

Nuclear and Particle Physics

A: Background and Symmetries

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Nuclear and Particle Physics

A: Background and Symmetries

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Hans Frauenfelder and Ernest M. Henley

A: Background and Symmetries, 1975

*B: Electromagnetic and Weak
Interactions, in preparation*

This book is dedicated to our children, Anne, Bradford, Karen, Kätterli, and Uli, four of whom have grown to adulthood while we were writing the many drafts that led to this final version.

FOREWORD

Everyone concerned with the teaching of physics at the advanced undergraduate or graduate level is aware of the continuing need for a modernization and reorganization of the basic course material. Despite the existence today of many good textbooks in these areas, there is always an appreciable time-lag in the incorporation of new viewpoints and techniques which result from the most recent developments in physics research. Typically these changes in concepts and material take place first in the personal lecture notes of some of those who teach graduate courses. Eventually, printed notes may appear, and some fraction of such notes evolve into textbooks or monographs. But much of this fresh material remains available only to a very limited audience, to the detriment of all. Our series aims to fill this gap in the literature of physics by presenting occasional volumes with a contemporary approach to the classical topics of physics at the advanced undergraduate and graduate level. Clarity and soundness of treatment will, we hope, mark these volumes, as well as the freshness of the approach.

Another area in which the series hopes to make a contribution is by presenting useful supplementing material of well-defined scope. This may take the form of a survey of relevant mathematical principles, or a collection of reprints of basic papers in a field. Here the aim is to provide the instructor with added flexibility through the use of supplements at relatively low cost.

The scope of both the lecture notes and supplements is somewhat different from the FRONTIERS IN PHYSICS Series. In spite of wide variations from institution to institution as to what comprises the basic graduate course program, there is a widely accepted group of "bread and butter" courses that deal with the classic topics in physics. These include: mathematical methods of physics, electromagnetic theory, advanced dynamics, quantum mechanics, statistical mechanics, and frequently nuclear physics and/or solid-state physics. It is chiefly these areas that will be covered by the present series. The listing is perhaps best described as including all advanced undergraduate and graduate courses which are at a level below seminar courses dealing entirely with current research topics.

The above words were written in 1962 in collaboration with David Jackson who served as co-editor of this Series during its first decade. They serve equally well as a Foreword for the present volume, which offers to graduate students and to research physicists alike an unusually lucid and unified view of basic concepts common to nuclear and particle physics.

Hans Frauenfelder and Ernest Henley have made many important contributions to both nuclear and particle physics; gifted pedagogues as well as researchers, they are thus especially well qualified to write a text which describes in depth those features which are important to both of these major fields of physics. It is a pleasure to welcome them as contributors to LECTURE NOTES AND SUPPLEMENTS IN PHYSICS.

David Pines

PREFACE

NUCLEAR AND PARTICLE PHYSICS have grown so much in the last few decades that it is impossible to give a complete in-depth treatment in one or even a few volumes. Any text thus must compromise between breadth and depth, favoring one or the other. In an earlier book, SUBATOMIC PHYSICS¹⁾, we have surveyed the entire field, sacrificing depth. In the present volume we lean towards the other extreme by selecting some topics and filling the gap between an introductory text and research reviews. We stress features that are common to nuclear and particle physics and emphasize concepts that we expect to remain important. The book is intended for a graduate post-quantum mechanics course and for students who wish to learn the

1. H. Frauenfelder and E. M. Henley, Subatomic Physics (Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1974).

subject independently.

We should like to thank the many colleagues and students who have helped with criticisms and valuable suggestions. We thank Diane Florian for the careful typing of the final version. We are grateful to the Universities of Illinois and Washington, the Aspen Center for Physics, CERN, and the Los Alamos Scientific Laboratory for making joint work possible. Finally we acknowledge support from the John Simon Guggenheim Memorial Foundation.

HANS FRAUENFELDER

ERNEST M. HENLEY

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