Book Reviews

Particle Physics

Proceedings of the Eighth Hawaii Topical Conference in Particle Physics. Honolulu, Aug. 1979. V. Z. PETERSON and S. PAKVASA, Eds. University Press of Hawaii, Honolulu, 1980. viii, 638 pp., illus. Paper, $20.

The eighth and apparently last Hawaii Topical Conference in Particle Physics was held at a time at which it was becoming increasingly clear that the electromagnetic, weak, and probably even strong interactions are all described by gauge field theories. The discovery and detailed investigation of the weak neutral current interactions and of the charmed quark during the previous half dozen years had verified the low energy structure of the Glashow-Weinberg-Salam theory of weak and electromagnetic interactions and would lead to the awarding of the Nobel Prize in physics to those individuals shortly thereafter. During the previous decade a series of experiments in which electrons or neutrinos were scattered from hadronic targets or beams of electrons and positrons were allowed to annihilate had essentially established the existence of quarks, and in the summer of 1979 the first tentative evidence for the existence of the vector gluons that were widely believed to mediate the strong interactions had been reported.

The Hawaii conference occurred at the culmination of this extremely fruitful period. This fact along with the quality of the lectures makes this volume much more useful than most conference or summer school proceedings.

There are two theoretical lectures, by J. J. Sakurai and H. D. Politzer, which are devoted to quantum flavor dynamics (the weak and electromagnetic interactions) and quantum chromodynamics (the gauge theory of the strong interactions of quarks and gluons), respectively. Experimental lectures by G. Flügge and J. Steinberger are devoted to the description and interpretation of two of the types of experiments (electron-positron annihilation and neutrino scattering) that have contributed so much to our understanding of the basic interactions. These four lectures collectively describe most of the relevant phenomenological and experimental advances in particle physics in the last decade.

The lectures by Sakurai are an excellent introduction to the weak and electromagnetic interactions. The Glashow-Weinberg-Salam theory and the experimental status of the charged and neutral current interactions are described in detail. Possible alternatives to gauge models are discussed and expectations for future experiments are considered.

Unfortunately, the book does not contain a comparable introduction to the strong interactions. The lectures by Politzer assume that the reader already has a knowledge of quantum chromodynamics, deep inelastic scattering (some background on this topic is given in Steinberger's lecture), and heavy quark-antiquark bound states. The reader who possesses this background will find a useful series of critical discussions of the validity of various quantitative quantum chromodynamics tests. The factorization theorem is described in detail, and exclusive processes, sum rules, jets, bound states, $1/N$ expansions, and leading log calculations are considered.

Flügge's lectures describe most aspects of intermediate and high energy electron-positron annihilation physics. They include a very good balance of accelerator and detector properties, physics motivations, theoretical background, data, and results. The topics covered include tau lepton and bottom quark physics, top quark searches, quark and gluon jets, quantum electrodynamics tests, and two-photon processes.

Steinberger's lectures on topics in neutrino physics include descriptions of neutrino beams and detectors and of charged- and neutral-current neutrino scattering results. Considerable emphasis is placed on the use of neutrino scattering as a probe of hadronic structure, including tests of the quark-parton model and quantum chromodynamics corrections and measurements of the strange-sea component of the nucleon.

The lectures in this volume are highly readable. They could be read profitably by students (and by many workers in the field) to gain an overview of the status of the strong and electroweak interactions that covers current issues and expectations for the near future.

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Avian Paleontology

The Age of Birds. ALAN FEDUCCIA. Harvard University Press, Cambridge, Mass., 1980. xii, 196 pp., illus. $20.

The past decade has seen an extraordinary growth in the contributions of avian paleontology to our knowledge and understanding of avian evolution. From a mere handful of dedicated paleornithologists who struggled for decades to develop the study of fossil birds, the field has recently grown to include numerous new workers who are approaching both old problems and new discoveries with fresh ideas born of a modern grasp of biological principles. The sudden large growth in our knowledge of fossil birds makes the appearance of this volume, summarizing as it does for the nonspecialist our current knowledge of the better-known fossil birds and avian evolution, most timely.

The first third of the book is devoted to what is known about the early stages of avian evolution. After a brief overview of the structural features of birds and a thorough, interesting history of the discoveries of all five specimens of *Archaeopteryx*, the questions of which reptilian group might have given rise to birds and how birds evolved feathers and the powers of flight are addressed. Feduccia handles such controversial topics well. Arguments supporting all sides are presented in such a way as to enable readers to draw their own conclusions or at least to pursue the subject in the literature. Nonetheless, after presenting all the evidence Feduccia states his own views straightforwardly. In most cases only additional research will provide definitive answers, but the summaries of current views should be welcome to those outside the field.

In the chapters that follow, the evolution of major avian groups is considered. In some chapters the treatment follows a traditional systematic approach—for example, the last chapter traces the rise of the numerous groups of land birds such