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An Experiment to verify Ampere's law for a "long" straight current carrying conductor PONN MAHESWARANATHAN, Winthrop University — In electromagnetism, the topic of magnetostatics is introduced with Oersted's discovery of the magnetic field caused by an electric current, followed by Biot-Savart law for the magnetic field of the element of current. Ampere's law is used to derive expressions for magnetic fields of current distributions with a high degree of symmetry. Circular coils, solenoids and toroids are commonly available in the introductory physics laboratory for verifying Ampere's law. However, when it comes to quantitative measurements, it is difficult to measure the magnetic field of a long steady current, since it is very small. In this study, a simple experiment is described to verify Ampere's law for a long straight current carrying conductor. A narrow and long rectangular multi-loop design is used to increase the strength of the magnetic field in between the long sides. As expected, magnetic field is found to be linearly proportional to the electric current. The current dependence of the magnetic field is used to determine the fundamental constant, the permeability of free space with acceptable experimental error. Theory predicts that the effect of shorter sides are only 2 percent for a width to length ratio of 0.2, and hence smaller dimensions, down to 20-cm by 4-cm, can be employed for good results.

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