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The symmetry of Gauss's law and Ampère's law

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Abstract content
 (Max 300 words)

The correct application of Gauss's law in electrostatics requires symmetry considerations which students often struggle with and which are often inadequately explained in textbooks. Ampere's law in magnetostatics is the analogue of Gauss's law, yet during its application symmetry arguments are seldom applied and other means are found to motivate the form of the magnetic field. A systematic approach for analyzing the symmetry necessary to apply Gauss's law is first presented. Then, with the important consideration that the symmetry applies to the magnetic force rather than the magnetic field, this approach is used for analyzing the symmetry necessary to apply Ampere's law. This strengthens the conceptual link between these two laws, but can also be used to introduce the interesting (but seldom discussed) idea that the magnetic field is an axial vector while the electric field is a polar vector.

References

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