# ELECTROMAGNETISM

- Maxwell's Equations
  - $\oint \bar{E} \cdot d\bar{A} = \frac{Q}{\varepsilon_0}$ Gauss' Law
  - $\oint \bar{B} \cdot d\bar{A} = \emptyset$ Gauss' Law for Magnetism
  - $\oint \bar{E} \cdot d\bar{l} = -\frac{d\Phi_B}{dt}$ Faraday's law
  - $\oint \bar{B} \cdot d\bar{l} = \mu_0 I$ Ampère's Law

- Comments
  - $\oint dA \rightarrow$ surface area (usually a sphere $\Rightarrow 4\pi r^2$)
  - $\oint dl \rightarrow$ length (usually circumference $\Rightarrow 2\pi r$)

- Gauss' Law
  - charged particles create an electric field
  - Only charges inside gaussian surface contribute to electric field
- Gauss' Law for Magnetism
  - there are no isolated magetic poles
- Faraday's Law
  - electric field is created by a changing magnetic field
  - $\mathcal{E} = -\frac{d\Phi_B}{dt}$

    ↙ induced emf
  - $\Phi_B = \int \bar{B} \cdot d\bar{A}$
  - $\mathcal{E} = -\frac{d}{dt}\left[\int \bar{B} \cdot d\bar{A}\right]$

    $= -\frac{d}{dt}\left[|\bar{B}||\bar{A}|\cos\theta\right]$
- Ampère's Law
  - currents create a magnetic field
  - Only currents inside the amperian loop contribute to the magnetic field