could substitute for a third-semester course. It is certainly true that this text deepens the understanding of quantum mechanics because of the numerous relevant illustrations from laser physics. I would, however, prefer to teach this material in a separate course, in addition to the regular quantum-mechanics sequence.

Each chapter begins with a brief summary of the subject matter to be treated—this is a valuable feature. In keeping with the pervasive characteristic of the book, each topic is discussed in a clear context. Each chapter concludes with a set of problems which are well chosen and serve not only to test but also to enhance the understanding obtained from reading the text.

The book is carefully prepared and printed, with simple, clear figures, a good glossary of notation and about ten useful appendices. I was, however, annoyed by the similarity of printed symbol "a" and alpha "α." Even when these symbols appear side by side, it is difficult to recognize their difference. The price is reasonable and the paperback may be called a bargain in today's scientific book market. The book should be a part not only of every institutional library serving physicists, electrical and optical engineers, but is also recommended for the individual collections of graduate students and advanced research workers with an active interest in lasers. It is restricted to lasers *per se*, and does not cover other topics in quantum electronics. It is a good theoretical textbook, that takes the reader from basic physical principles to the point where he can tackle the original research papers in the laser field on his own.

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Superconducting Magnet Systems

H. Brechna
590 pp. Springer-Verlag, 1973. $65.60

I was surprised to find that the publisher has failed to give adequate recognition to the two co-authors and that the principal author also failed to acknowledge their assistance. The book contains a chapter on "Superconductivity Theory" by G. D. Cody of RCA Laboratories and a contribution "Cryogenics" by H. M. Long of Oak Ridge National Laboratory. These sections comprise 32% of the text. A further 43% of the text is concerned primarily with theoretical discussions of traditional magnet-design theory and the effects of varying fields on superconductors. Chapters on magnets in general (5%), economic considerations for all magnet types (13%) and specific superconducting coil systems (7%) make up the balance of the work. Some might question the wisdom of including material in these last named three chapters that is not relevant to superconducting coils. Examples of such material include the listings of conventional high-field test magnets, accelerator magnets and pulsed magnets and the various discussions on conventional and cryogenic coils.

Cody's chapter is a good summary of the state of research into those aspects of theory concerned with the critical fields and currents of Type II superconductors. A simple model is introduced to account for the wide variety exhibited by the critical current of Type II superconductors as a function of magnetic field and temperature. This model accounts for the value of the critical current to better than an order of magnitude when reasonable estimates are made of relevant parameters. Cody indicates some areas for further research, summarizes the free electron, BCS and GLAG formulas, discusses the mixed state of Type II superconductors and explains the principal physical phenomena underlying practical superconductor behavior. The 105 references to this chapter are well chosen and up to date.

The chapter on "Cryogenics" by Brechna and Long is based primarily on a contribution by Long. It describes some of the properties of cryogenic fluids, precautions to be taken in their handling and use, and the theory and techniques of liquefaction and refrigeration. Discussions of various physical properties of some of the solid materials used in cryogenic technology are included. It is a valuable introduction to the cryogenics essential to superconducting-magnet technology.

The chapter on magnetic-field calculations for various conductor configurations with and without iron will be of value to those with a good theoretical background wishing to specialize in magnet design or to solve a specific design problem. It is applicable to any magnet type and lists some existing up-to-date computer programs with their primary location. The references are particularly valuable.

The chapter entitled "Superconducting Alternating Current Magnets" contains much valuable material but is wrongly named since such magnets do not really exist as yet. However, pulsed magnets with rise times of seconds to minutes are under development for proposed high-energy circular particle-accelerator installations; energy-storage magnets with discharge times in the millisecond range are required for some development applications. This chapter is directed primarily at such possibilities. Hysteresis and eddy-current effects in practical, composite, twisted, multifilamentary conductors subjected to varying or reversing magnetic fields are treated theoretically after more formal discussions related to finite-size superconducting slabs and cylindrical conductors. Brechna discusses loss measurement and includes a discussion of various types of coil and conductor stability. Three pages of the chapter are devoted to coil fabrication and about a dozen to electrical design. There is a final section on irradiation effects, but work in this field is in its infancy and this may be premature.

The chapter on economics attempts to compare water-cooled copper systems, cryogenically-cooled conductors and superconducting coil systems in specific cases. Many aspects of this discussion might appear questionable or contentious at this phase in the development of these technologies. Much of the theoretical treatment seems irrelevant to the basic economic argument and might have been better included elsewhere. Examples include the tabulations of formulae for energy stored in various winding types and shapes and the theoretical discussion of the focussing properties of various magnetic-lens systems—but this may be a matter of personal preference and style.

Only a fourth of the text is devoted to specific examples of superconducting-magnet systems, and some parts of this discussion were inaccurate and misleading. A more thorough treatment of the design, construction and operation of practical systems might have been more useful to those wishing to learn about superconducting-magnet design.

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Scanning Electron Microscopy

O. C. Wells
421 pp. McGraw-Hill, New York, 1974. $22.95

A little over 300 years have passed since the first microscopic observations. During this period the instruments changed, even the physical principles used for the observation changed, and, last but not least, the requirements placed on the observer became very different. Let us look at the earliest microscopists: They had to grind and polish their own lenses, they had to be very patient and painstaking observers and, finally, they had to be graphic artists to record faithfully what they saw in their instrument.

Today, more often than not, the observer buys a ready-made instrument. He does not have to worry about straining his eyes for seeing the minutest detail, and the means for recording the information are easily available. His main concern today is the best possible preparation of the specimen he is investigating and the most correct interpretation of the data obtained. For both purposes it is advantageous to the observer to be cognizant of the physical principles on which his instrument is built and to have a fair idea about the mechanism of the image formation.

Oliver Wells started publishing papers on the scanning electron microscope in 1957. Ten years later came his first contribution to an overall view on the subject, in the form of an excellent bibliography published in the *Record* of the IEEE 9th Annual Symposium on Electron, Ion and Laser Beam Technology (San Francisco, 1967). This bibliography was supplemented in later issues of that Symposium Record and formed a solid basis for the book reviewed here.

The author, thus, is one of the best qualified persons to write an authoritative account on this fascinating instrument, and he has succeeded very well in giving a good insight into the physical basis, design principles, operation and applications of SEM. The book starts with a brief historical section and an abbreviated account of related instruments, outlining clearly the distinction between different modes of operations of each. I enjoyed very much chapters 2, 3 and 4, which are devoted to the physical principles on which SEM is based, to wit: electron optics, electron scattering, secondary emission and signal-to-noise ratio in SEM. Incidentally, the order of presentation of these items is 4, 3, 2 in the book—I list them reversed, because I have a slight preference for that order, and think that the reader may benefit from reversing these three chapters.

I am wondering also why the chapter on instrument design precedes both those on contrast and resolution and on voltage contrast and magnetic contrast. In my mind at least there may be a slight advantage in grouping together the discussion of physical parameters, before describing constructional details.

The last few chapters are devoted to the applications of SEM where three more authors (Alex Rezanowich, Eric Lifshin, Alan Boyde) supplied very good descriptions of special fields of use for the instrument.

A minor comment may be made about the discussion of the so-called Thomson–Whiddington law. On page 44 the exponent is given as 2, but page 262, equation 10.26 implies that the exponent is 1.65. There are several instances in the relevant literature, where different exponents were presented: If there is a second edition of this book I think a more cautious discussion of the law may be in order.

The book is very well presented and it should be used quite profitably by physicists, chemists, biologists and whoever can find a good application for SEM.

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High Energy Electron Scattering

R. A. Bonham, M. Fink
311 pp. Van Nostrand Reinhold, New York, 1974. $24.50

Perhaps the best way to answer the question stated by R. S. Mulliken, "What are the electrons really doing in molecules?" is by allowing another particle to play a short moment with them.

After their long use for predicting the geometrical structure of molecules, fast electrons have been very successful probes for investigating the electronic structure of atoms and molecules over the last decade. At the present time, high-energy electron-scattering experiments have been proven to be fairly competitive with x rays and gamma rays within their proper field of application as shown by the increasing number of results which at this point need to be summarized. In this respect, the American Chemical Society monograph *High Energy Electron Scattering* by Russell A. Bonham and Manfred Fink is a welcome contribution, which provides a missing bridge between books on collision theory and quantum chemistry.

The state of the art is surveyed clearly in the opening chapters. The most recent and promising work such as electron-impact ionization studies have also been presented. Although the latest reported electron-impact energy-loss experiments have not yet been fully explained and some of the authors comments may be premature, I feel that the problem of understanding electronic correlation in atoms and molecules will eventually be aided by such experiments together with coincidence techniques. Except for some present developments such as the (e,2e) experiments of Weigold, Teubner and McCarthy, which have not been covered, the text provides a detailed bibliography of the latest experimental progress with attempts at their physical interpretation.

Written by two specialists who have made substantial contributions to these topics, the book should be useful to many in addition to other specialists