Group applications

UNITARY SYMMETRIES AND THEIR APPLICATION TO HIGH ENERGY PHYSICS. By M. Gourdin. 303 pp. North-Holland, Amsterdam (Interscience, New York), 1967. $12.75

by Don B. Lichtenberg

This book is most useful for those who already know something of group theory and unitary symmetry and who want to become better acquainted with the progress of the applications to elementary-particle physics. The different applications discussed do not all represent progress in the field, but at least they represent lines of research that have been pursued and which are worth knowing about if only to avoid pursuing them again.

I should like to regard the book as being divided into three main parts. The first part, comprising chapter 1, contains a summary of some of the main properties of the unitary group SU(3). This chapter is highly condensed and is filled with many technical terms from the theory of Lie groups, Lie algebras and topology. The second part, including chapters 2 through 11, contains the main applications to particle physics of the unitary groups U(3), U(6) and higher dimensional groups, including noncompact groups and current algebras. The third part, containing chapters 12 through 17, is an introduction to the theory of Lie groups, Lie algebras, topology and group representations. For the uninitiated, a reading of chapters 12 through 17 is necessary to understand chapter 1.

However, even these last chapters, although of an introductory nature, are condensed and incomplete. It will be difficult to learn about the necessary group theory from them without having been previously exposed to some knowledge of group-theoretical concepts. For example, factor groups are used quite often in this part, but nowhere could I find a definition of a factor group. The entry "factor group" is not in the index. In fact, a number of undefined concepts that have been used extensively are not referred to in the inadequate index. Nevertheless, these last chapters provide the valuable function of giving the reader an acquaintance with many of the important ideas.

But the main merit of the book, in my opinion, lies in the applications. The author has shown good judgement in including applications to strong, electromagnetic and weak interactions. He has shown that unitary symmetry, including symmetry-breaking effects and the ideas of current algebras, has many applications over the whole range of elementary-particle physics. It is impressive to see so many different kinds of applications all discussed in a few chapters of one book. But this very richness of material has meant that in many cases the treatment has had to be quite sketchy and the reader has had to be referred to the original literature for further information.

Sometimes Gourdin is overly optimistic, as when he describes the SU*(6)* prediction of the ratio of the proton to the neutron magnetic moment as being in "perfect" agreement with experiment. The actual discrepancy of about 3% is very small when judged by the standard of the usual predictions made in elementary-particle physics, and I assume that is all Gourdin meant to imply.

This book is most useful as a summary of "the state of the art" in the applications of unitary symmetry to high-energy physics, rather than a book to teach the uninitiated about the field. As such, it is a valuable book for the young researcher who has worked in only one part of this rapidly developing area of research but who wishes to acquaint himself with a broader picture. The book will also be valuable to advanced theoretical graduate students who, however, may find it a bit rough going unless they are prepared to take much of what is said on faith.

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The reviewer, a professor of physics at Indiana University, has worked for several years in unitary symmetry.

Updated and rewritten introductory textbook

FUNDAMENTAL PHYSICS. (2nd edition). By Jay Orear. 472 pp. Wiley, New York, 1967. $8.95

by Garrison Sposito

The second edition of *Fundamental Physics* is an enlarged, updated version of its predecessor and, according to the author, represents "a serious attempt to rewrite the entire book in order to increase the amount of explanation without much increase in subject matter." This has indeed been the case, for the revision of the first ten chapters is essentially a reorganization, while that of the last six (on relativity and quantum physics) comprises primarily discussions of the laser and the advances in particle physics during the past seven years. Moreover, the book now reads more smoothly, offers more and better illustrations and problems, and enjoys the benefit of the programed approach to self-study in the form of "test your understanding" questions (and answers) at the bottom of nearly every page.

Given that the new edition is an improvement on the first, the question left to be answered is whether *Fundamental Physics* can be used successfully in a course on physics for students with little background in science. If the point of view is taken that such a course should be encyclopedic, involving many aspects of physics, and should impart a certain degree of skill in dealing with applications, then the answer to the question is essentially affirmative. Most everything in classical and quantum physics is touched upon in the book, then embellished by worked-through examples and discussions of important applications. This eclecticism is probably not seriously disadvantaged by the occasionally unintelligible prose ("This mathematical procedure, called Fourier analysis, requires an infinite number of pure sine waves using integral calculus.") or the misleading remarks concerning the visibility of the Lorentz contraction, simultaneity, and the uncertainty principle.

On the other hand, the review of elementary mathematics in the first chapter and the use of mathematics in general throughout the book are not adequate. For example, the reader is told in the review that the slope of a curve is its steepness; yet, in a later