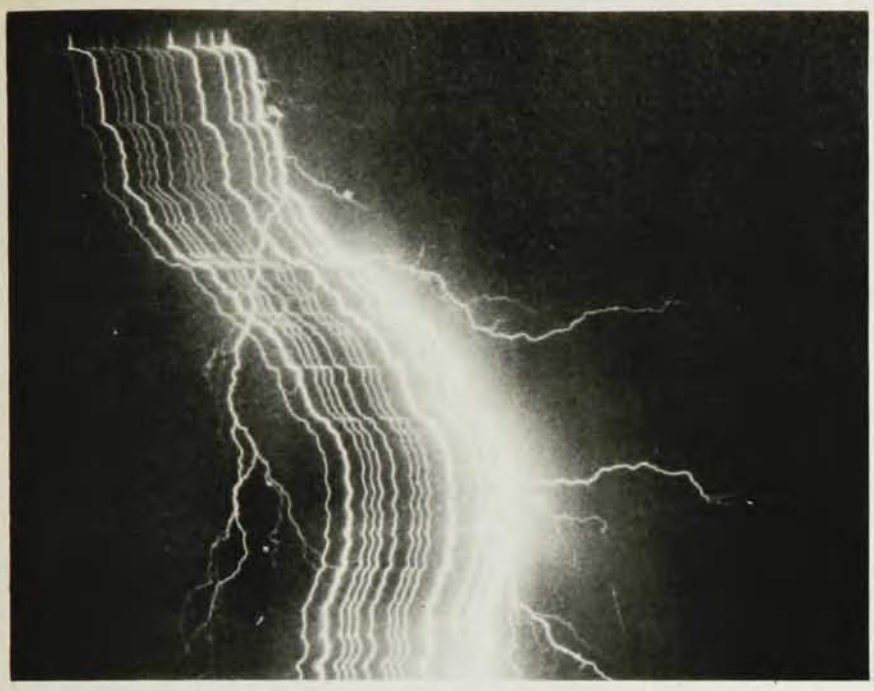

A multistroked flash of lightning. A camera mounted to swing back and forth while its shutter was held open produced the above photograph. Courtesy of New Mexico Institute of Mining and Technology, this illustration appears in *Lightning and its Spectrum. An Atlas of Photographs* by Leon E. Salanave (153 pp. U. of Arizona P., Tucson, Ariz., 1980. $25.00), which records typical and unusual appearances of lightning, such as bead and ribbon phenomena, and their spectra and explains the techniques whereby the photographs were obtained.

fects. As a result, the present volume is incomplete by itself. A student, even after mastering everything in the book, will have difficulty in analyzing real atomic spectra.

The first four chapters, however, contain excellent summaries of the historical background and application of quantum mechanics to atomic structure that could serve well as a text for a short course on atomic structure. The condensed discussions on Racah algebra and group theory in the next three chapters are more useful as a refresher for those who are already familiar with the subjects than as a text for beginners.

The Thomas–Fermi model and various versions of the self-consistent field method, including the Hartree–Fock method, are treated in the last two chapters with ample numerical examples. Comparisons with experimental data, however, are of limited scope because relativistic and correlation effects are not discussed. There are no exercises in this book, but adequate references are furnished with each chapter.

The book contains useful formulas not easily found in other books, for example, hydrogenic radial functions to $n = 8$, $l = 6$, and the Coulomb interaction matrix elements for f^q configurations. Also, the energy expressions in Appendix III are in the form of a configuration average plus a remainder. This convenient form for the Hartree–Fock code, developed by Charlotte Fischer, is one of the most widely used.

As in any first printing of a book with complicated equations and tables, there are some typographical errors, but they can be easily identified. The graph containing 4d and 5d radial functions for the hydrogen atom (page 193) has the wrong number of nodes.

In summary, the book will be very useful to researchers in atomic-structure theory as an excellent source of formulas and recent references. The topics covered in the book, however, are of limited scope, and to analyze atomic spectra of any complexity, the reader will have supplement this volume with other texts, such as *The Introduction to the Theory of Atomic Spectra* by I. I. Sobel'man or even the original TAS.

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The Art of Electronics

P. Horowitz, W. Hill
716 pp. Cambridge U.P., New York, 1980. $24.95

In the past few years the electronics industry has been in a state of rapid advancement. New and more powerful electronic devices are introduced on the market almost daily. As the devices become more powerful, they also become easier to use: One no longer needs a degree in electrical engineering

to design state-of-the-art electronic instruments. With the proliferation of powerful computers under $1000, researchers in the experimental sciences find more and more reason to apply the new electronic technology to measurements and data manipulation. Students now find that a little background in applying electronics to measurement problems opens doors to many jobs that they would otherwise not have access to.

If one does not have a background in electronics, but wants to learn, where does one start? *The Art of Electronics* by Horowitz and Hill is a great place. The book is designed for students with no previous background in electronics or, for that matter, any math beyond beginning calculus. (It isn't true that one needs a course in differential equations or Fourier analysis in order to design top-notch instruments, and *The Art of Electronics* makes this clear.) Although the book is for the beginner, it is thorough and abounds in information useful to readers who want to build electronic instruments and not just read about them. In their circuit examples, the authors almost always point out the specific devices they are using—which type of operational amplifier, for example—and why this specific device was chosen. This approach is much more useful to the beginner than that taken by most texts, in which examples seem to imply, for instance, that all operational amplifiers are the same.

The book contains up-to-date lists of different manufacturer's transistors, op amps, comparators, etc., along with data on each device, data which are quite valuable both for the person who wants to build a circuit but does not have access to all the manufacturer's catalogs and for someone who wishes to make quick comparisons of different devices.

Along with an excellent presentation of the standard subjects of transistor amplifiers, operational amplifiers, filters, and digital electronics, the book contains very practical chapters on the design of power supply (including switching supplies), low-noise techniques, interfacing between analog and digital circuits, high-speed techniques and electronic construction techniques. In all chapters, the authors are able to convey details of circuits without going into a mathematical complexity that might discourage the beginner and that usually contributes little to understanding the circuit.

Many texts on electronic design gloss over computers, assuming that they are not parts of electronic devices. With the use of microprocessors in almost every electronic instrument we buy, this is, of course, no longer the case. *The Art of Electronics* has a chapter on minicomputers that covers assembly-language programming and computer interfacing and one on microprocessors and their associated support electronics. Because microprocessors are becoming central to all instruments, they deserve a lengthier treatment than that given here. Although the book does better than other general electronic texts on the microprocessor, it would have been useful either to include a chapter giving examples of the use of microcomputers in various instruments and citing the advantages gained in such applications or to go over previous examples in the book and show how a microcomputer could improve the design, even in analog circuits.

The text developed out of a one-semester course taught at Harvard to undergraduate and graduate students in the sciences who wanted to learn practical electronics. It is appropriate for a course in which the students have access to a lab where they can build

real circuits and instruments and verify points made in the text. In a program I direct—in laboratory-oriented scientific instrumentation for graduate students in science who have no background in electronics—we have not used a text before because we have found none to be appropriate. *The Art of Electronics* is what we have been looking for.

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Field Theory and Strong Interactions. P. Urban, ed. 815 pp. Springer-Verlag, New York, 1980. $98.00

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Giant Resonance Phenomena in Intermediate-Energy Nuclear Reactions, Springer Tracts in Modern Physics, Vol. 89. F. Cannata, H. Uberall. 112 pp. Springer-Verlag, Heidelberg, 1980. $29.00

Quarks and Leptons. Cargèse 1979. M. Levy, J.-L. Basdevant, D. Speiser, J. Weyers, R. Gastmans, M. Jacob, eds. 736 pp. Plenum, New York, 1980. $75.00

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