most important achievements of modern physics and provides the foundation for analysing the experiments which are carried out at particle accelerator laboratories to probe the fundamental structure of the Universe.

It was originally developed during the middle decades of this century to try and understand how electrically charged particles interact through the electromagnetic field, whose quantum particle is the photon. The resulting formalism is, at least on first acquaintance, rather forbidding and one of the most welcome and useful conceptual breakthroughs was the demonstration by Feynman that any given process can be pictured as proceeding through a series of interaction diagrams, for each of which a fairly straightforward mathematical representation can be given by employing some quite easily remembered 'Feynman rules'. Furthermore, since each additional interaction introduces extra factors of the electronic charge, represented by the so-called 'fine-structure constant', whose value, approximately 1/137, is a rather small number, it is only the lowest order diagrams for a given process that usually have to be taken into account. This approach has provided the basis for most introductory expositions of the subject and the majority of its practical applications.

Subsequently, following pioneering work by Weinberg and Salam in the late 1960's, it was shown that the weak nuclear interaction, which is responsible for radioactive decays for example, can be treated in an analogous fashion, with heavy 'weak bosons' playing a similar role to that of the photon. The resulting unified electro-weak theory made concrete predictions for the masses of these weak bosons and the whole approach became fully accepted once the existence and masses of these particles were verified experimentally in the early 1980's. It has thus become an established part of the 'standard model' of particle physics, one which has passed all of the many stringent tests to which it has since been subjected. This standard model is now the starting point for trying to devise the even more comprehensive unified 'theories of everything', which currently preoccupy much of the particle theory community. It is thus an essential feature of any aspiring theorist's education.

Despite the prominence given to Feynman diagrams in the title of this book they do not actually make an appearance until the sixth chapter (out of ten). The author begins with an entirely conventional and quite detailed introduction to the foundations of quantum field theory and only gradually works his way round to an account of how to calculate the lowest order Feynman diagrams for some of the more important electroweak processes. The final chapters are devoted to applying these results to weak decay rates and the cross-sections for electron-positron and neutrino-nucleon scattering.

There is no discussion of more advanced topics such as renormalisation and radiative corrections or even such important processes as the production of the weak bosons or the Higgs particle. The presentation is thorough but perhaps a bit dull. Regrettably there are no references to the original literature or to the small amount of experimental data which is invoked. Instead there is a list of some, mainly rather old, textbooks at the end. It is not clear when the lecture course on which the book has been based was first prepared but the fact that the most recent reference is to a textbook published in 1985 perhaps indicates why the approach now seems a bit old fashioned. So, although this book can be used as an introductory text, it does not really provide the kind of lively and stimulating account which is needed to carry the novice willingly through the initial complexities of field theory because it does not attempt to keep the exciting developments at the frontiers of the subject in view. Nor does it, as its title might suggest, follow the example of several recent books with somewhat similar aims which invoke only those concepts which are absolutely essential to introduce Feynman diagrams and are thus able to omit many of the more off-putting technicalities. It certainly provides a useful and detailed account of elementary electro-weak theory but, to my mind, it is not sufficiently enlivening to constitute an inspiring introduction, nor is it sufficiently comprehensive and up-to-date to be of great value as a reference text for the more experienced practitioner. It can therefore only be recommended with reservations.

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Chaos—The Interplay Between Stochastic and Deterministic Behaviour, in the series ***Lecture Notes in Physics***
Edited by P. Garbaczewski, M. Wolf and A. Weron

1995, DM168·00 (hbk), pp. xii + 571. Springer, ISBN 3 540 60188 0. Scope: winter school proceedings. Level: postgraduate and specialist.

About 20 years ago, stimulated by enormous advances in computer technology, it became known to a wider community of physicists that the deterministic equations of Newton's mechanics do not necessarily imply predictability. It is possible that the solutions of perfectly deterministic equations of motion are as random as a coin toss. This observation, also called 'deterministic randomness' was the guiding theme of the Winter School on Chaos held in 1995 in Karpacz, Poland. Its proceedings, skillfully edited by P. Garbaczewski, M. Wolf and A. Weron are now available published by Springer under the title: *Chaos—The Interplay Between Stochastic and Deterministic Behaviour*.

In line with the traditional organization of a School the book is divided into two parts: (I) Lectures and (II) Seminars. The Lectures, written with considerable pedagogical care, prepare the reader for the more advanced and specialized material presented in part II, the Seminars. The variety of material covered in this book is enormous. It ranges from stochastic differential equations through Lévy flights to the large scale structure of the Universe. The level of the contributions is very homogeneous but consistently on the 'advanced' side. I would not recommend this book to a chaos novice. And even advanced graduate students in chaos and nonlinear dynamics will have a hard time to follow some of the articles collected here. On the other hand, this book presents an excellent cross-section of current research themes in chaos and nonlinear dynamics. Therefore I recommend it wholeheartedly to graduate students and researchers in the field.

Right from the beginning of the 'chaos revolution' many scientists asked the question of how chaos manifests itself in quantum mechanics. This line of research became known as quantum chaology. While quantum phenomena with all the earmarks of classical chaos were never observed, the search for 'fingerprints' of classical chaos in quantum systems is currently one of the most exciting research areas in many of the traditional fields of physics, such as solid state physics, quantum optics and atomic physics. The book reflects this trend completely. More than half of the lectures and seminars deal with the classical-quantum correspondence in connection with classical chaos, or questions on how to identify and characterize chaotic features in quantum mechanics. In particular we learn about Lévy flights in relativistic quantum dynamics, chaotic bosons and laser-cooled two-level atoms, wave-packet propagation in chaotic race-tracks, and the latest news on quantum chaotic scattering and the applications of chaos in atomic physics.

In my opinion this book is essential reading for anyone who wants to become or stay up to date in the modern developments of chaos and quantum chaology.

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Diverse Topics in Theoretical and Mathematical Physics
By R. Jackiw

1995, £42 (pbk), pp. viii + 514. World Scientific, ISBN 981 02 1697 1. Scope: reprinted articles. Level: postgraduate and specialist.

For someone to gather together in one publication a collection of articles which are the written versions of talks given at various summer schools or workshops from 1969 onwards might be regarded as verging on hubris, or at the least lead to a rather fractured book containing rather unrelated themes. Nevertheless the book under review manifestly transcends these dangers and is a pleasure to sit down and just read rather than merely use as a reference on particular esoteric areas. This is a tribute to the style of the author which while concerned with quantum field theory always emphasises the links with standard quantum mechanics and keeps the mathematics well under control without losing undue rigour or requiring significant repetition.

The areas covered, which remain of considerable topical interest, are anomalies, the connection between gauge theories and gravity, understanding symmetries in the context of gauge theories (including quantum field theory at finite temperature), differing methods of quantisation and also some discussion of solitons and instantons in semi-classical quantum field theory. The discussion of anomalies is particularly valuable, not least since the author uses one of the originators of our understanding of the chiral anomaly (it is nice to hear how the seminal work of Bell and Jackiw had its gestation in the CERN cafeteria). What is also significant and seems to me to merit wider appreciation, is the development of methods for treating quantisation of constrained systems which provide a simpler, but equivalent, treatment to the Dirac analysis of first and second class constraints. There is also a fairly extensive discussion of the Schrödinger formulation of quantum field theories which cannot be found in any standard textbooks but which provide illumination on many problems.

Altogether this collection of articles provide in one place a valuable and very comprehensible source for understanding quantum field theory, and quantum mechanics, which I would recommend not just for libraries but also for penurious PhD students. It deserves to stand next to the well known collection of articles by Sidney Coleman which added greatly to the understanding of a generation of theoretical physicists.

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Exploring the X-ray Universe
By P. A. Charles and F. D. Seward

1995, £50·00 (hbk), £24·95 (pbk), pp. xiii + 398. Cambridge University Press, ISBN 0 521 43712 1. Scope: monograph. Level: postgraduate and non-specialist.

X-ray astronomy sprang to life in the 1960's with the advent of rockets and satellites, enabling for the first time astronomical observations to be made from above the Earth's atmosphere. Before the first surprising and totally unexpected observations of detectable X-ray sources outside the solar system were made, astronomers had little or no indication of the wealth of incredible phenomena waiting to be discovered in this new window on the Universe. From the first very crude measurements, X-ray astronomy has continued to develop to the present day with ever increasing sophistication of both the instruments used and the ideas needed to account for the observations. It has indeed been a voyage of exploration and discovery and the title *Exploring the X-ray Universe* is very apt.

The book builds on the observations from the first primitive attempts to detect cosmic X-ray sources to the sophisticated