Maxwell's Equations: Gauss' Law for $\vec{E}$

Gauss' Law for Electric fields

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q}{\epsilon_0}$$

This is equivalent to Coulomb's Law

Maxwell's Equations: Gauss' Law for $\vec{B}$

Gauss' Law for Magnetic Fields

$$\oint \vec{B} \cdot d\vec{A} = 0$$

There are no isolated magnetic monopoles.

Maxwell's Equations: Faraday's Law of Induction

Changing Magnetic Flux produces an Electric Field.

$$\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_m}{dt}$$

Maxwell's Equations: Faraday's Law of Induction

A Current or a Changing Electric Flux produces a Magnetic Field.

$$\oint \vec{B} \cdot d\vec{s} = \mu_0 I_{\text{through}} + \epsilon_0 \mu_0 \frac{d\Phi_e}{dt}$$

Maxwell's Equations: All of them

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q}{\epsilon_0}$$

$$\oint \vec{B} \cdot d\vec{A} = 0$$

$$\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_m}{dt}$$

$$\oint \vec{B} \cdot d\vec{s} = \mu_0 I_{\text{through}} + \epsilon_0 \mu_0 \frac{d\Phi_e}{dt}$$

And there was light!

Maxwell's Equations: All of them

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q}{\epsilon_0}$$

$$\oint \vec{B} \cdot d\vec{A} = 0$$

$$\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_m}{dt}$$

$$\oint \vec{B} \cdot d\vec{s} = \mu_0 I_{\text{through}} + \epsilon_0 \mu_0 \frac{d\Phi_e}{dt}$$

And there was light! and radio waves too.

Maxwell's Equations: All of them

The last two of Maxwell's equations, in free space are:

$$\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi_m}{dt}$$
$$\oint \vec{B} \cdot d\vec{s} = \epsilon_0 \mu_0 \frac{d\Phi_e}{dt}$$

- a changing electric field induces a magnetic field
- a changing magnetic field induces an electric field
- these two fields interact throughout space, producing each other in the form of an elecromagnetic wave.
- the speed of the wave's propagation is $c = \frac{1}{\sqrt{\epsilon_0 \mu_0}} = 3.00 \times 10^8$ m/s