WUN2K

- Magnetic Fields

N	S

dipole

magnetic charges don't exist, always dipoles

- Force on moving charge

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

$\downarrow \vec{F}_m$ centripetal force

$$R = \frac{mv}{qB}$$

RHR #1

- Currents are source of $\vec{B}$ field
(moving chges)

Biot-Savart

$$d\vec{B} = \frac{\mu_0 I d\vec{l} \times \hat{r}}{r^2}$$

HOW-TO

Electric	Magnetic
Q	moving Q
$d\vec{E} = \frac{k\,dQ}{r^2}$	$d\vec{B} = \frac{\mu_0 I\, d\vec{l} \times \hat{r}}{r^2}$

RHR #2
Circumferential
$\vec{B}$ from I

Gauss $\oint \vec{E} \cdot d\vec{A} = \frac{Q_{in}}{\varepsilon_0}$ (closed surf)

$\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{encl}$ (closed loop) — Ampère's Law

HOW-TO

- Changing $\vec{B}$ fields create $\mathcal{E}_{ind}$ (& I_{ind})

Faraday $$\mathcal{E}_{ind} = -\frac{d\Phi_B}{dt}$$

Lenz: direction opposes change
"Loops Hate Change"

- Mutual Inductance

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$$\mathcal{E}_{ind_2} = -M_{12}\frac{dI_1}{dt}, \quad \mathcal{E}_{ind_1} = -M_{12}\frac{dI_2}{dt}$$

$\rightarrow$ $M_{12} = \frac{N_2 \Phi_{2,1}}{I_1}$

"sensitivity to changing current"