# Brief History of Maxwell's Equations

**Andre-Marie Ampere** - 1775 – 1836 - French physicist

In 1820, a week after Ampere heard of H. C. Ørsted's 1806 discovery that a magnetic needle is acted on by a voltaic current, he presented a paper to the Academy containing a far more complete exposition of that and related phenomena.

Ampere, the unit of current, and "Ampere's law" are named after him. Oersted is a unit of magnetic field.

Ampere's Law: $\nabla \times \bar{H} = \bar{J} + \frac{\partial \bar{D}}{\partial t}$

**Carl Friedrich Gauss** – 1777-1855 - German mathematician

Independently stated Green's theorem, generalized Coulomb's law, and formulated separate electrostatic and electrodynamic laws, including "Gauss's laws", which constitute two of the four "Maxwell's equations."

Gauss's Laws: $\nabla \bullet \bar{D} = \rho, \quad \nabla \bullet \bar{B} = 0$

**Michael Faraday** - 1791-1867 - British experimentalist

Discovered that moving a magnet near a loop of wire causes an electrical current to flow; this led to Faraday's law of induction.

Farad (unit of capacitance) and "Faraday's law" are named after him; also the Faraday effect (optics) and the Faraday cage.

Faraday's Law: $\nabla \times \bar{E} = -\frac{\partial \bar{B}}{\partial t}$

**James Clerk Maxwell** - 1831-1879 - Scottish physicist

Converted Faraday's physical ideas into a mathematical model. Suggested that Faraday's law of induction implies a corresponding "displacement current $\frac{\partial \bar{D}}{\partial t}$" that yields electromagnetic waves.

Maxwell's four equations (above) suggested that electromagnetic waves could be generated in the laboratory, a possibility first demonstrated by Heinrich Hertz in 1887, eight years after Maxwell's death.

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