chapter on relativity, which is the weakest in the book. There are too few examples to do more than whet the student's appetite, and the treatment of the special theory moves ponderously toward the velocity-addition rule, hardly the most judicious choice for a climax. The total absence of $E = mc^2$, the most celebrated formula of twentieth-century physics, is bound to be noticed by students. This is an unfortunate by-product of a total neglect of the energy concept (the word does not even appear in the index!).

Finally, historical fidelity is abandoned in the treatment of general relativity, which is presented as a reform of Newtonian gravity rather than the complete conceptual break it truly represents.

Despite its few failings, this book is one of the best of its genre, and it deserves a permanent niche in the wide spectrum of books for the one-term course.

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Polarized Electrons

J. Kessler
223 pp. Springer-Verlag, New York, 1976. $24.60

Although spin polarization of free electrons is a concept that developed with quantum theory, the attendant development of an extensive, reliable body of data based upon direct experimental observation has been much slower. Most of these data have emerged in the last 12 years. *Polarized Electrons* is the first self-contained monograph on this topic. Joachim Kessler states his objectives clearly: The style of presentation is to resemble a textbook; the material is intended for "readers at the graduate level, and while it may demand concentration, I hope it will not require deciphering."

These objectives are reflected in both the material presented and the order of presentation. The author begins with an exposition of why the Stern–Gerlach method is unsuitable for electrons, advances to a brief description of mathematical methods for depicting spin states and then launches a formal analysis of spin polarization. This analysis is contained in a single chapter that composes nearly a third of the book. The analysis starts with a development of the Dirac equation and then concentrates upon the spin polarization that results from the scattering of electrons. A variety of relevant equations are developed, and the results are expressed in several formalisms—scattering cross sections, density matrices, Sherman functions, vector sums and others. Throughout this analysis the primary emphasis is upon the development of a formal understanding of spin polarization. Simple physical models, introduced after the formal results and the presentation of limited experimental data, are designed to clarify and support the formal understanding.

The topic of exchange processes in electron–atom scattering, a specific scattering process not included in the preceding analysis, provides a transition in emphasis. Numerous results from the formal analysis are used and several natural extensions of those results are developed, but the emphasis shifts from the polarization of the electrons to the insight into atomic nature that the information about this polarization provides.

The remainder of the book provides a survey of experimental results for two major subject areas, polarized electrons by ionization and polarized electrons from solids, and brief glimpses into less well documented areas. The book concludes with a brief summary of the current level of understanding of spin polarization and with some very helpful indications of future work and its promise.

Consistent with his pedagogical objectives, Kessler has used a number of helpful techniques. First, every major subdivision in a chapter begins with a brief statement about the results to be developed and the procedures used in the development. Second, all the problems in the book are accompanied by complete solutions; often these solutions are quite detailed. Third, internal citations (references to other sections in the monograph that are related to a given discussion) are common. Finally, the presentation of ideas consistently moves from the conceptual to the practical, with the author carefully refraining from the introduction of too many practical concerns; such concerns might have detracted from the reader's conceptual understanding. This restraint is vividly illustrated in a statement that occurs in the discussion of sources: "It should, however, be pointed out that each of the sources mentioned took several years (sometimes a decade) for its development." This last feature of the monograph seriously reduces its use as a reliable guide for selections between competing experimental techniques, but this fact is fully consistent with Kessler's goals.

In contrast to the general excellence of this book, a number of minor but significant flaws occur. First, the author has been over zealous in his stated goal of limiting citations. For instance, I found the lack of any direct reference to Sherman functions, an essential and often used term, a distraction. Second, the use of pseudologarithmic plots without any discussion of their utility (or any reference to remedy this lack) was particularly disruptive; the use of these plots during the discussion of simple physical models that complement the formal analysis only served to intensify this disruption. Third, in the final chapter the author was very careful to point out that criteria other than the polarization are needed in judging a source. He proceeded to justify several different quantitative figures of merit. However, in the subsequent discussion of sources he often deviated from his own criteria without clearly indicating the reasons for these deviations.

As I indicated previously, the flaws in this monograph are minor. Kessler has achieved a valuable realization of his goal—a self-contained, intelligible introduction to the physics of spin-polarized free electrons. This monograph is an excellent guide for graduate students and research scientists interested in understanding either the growing field of polarized electrons or the insights this field can provide for other areas of physics.

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Classical Electrodynamics, 2nd edition

J. D. Jackson
848 pp. Wiley, New York, 1975. $20.95

Since the appearance fifteen years ago of the first edition of J. David Jackson's *Classical Electrodynamics*, his book has been gaining ground steadily as *the* text for electromagnetism in the core curriculum of graduate-physics programs. During these years, both students and teachers using this book have noticed several shortcomings. Undoubtedly many have shared my personal wish that these defects would be remedied one day. With pleasure I report that, indeed, the second editon has fulfilled most of my wishes (both as a student and teacher of the first edition and as a teacher from the second).

A complete, detailed listing of the salient changes incorporated in the new edition would far exceed the space allocated here. Apart from that consideration, it seems inappropriate to duplicate the author's own list in his new preface. I will only mention a few points in brief.

At the general level, the most welcome change is the weaving of a large amount of physics into the old text's contents; often I heard the complaint: "Jackson [the first-edition book] is a bag of mathematical tools!" Indeed, it is easy to lose sight of the physics in the jungle of Bessel functions and multipole moments. This new edition succeeds in turning the (conscientious) reader toward the reality of experimental numbers and the limitations of theoretical formulae whenever appropriate; the introductory survey and sections 6.7, 7.5e, and 11.2 provide a few examples of the shift. Other general improvements are the substantial references to *recent* articles and a large number of new, interesting problems.

The major revisions take place at the