This book has been found to be an excellent text for fuel cycle courses at the senior undergraduate and at the graduate levels. Most of the material is pertinent to the present nuclear industry, the clarity of presentation is outstanding, and good judgment is evident throughout in the selection of references from the vast literature in this field. The design and operational details that are provided for selected plants (e.g., the Barnwell Nuclear Fuel Plant for commercial fuel reprocessing, the French high-level waste Marcoule Vitrification Plant, the Savannah River heavy water plant, a gaseous diffusion uranium enrichment plant based on the published characteristics of a French barrier material) are particularly useful in design courses devoted to nuclear fuel cycle facilities. This reviewer missed a chapter on the chemical engineering aspects of the design and operation of nuclear power reactors (e.g., water treatments, chemical controls, hydrogen recombiners, metal-water reactions, decontamination, fission gas containment, radiation-induced reactions, etc.).

Nuclear Chemical Engineering should be of interest to a much wider group of readers than its title might imply and will certainly become a classical treatise on important aspects of nuclear energy.

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Particle Physics and Introduction to Field Theory
(Contemporary Concepts in Physics, Vol. 1)

Author	T. D. Lee
Publisher	Harwood Academic Publishers, New York (1981)
Pages	865
Price	$59.50 cloth bound; $19.50 paper bound
Reviewer	Howard Grotch

This book provides a much needed contemporary addition to the long list of texts dealing with various aspects of quantum field theory and particle physics. Written by one of the most eminent theoretical physicists of our time (Nobel laureate with C. N. Yang in 1957), this is the first of a number of volumes dealing with topics at the forefront of physics research.

In the early sections of the book, Lee introduces the spin 0, spin 1/2, and spin 1 fields. He does this systematically by first discussing the classical mechanics of finite systems. After developing the Feynman rules and applying them to basic processes in quantum electrodynamics, he then devotes a sizable chapter to solitons, a topic that has been very much in vogue in recent years. Since this subject has not been discussed in texts on field theory or particle physics, it is refreshing to see a comprehensive, yet understandable, treatment, which begins with the early history of the subject. This topic completes Part I of the book, which deals primarily with field theory.

Part II of the book, which far exceeds Part I in length, deals with many aspects of particle physics. It is broken into three subsections, the first of which is a short chapter on order-of-magnitude estimates. It gives the strengths of the four fundamental interactions, discusses various lengths in physics, and considers a number of processes at high energies.

Part IIA contains eight chapters, all of which treat symmetry principles in particle physics. Many of the topics, such as isospin, SU_3, and the discrete symmetries P, C, T, are treated in standard texts, but Lee updates these topics and explains them in an interesting way.

Part IIB comprises more than half of the book. It consists of a wealth of information on interactions in particle physics. In particular, emphasis is placed on strong and weak interactions. For the former, there is a timely discussion of the problem of quark confinement and an extensive chapter on quantum chromodynamics, the field theory used to describe strong interactions. Lee's own research on color dia-electrics is treated in this section. Chapter 19 develops the path-integration method and uses this to generate Feynman rules. There is a great deal of material on the quark model of hadrons and the use of the quark-parton model to analyze high-energy scattering. This includes a discussion of the Massachusetts Institute of Technology and Stanford Linear Accelerator Center bag models. There are several chapters devoted to weak interactions. This includes the phenomenology of weak processes as well as gauge theories that unify weak and electromagnetic interactions. Chapter 24 discusses chiral symmetry. The brief concluding chapter provides some interesting comments on the present status of particle physics and future directions.

Interspersed throughout the book are suggested exercises of varying degrees of difficulty. A serious reader intent on mastering the material should attempt these exercises.

Generally, the equations in the text are well presented and the balance between mathematics and explanation is good. The only criticism I have concerns notation. Lee uses an imaginary fourth component for his four vectors. Others in this field also use this, but I believe it is more standard to use real components and to utilize a metric tensor and covariant and contravariant vectors.

Although I enjoyed reading this book and would certainly recommend it to both students and faculty in the field of high-energy physics, much of the book is probably too far removed from the area of nuclear technology to be of practical use. However, those who are interested in keeping abreast of this exciting field of physics will find that their effort is justly rewarded.

Howard Grotch is a professor of physics at The Pennsylvania State University at University Park, Pennsylvania. He is a theoretical physicist whose research encompasses a variety of topics in atomic and elementary particle physics. He is also a coauthor of a textbook, Physics for Science and Engineering.