popular. His new book, *Quantum Physics: A Text for Graduate Students*, faces stiff competition in an area already crowded with excellent texts.

I find Newton's text comprehensive but rather terse: It would be tough going for most first-year graduate students. Within only 400 pages, it covers topics from such basics as the harmonic oscillator to the Dirac equation. One finds all the major areas of a standard first-year graduate curriculum, including angular momentum, time-independent and time-dependent perturbation theory, and multiparticle systems. The treatments are logical and accurate, but explanations are minimal. Furthermore, some topics are discussed before a student is prepared for them. For example, field quantization appears in the very first chapter, but might better have been deferred until after discussion of the operator form of the harmonic-oscillator solution.

The book has its high points. A section on interaction of radiation with matter is exceptionally good because the groundwork for quantization of the electromagnetic field was laid earlier. That allows for an elegant treatment of spontaneous emission. Several good exercises end each chapter, and concise, well-written appendices end the book. One such appendix, on group theory, is particularly useful as a springboard to additional study.

I would recommend Newton's book more as a reference than as a general text. It is a difficult book for learning quantum mechanics on one's own, but might work as a companion to detailed lectures. As introductory graduate texts, I prefer Ramamurti Shankar's *Principles of Quantum Mechanics* (2nd ed., Plenum, 1994) and J. J. Sakurai's *Modern Quantum Mechanics* (2nd ed., San Fu Tuan, ed., Addison-Wesley, 1994). Albert Messiah's *Quantum Mechanics* (Dover, 1999), although voluminous, is always a good supplement.

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From Nuclear Transmutation to Nuclear Fission, 1932–1939

Per F. Dahl
IOP, Philadelphia, 2002. $75.00 (304 pp.). ISBN 0-7503-0865-6

Nuclear physics started with radioactivity. At first, no way could be found to alter radioactive decay rates: Nuclear transmutations occurred at their own inexorable pace. Then, in 1919, Ernest Rutherford showed that alpha particles from natural radioactive decay that pass through nitrogen could generate hydrogen nuclei. That was the first observation of an externally-induced nuclear transmutation. Ten years of further study led to some extension of the initial results, but also stimulated a strong desire for beams of artificially accelerated particles that could be more intense and more under the experimenters' control.

In 1928, George Gamow, and independently Edward Condon and Ronald Gurney, explained quantum-mechanical barrier penetration. Their explanations helped physicists understand how charged particles get out of a nucleus in radioactive decay—and further, how such particles might tunnel into the nucleus. Thus began what Per F. Dahl calls, in the preface to his book *From Nuclear Transmutation to Nuclear Fission, 1932-1939*, ". . . a race, circa 1930, between four laboratory teams to be the first to achieve the transmutation of atomic nuclei with artificially accelerated nuclear projectiles." Dahl's title is a bit of a misnomer; much of the book concerns what happened before 1932.

Dahl follows closely the work of the research groups led by John Cockcroft at the Cavendish Laboratory in Cambridge, England; Merle Tuve at the Carnegie Institution of Washington, DC; Ernest Lawrence at the University of California, Berkeley; and Charles Lauritsen at Caltech. Cockcroft and Ernest Walton won the race in April 1932, when they saw the alphas generated by 600-keV protons on lithium, but the other labs were not far behind, and each made impressive contributions in the next few years. Dahl's story is based in part on archives at the University of California, Berkeley; in Cambridge at Churchill College, the Cambridge University Library, and the Cavendish Laboratory; at the Center for History of Physics in College Park, Maryland; and at the Library of Congress and the Carnegie Institution, both in Washington, DC. The story is rich in the interplay among physicists in the context of economic depression and the rise of fascism. Anyone with even a moderate interest in how physics developed in the 1920s and 1930s will enjoy the book.

Dahl amply documents an exciting time for physics. Consider just the first half of 1932. January saw the report by Harold Urey, Ferdinand Brickwedde, and George Murphy of the discovery of deuterium. February brought James Chadwick's discovery of the neutron and a crucial advance in cyclotron operation at Berkeley. In April came the Cockcroft–Walton work, and June saw Carl Anderson's discovery of the positron and Werner Heisenberg's description of the nucleus in terms of protons and neutrons as isospin partners (in all but name).

The Cavendish lab won the race for artificial disintegration, but four years later Tuve, Gregory Breit, Lawrence Hafstad, and Norman Heydenburg at the Carnegie Institution made the first direct studies of the nucleon–nucleon interaction. Much information about the interaction had been inferred from data on nuclear masses and sizes, as one can see from the review by Hans Bethe and Robert Bacher (*Rev. Mod. Phys.* **8**, 82, 1936). But if one wants to learn about an interaction, nothing is more fundamental than a scattering cross section. Scattering of all sorts—elastic, inelastic, and transmutational—would become the preeminent tool in nuclear and particle physics.

Dahl concludes his history with an original and exciting account of the early developments in nuclear fission—a special kind of transmutation in which one element becomes two. The discovery of fission in 1938–39 was a major paradigm jolt, which led to an eruption of activity among physicists and chemists that culminated in the Manhattan Project.

The raisins in this plum pudding of a book include accounts of the lifelong friendship and occasional rivalry between Tuve and Lawrence, the difficulties faced by Tuve and his group in trying to achieve high DC voltage by using a Tesla coil, the development by Robert J. Van de Graaff of his moving insulator-belt generator of high voltages, the work of Lawrence and Stanley Livingston on the cyclotron, and the work of Lauritsen in developing high-voltage x-ray generators for medical use and then adapting them to nuclear physics.

An especially interesting theme brought out by Dahl is the importance of Norwegians and other Scandinavians in the development of accelerators and early nuclear physics. Tuve and Lawrence were of Norwegian descent, Hafstad was the son of a Norwegian immigrant, and Norwegian engineer Rolf Wideröe had conceived the basic ideas of several methods of particle acceleration. The Swedish physicist Gustaf Ising thought up the traveling-wave linear accelerator in Stockholm. Lauritsen was Danish. Even more intriguing is the extraordinary career of the Norwegian Odd Dahl—aviator, explorer, pioneer in radio wave propagation, oceanographer, designer and builder of particle accelerators, and father of the book's author, to mention only a few highlights.

Per Dahl is now retired from the Lawrence Berkeley National Laboratory, where he made important contributions to the development of superconducting accelerator magnets. On the history of physics, he published four previous books, which covered conservation of energy, superconductivity, the discovery of the electron, and the story of Norwegian heavy water and its role in World War II.

It is not easy to weave as much as Dahl has into a coherent whole, especially when many of the side stories are as interesting as the main scientific thread. Dahl has effectively organized his work so that the main and tangential stories come through clearly. The history is well worth revisiting and Dahl's summary of it is fresh and engaging.

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Tools for Computational Finance

Rüdiger Seydel
Springer-Verlag, New York, 2002. $49.95 paper (224 pp.).
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The past quarter century has witnessed accelerating growth in use of financial derivatives—transactions betting on the future prices of one or more assets. Many derivatives take the form of options—in which one party acquires the right to buy or sell, at a later date, a certain asset at a given price.

The options traded on stock exchanges are relatively easy to understand and implement. However, more sophisticated and tailor-made options exist that are not traded on stock exchanges. Those financially engineered products have gradually increased in complexity to the point where they can appear quite obscure to casual investors. That is one reason such investors and even auditors suspect that sophisticated options are being used for murky speculation—and sometimes they are. However, when options are correctly implemented as hedges, they become powerful instruments of risk management. Today, they are an integral part of financial engineering.

An important prerequisite to trading options is calculating their price. In general, the task amounts to solving linear partial differential equations of the second order in both time and future prices of the underlying assets. The complexity of the problem resides in the stochastic nature of those prices and the idiosyncratic boundary conditions. The problem is reminiscent of Brownian motion and much has been written about numerical solutions of such equations. In finance, with its peculiar boundary conditions, the literature is expanding fast, but few textbooks exist. Rüdiger Seydel's *Tools for Computational Finance* helps fill the textbook void.

First published in German, the text arose from the author's lectures on computational finance at the University of Cologne, where he is a professor of applied mathematics. The English edition contains a few more comments on risk-neutral valuation, stochastic processes, and Monte Carlo integration. It also contains a new chapter on the pricing of exotic options. The English title is a bit misleading, because the book examines only one aspect of finance—calculating the price of financial options. Although that aspect is undoubtedly a glorious part of mathematical finance, it is not the only one that requires serious numerical analysis.

Seydel has sought a compromise between justifying his results and avoiding formal proofs. I think he has struck a healthy balance, and I enjoyed reading the book. Wherever I thought the author could have said more, he referred to the extensive bibliography. However, the bibliography may have limited value to readers unfamiliar with the literature, because it does not classify its contents according to readability or breadth.

In his preface, the author advocates "learning by calculating." That principle is easily fulfilled in the first few chapters, but is less practical for the later, more abstract ones. It is symptomatic that the first chapter contains 13 exercises, but the last one has only three, and those three are purely analytical. I would have liked more exercises in the form of numerical experiments. I would also have appreciated an accompanying CD or a reference to a Web site with standard solutions in the form of code. The preface does refer to a Web site, but that site provides hardly any additional information except for a few hints on some of the exercises.

Owing to the inherent technicalities in the valuation of financial instruments and to their increasing complexity, it is no surprise that a growing number of scientists—physicists in particular—have been attracted to finance. After a short period of acclimatization, many physicists turned bankers (including all the ones I know) have come to thoroughly enjoy their new profession.

Tools for Computational Finance is targeted at financial engineers and mathematically inclined financial economists, but physicists who are attracted to finance and know the basics of options will probably find it useful. Other physicists will easily grasp the mathematical concepts and recognize many familiar techniques, but may find some important issues are skipped or not treated at an accustomed depth. Furthermore, physicists unfamiliar with financial derivatives may wonder about the broader context and may misunderstand concepts that the book takes for granted.

Seydel's text is not an adequate introduction to finance, because it is too narrow and assumes too much prior knowledge of options. I strongly recommend that interested physicists first read John Hull's classic text *Options, Futures, and Other Derivatives* (4th ed., Prentice Hall, 2000), which I consider to be the best and most readable introduction to the field. Its intuitive style will appeal to physicists. In a sense, the two books are complementary: Hull's book teaches how to write the equations and Seydel's teaches how to solve them.

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New Books

Acoustics

Fundamentals of Ocean Acoustics. 3rd edition. L. M. Brekhovskikh, Yu. P. Lysanov. *AIP Series in Modern Acoustics and Signal Processing*. AIP Press/Springer-Verlag, New York, 2003 [1991]. $99.00 (278 pp.). ISBN 0-387-95467-8

Astronomy and Astrophysics

AGN Surveys: IAU Colloquium 184. R. F. Green, E. Ye. Khachikian, D. B. Sanders, eds. *Astronomical Society of the Pacific Conference Series 284*. Proc. colloq., Byurakan, Republic of Armenia, June 2001. Astronomical Society of the Pacific, San Francisco, 2002. $57.00 (425 pp.). ISBN 1-58381-127-3

Astronomical Data Analysis Software and Systems XI. D. A. Bohlender, D. Durand, T. H. Handley, eds. *Astronomical Society of the Pacific Conference Series 281*. Proc. mtg., Victoria, British Columbia, Canada, Sept.-Oct. 2001. Astronomical Society of the Pacific, San Francisco, 2002. $57.00 (522 pp.). ISBN 1-58381-124-9