

18-01 The Maxwell Equations

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Before Maxwell, the equations that became Maxwell's equations didn't form a single consistent system. They were:

- Gauss's Law (1773/1813)
- The Law with No Name ("There are no magnetic monopoles")
- Faraday's Law (1831)
- Ampere's Law (1827)

I originally wanted to list all the equations that became Maxwell's equations and which years they were originally formulated. I was a little bothered when I couldn't find a name or year for the equation that says that the divergence of the magnetic field is zero. As I thought about it, I decided that I actually kind of like just calling it "The Law with No Name".

Maxwell made an addition to Ampere's Law in 1861. Ampere's original law (in modern notation) is:

$$\vec{\nabla} \times \vec{B} = \frac{\vec{j}}{\epsilon_0 c^2}$$

Maxwell noticed that if you take the divergence of each side, you get this (since the divergence of any curl is zero):

$$\vec{\nabla} \cdot \vec{j} = 0$$

Since this has to be true in general, it must mean that there can't be any current anywhere, which can't be right.