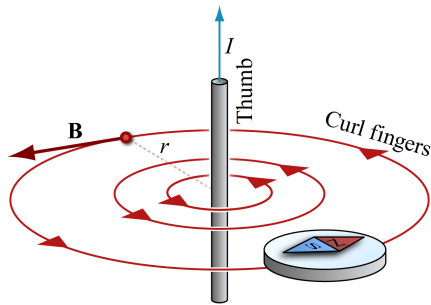


# Magnetism

Moving charges create magnetic fields, and magnetic fields exert magnetic forces on moving charges.

Moving charges create magnetic fields

**Steady infinite line current**



$$|\vec{B}| = \frac{\mu_0 I}{2\pi r}$$

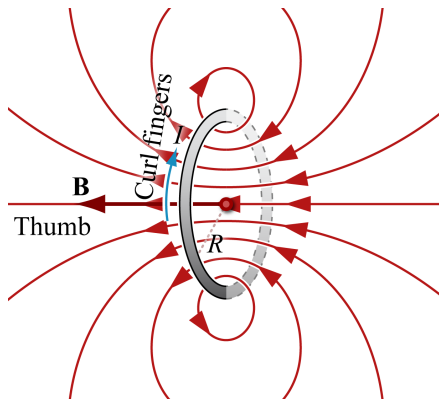
$$[B] = \text{T}$$

$$\mu_0 = 4\pi \times 10^{-7} \frac{\text{T} \cdot \text{m}}{\text{A}}$$

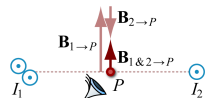
(All panels illustrate **right hand rules**)

Legend: out (arrowhead)  
 in (fletching)

**Steady circular loop current**



$$|\vec{B}_{\text{CENTER}}| = \frac{\mu_0 I}{2R}$$

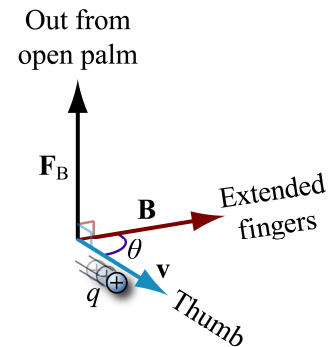


**Superposition**

$$\vec{B}_{1\&2 \rightarrow P} = \vec{B}_{1 \rightarrow P} + \vec{B}_{2 \rightarrow P} + \dots$$

Magnetic fields exert magnetic forces on moving charges

**Force on a moving charge**

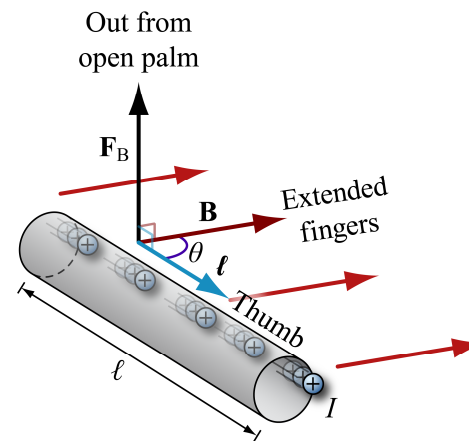


$$\vec{F}_B = q\vec{v} \times \vec{B}$$

(RHR for positive moving charge illustrated; for negative moving charge, reverse direction of thumb)

$$|\vec{F}_B| = |q||\vec{v}| \sin \theta |\vec{B}|$$

**Force on a line segment of current**



$$\vec{F}_B = I\vec{\ell} \times \vec{B}$$

$$|\vec{F}_B| = I|\vec{\ell}| \sin \theta |\vec{B}|$$