

*THE ELECTRIC FORCE OF A CURRENT: WEBER
AND THE SURFACE CHARGE OF RESISTIVE
CONDUCTORS CARRYING STEADY CURRENTS*

NOTE DE LECTURE

The Electric Force of a Current: Weber and the Surface Charge of Resistive Conductors Carrying Steady Currents, A. K. T. ASSIS and J. A. HERNANDES, Apeiron, Montreal, 2007 – 239 pages, ISBN: 978-0973291155: US\$20.00.

How often do you often read a book that has a large number of ‘aha!’ moments? This is a significant piece of scholarship that penetrates into a rather common misconception, no force on a stationary charge outside a current carrying wire, to elucidate its cause of error and to present the correct and insightful picture of the phenomenon.

No theory can survive without experimental verifications. This book discusses a large number of experimental results that show the existence of the electric field outside resistive wire carrying steady currents. The experimental results are classified into three classes: first, due to the zeroth order electric field; second, due to the battery and the current; and third, related to the square of the drift velocity of conduction electrons.

In the past, many authors, including prominent physicists, held incorrect points of view regarding steady currents and some still do in recent years. The problem seems to stem from the fact that the frame of reference is rigidly chosen as an inertial frame of reference, say, the current carrying wire, i.e., the approach taken by the field electrodynamics. Even though, a relativistic consideration is implemented, the electric field outside the conductor cannot exist. So, what is a better way to handle this?

The force on an electric charge solely depends on the relative motions with other charges can lead to correct explanation: This is the idea developed by Wilhelm Weber before the particles of electron and protons were discovered.

The authors with profound knowledge and expertise in Weber's electrodynamics stride in knitting together experimental results and predictions of theoretical analyses.

The book starts with simple examples to electric fields outside conductor carrying a steady current for various shapes of conductors with and without potential difference. The calculations yields the distributions of the surface charges on a conductor, an important knowledge to understand the phenomena involved in the current carrying conductor. The vast calculation results are worth the price of the book alone. In addition, the hundreds of references and appendices are indispensable for serious researchers of electrodynamics.

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