A Quantum Approach to the Solid State (Prentice-Hall, 1970). The authors deserve great credit for having labored to update the old text. Traditionally, solid-state physics and the collective effects of many-body interactions are treated in separate texts. Now, Taylor and Heinonen try to make condensed matter physics more accessible by molding the two approaches together in a single text. The book attempts to minimize the mathematical machinery, and claims to be accessible to students with a basic understanding of quantum mechanics.

The new text is ambitious in its breadth. It covers the basic concepts, including excitations and second quantization. Then it builds on those ideas to discuss a wide range of modern applications. Each of the book's 11 chapters is accompanied by a set of exercises, for which solutions are available on request from the publisher.

The book begins admirably. Its first chapter, devoted to elementary excitations, discusses traditional excitations (electron and phonon quasiparticles), and also plasmons, solitons (through the example of the one-dimensional Toda lattice), and the quantum Hall effect. The reader thus learns at the outset the importance of interactions in collective behavior. I was very encouraged. The next two chapters discuss Fermi and Bose fluids. After that introduction, the authors discuss one-electron theory, quasicrystals, and density-functional theory. I applaud the appearance, side by side, of density-functional theory and the notion of quasicrystals. From this point, the authors move on to consider interacting electrons.

Is this the condensed matter book our students have awaited? Unfortunately, no. In modernizing the book, the authors have added new material without devoting enough space to introduce key concepts. I was astonished to discover that the concepts of broken symmetry, order parameters, renormalization, and fixed points do not appear anywhere in the book. The omission of such ideas puzzles me, because those concepts are essential to physicists who attempt to describe the emergent behavior of collective matter.

The sections on Bose–Einstein condensation and superfluidity and the entire chapter on superconductivity, for example, never allude to broken symmetry or to the order parameter. Indeed, the student, having labored through the calculation of the Meissner effect, is not told about London's idea of wavefunction rigidity and will remain puzzled as to why a superconductor can expel magnetic fields. The section on mesoscopics omits the concept of quenched disorder and fails to explain localization as a constructive interference between time-reversed paths. Lastly, the chapter on the Kondo model and heavy fermions does not explain the concept of a localized moment, nor does it mention renormalization or fixed points.

A Quantum Approach to Condensed Matter Physics will perhaps be of interest to students looking for a large cross section of modern condensed matter physics in a short text. The book has the merit of plentiful problems that cover a broad range of topics. However, the text is sorely wanting in many important respects, and I regret that it fails to rise to the promise of its introductory chapters.

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Energy and the Environment

James A. Fay and Dan S. Golomb
Oxford U. Press, New York, 2002. $60.00 (314 pp.).
ISBN 0-19-515092-9

According to their preface, James Fay and Dan Golomb intended *Energy and* *the Environment* to be an upper-level undergraduate text for mechanical engineering students. The content of the book, however, is not part of the core curriculum in mechanical engineering. Rather, it has more general interest and would be accessible to many readers with some college mathematics and physics. Fay, a professor emeritus in mechanical engineering at MIT, has much practical experience in air-pollution control policy. Golomb is a professor of environmental sciences at the University of Massachusetts, Lowell, and has worked extensively in air-pollution science.

The text covers human use of energy and the main environmental problems associated with that use. Any text on energy faces an enormous challenge because energy provision to and use by people is a huge, sprawling subject. *Energy and the Environment* has limited success in meeting that challenge, although its treatment of thermodynamics and its analysis of a few important devices is good. Far more focused and authoritative than the energy material are the two environment-related chapters, which deal primarily with global warming and local and regional air pollution. These chapters present useful discussions of the environmental impacts of pollutants and emphasize greenhouse gases and acid deposition.

The section on energy use is restricted to electricity and transportation—a sensible choice, for those categories represent the greatest fraction of the power generated in the industrial world, and are the fastest growing categories worldwide. But the section includes almost nothing on related energy supply and mentions petroleum refining only incidentally. Many instructors and students would want oil and gas supply to be discussed in more than the half-page that each receives in Fay and Golomb's text. What exploration and development technology is emerging? What are the prognoses? The future petroleum supply is too briefly mentioned, and the statement that production might peak in the present decade is a controversial minority view. (See the article by Brian Clark and Robert Kleinberg in PHYSICS TODAY, April 2002, page 48.)

The presentation quality is mixed. For example, the section on wind energy offers an excellent selection of important topics. However, the discussion of wind-power economics (p. 181) is too simplified to be useful, even granting the space limitations of an inclusive text. The fuel-cell discussion is good but misses a chance to indicate that there are more complex and interesting things than the linear voltage–current relationship assumed in Fig. 3.10a. (See the article by Sivan Kartha and Patrick Grimes in PHYSICS TODAY, November 1994, page 54.)

Quantitative information in the energy section is usually presented without any citations. Such data should be cited, if only to teach students to examine numbers critically. The book does not mention the Annual Energy Review (AER) from the Energy Information Administration. That review, available on the World Wide Web at http://www.eia.doe.gov/emeu/aer/contents.html, is the premier US statistical resource on energy. Fay and Golomb's text contains many figures that are inconsistent with the AER.

For example, page 1 states, "Fossil fuel use per capita . . . [is] 56 times the necessary daily food energy." But from Table 1.3 of the AER, the year-2000 US fossil-fuel use was 85.2 quadrillion British thermal units, which, divided by a resident population of 275 million, results in 214 000 kilocalories per day. If one person needs 2500 kilocalories of food intake per day, then the per-capita fossil-fuel use, on the average, is slightly more than 85 times as great.

Another example of the book's inconsistency with the AER occurs on page 6, which says per-capita energy use in the US was 13 kilowatts in 1995. According to Table 1.3 of the AER, it was less than 12 kilowatts.

Inconsistencies of numbers also occur within the book itself. For example, page 16 shows the primary use of biomass in the US as less than 0.7% on page 16, but page 48 shows it as 1.25%. Both numbers are inconsistent with the more plausible 3% figure cited in the AER: Forest-product industries and firewood alone account for at least 1.25% of the per-capita energy use. Table 3.1 shows high heat value for gasoline, but the given quantity is defined to be low heat value. On page 84, it says, "If the capital cost is $500 per kilowatt of power, then the capital cost of pumped storage energy is $23 per gigajoule." Such a statement makes no sense unless one specifies a period of time.

Finally, some numbers in the book are intrinsically implausible. For example, page 4 cites a particular power plant as generating nearly 3000 megawatts of electrical power. That's a very large power plant indeed; the 3000 megawatts probably refers to the thermal power before it is converted to electricity.

In summary, *Energy and the Environment* presents basic thermodynamics, device descriptions, and environmental-impact descriptions clearly enough to be read by students and casual readers. Its numerical data, however, are insufficiently referenced and contain enough errors that the book should not be used as a reference resource. If the book were used as a text, a useful student exercise would be to check the accuracy of the illustrative numbers.

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New Books

Particle Physics

Quantum Chromodynamics. 2nd revised edition. W. Greiner, S. Schramm, E. Stein. Springer-Verlag, New York, 2002 [1994]. $69.95 *paper* (551 pp.). ISBN 3-540-66610-9

Unification and Supersymmetry: The Frontiers of Quark-Lepton Physics. 3rd edition. R. N. Mohapatra. *Graduate Texts in Contemporary Physics*. Springer-Verlag, New York, 2003 [1992]. $79.95 (421 pp.). ISBN 0-387-95534-8

Plasmas and Fusion

Atomic Processes in Plasmas. D. R. Schultz, F. W. Meyer, F. Ownby, eds. *AIP Conference Proceedings 635*. Proc. conf., Gatlinburg, Tenn., Apr. 2002. AIP, Melville, N.Y., 2002. $130.00 (307 pp.). ISBN 0-7354-0090-3

Production and Neutralization of Negative Ions and Beams. M. P. Stockli, ed. *AIP Conference Proceedings 639*. Proc. symp., Gif-sur-Yvette, France, May 2002. AIP, Melville, N.Y., 2002. $115.00 (208 pp.). ISBN 0-7354-0094-6

Science of Superstrong Field Interactions. K. Nakajima, M. Deguchi, eds. *AIP Conference Proceedings 634*. Proc. symp., Hayama, Japan, Mar. 2002. AIP, Melville, N.Y., 2002. $165.00 (427 pp.). ISBN 0-7354-0089-X, *CD-ROM*

Popularizations

Behind Deep Blue: Building the Computer that Defeated the World Chess Champion. F.-H. Hsu. Princeton U. Press, Princeton, N.J., 2002. $27.95 (298 pp.). ISBN 0-691-09065-3

Conversations on the Dark Secrets of Physics. E. Teller, W. Teller, W. Talley. Perseus, Cambridge, Mass., 2002 [1991, reissued]. $16.00 *paper* (247 pp.). ISBN 0-7382-0765-9

Dear Professor Einstein: Albert Einstein's Letters to and from Children. A. Calaprice, ed. Prometheus Books, Amherst, N.Y., 2002. $24.00 (232 pp.). ISBN 1-59102-015-8