project from its conception to the present. Corresponding laboratories in the US and USSR are, however, also covered, so that the book is truly a commentary on the whole scene viewed through the eyes of an historian and journalist.

The book was not written specifically for the research physicist and caters largely to the nonscientist. The physicist, therefore, should not expect information on the principles or design of the proton synchrotron or the concepts, problems and solutions in high-energy physics. Indeed, the specialist may occasionally be nauseated (or intoxicated) by the attempts to convey in lay terms the underlying physics and engineering principles. The language may perpetuate the aura of mystery and magic about the activities at these advanced-research institutes.

What the physicist will find most rewarding, however, is the discussion of those things that can not be found in scientific journals. The book, for example, covers the very beginnings of CERN; the interplay of scientists and politicians; the problems, pressures and competition that motivate the research worker and influence the program, in addition to the pure search for knowledge (this is nicely illustrated with a rather full account of the famous "second" neutrino experiments and of the courses followed at Brookhaven National Laboratory and CERN), and the scientist's role in the development of modern civilization.

The research manager will be interested in the discussions of management philosophies adopted during the construction and operation phases of the CERN machine under the direction of John Adams and later Victor F. Weisskopf. The desire to foster the productivity and originality of the research scientist, the requirements of ensuring that the visiting scientist achieves recognition through publications for his contributions, and many other factors lead to tension within a large laboratory particularly between the "beam makers" and beam users. This led Weisskopf to exercise considerable restraint in making authoritarian decisions.

The author rarely offers his own opinions and relates very successfully the ideas and comments of the many people with whom he talked during the book's preparation. I found this a fascinating book that can be thoroughly recommended, because the author and translators have succeeded in making it very easy to read. The author, Robert Jungk, born in Germany but now a US citizen living in Austria, is well known for his previous works: *Tomorrow is Already Here*, *Brighter than a Thousand Suns*, and *Children of Ashes*, for which he was awarded the International Peace Prize.

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Annual Review of Astronomy And Astrophysics

Leo Goldberg, David Layzer, John G. Phillips, *eds.*
528 pp. Palo Alto, Calif., 1968. $8.50

It is impossible to be fair in reviewing a collection of 17 articles, each of which deserves a page or two of discussion. I, therefore, have to concentrate upon a few of them that happen to interest me personally. I shall tend to overemphasize the new techniques of observation and neglect the large number of excellent articles concerned with old techniques. This is perhaps the fundamental cultural gap between physics and astronomy; a physicist instinctively prefers to use new techniques, yet an astronomer prefers to make new discoveries with old techniques.

The scope of this volume covers almost all branches of astrophysics, from planetary dynamics to cosmology. It provides a good overview of the rapid progress made during recent years by many diverse types of astronomers. Each of the articles is thoroughly professional. There is no wild speculation, and there is no attempt to include the latest developments in such fashionable areas as pulsar astronomy.

Sir Martin Ryle, in a short article, summaries the results of 20 years of observation of the statistical distribution of radio sources. The old source counts, including the third and fourth Cambridge catalogs, showed an excess of faint sources, indicating an increased density of emitting objects at very large distances. The new counts, including the fifth catalog, extend to sources about 100 times as faint as the old. One now sees a clearly defined peak in the apparent density of sources, followed by a decrease at still greater distances. These data are well fitted by an evolutionary model in which radio emission rose to a maximum at the time of formation of galaxies early in the history of the universe. Irrespective of the cosmological interpretation, Ryle's great work in surveying the sky for radio objects down to the 29th bolometric magnitude has been basic to the whole development of radio astronomy.

Hanbury Brown has written an equally authoritative article on the measurement of stellar diameters by optical interferometry. He describes the old measurements using the phase interferometer of Michelson, and the new measurements using the intensity interferometer invented by Twiss and himself. It is remarkable that nobody has been able to do substantially better with phase interferometry than Michelson did 50 years ago. The Michelson interferometer can measure only red-giant stars, and the Brown–Twiss interferometer can measure only blue and white stars. Brown vividly describes the frustrations that attend efforts to improve the performance of these devices, and discusses the chances of future success.

An article on electronic image intensifiers by Kent Ford discusses in detail the various techniques of image intensification and the snags that held up for so many years their fruitful application to astronomy. The snags are now finally being overcome, and the resulting revolutionary improvement in the speed of optical telescopes is gradually being exploited. One application to which image intensifiers are particularly well suited is the spectroscopy and red-shift determination of faint galaxies and quasars.

A beautiful article by Peter Gold-

PHOTO BY JOHN T. SCOTT

SIR MARTIN RYLE

reich and Stanton Peale develops the theory of the peculiar resonances that have recently been discovered in the rotation periods of Mercury and Venus. It is now observationally established that Mercury's rotation is locked to its orbital motion, the rotation period being two thirds of the orbital period. Also the rotation of Venus appears to be locked to the orbital motion of itself and the earth, the rotation rate of Venus being equal to four times its revolution rate minus five times the earth's revolution rate. These relationships can be understood on the basis of Newtonian mechanics, when tidal interactions are properly taken into account. The theory is an exercise in analytical dynamics, which any of the great 19th-century mathematicians from Lagrange to Poincaré would have enjoyed working out. What a demonstration of the poverty of human imagination it is that nobody considered the possibility of such resonances in the dynamics of the solar system until the radar astronomers observed them!

I have described just a few of the contributions in this volume. My advice to the reader is to begin reading the article that you think will interest you least. The chances are that you will be pleasantly surprised.

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Fundamentals of Electricity and Magnetism

By Arthur F. Kip
(2nd edition) 630 pp. McGraw-Hill, New York, 1969. $9.50

There are several interesting features about this excellent text by Arthur F. Kip, physics professor at Berkeley. For one thing, a description of the chapter contents precedes the table of contents. This, with the table, forms a clear and easy sketch of what material the book covers and how it is covered. A second feature is a fine last chapter on units of measurement. The third feature is the relegating of mathematics to the appendixes. It is thus convenient to instructor and student, but is not a part of the regular text.

Although the inclusion of alternating-current circuits is not too unusual in electricity and magnetism books, Kip's chapter is exceptionally well done. There are sections on complex-number concepts, generators and motors, which may be omitted if desired.

The book includes two other features less frequently found in books at this level—a first course in electricity and magnetism. One is on electric and magnetic quantum effects and the other on vacuum tubes and semiconductor devices. Both chapters are "starred," meaning they may be omitted.

The rest of the material is usually found in other books at this level. This book appears to cover the material well, has good illustrations and has enough detailed examples to give the student an insight into the solution and handling of electricity and magnetism problems.

I am sure this is a good teaching book with certain touches, for example, the explanation of the galvanometer principles, that should make it of special interest and use to the student who wants a little more for his time and effort.

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Lecons sur la Theorie des Groupes et les Symétries Des Particules Elementaires

By H. Bacry
449 pp. Gordon & Breach, Paris, 1967. Paper 91.50 F, cloth 109 F

Group Theory and Its Applications

Ernest M. Loebl, ed.
696 pp. Academic Press, New York, 1968. $19.50

Because group theory is a natural framework for the study of symmetries, theoretical physicists have always been interested in this branch of mathematics to fulfill their cherished desire to discover and understand symmetries in our natural systems.

This interest, however, remained only in permutation groups or some compact groups like the three-dimensional rotation group. The age of relativity brought with it serious study of the noncompact Lorentz group and simple generalizations, like the de Sitter group. A recent boost in this interest is perhaps a result of the discovery of SU(3) as a possible broken higher symmetry group for the elementary constituents of matter.

This has resulted in attempts by the theoretical physicists to rewrite the great work done by the mathematicians on the theory of compact and noncompact continuous groups (Lie groups) and to communicate it to their colleagues in a language they can comprehend. They have also been able to contribute a great deal to this far-from-complete, although ever expanding, storehouse of knowledge.

These two excellent books are written to bring this expanding knowledge to its potential users. The appeal of the two books is, however, to somewhat different audiences. Henri Bacry's book is intended mainly for graduate students, but the contributions in the book edited by Ernest M. Loebl aim very much beyond and are meant for serious researchers and those who would like to acquaint themselves with the contribution that group theory is making in branches of theoretical physics.

Bacry's book, which is unfortunately in French, resulted from a series of lectures delivered at l'Université de Marseille (1962–63 and 1965–66) and l'Istituto di Fisica dell'Università di Bologna (spring 1965). Its aim is to bring students studying symmetries to the threshold of group theory without involving them in complicated proofs. The mathematical jargon is not avoided, so that the student will be able to face the literature later. The book is full of many nice problems containing useful results. Leaving them to the students to answer has also helped a great deal in keeping the book to a handy size. The book concludes with two chapters on elementary particles oriented towards a brief description of their internal and external symmetries.

Group Theory and its Applications contains contributions from authors who are masters of the application of group-theory techniques to a wide range of theoretical physics. I believe that this book will prove very useful in widening the scope and outlook of many of its users.

It can be considered to have a virtual division into three parts. The first part consists of well written mathematical articles, including a particularly interesting one on induced representations by A. J. Coleman. The technique of inducing representations for finite groups from representations of their subgroups was known quite early to the mathematicians. Their techniques have only recently been