ter 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.

CHARLES LAVERICK
Argonne National Laboratory
Argonne, Illinois

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.

L. L. MARTON
Smithsonian Institution
Washington, D.C.

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 working in the field. Every scientist dealing with the problem of the electronic structure of atoms and molecules in terms of many-electron wave functions and electronic energy calculations (in any other way than using computers up to the *n*th decimal place!) should be interested in its contents. I also suspect that even those quantum chemists concerned only in ground-state energy calculations of molecular wave functions will also find some interest in its reading.

CLAUDE H. TAVARD
Université de Metz
Metz, France

Physical Aspects of Lie Group Theory

R. Hermann
271 pp. Les Presses de l'Université de Montréal, Montréal, 1974. $9.50

This book resulted from lectures given by the author at the Université de Montréal in 1972. It treats several topics in abstract harmonic analysis and representation theory, and their applications in physics. More specifically, the book develops connections between physics and Lie group theory and geometry, with particular emphasis on the connections between operator theory (mainly resolvent theory) and Fourier analysis on Lie groups. To some extent the present book is a continuation of the author's earlier book *Fourier Analysis on Groups and Partial Wave Analysis* (W. A. Benjamin, 1969), although knowledge of the earlier book is not a prerequisite for reading this one.

The level of presentation of the book is fairly elementary (for this area of mathematical physics or applied mathematics), partly because the author eschews mathematical rigor and epsilonics. Consequently, the material in this book should be accessible to anyone with an elementary knowledge of functional analysis, Lie-group theory, and quantum-field theory. A related, but more difficult, book is Krzysztof Maurin's *General Eigenfunction Expansions and Unitary Representations of Topological Groups* (Polish Scientific Publishers, 1968).

Some mathematical topics of physical interest that are discussed are Heisenberg Lie algebras and their representations, deformations of various mathematical structures (such as Lie groups), an abstract Lie-algebraic method of quantizing free fields and an abstract formulation of classical scattering theory.

Some shortcomings of the book are the superficiality of the physical applications, a lack of polish which suggests hasty preparation, the generous sprin-