modern flavor while retaining a historical perspective, give a feel for experimental and computational methods, cover many of the exciting new developments, and go beyond the traditional "crystal physics" to complex materials, fluids, and hybrid forms of condensed matter. Has he succeeded? My answer is that he did a very good job, but there are some shortcomings that can, at least to some extent, be improved in a second edition.

The book gives a good account of the now-classical "crystal physics" that is the heart and soul of the venerable old books. It also gives a panoramic view, however, of the diversity of modern condensed matter physics by covering surfaces and scanning tunneling microscopy, interfaces, the quantum and fractional Hall effects, giant magnetoresistance, quantum dots, high-temperature superconductivity, and critical phenomena. The book also provides a credible account of polymers and fluids, dislocations and cracks, plasticity, alloys, and liquid crystals, and it does not shy away from transistors. For the most part, Marder gives what one might call an "initial account" of these diverse topics, enriching students without taxing them with advanced formulations.

Marder also does an excellent job of outlining the mainstream experimental methods that are used to measure the various properties. This is an important element for a textbook aimed at a mix of students who will pursue either experimental or theoretical research. In addition, he gives introductory glimpses of computation, which is emerging as a third, distinct mode of research. He also mentions some of the challenges faced by the pioneers in the field and places them in their historical context. These descriptions are both enriching and unobtrusive, as he carefully avoids getting dragged into the historical evolution of the field. The book also contains a collection of tables that give a sense of reality and provide a handy reference. The problem sets are substantial and a solutions manual is being compiled to make the teacher's life a bit easier.

Marder made a good effort to avoid one of the major sins of most books with similar objectives: He goes to great lengths to tell you where all the equations come from; the use of tiny print next to equations often tells you where you can find derivations. He still falls into the trap here and there, however. For example, in the section on phase separations, he mentions Fick's law of diffusion without any indication of where it comes from or where one can find a derivation. Clearly, problems of this kind can be fixed in a second edition.

One weakness that may be hard to fix is the emphasis on rather disconnected models, a practice that does not convey the underlying unity of the field and does not reveal the connections to corresponding computational methods. My point is best exemplified by the chapters on electronic structure. They first cover "free-electron" bands, the periodic crystal potential and the Bloch theorem, and nearly-free-electron bands. A subsequent chapter starts with the Born–Oppenheimer approximation, the many-electron problem, Hartree–Fock, and density functional theory. I would much rather do it in reverse: show how density functional theory rigorously yields an effective one-electron potential, introduce the Bloch theorem, and then describe the range of solutions from free to nearly-free to real electrons and realistic computations. Similar comments apply to a few other topics.

In summary, the main strength of the book is that it conveys the enormous breadth of modern condensed matter physics and gives a basic, often conceptual account of these diverse topics. But the exposition tends to be fragmented and does not capture underlying unifying themes.

Sokrates T. Pantelides
Vanderbilt University
Nashville, Tennessee

Introduction to High Energy Physics

Donald H. Perkins
Cambridge U. Press, New York, 2000 [1972], 4th ed. $49.95 (426 pp.). ISBN 0-521-62196-8

Introduction to High Energy Physics by Oxford University professor Donald Perkins has been, since its first publication in 1972, one of those essential textbooks that can be found on the shelf of just about every particle physicist. It holds a unique place in the literature. Many fine texts exist on the elegant mathematics and theoretical implications of quantum field theory (for the Standard Model of particle physics). There also exist many surveys of 20th-century experimental physics ("modern physics"). However, few texts describe at an advanced level (advanced undergraduate or graduate) the messiness of the real world, the plethora of particles, their masses and phenomenology, and the tools and analysis techniques of the experimentalist. Perkins does, and Cambridge University Press has recently released a fourth edition of his classic textbook.

Many exciting discoveries have occurred since the third edition was published in 1987. The most exciting is the growing body of evidence that neutrinos have mass. This discovery has profound implications both for particle theories and for cosmology. The book's first page promises that "this fourth edition includes all recent developments in elementary particle physics, as well as its connections with cosmology and astrophysics," and it fulfills this promise very nicely.

A new chapter on Particle Physics and Cosmology covers Hubble's law, cosmic microwave radiation, nucleosynthesis, matter–antimatter asymmetry, dark matter, and inflation. The material on "Physics Beyond the Standard Model" is also almost entirely new; it covers much of the kind of physics that will be studied in the coming decade. In total, there are approximately 80 pages of material that was not covered in earlier editions. The new edition also updates the material in the earlier chapters to include the many new results in this field since 1987, such as the discovery of the top quark and precision results on the properties of the Z boson. The material has also been reordered to give it a more modern feel.

However, perhaps because the book is such an important one, it is easy to complain about its quirks, all of which are still present in the new edition. Reading Perkins is more like listening to a lecture by a famous professor at one of the world's greatest universities than reading a modern textbook. The explanations often are obviously based on knowledge the author has, feels is too advanced for the text, but cannot resist dangling in front of the reader's nose (for example, "recall that it is the longitudinal components that eat the Higgs," on page 263).

Perkins also often uses words unfamiliar to most undergraduates without defining them in the text: ("Cabibbo-favored" on page 133, for example). And, because he uses only advanced undergraduate-level mathematics, his book does not manage to convey the elegance and beauty of particle theory. Also, strangely, he has moved the chapter "Experimental Methods," which describes in detail the kinds of apparatus used in particle experiments and how they work. It was the second chapter in previous editions; now it is at the end of the book. I don't know what "shower in the electromagnetic calorimeter" on page 218 will mean to a student who hasn't read the detector section first. And a reasonably large fraction of the text consists of detailed descriptions of experiments.

It would probably be impossible to correct many of these faults, as one of the book's biggest shortcomings is also in some ways its biggest strength: It tries to be all things to all people. It is for graduates and undergraduates, and it describes in detail experiment, theory, particle physics, and cosmology. That's a lot of material in one book.

Other popular textbooks do exist that can partially fill this book's niche. *The Experimental Foundations of Particle Physics*, by Robert N. Cahn and Gerson Goldhaber (Cambridge U. Press, 1989), gives a historical review of pivotal experiments, including reprints of their publications. *Introduction to Elementary Particles*, by David Griffiths (Wiley, 1987), *Modern Elementary Particle Physics*, by Gordon L. Kane (Addison-Wesley, 1993), and *Collider Physics*, by Vernon Barger and Roger Phillips (Addison-Wesley, 1997), all discuss most of the essential phenomenology that a young particle physicist needs to learn, and they all include elementary quantum field theory.

They don't, however, describe experiments in detail. Perkins will thus continue to be a "must-have" for practicing experimentalists. It will also continue as a good choice for advanced undergraduates who have completed a course on quantum mechanics that includes scattering theory (it would be nice if this text reviewed scattering theory), or as part of a graduate course.

Sarah C. Eno
University of Maryland, College Park

Mathematical Methods: For Students of Physics and Related Fields

Sadri Hassani
Springer-Verlag, New York, 2000. $69.95 (659 pp.). ISBN 0-387-98958-7

Sadri Hassani's *Mathematical Methods* is the latest addition to the already long list of textbooks for an undergraduate course on mathematical methods for students of physics, engineering, and related fields. Four of these books (not including this one) were recently discussed in an excellent comparative review by Donald Spector (*American Journal of Physics*, volume 67, page 165, 1999). In terms of target audience, pace, and field coverage, Hassani's text is most nearly comparable to *Mathematical Methods in the Physical Sciences*, second edition, by Mary L. Boas (Wiley, 1983).

The topic coverage is fairly standard—infinite series, vector analysis, eigenvalues and eigenvectors, complex analysis, and ordinary and partial differential equations. There is an entire chapter on the Dirac delta function, including two- and three-dimensional versions, that I particularly like, and a chapter on nonlinear dynamics and chaos that is also well done. Topics covered in other books at this level but not covered here include the calculus of variations, probabilities, tensors, integral transforms, and the use of computers either for symbolic computing or numerical analysis. The first I don't particularly miss; students can learn the calculus of variations, when the need arises, in a classical mechanics course. The rest, however, I do miss to varying degrees.

The book has many strengths. For example: Each chapter starts with a preamble that puts the chapter in context. Often, the author uses physical examples to motivate definitions, illustrate relationships, or culminate the development of particular mathematical strands. The use of Maxwell's equations to cap the presentation of vector calculus, a discussion that includes some tidbits about what led Maxwell to the displacement current, is a particularly enjoyable example. Historical touches like this are not isolated cases; the book includes a large number of notes on people and ideas, subtly reminding the student that science and mathematics are continuing and fascinating human activities.

Sometimes, the author deviates from the traditional subdivisions to stress connections among different topics and techniques. For instance, he unifies the discussion of finite-dimensional vector spaces and orthogonal polynomials so that, when Fourier series or special functions are later used to solve ordinary differential equations, the notion of a function space with an orthogonal basis set is no longer entirely new. There are numerous detailed examples that students should find helpful, and many and varied end-of-chapter problems.

On the other hand, the first two-and-a-half chapters review material that students taking a mathematical methods course should already know. The chapters are not just straightforward review, however. It seems as if the author has identified certain problems and misconceptions that he is determined to exorcise, but the exorcisms