and modern geometry. In particular, it gives the solution to deciding whether the roots of an algebraic equation can be obtained by radicals, a problem that had remained open for centuries. Before discussing the central figures of the book, Lie and Klein, the author describes many of the 19th-century contributions to geometry together with biographical sketches of the contributors, among them Gaspard Monge, Victor Poncelet, August Monge, Hermann Grassmann, Niels Abel, Riemann, Arthur Cayley and Jakob Steiner.

Late in the century Klein and Lie met in Paris and started a friendship lasting the rest of their lives. They also began to understand the central importance of group theory in mathematics. Klein concentrated mostly on discrete groups, while Lie devoted his life to a systematic study of continuous groups. Klein's famous Erlangen program explains the central role of group theory in the unification of various fields of mathematics. This line of thinking finally brought recognition to the non-Euclidean geometries of Janos Bolyai and Nicolai Lobachevski. In different contexts, both Klein and Lie realized the power of group transformations and group invariants in the classification of different geometries as well as in mechanics, differential equations, automorphic functions and other areas.

Yaglom presents a very lucid exposition of the contributions of these great mathematicians, and gives many interesting details of their lives. The book also contains extensive notes on the main text so that the interested reader can pursue selected points in greater depth. This is a very recommendable book for anyone interested in the problems, ideas and motivations that generated one of the most useful concepts in modern physics and mathematics.

LUIS ALVAREZ-GAUMÉ
Boston University

Introduction to Synchrotron Radiation

Giorgio Margaritondo
Oxford U. P.,
New York, 1988. 280 pp.
$45.00 hc ISBN 0-19-504524-6

Twenty years ago, the users of synchrotron radiation were a small band of enthusiasts willing to travel to distant lands (for example, Stoughton, Wisconsin) to perform their experiments. Today, the users of synchrotron radiation can be numbered in the thousands, and they are still willing to travel to distant lands (for example, Upton, New York). A third generation of synchrotron radiation sources is now under construction, with price tags in the $100–400 million range. Synchrotron radiation science has therefore become "big science," yet most of its practitioners would place themselves in the "small science" community.

Giorgio Margaritondo's brisk survey conveys in less than 300 pages the breadth and excitement of the field. Margaritondo has done distinguished research using synchrotron radiation; he is currently the associate director for research at the Synchrotron Radiation Center in Wisconsin. It is fitting that his *Introduction to Synchrotron Radiation* should appear in 1988, the 20th anniversary of the Wisconsin SRC, which was the first source dedicated solely to the production of synchrotron radiation for research purposes.

The first 90 pages of the book define synchrotron radiation and discuss how it is produced, how it is monochromatized and how it is delivered to the samples on which measurements are to be made. This part of the book is essential reading for newcomers contemplating experimental work with synchrotron radiation. The book continues with a discussion and presentation of the rudiments of various disciplines that use synchrotron radiation: optical spectroscopy and EXAFS (both gas phase and solid state), photoemission spectroscopy, elastic x-ray scattering, photodeposition, microscopy, fluorescence and other techniques. The overall coverage is fairly even, although Margaritondo has forgivably dwelt at greater length on his own specialty, photoemission investigations of semiconductor surfaces and interfaces.

There is a particularly interesting chapter on synchrotron radiation in technology and medicine. The possible implementation of x-ray lithography using synchrotron radiation has stimulated considerable activity in the US, Europe and Japan. One can foresee the use of small storage rings as components in production lines for the manufacture of microelectronic chips. A principal potential medical application is noninvasive angiography. Present methods of angiography require the use of catheters, making the diagnosis of heart disease as hazardous as the corrective surgery itself.

The book's level of presentation is agreeably conversational and largely qualitative. The most sophisticated piece of mathematics is the Fourier transform connecting EXAFS with the

atomic radial distribution function. To whom is the book addressed? Certainly not to seasoned specialists; they will find deeper nourishment in such books as the monumental and rather expensive *Handbook on Synchrotron Radiation* (North-Holland, New York, 1983 and 1987; volume 2 reviewed in PHYSICS TODAY, May, page 72), two volumes of which are already published and two further volumes promised. Margaritondo's book should find a receptive audience among newcomers to the field and readers with a more general interest. I would recommend it especially to those managers of research organizations and officers of funding agencies who feel that they have neglected their education about synchrotron radiation and who would welcome a quick way to catch up. Active researchers will no doubt wish to keep a copy or two on their shelves to lend out to students contemplating thesis projects using synchrotron radiation.

N. V. SMITH
AT&T Bell Laboratories
Murray Hill, New Jersey

Models of the Nucleon: From Quarks to Soliton

Rajat K. Bhaduri
Addison-Wesley, Redwood City, Calif., 1988. 360 pp.
$41.95 hc ISBN 0-201-15673-3

Three decades ago the nucleon and pion–nucleon resonances were very revered topics in elementary-particle physics. After discovering that the nucleon was composed of quarks, elementary-particle physicists dropped the study of the nucleon and its excited states. Of course, just because elementary-particle types have abandoned the nucleon, it does not follow that all is well understood and finished. Nuclear physicists have now moved in, claiming the study of the nucleon for nuclear physics and continuing research. Thus there is a need for books to teach nuclear physicists what is known and to direct them into the unknown. Instruction is the motivation of Rajat Bhaduri's *Models of the Nucleon*. Bhaduri is a well-known nuclear theorist who made such a transition to nucleon physics successfully in his own research; so he is in a good position to teach others this material.

However, the book covers a great deal more than the modest title suggests. Indeed most of the standard model is surveyed: quarks, deep inelastic scattering, bag models, chiral anomalies, gauge theories, the electroweak model, the Higgs mechanism, instantons. The expedient Bhaduri uses to cover so much in so little space is to deliver much of the material in the form of exercises. The reader who is capable of solving all the exercises will learn a great deal. However, for most others, a lot of unnecessary frustration will result, since I would guess that much of the material is neither essential to understanding the nucleon nor easy to absorb. In addition the material that is closer to the book's title is disposed of very briefly. As a result the book overlaps a great deal with other texts on the standard model, such as Frank Close's *An Introduction to Quarks and Partons* (Academic, Orlando, Fla., 1979). On the other hand, some of the recent material Bhaduri covers is not yet in most physics books, such as the Skyrme model and the large-N limit of quantum chromodynamics. This recent work shows that hadron physics is very much alive, and its inclusion shows that Bhaduri is keeping himself well informed about new developments. Perhaps unavoidably, the new material is not well integrated with the traditional material: Is the proton a bag of quarks or a topological monstrosity? There is no consensus on this question as yet, so we should not blame Bhaduri for failing to tell us what to think.

I think that the book will be very useful to those who are already familiar with the material—as a good source of references and a compact guide to the main ideas. The book is less suitable as a starting point for graduate students or others unfamiliar with the field. There are many misprints and some mistakes. In particular, many names are misspelled and some formulas are incorrect. Despite some problems, the book is a useful addition to the literature on the standard model and the nucleon.

GABRIEL KARL
University of Guelph, Ontario, Canada

One-Dimensional Conductors

S. Kagoshima, H. Nagasawa and T. Sambongi
Springer-Verlag, New York, 1988 [1982]. 235 pp.
$65.00 hc ISBN 0-387-18154-7

The general area of one-dimensional conductors became a subject of wide research interest at the beginning of the 1970s. The successful fabrication of several chain-like organic and inorganic conducting compounds has led to a tremendous volume of published papers, the bulk of them having appeared from the beginning of the 1970s to the early 1980s. The initial impetus for the unusually large interest in the subject was a paper by Anthony Garito, Alan Heeger and their collaborators (*Solid State Commun.* **12**, 1125, 1973) in which they published results for the electrical conductivity of the one-dimensional charge-transfer compound TTF-TCNQ. They found that in TTF-TCNQ the rate of increase in the conductivity as the temperature decreases is larger than that in normal conductors. From their results these authors conjectured that they had found what—at that time—could have been called a high-temperature superconductor. But the unusual properties of TTF-TCNQ were not due to superconducting fluctuations; instead they were related to the "Peierls instability" that is characteristic of one-dimensional conductors—of which TTF-TCNQ became the prototype.

Researchers from several camps then realized that the physics of one-dimensional conductors is inherently quite interesting. For example, concepts like the Peierls transition, the Kohn anomaly, the Peierls–Frölich mechanism, charge-density waves, spin-density waves, charged solitons and phasons have become part of the standard language of research on one-dimensional condensed matter.

One-Dimensional Conductors by Seiichi Kagoshima, Hiroshi Nagasawa and Takashi Sambongi is the first attempt at giving an overview of the field at an introductory level. It is a translation of a book published in Japanese in 1982; the English edition has been briefly updated. Some of the topics covered were still evolving at the time the book was written. Therefore there are important new results not covered in the book. The authors are experimenters, and the book is to a large extent directed to an audience of experimenters.

The book is divided into seven chapters. The first one is an introduction to the field, while the second gives a brief theoretical review of some of the basic ideas behind the Peierls transition, the Kohn anomaly and other typical one-dimensional concepts. This theoretical discussion is written clearly enough for the novice. The remaining five chapters deal with experimental results for different chain-like materials that have been the subjects of significant amounts of research.

Each of the experimental chapters starts with a discussion of the chemical structure of the materials and a