Al-Mustaqbal University

Department of medical physics

Second stage

Magnetism

Fourth Ten

Applications of Magnetic Field

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Mass Spectrometer

The mass spectrometer is a device that separates ions according to their charge-to-mass ratios. One particular version, the Bainbridge mass spectrometer is illustrated in Figure. Ions produced at a source are first sent through a velocity selecto, where the magnetic force is equally balanced with the electric force. These ions all emerge with the same speed

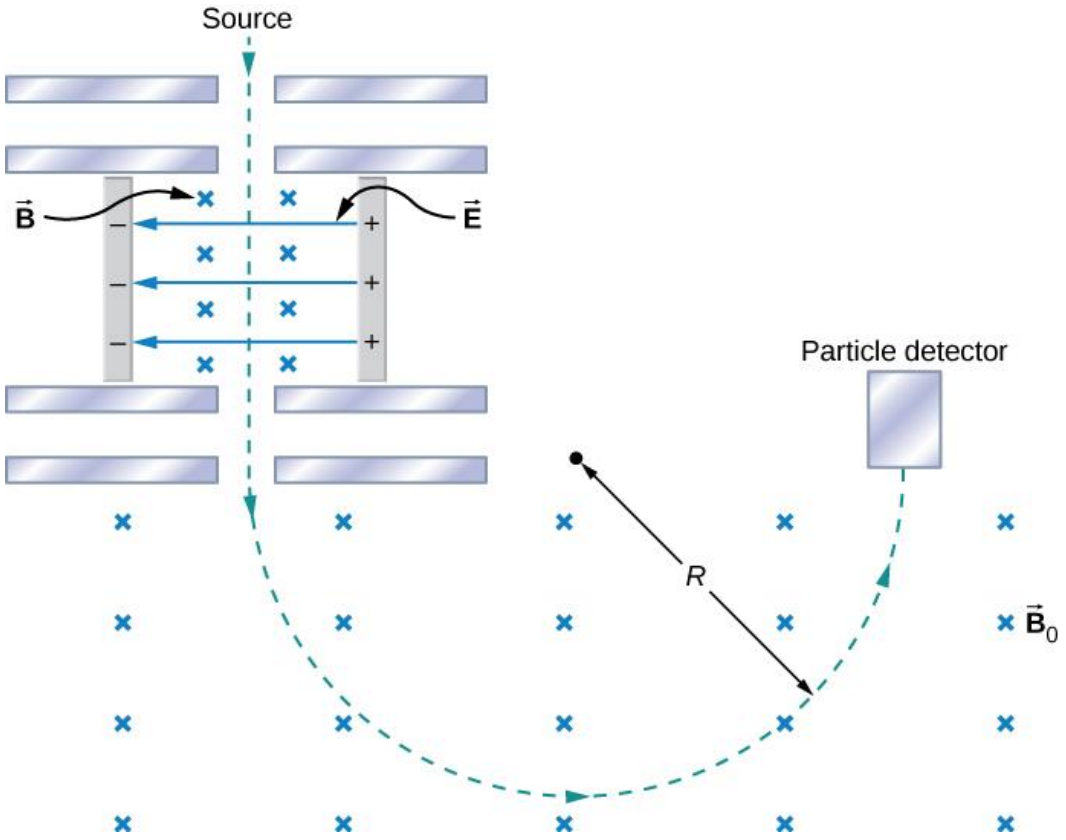
$$v=E/Bv=E/B$$

since any ion with a different velocity is deflected preferentially by either the electric or magnetic force

, and ultimately blocked from the next stage. They then enter a uniform magnetic field B0B0 where they travel in a circular path whose radius **R** is given by Equation ,

$$r=mvqBr=mvqB.$$

The radius is measured by a particle detector located as shown in the figure.



schematic

Cyclotron

The cyclotron was developed by E.O. Lawrence to accelerate charged particles (usually protons, deuterons, or alpha-particles) to large kinetic energies. These particles are then used for nuclear-collision experiments to produce radioactive isotopes. . The particles move between two flat, semi-cylindrical metallic containers D1 and D2, called

dees

. The Dees are enclosed in a larger metal container, and the apparatus is placed between the poles of an electromagnet that provides a uniform magnetic field. Air is removed from the large container so that the particles neither lose energy nor are deflected because of collisions with air molecules.