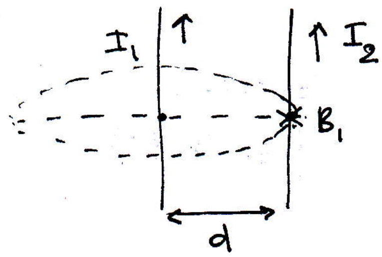
Magnetic force between 2 wires.

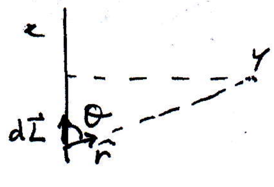
$$F_2 = I_2 L \times B_1 = I_2 L B_1 \underbrace{\sin\theta}_{1}$$

$$= I_2 L B_1$$

$$= I_2 L \frac{\mu_0 I_1}{2\pi d}.$$

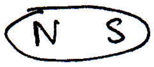
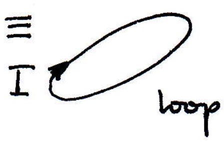


$$\left[B_1 = \frac{\mu_0}{4\pi} I \int \frac{dL}{x^2+y^2} \underbrace{\frac{y}{\sqrt{x^2+y^2}}}_{\sin\theta} \right.$$



$dL = dx.$

$$\left. = \frac{\mu_0 I}{4\pi} y \int_{-\infty}^{\infty} \frac{dx}{(x^2+y^2)^{3/2}} = \frac{\mu_0 I}{2\pi y}. \right]$$

Magnetic dipole	Electric dipole.
	
$\equiv$ 	
$\vec{\mu} = I\vec{A}$ ↑ area of loop × normal vector.	$\vec{p} = qd.$
$\tau = \vec{\mu} \times \vec{B}$ $= \mu B \sin\theta$	$\tau = \vec{p} \times \vec{E}$ $= pE \sin\theta.$
$U = -\vec{\mu}.\vec{B} = -\mu B \cos\theta$	$U = -\vec{p}.\vec{E} = -pE\cos\theta.$

Ampère's Law:

$$\oint \vec{B}.d\vec{r} = \mu_0 I_{enc}.$$

Note: $\oint \vec{B}.d\vec{A} = 0 \rightarrow$ no m. monopole.
(Compare with $\oint \vec{E}.d\vec{A} = \frac{Q_{enc}}{\varepsilon_0}$).

→ for a straight wire: $B(2\pi d) = \mu_0 I \rightarrow B = \frac{\mu_0 I}{2\pi d}.$

→ used to compute $\vec{B}$ inside & outside a wire.

→ $\boxed{\text{Table 26.1}}$