

Maxwell's Equations

Electrical Engineering

The four field equations in differential form, and what each asserts.

Four laws, and the physical claim behind each one.

Law	Differential form	What it says
Gauss, electric	$\nabla \cdot \mathbf{D} = \rho$	Charge creates electric flux
Gauss, magnetic	$\nabla \cdot \mathbf{B} = 0$	No magnetic monopoles exist
Faraday	$\nabla \times \mathbf{E} = -\partial \mathbf{B} / \partial t$	Changing B produces E
Ampere–Maxwell	$\nabla \times \mathbf{H} = \mathbf{J} + \partial \mathbf{D} / \partial t$	Current and changing D make H

The displacement current $\partial \mathbf{D} / \partial t$ is Maxwell's own addition, and it is what allows a wave to travel through empty space.