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Review of *Integrated Physics and Calculus* by Andrew F. Rex and Martin Jackson

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BOOK REVIEWS

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Cosmology and Particle Astrophysics. Lars Bergström and Ariel Goobar. 344 pp. Wiley, New York, 1999. Price: $49.95 (paper) ISBN 0-471-97042-5. (Andrew H. Jaffe, Reviewer.)

With its constant influx of new and exciting data—and extensive coverage in daily newspapers—cosmology attracts students with a wide range of education and research experience. Because of its recent transformation from a data-starved field to a data-driven one, any textbook attempting an overview of this subject is destined to be out-of-date soon after its publication.

Bergström and Goobar (not ''Goodbar'' as he is unfortunately referred to on the spine of the book!) have written an advanced undergraduate or beginning graduate text on the subject. One reason cosmology remains fun and exciting for its practitioner is that it requires (and rewards) understanding of disparate fields of physics (radiative hydrodynamics, particle physics,...) and disparate physical situations (the hot and dense early universe, the cold intergalactic medium, ...). Cosmology is a field for generalists, and much of the physics can indeed be understood at this level.

To keep the book both short and self-contained, the authors have made a number of choices which probably make it sufficient as the sole text for a class. On the other hand, this means that a large fraction of the book is spent developing general relativity, relativistic quantum mechanics, particle physics, and basic field theory. This space could have been better spent concentrating on the core subjects of the book (of 332 pages, 125 are devoted to this introductory material). In particular, I think short shrift has been given to the study of large-scale structure and the cosmic microwave background (my own subjects, admittedly), especially in light of recent data in these fields.

The authors were unlucky in their timing, as recent results from neutrino oscillation experiments, the MAXIMA and BOOMERANG CMB anisotropy experiments, as well as the 2DF and Sloan Digital Sky Survey, are in the midst of honing our picture of the Universe. Perhaps naturally, the authors go into greater depth on their own specialities: Bergström is an expert on the study of particle dark matter, and Goobar is a member of the Supernova Cosmology project, one of the groups that has recently been responsible for observations of the purported accelerating expansion of the Universe.

Compared to other recent cosmology texts (e.g., Kolb and Turner's *The Early Universe*, Peebles' *Principles of Physical Cosmology*, Peacock's *Cosmological Physics*, all from the late 80s or 90s and already somewhat out-of-date), *Cosmology and Particle Astrophysics* is less likely to be useful to specialists as a reference—nor is it aimed at such an audience. Within its chosen scope, the book is clear, (very) concise, and fresh in its presentation, although the development of some topics is quite standard (in particular, the treatment of thermodynamics in an expanding universe closely mirrors the one given in Kolb and Turner's *Early Universe*).

However, it does lack some features that might have made it a better introduction to the field. In addition to the relatively shallow treatment of some topics, the references are quite meager: Along with a short list of other texts (and the research papers specifically cited), a list of good, modern review articles to go along with each chapter would have been especially useful (perhaps the authors will consider adding such a bibliography to the web site they dedicate to the book). Also important to beginning students would be some sense of the history of the field, as it slowly over the course of the 20th century achieved the status of a science in its own right.

For students with some knowledge of undergraduate physics and astrophysics, *Cosmology and Particle Astrophysics* provides a solid, concise introduction to the field. If paired with a selection of topical reviews and research articles (for which this book should be adequate preparation), it would offer a fine entree for students wishing to pursue research in cosmology.

Andrew H. Jaffe is an Assistant Research Physicist at the University of California, Berkeley. He investigates the cosmic microwave background, the growth of large-scale structure, and other aspects of the history and evolution of the Universe.

In the Shadow of the Bomb: Oppenheimer, Bethe, and the Moral Responsibility of the Scientist. S. S. Schweber. 260 pp. Princeton U.P., Princeton, NJ, 2000. Price: $24.95 ISBN 0-691-04989-0. (Leo Sartori, Reviewer.)

J. Robert Oppenheimer and Hans Bethe are two of the leading figures in twentieth-century physics. Both played important roles in the atomic bomb project and later advised the US government on issues related to nuclear weapons. Oppenheimer was the nation's most influential scientist/politician during the immediate post-war period, but suffered a dramatic fall from grace, culminating in the revocation of his security clearance after the infamous ''trial'' of 1954. Bethe played a prominent part in the negotiations that led to the Limited Test Ban Treaty and has long been an outspoken critic of ballistic missile defense. Now in his nineties, he continues to contribute to the policy debate. Sam Schweber's new book provides mini-biographies of both men but focuses on their contrasting responses to the moral and political questions posed by nuclear weapons.

The problem with the book is the marked asymmetry in the treatment of its two protagonists. In spite of its title, this is really a book about Bethe, whom the author has known intimately since he was his post-doc at Cornell in the early 1950s; they co-authored the text from which many of my generation learned about meson theory. Schweber has for some time been working on a full-scale biography of Bethe; the present book began as a chapter in that work. It is apparent that he admires Bethe greatly and has discussed with him in detail all the issues addressed in the book. The treatment of Oppenheimer is less authoritative and less satisfying, relying largely on Oppenheimer's published words. Oppenheimer, who died in 1967, was a charismatic and enigmatic figure; after more than forty years, I can recall sitting in awed fascination at Institute seminars as he demolished one speaker after another. An authoritative biography of Oppenheimer has yet to be written; I had hoped to learn more about him from this book.

Schweber attributes much of Oppenheimer's intellectual development and moral outlook to his early association with Felix Adler's Ethical Culture Society in New York City. The book includes a lengthy digression on Adler and his society, which, though informative, seems unnecessarily detailed for a work of this scope.

For me, the most interesting portion of the book is the description of two national security cases involving physicists, Philip Morrison and Bernard Peters, which were played out during the witch hunts of the late 1940s and early 50s. Bethe was involved in Morrison's case and Oppenheimer in Peters'; both Morrison and Peters had been Oppenheimer's students at Berkeley. Bethe emerges in by far the superior moral position. Morrison was a tenured associate professor at Cornell in 1951 when he came under fire for his involvement in leftist causes, which his attackers charged was damaging the University. The case dragged on for several years; in 1953 Morrison was grilled by Senator William Jenner's Internal Security Subcommittee. Throughout the long ordeal Bethe worked diligently with Morrison and University administrators to find a compromise solution that would protect Morrison's academic freedom while meeting the University's concerns.

Oppenheimer, by contrast, provided damaging testimony against Peters during an interrogation by the security chief at Los Alamos and later at a closed session of the notorious House Committee on Un-American Activities. He described Peters as ''a crazy person,'' ''quite red,'' and ''truly dangerous,'' a characterization that was entirely unwarranted. When news of Oppenheimer's testimony leaked, many of his close friends, including Bethe, were appalled and told him so. Although the University of Rochester, to its credit, did not fire Peters and even promoted him to full professor, the State Department withdrew his passport; unable to continue his cosmic-ray research, which required foreign travel, he felt compelled to leave the country. Schweber provides many illuminating details concerning both cases. As he notes, Oppenheimer was in a much more vulnerable situation than was Bethe because of his own leftist associations dating back to the 1930s. Still, his denunciation of Peters seems inexcusable and is undeniably a blot in his record.

The chapter on nuclear weapons policy contains some well-known material on the history of the atomic and hydrogen bomb projects, but is largely devoted to an exposition of Bethe's views on the hydrogen bomb. He at first opposed the development of the H-bomb on moral grounds; that was also the position of the General Advisory Committee of the AEC, which Oppenheimer chaired. At the time, it was not at all clear that a fusion weapon could be made to work. After Stan Ulam and Edward Teller had shown that it was indeed feasible, Bethe reluctantly concluded that the United States had to develop the bomb because the Russians were likely to do so. He helped design the weapon even though he believed it was a ''terrible error,'' and publicly urged that the United States pledge that it would never be the first to use one. In 1983 he voiced his regrets, declaring that ''we would now be very much better off if the hydrogen bomb had never been invented.''

In sum, this brief book whets my appetite for Schweber's full biography of Bethe. I wish someone were doing a similar job for Oppenheimer.

Leo Sartori is Professor Emeritus of Physics at the University of Nebraska–Lincoln. He has a long-standing interest in issues of science and society. During the Carter administration he served at the U.S. Arms Control and Disarmament Agency and was an advisor to the SALT II delegation at Geneva.

The Odd Quantum. Sam B. Treiman. 262 pp. Princeton U.P., Princeton, NJ, 1999. Price: $24.95 ISBN 0-691-00926-0. (Barry Holstein, Reviewer.)

When pressed to justify time and effort spent on research activities, many of us have dusted off the old adage that the best researchers often make the best teachers. I realize that this is not always true, but it certainly was the case with the late Sam Treiman. Sam was an outstanding particle theorist—known among other things for the Goldberger–Treiman relation, the Callan–Treiman equation, the Treiman–Yang angle, the Khuri–Treiman equations—as well as for the fine group of students he produced—including Steve Weinberg, Steve Adler, Curt Callan, Glennys Farrar, etc. He was also a classroom star. When I was a postdoc at Princeton during the late 1960's I had the privilege of working with him, and while I never took one of his classes, I used to hear the students describe his quantum mechanics course in reverential terms as a ''classic.'' This legendary classroom prowess was recognized by the AAPT when in 1985 Treiman was honored as the recipient of the Oersted medal [Am. J. Phys. **53**, 817 (1985)].

In the book *The Odd Quantum*, completed just before his untimely death last year, Treiman describes quantum mechanics, not in the mathematically precise form given in his graduate course, but rather in the style in which he gave an introductory and descriptive set of lectures to a group of Princeton freshman in an honors course. (*Warning*: Princeton being Princeton, there is enough mathematics in this volume to scare away the standard freshman in most universities—certainly mine!) What results is a concise and beautifully written summary of an expert's view of the subject.

The first few chapters are fairly standard and are included in order to bring the reader up to speed. However, since the entire subject is covered in only a little over 250 pages, the author is forced to skim over a great deal of material. Thus after a brief first chapter in which he introduces the historical background and some of the basic concepts to be considered, in the thirty pages of Chapter 2 he discusses classical mechanics, electricity and magnetism, and special relativity. Treiman is not afraid to introduce basic mathematics (including partial derivatives), and this will definitely intimidate some readers.

After a chapter in which he outlines what is generally called ''modern physics''—including blackbody radiation, the Rutherford atom, the Bohr model, etc.—he finally gets into quantum mechanics in Chapter 4. Eschewing watering down the subject, after a brief discussion of two-slit scattering he goes right to the Schrödinger equation, and discusses the meaning of the wave function, operator notation, commutation relations, the uncertainty principle, tunneling, etc.—it's all there. Then in Chapter 5 he summarizes some of the classic quantum mechanical problems—the free particle, harmonic oscillator, hydrogen atom (including fine and hyperfine structures), a variant of the Bohm–Aharonov effect, and alpha decay. These are enjoyable for a physicist to read, but again I wonder about the novice.

The next two chapters—on identical particles and on ''What's going on?''—are for my money the most interesting in the book. Both deal with essential ways in which quantum mechanics differs from its familiar classical limit. It is tempting to try to understand quantum phenomena from our classical experience, but this is difficult because quantum mechanics really *is* different. One manifestation of this fact is how identical particles are treated in the two regimes. In classical mechanics, particles can be identical, but it really makes little difference, because we could in principle follow their motion (though the huckster moves the shells more rapidly than the eye can follow, the pea is definitely under one shell and this is in principle determinable). On the other hand, in quantum mechanics identical particles are *utterly* identical. The presence of a particle is indicated only by a peak in $|\psi|^2$ and there exists no conceivable way to distinguish one electron from its wave function partner. Treiman notes that this fact has deep and far-reaching consequences. There exist two possibilities for identical particle wave functions—one antisymmetric under interchange of particle identities and the other symmetric. (Only these choices are possible because two interchanges bring us back to where we started.) By the spin-statistics theorem, the former (latter) is associated with fermions (bosons) carrying half-integral (integral) spin. The Pauli exclusion principle, which follows from the antisymmetry of the fermion wave function, leads to the remarkably different chemical properties of neighboring elements on the periodic table. In a world where electrons were bosons, the hydrogen and helium atoms (and indeed all others) would be very similar, since every electron could (and would) occupy the ground state orbital preferentially. Thus it could be said that the quantum mechanical property associated with particle identity is responsible for the world as we know it and for life itself! On the boson side such simultaneous occupation of the ground state energy levels allows for the existence of phenomena such as superconductivity, superfluidity, etc., and Treiman also makes reference to the *au courant* topic of Bose–Einstein condensation. (Surprisingly, he omits stimulated emission topics such as lasers or masers, however.)

The brief chapter titled ''What's going on?'' also rewards a careful reading. In it the author explores the essence of quantum/classical differences, with discussions of double-slit scattering, Schrödinger's cat, the Einstein–Podolsky–Rosen (EPR) paradox, and Bell's inequalities. Though terse, the discussion here is among the best I have seen. Treiman stresses that all of us in our daily existence are quantum mechanical cats—to an outside observer, we are all superpositions until an observation is made. On the EPR paradox Treiman notes that ''One has to say simply (though it is rarely said simply) that the EPR notion of physical reality is too demanding for the quantum world we actually inhabit.'' And he does say it simply, pointing out that even though via EPR we can predict the spin of a remote system with absolute certainty, this does *not* indicate that it is a classical system. What breaks down here is that in this sense quantum mechanics is nonlocal, and this is an essential feature that does not exist in classical mechanics. The same problem plagues those who have tried to evade quantum mechanical behavior by postulating unknown hidden variables which, were they known, would resolve mysteries such as the EPR phenomenon. However, the experimental exclusion of Bell's inequalities shows that this is definitely *not* the case. Any *local* manifestation of hidden variables is ruled out by such measurements.

The volume closes with a chapter on building blocks and then one on quantum field theory. The former is fairly standard and chronicles the fundamental fermions (quarks, leptons) and bosons ($W^{\pm}, Z^0, \gamma$), together with their interactions and basic symmetries—parity, charge conjugation, time reversal, etc. The ideas of gauge theory and the standard model are developed. The chapter on quantum field theory (QFT), however, is unusual in that in words and pictures (well, Feynman diagrams) Treiman shows how QFT, which of necessity involves creation and destruction of quanta, is able to account for the myriad of processes seen in nature. In particular he makes the connection between the eigenstates of free field theory (states consisting of 0,1,2,... noninteracting quanta) with the identical particles seen in nature. The existence of precisely identical and indistinguishable copies of fermions and bosons, with their attendant significance for quantum mechanics, is *required* by the validity of QFT. This field-theoretic description requires the constant creation/destruction of identical real and virtual quanta, and it is this continual resewing of the fabric in which our world is clothed that is responsible for its marvelous variety. On the other hand, Treiman acknowledges in closing that while QFT provides an excellent description of nature, it really does not explain *why* things are as they are.

Summarizing, although I am not particularly sanguine about the utility of the volume for beginning students (outside Princeton), this book *is* a good read for those of us who already know quantum mechanics and wish to understand it more deeply, or for technically able readers who wish to know some of the intriguing aspects and beauty of the subject.

Barry R. Holstein is Professor of Physics at the University of Massachusetts at Amherst. Besides being a frequent contributor to this journal he is active as a particle/nuclear theorist, and has published papers with Sam Treiman (and others) on symmetry issues, especially those which probe the fundamental structure of the electroweak interaction.

Integrated Physics and Calculus. Andrew F. Rex and Martin Jackson. 592 pp. (Vol. I), 608 pp. (Vol. II). Addison–Wesley, San Francisco, CA, 2000. Price: $45.00 per volume (paper) ISBN 0-201-47396-8, 0-201-47397-6. (Robert G. Fuller, Reviewer.)

Are you ready to try something that seems obvious and yet is innovative? If so, then maybe you are ready to teach a combined physics and calculus course. In fact, many of us who have been teaching calculus-based physics have always felt that we had to teach both physics and calculus, because our students seemed to be unable to do anything we thought they had learned to do in the prerequisite calculus course(s).

Now, at last, a courageous physicist and mathematician have worked together to create a combined physics and calculus textbook. Professors Rex and Jackson have written a textbook for such a combined course based on their teaching experiences at the University of Puget Sound since 1994. I have struggled with my own versions of such a course at two different institutions, with different mathematicians. The Rex/Jackson text would have saved us immense headaches.

This text follows a very traditional sequence of physics topics while building in the calculus concepts as they are needed for the physics. For example, differential equations are introduced along with the applications of Newton's second law. Line integrals are taught in the chapter with work done by a variable force. In the second volume, partial derivatives and gradients are included in the chapter on electric potential. This text includes a variety of math and physics problems at the end of each chapter and has the answers to most odd-number problems in the back of the books. The problems are arranged by sections of the book and include a good variety of mathematical and physical problems. I wish they would add a collection of multiple concept problems, not directly associated with a particular section of the book, to challenge students to figure out what mathematics and physics concepts to use to solve the problems. But an instructor can add his or her own context-rich problems as desired.

The Rex/Jackson approach matches quite closely the approach I successfully tried when co-teaching with a mathematician, but our students had two different textbooks, one on physics and another on calculus. The two textbooks had different approaches and different notations, stumbling blocks for the students. This book would have helped our students considerably.

The Rex/Jackson text uses Newton's second law (Chapter 5) as a motivation for introducing differential equations (Chapters 6.1 and 6.2). Then they use differential equations to study more applications of Newton's second law (Chapter 6.3). Doesn't this seem more reasonable than waiting until after the students take several semesters of calculus before studying differential equations?

What a joy it was to teach simple harmonic motion just after the students had studied Taylor's theorem in mathematics! I was able to give my thrilling ''all systems are simple harmonic'' lecture to a class of believers, instead of the typical classroom full of blank stares when the words ''Taylor series'' are mentioned. The Rex/Jackson text can enable you to have the same joyful experience. Their presentation of sequences and series, including the Taylor series, Chapter 11, Section 6, just precedes the Oscillations and Second-Order Differential Equations, Chapter 12.

The calculus reform movement has created, in my opinion, mathematics departments around the country that are willing to explore very different sequences of calculus topics and may be willing to work with you to co-teach a course using the Rex/Jackson text. A calculus-reformed mathematics faculty should welcome this text.

I believe this is one direction for the next important physics curriculum reform movement to go. I encourage you to try the Rex/Jackson approach to breathing some new life into the calculus-based physics courses at your institution. Using this text in your course can foster a new understanding of calculus as the ''language of physics'' that was so important in Newton's development of calculus.

Try letting the Rex/Jackson textbook lead you into the thrilling experience of teaching a physics course integrated with calculus. I think you will like it.

Robert G. Fuller is professor of physics and director of the research in physics education group at the University of Nebraska–Lincoln. He has taught using the Keller Plan, Piagetian-based instruction, Karplus learning cycles, interactive videodiscs, and ''paperless'' physics.

BOOKS RECEIVED

Academic Excellence: The Role of Research in the Physical Sciences at Undergraduate Institutions. Edited by Michael P. Doyle. 199 pp. Research Corporation, Tucson, AZ, 2000. Price: $3.00 ISBN 0-9633504-5-5.

Advances in Chemical Physics, Vol. 114. Edited by I. Prigogine and Stuart A. Rice. 630 pp. Wiley, New York, 2000. Price not given, ISBN 0-471-39267-7.

Advances in Chemical Physics, Vol. 115. Edited by I. Prigogine and Stuart A. Rice. 441 pp. Wiley, New York, 2000. Price not given, ISBN 0-471-39331-2.

The Bit and the Pendulum: From Quantum Computing to M Theory—The New Physics of Information (paperback edition). Tom Siegfried. 281 pp. Wiley, New York, 1999, 2000. Price: $15.95 (paper) ISBN 0-471-39974-4.

Data Analysis Techniques for High-Energy Physics, 2nd ed. R. Frühwirth *et al.* 384 pp. Cambridge U.P., New York, 1990, 2000. Price: $120.00 (cloth) ISBN 0-521-63219-6; $54.95 (paper) ISBN 0-521-63548-9.

Diffusion and Reactions in Fractals and Disordered Systems. Daniel ben-Avraham and Shlomo Havlin. 316 pp. Cambridge U.P., New York, 2000. Price: $90.00 ISBN 0-521-62278-6.

Einstein, Physics and Reality. Jagdish Mehra. 156 pp. World Scientific, River Edge, NJ, 1999. Price: $32.00 ISBN 981-02-3913-0.

El Niño and the Southern Oscillation: Multiscale Variability and Global and Regional Impacts. Edited by Henry F. Diaz and Vera Markgraf. 496 pp. Cambridge U.P., New York, 2000. Price: $90.00 ISBN 0-521-62138-0.

Essentials of Electromagnetics for Engineering. David A. de Wolf. 509 pp. Cambridge U.P., New York, 2001. Price: $69.95 ISBN 0-521-66281-8.

Explicit Birational Geometry of 3-Folds. Edited by Alessio Corti and Miles Reid. 349 pp. Cambridge U.P., New York, 2000. Price: $44.95 (paper) ISBN 0-521-63641-8.

The Foundations of Newtonian Scholarship. Edited by Richard H. Dalitz and Michael Nauenberg. 242 pp. World Scientific, River Edge, NJ, 2000. Price: $60.00 ISBN 981-02-3920-3.

Fundamentals of Carrier Transport, 2nd ed. Mark Lundstrom. 418 pp. Cambridge U.P., New York, 1990, 2000. Price: $59.95 ISBN 0-521-63134-3.

Instructor's Manual: Fundamentals of Ethics for Scientists and Engineers. Edmund G. Seebauer and Robert L. Barry. 176 pp. Oxford U.P., New York, 2001. Price not given (paper) ISBN 0-19-514419-8.

Introduction to Partial Differential Equations (reprint). Donald Greenspan. 195 pp. Dover, Mineola, NY, 1961, 2000. Price: $8.95 (paper) ISBN 0-486-41450-7.

Introduction to the Replica Theory of Disordered Statistical Systems. Viktor Dotsenko. 220 pp. Cambridge U.P., New York, 2001. Price: $74.95 ISBN 0-521-77340-7.

Introduction to Surface and Thin Film Processes. John A. Venables. 372 pp. Cambridge U.P., New York, 2000. Price: $110.00 (cloth) ISBN 0-521-62460-6; $39.95 (paper) ISBN 0-521-78500-6.

Mass Transport in Solids and Fluids. David S. Wilkinson. 270 pp. Cambridge U.P., New York, 2000. Price: $110.00 (cloth) ISBN 0-521-62409-6; $39.95 (paper) ISBN 0-521-62494-0.

Mathematical Modeling in Continuum Mechanics. Roger Temam and Alain Miranville. 288 pp. Cambridge U.P., New York, 2000. Price: $54.95 ISBN 0-521-64362-7.

Mechanics, Heat, and the Human Body: An Introduction to Physics. Howard D. Goldick. 212 pp. Prentice Hall, Upper Saddle River, NJ, 2001. Price not given (paper) ISBN 0-13-922816-0.

Microhardness of Polymers. F. J. Baltá Calleja and S. Fakirov. 237 pp. Cambridge U.P., New York, 2000. Price: $95.00 ISBN 0-521-64218-3.

A Modern Introduction to Particle Physics, 2nd ed. Fayyazuddin and Riazuddin. 717 pp. World Scientific, River Edge, NJ, 1992, 2000. Price: $99.00 ISBN 981-02-3876-2.

Modern Mathematical Methods for Physicists and Engineers. C. D. Cantrell. 763 pp. Cambridge U.P., New York, 2000. Price: $120.00 (cloth) ISBN 0-521-59180-5; $49.95 (paper) ISBN 0-521-59827-3.

Mother Nature's Two Laws: Ringmasters for Circus Earth. Lessons on Entropy, Energy, Critical Thinking, and the Practice of Science. A. D. Kirwan, Jr. 173 pp. World Scientific, River Edge, NJ, 2000. Price: $28.00 ISBN 981-02-4314-6.

The Nature of Space and Time (paperback edition). Stephen Hawking and Roger Penrose. 141 pp. Princeton U.P., Princeton, NJ, 1996, 2000. Price: $14.95 (paper) ISBN 0-691-05084-8.

Numerical Simulation of Reactive Flow, 2nd ed. Elaine S. Oran and Jay P. Boris. 529 pp. Cambridge U.P., New York, 1987, 2001. Price: $90.00 ISBN 0-521-58175-3.

The Physics of Consciousness: The Quantum Mind and the Meaning of Life. Evan Harris Walker. 368 pp. Perseus, Cambridge, MA, 2000. Price: $17.00 (paper) ISBN 0-7382-0436-6.

The Physics of Information Technology. Neil Gershenfeld. 370 pp. Cambridge U.P., New York, 2000. Price: $39.95 ISBN 0-521-58044-7.

The Pursuit of Destiny: A History of Prediction. Paul Halpern. 250 pp. Perseus, Cambridge, MA, 2000. Price: $25.00 ISBN 0-7382-0095-6.

Quantum Computation and Quantum Information. Michael A. Nielsen and Isaac L. Chuang. 676 pp. Cambridge U.P., New York, 2000. Price: $130.00 (cloth) ISBN 0-521-63235-8; $47.95 (paper) ISBN 0-521-63503-9.

Quantum Evolution: An Introduction to Time-Dependent Quantum Mechanics. James E. Bayfield. 386 pp. Wiley, New York, 1999. Price: $99.95 ISBN 0-471-18174-9.

Raman Spectroscopy for Chemical Analysis. Richard L. McCreery. 420 pp. Wiley, New York, 2000. Price: $99.95 ISBN 0-471-25287-5.

The Runaway Universe: The Race to Find the Future of the Cosmos. Donald Goldsmith. 232 pp. Perseus, Cambridge, MA, 2000. Price: $16.00 (paper) ISBN 0-7382-0429-3.

Scattering of Waves from Large Spheres. Walter T. Grandy, Jr. 370 pp. Cambridge U.P., New York, 2000. Price: $95.00 ISBN 0-521-66126-9.

Selected Papers of Richard Feynman, with Commentary. Edited by Laurie M. Brown. 999 pp. World Scientific, River Edge, NJ, 2000. Price: $96.00 ISBN 981-02-4130-5.

Smart Structures: Analysis and Design. A. V. Srinivasan and D. Michael McFarland. 228 pp. Cambridge U.P., New York, 2001. Price: $95.00 (cloth) ISBN 0-521-65026-7; $34.95 (paper) ISBN 0-521-65977-9.

Theory of Satellite Geodesy: Applications of Satellites to Geodesy (reprint). William M. Kaula. 124 pp. Dover, Mineola, NY, 1966, 2000. Price: $7.95 (paper) ISBN 0-486-41465-5.

Turbulent Flows. Stephen B. Pope. 771 pp. Cambridge U.P., New York, 2000. Price: $130.00 (cloth) ISBN 0-521-59125-2; $49.95 (paper) ISBN 0-521-59886-9.

Wonders of Numbers: Adventures in Mathematics, Mind, and Meaning. Clifford A. Pickover. 396 pp. Oxford U.P., New York, 2001. Price: $27.50 ISBN 0-19-513342-0.

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