The second edition follows the first exactly in organization, format and chapter titles, except for the addition of a new chapter on laser and microwave fields. A large part of the second edition is, appropriately, reprinted from the first. Because it contains a good share of new material, it is noticeably larger than its predecessor—519 larger pages in contrast to the original 420.

In addition to containing new material on nonionizing radiation, the second edition differs from the first in other respects. It introduces SI units as the standard, although it often expresses quantities also in the older units for "old-timers." Chapter 8 on "Radiation Protection Guides," is substantially revised in accordance with the recommendations of the International Commission on Radiological Protection on risk and total detriment. These supplant the earlier maximum permissible dose-equivalent limits to organs of the body. Cember also presents the Commission's procedures for internal dosimetry. He has brought Chapter 9—on instrumentation—somewhat up to date, and he has added a large appendix on specific absorbed fractions. In contrast to the original, the second edition also includes answers to problems and an author index.

I have used the first edition of *Introduction to Health Physics* for several years as the text for a course with the same title at The University of Tennessee, and I have found it authoritative, comprehensive and well organized. It contains the basic physics and the formulas, graphs, tables and rules of thumb that are useful in solving practical problems. It is a very fine textbook—except for an inordinate number of misprints. (One of my copies, printed in 1980, carries three pages of errata.) Although many errors appear corrected in the new edition, a disappointing number remain. For example, only one of the two errors in the serial decay on page 87 (new edition) has been corrected; in equation (5.17), page 108, M is still incorrectly identified as the mass of the ionizing particle, rather than that of the electron; on page 319, 1.1/0.95 still equals 1.06.

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Quarks, Leptons & Gauge Fields

K. Huang
281 pp. World Scientific (US dist. Heyden, Philadelphia), 1983. $34.50

It is hardly a secret that during the past decade great developments have occurred in fundamental elementary-particle theory. What has come to be called the standard model has two parts: quantum chromodynamics, describing the strong interactions; and the Glashow–Weinberg–Salam model, describing the weak and electromagnetic interactions. The attempt to unify and extend these gauge theories is a flourishing industry.

The volume under review presents the mathematical methods that are used in studying gauge theories and explains some of the calculations that have highlighted the development of the standard model. The book also gives the phenomenological evidence for the standard model.

This is a very worthwhile book. Its greatest strength is its choice of subject matter. There are detailed discussions of such important theoretical topics in gauge field theory as instantons (and their effects), the renormalization group, the axial anomaly, and the effective potential. These subjects have been the focus of much interesting research during the past few years, yet only rarely do they find their way into texts or field-theory courses. The exposition is generally clear and concise.

The book grew out of a course for advanced students, and it provides a convenient way for such students to learn much of the material that comprises the standard model. It is not a substitute for a basic field-theory text. Most of the book is written at a level that presumes that the readers have already had a course in quantum field theory. The phenomenological discussion, however, is so written as to be accessible to readers without extensive mathematical preparation.

There is a brief exposition of relevant aspects of group representation theory. It covers the quantum numbers of particles and gives a useful set of computational rules, illustrated with examples. Scalar electrodynamics provides a clear model for gauge invariance and for spontaneous symmetry breaking, both in the Goldstone and the Higgs modes.

Huang discusses both classical and quantized gauge fields. In the classical treatment, he briefly reviews the relevant Lie group theory and the construction of the Yang–Mills Lagrangian. He also covers instantons, solitons, the coupling of matter fields, and the Glashow–Weinberg–Salam Lagrangian. Conciseness is generally a strength of this book. However, it is overdone in very theoretical matters, such as topological stability, whose the treatment is somewhat confusing.

Huang bases his treatment of quantized gauge fields on path integrals, which is certainly the preferred approach. He derives the path-integral formulation of quantum mechanics and quantum field theory and uses it to

recover the Feynman diagrams for ϕ^4 theory. He also discusses fermion path integrals and includes, in the ensuing discussion of the quantization of Yang–Mills fields, the Fadeev–Popov determinant and ghosts. He explains the origin and physical meaning of θ worlds especially clearly.

The book covers a number of important and advanced topics in field theory in a traditional manner. These include the Callan–Symanzik equation and the renormalization group (including a review of renormalization *per se*), spontaneous symmetry breaking and the effective potential, dimensional transmutation, and the axial anomaly.

The book's last chapter is a discussion of quantum chromodynamics that is much less technical than most of the rest. It briefly covers the color and flavor groups and presents important results for which the body of the book had provided the mathematical background. Whereas most of the book is devoted to developing methods, this chapter pulls together results (from earlier chapters or the literature) as they apply to chromodynamics.

The book's most serious limitation is the absence of any material on lattice QCD. There is no discussion of numerical techniques or results, of confinement nor of the hadron spectrum.

It is easy to use the book for learning separate subjects. Most chapters are self-contained and use standard notation, so they can almost be read in any order and an individual topic can be studied alone, surely a virtue for many prospective readers, and a pleasant contrast with many other texts.

Huang has written quite a useful book. It is a slim volume, but the material in it is very well chosen. It covers the core analytic field-theoretic material of the standard model in a clear concise manner.

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Quantum Field Theory

C. Itzykson and J.-B. Zuber
705 pp. McGraw-Hill, 1980. $55.00

Until four years ago, when this book first appeared, there was no textbook that presented a coherent and comprehensive account of quantum field theory from the basics through to the developments of the 1960s and 1970s. Those of us who had the task of introducing graduate students to the subject had to rely for background reading on the older classics, such as the two volumes by James Bjorken and Sidney Drell, supplemented by reviews of specialized topics. The arrival of a more comprehensive treatment was thus extremely welcome. Since that time, several other books have been