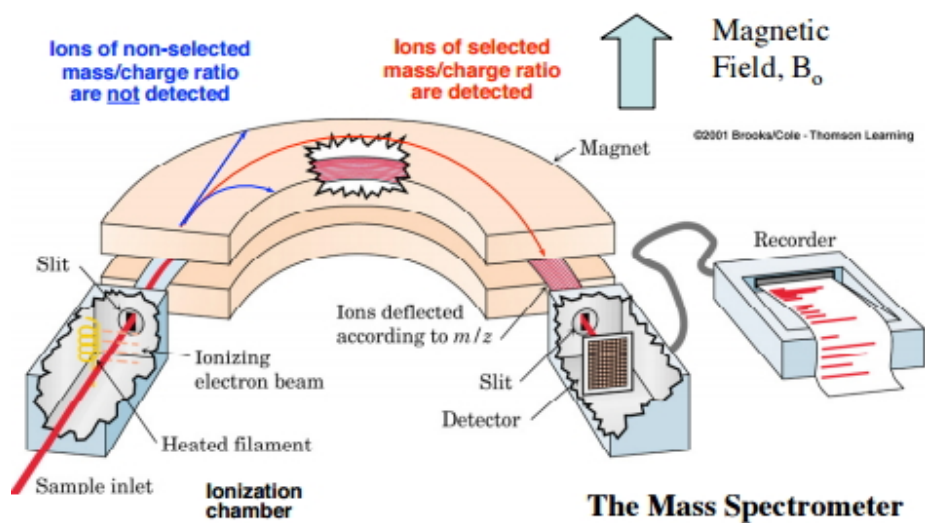


Figure 2: Mass Spectrometer