BOOK REVIEWS

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The following review is the third in a series of three that discuss new textbooks for calculus-based introductory physics. A review of Physics for Scientists and Engineers by Randall D. Knight was published in the February issue; a review of Six Ideas That Shaped Physics by Thomas A. Moore was published in the March issue.

Post-Use Review. Matter and Interactions (two volumes). Ruth Chabay and Bruce Sherwood. 992 pp. Wiley, Hoboken, NJ, 2002. Price: $165.90 (paper) ISBN 0-471-35491-0, 0-471-44255-0. (Aaron Titus, Reviewer.)

In my third year of teaching I had a professional epiphany. About two weeks into the first semester of a standard calculus-based introductory course, I drew a two-dimensional velocity vector and a student asked, "Is that velocity positive or negative?" On that day, I realized that students worked hard one week to learn the "rules" of one-dimensional motion, only to be asked the next week to unlearn what they knew in order to learn the rules of multi-dimensional motion. I realized that the standard course spends a great deal of time teaching rules for special cases, rather than the fundamental laws of physics. Yet students want to know what rules apply to all situations. I thought to myself, why not learn the more general case first?

I had known of *Electric and Magnetic Interactions* (reviewed in AJP by John Gastineau in July 1995), which was the precursor to Volume II of *Matter and Interactions*, so my epiphany caused me to look at this new two-volume text. Here I found what I was looking for: an emphasis on fundamental principles, rather than a text that reads like an encyclopedia. It is also a truly modern textbook, in both content and approach.

I began using *Matter and Interactions* for my introductory, calculus-based physics course at High Point University in 2003. My classes are small—about 20 students on average—and consist mostly of chemistry, computer science, mathematics, and biology majors. Students and my colleagues in the departments I serve have been very receptive of the innovative approach.

Volume I, *Modern Mechanics*, is clearly organized according to four fundamental principles and includes applications of these principles in mechanics, electrostatics, nuclear physics, atomic physics, and thermodynamics. The four principles are: (1) the momentum principle (Newton's second law); (2) the energy principle (conservation of energy); (3) the angular momentum principle (Newton's second law for rotation); and (4) the fundamental assumption of statistical mechanics.

Volume II, *Electric and Magnetic Interactions*, is devoted to electromagnetic interactions, culminating with Maxwell's equations and the classical model of the interaction of light and matter, followed by a discussion of wave-particle duality. Both volumes address macroscopic phenomena as reflections of atomic and molecular interactions, and much content is devoted to atomic-level description and analysis.

Within this revolutionary approach to organizing content, Chabay and Sherwood also revolutionize the presentation of certain topics, as they have suggested in earlier AJP papers. Their treatment of energy and angular momentum in Volume I and their treatment of electric circuits in Volume II particularly stand out. To illustrate, consider Volume I's four chapters on energy.

Some textbooks carelessly attribute potential energy to a single particle ("the gravitational potential energy of a projectile" for example), do not consistently define the system being analyzed, and/or incorrectly apply conservation of energy to deformable systems. The difference between pseudowork and work, such as when calculating work done by friction, is either not explained or given minimal attention. With the traditional ordering of topics, it's difficult to ascertain how work should be calculated for certain situations and how conservation of mechanical energy and the first law of thermodynamics are related.

On the other hand, after *Matter and Interactions* defines work, the relativistic energy of a particle, and the work-energy relationship for a particle (Chapter 4), it then applies the energy principle ($\Delta E = W$) to a multi-particle system, being very careful to define the system and account for the potential energy of each pair of particles. In Chapter 5, *Matter and Interactions* applies the energy principle to macroscopic systems ($\Delta E = W + Q$), taking into account thermal transfers of energy into or out of the system, and in Chapter 6, it applies the energy principle to quantum mechanical systems including energy quantization of the hydrogen atom and molecular vibrations. It completes the chapters on energy (Chapter 7) by applying the energy principle to deformable systems. But rather than introduce pseudowork, *Matter and Interactions* continues its emphasis on the choice of system by applying the energy principle to the real system ($\Delta E = W + Q$) and the point particle system ($\Delta K_{\text{trans}} = \int \boldsymbol{F}_{\text{net}} \cdot d\boldsymbol{r}_{\text{cm}}$). This treatment enables students to account for changes in thermal energy and to correctly calculate work done by air resistance or friction.

The story line from Chapter 4 to Chapter 7 is beautiful. It connects the work-energy relation for a particle to the energy principle for a macroscopic system. Furthermore, it illustrates why both are needed, how work is correctly calculated in each case, and how to apply it to various situations including Coulomb interactions, nuclear reactions, emission and absorption of light, simple harmonic motion, and more.

Matter and Interactions is revolutionary in its inclusion of modern topics throughout the textbook, preferring to give relativistically correct definitions of quantities before simplifying to the nonrelativistic case. For example, Chapter 1 first defines the relativistic momentum of a particle and then approximates it for classical speeds. Chapter 4 defines the (relativistic) energy of a particle and then approximates the particle's kinetic energy for classical speeds. But beyond giving mere definitions of quantities like momentum and energy, *Matter and Interactions* includes applications to particle physics, nuclear physics, and atomic physics throughout the text, where appropriate. These topics bring the introductory course up to date and provide enough "fun stuff" to capture the interest of teachers and students alike.

Finally, *Matter and Interactions* is revolutionary in its emphasis on using physical models and computational techniques to solve problems. Various end-of-chapter problems require students to make simplifying assumptions and estimations. Some problems require numerical differentiation or integration. Chabay and Sherwood recognize computational physics as an essential tool for today's scientist and have given it its due prominence in the textbook. They provide a PYTHON module called VISUAL that makes it trivially easy to write simulations with three-dimensional animation. The combination of PYTHON and VISUAL is usually called VPYTHON. Although VPYTHON is not a requirement for teaching with *Matter and Interactions*, students can so easily learn to use it for Euler-method numerical integration that I cannot imagine teaching without it. Calculating a few iterations by hand and then with a spreadsheet helps students understand how to write the iterative loops in VPYTHON and clarifies the strengths of VPYTHON.

But *Matter and Interactions* is not just a high-tech textbook. Thought-provoking questions, exercises, and hands-on low-tech experiments are woven into the dialogue of the book. Students who read the book as intended will stop to ponder the questions and do the low-tech experiments. A professor using *Matter and Interactions* will likely implement the low-tech experiments as part of the required laboratory that accompanies the course. A student desktop experiment kit for Volume II is available for $39 from PASCO and includes batteries, bulbs, magnet, compass, and other materials for doing the E&M experiments described in the book.

Professors and students alike will appreciate the book's well-focused exercises, review questions, and problems. The exercises are placed at the ends of most sections, usually following a worked-out example, and merely require a simple application of an equation or idea. At the end of each chapter are review questions, problems, and answers to the exercises. Though a few end-of-chapter problems are familiar, most have been specially created by Chabay and Sherwood to focus students' attention on the emphases of the course: physical modeling and application of fundamental principles. Though there are fewer end-of-chapter problems than in most introductory textbooks, they do adequately cover all the topics and the richness of the problems is extraordinary.

Matter and Interactions is the kind of book that you, the physicist, will enjoy. On the other hand, it's possible that many students don't have the background knowledge necessary to appreciate how lucidly it is written and how enlightening its approach is. In this sense, it bears a strong resemblance to *The Feynman Lectures on Physics*—treasured by physicists but probably underappreciated by beginning students.

One criticism of *Matter and Interactions* is that it deviates too far from the typical textbook. Granted, it's not a small perturbation. You won't find an emphasis on constant acceleration or a whole chapter on one-dimensional motion. You won't find geometric optics or fluid dynamics or relativistic kinematics. Against tradition, the book introduces the Coulomb force and electric potential energy early in the first volume. But, a "glass is half full" response to this criticism is that the book has clear purpose and focuses on that purpose. Besides the omission of geometric optics, which I cover in my course, I find the book to be right on target.

Another criticism I've heard is that *Matter and Interactions* is too hard for the average student or that it's appropriate only for physics majors. However, I've found the level to be appropriate for my own students, none of whom are physics majors. The students themselves have reacted in about the same way as to other physics textbooks: They usually don't read the book, and they wish it had more examples. Naturally, when doing homework, students look first for examples. As an instructor I am content with the number of examples in the book because I provide additional examples in class.

Chabay and Sherwood have used their text in a large-enrollment course for engineering students at North Carolina State University. In this context they have learned a great deal about making the material accessible to a wide variety of students, and have developed a number of supplementary materials and instructor resources that can help. These materials are available on the web at http://www4.ncsu.edu/~rwchabay/mi/mi_instructor_resources.htm. Their success is evidenced by the diversity of institutions that use *Matter and Interactions*.

For physics and chemistry majors, there is probably little argument that *Matter and Interactions* lays a strong foundation upon which upper-level courses can build. Among the many examples are the authors' extensive use of potential energy diagrams and treatment of the quantum oscillator. This is clearly in anticipation of further development of the topic in classical mechanics, quantum mechanics, and physical chemistry.

For this reason, larger departments considering adoption of *Matter and Interactions* for a calculus-based physics course may want to first use it with an honors section or a section for physics majors. A few notable engineering schools did this and are now considering adoption for all of their sections of calculus-based physics. I personally believe that *Matter and Interactions* is appropriate for classes of any size, at schools of every type, though there will be additional challenges in large-enrollment courses.

When I think of those who are confronting the status quo of the physics curriculum, I think of David Hestenes, advocate of geometric algebra; Edwin Taylor, advocate of the principle of least action; and Thomas Moore with *Six Ideas That Shaped Physics*. Add to this list Ruth Chabay and Bruce Sherwood, who with *Matter and Interactions* have perhaps defined the standard for the contemporary calculus-based physics course.

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The Man Who Changed Everything: The Life of James Clerk Maxwell. Basil Mahon. 226 pp. Wiley, Hoboken, NJ, 2003. Price: $29.95 (cloth) ISBN 0-470-86088-X; $14.95 (paper) ISBN 0-470-86171-1. (Jay M. Pasachoff, Reviewer.)

When I went for the first time to Edinburgh, I called the tourist office to ask where Maxwell's house had been, and whether I could see a plaque or a statue. Nobody had heard of Maxwell and it was only with perseverance and difficulty that I turned up an old address in the 18th-century New Town, which indeed had an inscription. At the same time, I tried to convince my traveling colleague, an art historian, that Maxwell had been important in science, indeed, ranking with Newton and Einstein.

At another visit to the Cavendish Laboratory's current buildings in Cambridge, England, I was surprised to find on display a mechanical model, with little ivory balls, accompanying a prize-winning paper by young Maxwell solving the problem of Saturn's rings. He showed that they could not be solid or continuously fluid. (How much he would have enjoyed seeing the Cassini spacecraft's images of density waves in Saturn's rings; see http://ciclops.org). How many fabulous things had this physicist done? I already knew of Maxwell's demon and Maxwell's equations, not to mention the Maxwell-Boltzmann distribution. I hadn't known that he built the Cavendish and was its first director (succeeded in order by Lord Rayleigh, Thomson, Rutherford, and William Lawrence Bragg), making possible the institution that led, under the last director, to Watson and Crick's work on DNA. Did you know that Maxwell was responsible for explaining additive color vision? Think of him the next time you watch TV or upgrade to HDTV.

Basil Mahon's book humanizes Maxwell while at the same time making clear how brilliant a physicist he was and how widely he contributed to today's world. The book's title demonstrates the importance Mahon attributes to Maxwell. Mahon discusses, toward the end, why Maxwell was so obscure, even in his time in England. Why, for example, Cambridge experimenters didn't make "a serious and sustained attempt to confirm Maxwell's theory." Maybe then we would be talking of Maxwellian rays instead of Hertzian rays. Still, "Einstein's theory was more rapidly accepted than Maxwell's had been…*General Relativity* was from first to last a *field* theory of the kind pioneered by Maxwell. Einstein was fulsome [the misuse of this word, also on p. 85, was one of the few errors I found in the book] in recognition of Maxwell's crucial contribution and our hero's stock rose still higher with physicists. None of this, however, reached the public" (p. 181). Perhaps had Maxwell survived past the age of 48, he would have become better known outside the world of physics, maybe in response to the honors he had garnered abroad.

In the course of the book, we learn about many scientists and the relation of their work to Maxwell's. Examples include Faraday, William Thomson, Green, Stokes, Helmholtz, Boltzmann, Crookes, Michelson, Morley (an alumnus of Williams College, where he learned careful measurement techniques at our historic Hopkins Observatory), Hertz, Marconi, and J. J. Thomson.

Maxwell's life was not always the soap opera typical of Einstein's, but his family's persuading him at the age of 23 not to marry a cousin because of consanguinity worries was "deeply wounding" (p. 66). His eventual marriage at the age of 27, in 1858, was long and happy. That same year he won his prize for the Saturn paper, which was published in 1859. The next year he published papers on gases and on the colors of the spectrum. Then he lost his post, because of a merger, in spite of his having married the daughter of the Principal. Those worried about their own careers can take hope in the fact that Maxwell then did not win a professorship at Edinburgh, with his difficulties compounded by contracting smallpox and then an infection from a riding accident. Things soon improved for him, though. Later in the year, he was appointed professor of natural philosophy at King's College, London, and was awarded the Rumford Medal by the Royal Society for his work on color vision. Phew.

Of course, the biography discusses Maxwell's work on electricity and magnetism at great length, linking the development of intellectual ideas with the personalities involved and the ultimate achievement of the *Treatise on Electricity and Magnetism*, "probably, after Newton's *Principia*, the most renowned book in the history of physics" (p. 162).

The book ends (sort of) with a fine biography and a good index. It was strange to find four pages of advertisements for other works from the publisher after the index. The book also contains a useful chronology and endnotes, including enlarged discussions of the role of Maxwell's work in Einstein's.

Incidentally, I had always wondered about the "Clerk," but I should rather have wondered why "Maxwell"? Mahon explains early on how the family, originally Clerk, took on the Maxwell name as part of an agreement involved in inheriting an estate. Young James was brought up there. If you like, read "Clerk Maxwell" everywhere I have written solely "Maxwell" in this review.

Put Maxwell's birthplace, 14 India Street, Edinburgh, Scotland, owned by the James Clerk Maxwell Foundation (http://www.clerkmaxwellfoundation.org/) since 1993 and used for seminars and a display of memorabilia, on your touring itinerary. (A chair young Maxwell sat in and later embroidered by his aunt illustrating the wave theory of light is the most interesting item on their Web site. A discussion of applications of Maxwell's various discoveries is also of interest.) The James Clerk Maxwell Telescope on top of Mauna Kea in Hawaii is a current scientific tribute. The crater Maxwell on the Moon and Maxwell Montes on Venus, the tallest mountain on that planet (and in the solar system) put our subject among the Greek heroes after whom many constellations were named.

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Electricity, Magnetism and Light. Wayne Saslow. 800 pp. Harcourt/Academic-Elsevier, Stamford, 2002. Price: $73.95. ISBN 0-1261-94556. (Lane H. Seeley, Reviewer.)

Many introductory physics instructors do not choose a separate textbook for the E&M portion of the course. But for those who want to consider using a separate text, Wayne Saslow's *Electricity, Magnetism and Light* may be an attractive option. This textbook has a number of distinctive features that set it apart from other introductory textbooks. As a professor who has taught introductory physics many times, I was deeply impressed by the number of new insights I gained from looking over this text. I believe this textbook is best suited for highly motivated, highly capable students who are ready to transition from an introductory mechanics course toward more complex and subtle upper-division concepts.

A comparison with widely used introductory textbooks, such as *Fundamentals of Physics* by Halliday *et al.*, and *University Physics* by Young and Freedman, shows a very different style of delivery. In contrast to the elaborate, colorful artwork that is typical of these other texts, Saslow's book includes only black and white figures that are relatively unadorned and sparingly used. The style of presentation is more typical of advanced textbooks than other introductory texts. Presumably the rationale for colorful artwork and pictures is a need to make the subject more attractive and accessible to a wider audience. I am not aware of any rigorous research to reinforce this rationale. One can easily make the counter argument that a more refined presentation, such as Saslow's, will inspire a less distracted reading. Saslow's text is certainly written for an audience of careful, diligent readers. Students who read the text carefully will discover a writing style that encourages a thoughtful exploration of both fundamental ideas and subtle implications.

The area in which Saslow's text most significantly diverges from others is the introduction of magnetic fields. Where most textbooks put significant effort into dispelling the notion of magnetic monopoles, Saslow embraces magnetic monopoles as a useful model of magnetic fields outside of magnetic materials. This approach provides an intuitive model for talking about the most simple, tangible experiences students have had with magnets, namely, the polarity of ferromagnetic materials and the induced polarity of paramagnetic materials. Saslow extends this approach beyond qualitative intuitive explanations to address quantitative calculations such as the lifting strength of a bar magnet. Saslow's introduction to magnetism is quite ambitious, including a discussion of hysteresis loops to explore the distinction between the magnetic field, **H**, and the magnetic induction, **B**. Students who are able to gain a working understanding of the material in Saslow's introductory magnetism chapter will enter an upper-division course with a deep, nuanced background in magnetism. As Arnold Arons and others have noted, however, many students have ongoing difficulties differentiating the properties of magnetic fields from those of electric fields. For these students the introduction of a magnetic monopole model may reinforce those difficulties.

In addition to a nontraditional approach to introducing magnetism, there are numerous, more subtle aspects of Saslow's text that many instructors will appreciate. A number of "home experiments" are suggested, which provide easy ways for students to explore a variety of electric phenomena. "Concept quiz" questions are provided within each chapter. These questions require students to consider subtle implications of the material presented. Because solutions are presented immediately below these questions, however, students may be tempted to simply read the question and solution rather than carefully considering the question in light of the preceding material. Saslow provides students with a number of opportunities to perform numerical integration and differentiation using a spreadsheet program.

Saslow introduces challenging concepts that are typically reserved for upper-division textbooks. For example, the method of images, the screening length, and the surface dipole layer are all briefly treated in the text. For motivated students, this early exposure to advanced topics will probably be a significant benefit when they revisit these topics later on. Many introductory texts will gloss over complicating factors and make simplifying approximations (sometimes unstated) in order to present a simple, clear, and coherent picture. Saslow is consistently willing to tell a more complete story even when doing so may overwhelm some students. For example, in presenting Coulomb's law Saslow plunges bravely forward to cover the strength of materials and the need for additional forces in the atom. Saslow also provides a number of nice quantitative interdisciplinary examples ranging from cell membranes to lightning to car batteries.

The instructor who adopts this text should be aware of the potential shortcomings of such an advanced introductory textbook. A wide body of research has demonstrated the inherent conceptual difficulties that most students encounter when first exposed to fundamental concepts in electricity and magnetism. These difficulties include failure to correctly distinguish electric force, electric field, electric potential, and electric potential difference, and inability to appropriately apply the complementary models of electric potential and electric current in simple dc circuits. Various curricula have been developed to address these difficulties, including *Real Time Physics* by Sokoloff *et al.*, and *Tutorials in Introductory Physics* by McDermott *et al.* Several new introductory textbooks have recently been published that are heavily influenced by research in student learning and are written to prompt students to continually apply basic concepts; examples include *Understanding Physics* by Cummings *et al.*, *Physics for Scientists and Engineers* by Knight, and *Electric and Magnetic Interactions* by Chabay and Sherwood.

In contrast, Saslow's text relies more heavily on mathematical formalism to provide a framework for student understanding. As one reviewer is quoted saying on the publisher's web site, "The emphasis on the relationship between equations (mathematics) and physics is very strong." For students who readily construct understanding from a mathematically framework (as most of the readers of this journal do), Saslow's guidance will be very effective. For many students, however, using mathematics to frame conceptual understanding is extremely difficult. Therefore, an instructor will likely need to supplement the textbook with other conceptually focused materials or curricula (such as those mentioned above) in order to address common fundamental conceptual difficulties.

In summary, a decision to adopt this text should be made with careful consideration of the audience the text will serve. Professors and mathematically gifted physics students will discover a text that is elegant, intuitive, nuanced, concise, and generally a pleasure to read. The average physics student may discover a text that is obscure and inaccessible. Elegance is often in the eye or the mind of the beholder.

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Post-Use Review. Modern Problems in Classical Electrodynamics. Charles A. Brau. 594 pp. Oxford U. P., New York, 2004. $105.00 ISBN 0-19-514665-4. (Joel D. Rauber, Reviewer.)

To Jackson or not to Jackson, that is the question…

In selecting a text for a reasonably traditional graduate course in Classical Electrodynamics, one is faced with a relative paucity of choices in this particular market. The difficulty is accentuated by the shadow that the *de facto* standard casts on the collective consciousness of the physics community. Can it really be a graduate level E&M course if you haven't chosen Jackson?

I have been faced with this dilemma over the last decade when chosen to teach our department's graduate course in electricity and magnetism. We have a modest master's level program in which our student population allows us to offer the basic graduate courses in physics every other year. Frequently the students are less than well prepared. I used Brau's text in the fall term of 2004.

Modern Problems is essentially a traditional book, albeit one with an unusual order of topics—particularly considering that the author is a self-identified experimentalist. The book begins with a "Chapter 0," which serves as a 28-page overview of electrodynamics, introducing the high points of the classical theory at a level that ideally your graduating seniors have mastered. The overview is too short to actually learn from and serves mostly as a fiducial reference that acquaints the new student with the notation used in the text and its basic expectations. Given the nature of this chapter, one might think that it would be better placed as an appendix at the back of the book; however, given the subsequent ordering of topics I agree with the decision of the author to place this material at the beginning. If a quick overview of electrodynamics is unnecessary for your class, you can easily dive directly into Chapter 1.

In contrast to Jackson and the other book I have used for this course (VanderLinde's *Classical Electromagnetic Theory*), Brau begins with a relativistic treatment. He starts with a typical introduction to special relativity using 4-tensors. The reader is quickly and efficiently brought to the point of writing Maxwell's equations in covariant form in terms of the electromagnetic field tensor. The book takes the approach that classical electrodynamics is a relativistically covariant theory and is best understood in those terms, so one should start out from the beginning using the most appropriate language for the material. This is done in modern style with a metric tensor and all of the index gymnastics that that entails. However, the author eschews burdening the student with the full machinery, such as covariant derivatives and "connections."

Chapter 2 is devoted to applying variational techniques, starting with deriving equations of motion for charged particles and subsequently developing the "equations of motion" for the fields by varying the fields themselves. The author then explores the role of invariance and conservation laws. This material corresponds with that found in Chapter 12 of Jackson.

The mathematical techniques underlying the variational methods of Chapter 2, and to a lesser extent the "index" methods of Chapter 1, are rather tersely developed. If your students have had little contact with those methods you will likely need to provide background material in lecture or even some background reading.

The coverage of statics and boundary value problems occurs in Chapter 3. This material is de-emphasized compared to Jackson, but the author does provide a refreshing example that requires the use of spheroidal coordinates to efficiently produce a solution.

Next, we see a presentation of wave solutions. This is a fully integrated presentation that includes the motion of charged particles in plane waves, Fourier decomposition of the fields, and a discussion of radiation emission from oscillators and the canonical equations of motion for the electromagnetic field. Last, the motion of waves through plasmas is covered. This is where I ended the first semester of the course I taught; unfortunately the second semester of the course was canceled and my comments on the remaining two-thirds of the book are not based on actual use.

Chapters 5 through 9 are where the author's experimental background in laser physics shines. Chapter 5 continues the coverage of Fourier techniques and the method of virtual quanta. Chapter 6 lays the foundation for the succeeding three "optics" chapters by providing the background material for electromagnetic theory in macroscopic media. Chapters 7, 8, and 9 provide more extensive coverage of "optics" than Jackson. This includes a full chapter devoted to nonlinear optics.

The book ends with two chapters that take us back to basics: a chapter on the radiation produced by relativistic particles and a final chapter entitled "Fundamental Particles in Classical Electrodynamics," which covers electromagnetic mass, radiation reaction, magnetic monopoles, and the Thomas precession of spin.

Problems are interspersed throughout the reading at the ends of sections and subsections rather than being relegated to the ends of the chapters. The more applications-oriented problems appear to be drawn from the author's field of expertise. While there are a reasonable number of problems you may find yourself supplementing problem sets with some of your own favorites drawn from other sources. The text has been well edited and is relatively free of typographical errors; the few I found were minor in nature. The author maintains a website of errata, which I found to be well maintained and up-to-date. Indeed, I found the author to be quite affable to communication via email regarding the text. The book appears physically well constructed and is printed on acid-free paper; it is not obvious whether the signatures are sewn.

The answer to the question posed at the beginning of this review depends upon the role played by the graduate-level electrodynamics course in your department. Brau has given careful consideration to providing a unified text that efficiently takes the student into interesting material that is often omitted in courses. This is accomplished by rearranging the material and by de-emphasizing boundary value problems, which play a significant role in the first five chapters of Jackson. So if you are interested in a rigorous graduate-level text that accomplishes this in an up-to-date manner, along with downplaying the ponderous plod through boundary value problems, you will want to consider this text. On the other hand, if this course plays a significant role in your curriculum as an alternate or supplementary mathematical methods course, you may prefer to stay with the "canonical" choice, or at least supplement Brau's text with background mathematical material from other sources.

If your needs require a "Jackson-Lite," you may be better served by VanderLinde's *Classical Electromagnetic Theory*, which is now back in print. An interesting but radical departure from the usual would be Baylis' *Electrodynamics, A Modern Geometric Approach*, which presents the material using the mathematical methods of geometric algebras.

Unfortunately one can no longer make the decision based on eschewing SI units. Brau's book is fully SI compliant, and much of the latest edition of Jackson has also slipped into SI compliance, demonstrating the allure of the dark side.

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BOOKS RECEIVED

100 Years of Relativity. Edited by Abhay Ashtekar. 510 pp. World Scientific, Hackensack, NJ, 2005. Price: $88.00 ISBN 981-256-394-6.

Albert Einstein: Chief Engineer of the Universe (2 volumes). Edited by Jürgen Renn. 815 pp. (plus CD-ROM). Wiley, Hoboken, NJ, 2006. Price: $99.95 ISBN 3-527-40571-2.

Atoms, Molecules and Photons: An Introduction to Atomic-, Molecular- and Quantum-Physics. W. Demtröder. 571 pp. Springer, New York, 2006. Price: $79.95 ISBN 3-540-20631-0.

Cliff's Nodes: Editorials from The Physics Teacher. Clifford Swartz. 338 pp. Johns Hopkins U. P., Baltimore, 2006. Price: $65.00 (cloth) ISBN 0-8018-8306-7; $25.00 (paper) ISBN 0-8018-8307-5.

Columbia: Final Voyage. Philip Chien. 454 pp. Copernicus Books, New York, 2006. Price: $27.50 ISBN 0-387-27148-1.

Continuous-Time Sigma-Delta A/D Conversion. M. Ortmanns and F. Gerfers. 242 pp. Springer, New York, 2006. Price: $149.00 ISBN 3-540-28406-0.

Control Theory in Physics and Other Fields of Science. Michael Schulz. 300 pp. Springer, New York, 2006. Price: $229.00 ISBN 3-540-29514-3.

Einstein, 1905-2005: Poincaré Seminar 2005. Edited by Thibault Damour *et al.* 293 pp. Birkhäuser, Boston, 2006. Price: $99.00 ISBN 3-7643-7435-7.

The Einstein Dossiers: Science and Politics—Einstein's Berlin Period. S. Grundmann. 459 pp. Springer, New York, 2005. Price: $69.95 ISBN 3-540-25661-X.

Electromagnetic Processes. Robert J. Gould. 271 pp. Princeton U. P., Princeton, NJ, 2006. Price: $89.50 (cloth) ISBN 0-691-12443-4; $45.00 (paper) ISBN 0-691-12444-2.

Engineering Mechanics of Composite Materials (second edition). Isaac M. Daniel and Ori Ishai. 411 pp. Oxford U. P., New York, 2006. Price: $89.95 ISBN 0-19-515097-X.

Entangled World: The Fascination of Quantum Information and Computation (translation). Edited by Jürgen Audretsch. 300 pp. Wiley, Hoboken, NJ, 2006. Price: $35.00 ISBN 3-527-40470-8.

A Guide to Biomolecular Simulations. Oren M. Becker and Martin Karplus. 220 pp. Springer, New York, 2006. Price: $89.95 ISBN 1-4020-3586-1.

Introduction to Microfluidics. Patrick Tabeling. 301 pp. Oxford U. P., New York, 2005. Price: $99.50 ISBN 0-19-856864-9.

An Introduction to Programming with IDL. Kenneth P. Bowman. 286 pp. Academic Press, Burlington, MA, 2006. Price: $49.95 (paper) ISBN 0-12-088559-X.

Numerical and Practical Exercises in Thermoluminescence. Vasilis Pagonis, George Kitis, and Claudio Furetta. 208 pp. Price: $79.95 ISBN 0-387-26063-3.

The Science and Applications of Acoustics (second edition). Daniel R. Raichel. 660 pp. Springer, New York, 2006. Price: $89.95 ISBN 0-387-26062-5.

Space Shuttle Columbia: Her Missions and Crews. Ben Evans. 486 pp. Springer, New York, 2005. Price: $39.95 (paper) ISBN 0-387-21517-4.

Space Weather, Environment and Societies. J. Lilensten and J. Bornarel. 242 pp. Springer, New York, 2006. Price: $129.00 ISBN 1-4020-4331-7.

Teaching and Learning Astronomy: Effective Strategies for Educators Worldwide. Edited by Jay M. Pasachoff and John R. Percy. 268 pp. Cambridge U. P., New York, 2005. Price: $120.00 ISBN 0-521-84262-X.

Ultraviolet Radiation in the Solar System. M. Vázquez and A. Hanslmeier. 380 pp. Springer, New York, 2006. Price: $179.00 ISBN 1-4020-3726-0.