op new pollution-abatement techniques. Large site-specific sources of inert pollutants would be eligible for consideration for variances. Blanket variances could be granted to an industry with numerous small sources of pollution in a limited geographic region.

Though the authors are to be applauded for their efforts, a basic question raised by the volume is whether, after all, estimates of macroeconomic effects have much to contribute to environmental policy. Basing environmental policy on macroeconomic effects implies inescapably that tradeoffs between the various effects are being weighed. But, to improve policy, comparisons should be made not at the macro level but in relation to specific controls. A challenge is to carry out adequate individual studies of the costs and beneficial effects of specific controls. When general equilibrium effects exist beyond immediately affected industries, they should be taken into account. Too often, estimation of general equilibrium effects is equated with use of macroeconomic models. A case can be made that general equilibrium effects are in fact more adequately estimated by the more individualized studies.

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Particle Physics

Techniques and Concepts of High-Energy Physics. Papers from an institute, St. Croix, Virgin Islands, July 1980. THOMAS FERBEL, Ed. Plenum, New York, 1981. xii, 542 pp., illus. $65. NATO Advanced Study Institutes Series B, vol. 66.

Keeping abreast of what is important in the field of high-energy physics is a difficult and many-faceted task. It is particularly bewildering for students and young researchers who are being immersed in the field at a time when experiments and theories are evolving from an almost innocent phase of discovery and classification of many types of particles and their interactions to investigations motivated by the sweeping promise of a unified theory of matter that may in the foreseeable future be (to quote from Chris Quigg's contribution to the volume under review) "so restrictive as to compel the existence of the universe as we find it . . . no more, and no less."

Such heady aspirations are characteristic of the deep and in some respects wrenching changes in the nature of high-energy physics research over the past decade. Grand unified theories are accompanied by experiments on a grand scale, carried out by multinational consortiums, with funding and resources concentrated at a relatively small number of vastly expensive accelerators and detector systems.

In this context the present volume is of considerable interest. Given an audience of recent Ph.D.'s and as their mentors a small group of skilled and influential theorists, experimenters, and machine builders, what are shown as the important threads in the tapestry of high-energy physics?

The lectures reproduced in the proceedings include not only up-to-date, textbook-quality treatment of the physics and technology issues that are at the fore but also articulate commentary on their roles in the forces of change at work in the field.

On the theoretical side, Jonathan Rosner's lectures on quark models treat the present view of the particle aspects of fundamental processes, with the quarks as tangible entities in a first-order theory of elementary-particle interactions. The color field and gluons are introduced with a concise connection between the Regge-pole description of particle spectroscopy (which dominates all but the most recent books) and the parameters of strings and bags in quantum chromodynamics (QCD). Potential model calculations and a detailed treatment of the light-quark particle spectrum lead to a discussion of heavy-quark spectroscopy (the "onia" of charm and beauty) and the speculative issues that engage current efforts in experiment and theory: additional heavy quarks, bound states of gluons, free quarks, and nucleon stability. A thorough pedagogical development is given to an introduction to gauge theories by Quigg. He begins with the implications of phase invariance in quantum electrodynamics as an introduction to non-Abelian gauge theories. These theories are carried through Yang-Mills theory and spontaneous symmetry breaking to the Weinberg-Salam model for leptons, incorporating hadrons in a local-color gauge theory. The lectures conclude with a discussion of the motivating ideas for grand unification of the gauge theories of strong, weak, and electromagnetic interactions. Aimed primarily at experimental particle physicists, the lectures on models and theory keep closely in touch with their implications for experimental programs.

The ideas and predictions of QCD calculations are confronted with data from a broad range of experiments at the world's high-energy accelerator facilities in reviews by Donald Perkins (probes of nucleon structure with deep-inelastic electron, muon, and neutrino scattering) and Maurice Jacob (jet phenomena in particle production at e^+e^- and proton-proton colliding beams).

Accelerator theory is taken up by Melvin Month, who illustrates some phenomena of relevance to the design and performance of proton-proton colliding-beam machines (specifically, the ISR at CERN and Isabelle at Brookhaven). Using idealized beam models he discusses beam-beam interaction, including discussion of the relationship of tune shift and luminosity, an example of a beam-induced (resistive-wall) instability, and a filling and stacking procedure for proton storage rings. The treatment is simplified but rigorous and nicely displays some of the theoretical methods underlying the machine-related jargon of the colliding-beam era.

In an approach to accelerator design on another tack, the financial, political, and entrepreneurial elements are emphasized in a design study session led by Robert Wilson, in which technical and strategic considerations are developed for a scheme to provide an electron-proton colliding-beam facility on a short time scale.

Konrad Kleinknecht presents a thorough and informative catalog of the techniques of particle detection in high-energy experiments, including an assessment of the size, complexity, and capabilities of some of the big detector systems currently in operation. Electronic techniques for dealing with the huge quantities of information that pour forth from these detector installations are discussed by Donald Hartill, who includes an introduction to the soon-to-be implemented Fastbus system of data acquisition.

For the most part, each of the contributors has provided a self-contained treatment of his subject, with extensive references and in some cases appendixes covering detailed calculational techniques as well as problem sets that are both illustrative and provocative. The volume has an index. It is an excellent supplement to the standard textbooks for advanced graduate students and a stimulating view of the landscape for all who labor in the field of high-energy physics.

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