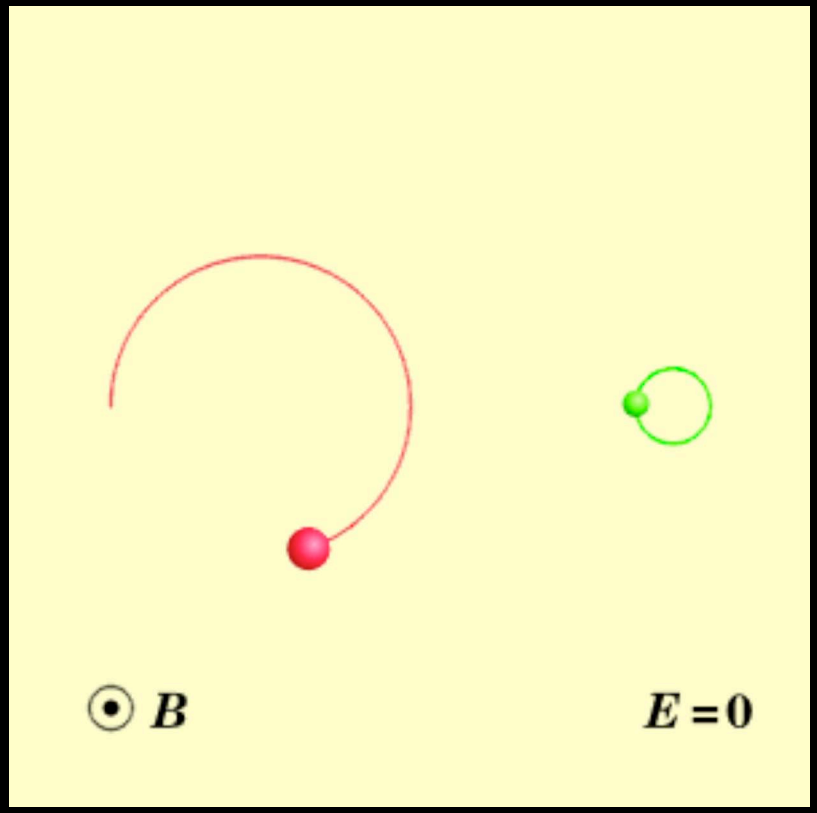
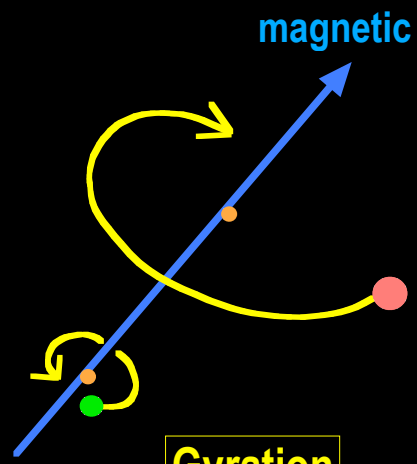
3. Interaction with magnetic field (Lorentz force: $F_L = q\, v \times B$)



$B_\perp$-plane

Red... ion (+)
Green... electron (–)
Orange... gyration center



Gyration

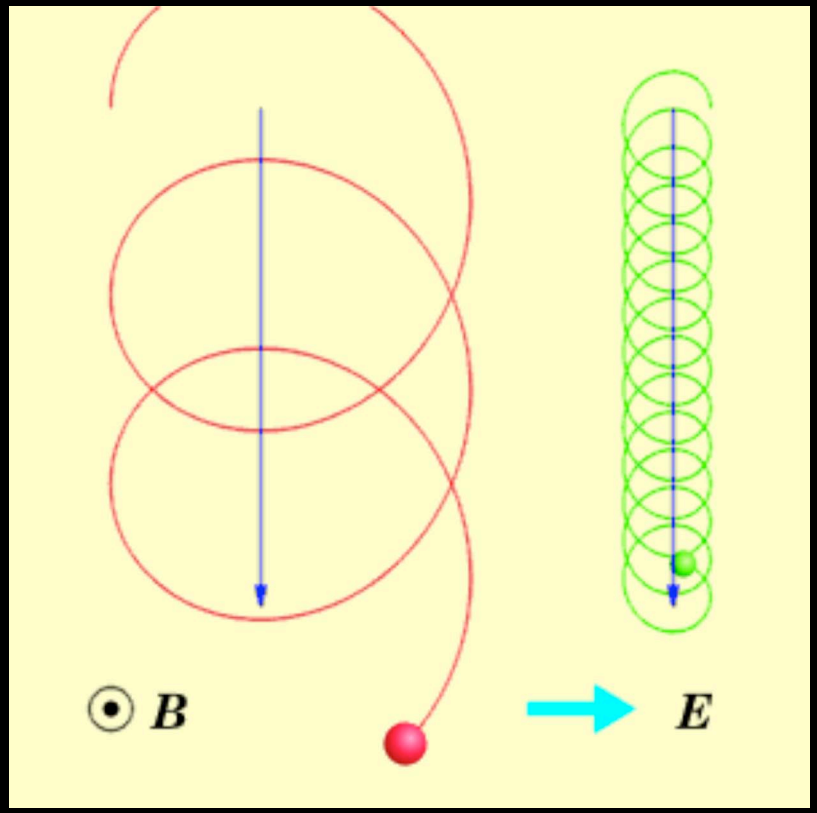
Charged particles gyrate around magnetic field.

Direction of v is changed.

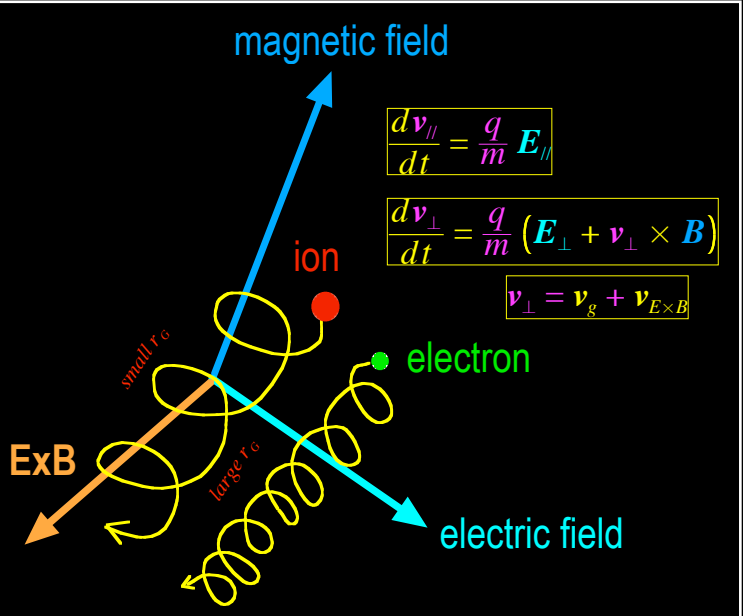
$$\frac{d\boldsymbol{v}_\perp}{dt} = \frac{q}{m}\,\boldsymbol{v}_\perp \times \boldsymbol{B}$$

Gyration center does **not** move.

4. Interaction with electric field and magnetic field



$B_\perp$-plane



$$\frac{d\boldsymbol{v}_{//}}{dt} = \frac{q}{m}\boldsymbol{E}_{//}$$

$$\frac{d\boldsymbol{v}_{\perp}}{dt} = \frac{q}{m}\left(\boldsymbol{E}_{\perp} + \boldsymbol{v}_{\perp} \times \boldsymbol{B}\right)$$

$$\boldsymbol{v}_{\perp} = \boldsymbol{v}_g + \boldsymbol{v}_{E\times B}$$

Gyration center **does** move: **ExB-drift**

$$\boldsymbol{v}_{E\times B} \equiv \frac{\boldsymbol{E} \times \boldsymbol{B}}{B^2}$$

... **perpendicular to** both electric field and magnetic field

... **does not depend on** mass & charge of a particle => keep local charge neutrality