

Charged Particles in Fields

Physics

How electric and magnetic fields deflect charges differently.

Electric field

- $F = qE$, along the field
- Does work on the charge
- Changes kinetic energy
- Parabolic path if entering perpendicular
- Used to accelerate

Magnetic field

- $F = Bqv$, perpendicular to both
- Does no work
- Speed unchanged
- Circular path, $r = mv/Bq$
- Used to steer and select

THE DIFFERENCE THAT MATTERS

A velocity selector uses both: only particles where $qE = Bqv$ pass straight through, so $v = E/B$.

The mass spectrometer and the cyclotron both work by combining these two behaviours.