Book Reviews

Weak Interactions

Unification of Elementary Forces and Gauge Theories. Papers from a conference, Batavia, Ill., Oct. 1977. DAVID B. CLINE and FREDERICK E. MILLS, Eds. Harwood Academic Publishers, London, 1978 (available in U.S. from P.O. Box 786, Cooper Station, New York, N.Y. 10003). xxii, 770 pp., illus. $39.50

The weak interaction is the force responsible for such diverse processes as nuclear beta decay, neutrino "pressure" in supernovae, and the capture of muons by atomic nuclei. Although it is about 100,000 times weaker than the nuclear "glue" that binds neutrons and protons together, the weak interaction is one of the four fundamental forces of nature, and its study constitutes an important field of elementary particle physics. Several years ago, I prepared a resource letter on weak interactions for the *American Journal of Physics*. In researching the paper, I found that although the "classic" topics, such as beta decay, muon capture, and kaon decay, were nicely and substantially covered by a variety of source materials there existed no single volume that tied together many of the more interesting subjects of recent concern in the field, such as atomic parity violation and astrophysical weak phenomena. *Unification of Elementary Forces and Gauge Theories*, which records the proceedings of a conference held at Fermilab, somewhat fills this need. The forefront topics in weak interactions are all covered, as is evidenced by the section headings: Weak Neutral Currents in Particle Physics, Parity Nonconservation in Atomic Processes, Parity Nonconservation in Nuclei, Search for New Particles Beyond Charm, Weak Interactions in Astrophysics, and Theory.

Since this was a meeting at which nearly all the participants were experts, many of the communications are terse and of only limited utility for a casual reader. Nevertheless, there are a number of papers that are notable for their readability and general interest. Contributions by E. G. Adelberger and D. Tadić are useful summaries of the experimental and theoretical aspects of weak interaction effects as detected in nuclear processes, and the paper by G. Feinberg provides a useful review of our understanding of the contributions of weak interactions to atomic physics reactions. Both of these areas of research involve seeking tiny (one part in a million) weak effects among an enormous nonweak background. However, they offer a unique window to weak interaction structure. Another quite useful review, by C. W. Wu, describes the results of careful studies of nuclear beta decay that have been performed over the last several years and have resulted in a significant improvement in our confidence in the validity of the quark model picture of the weak force.

One of the most interesting sections is that on weak interactions in astrophysics. Papers by D. N. Schramm on supernovae and gravitational collapse, by G. Steigman on the early universe, and by W. A. Fowler on neutrino emission from the sun provide stimulating reading. It has become increasingly clear that weak interactions do have an important role to play in stellar evolution (for example, the coherent scattering of neutrinos is important to the understanding of momentum transfer during the final stage of gravitational collapse). Conversely, astrophysical observations can constrain weak interaction theories—thus, recent studies of the abundance of ^{4}He in the universe have provided a limit on the number of types of massless neutrinos that exist.

In the section on theory, the paper by J. C. Pati provides a useful account of recent progress unifying the basic forces of nature. The contribution by J. D. Bjorken on alternatives to the currently fashionable spontaneously broken gauge models of the weak force demonstrates that only in such gauge models do many of the required constraints on weak interaction theories arise naturally. Thus, to my mind, there is promise that such gauge models really do provide the definitive description of the weak force, although detailed confirmation awaits the detection of the heavy (nearly 100 proton masses) W- and Z-particles whose exchange gives rise to weak effects.

Overall, then, this is a useful volume that most practitioners will wish to own. However, all the contributions assume that the reader is trained in elementary particle physics. The absence of a volume that treats subjects such as those covered here in a form accessible, say, to graduate students remains.

Finally, it would be remiss not to note that this conference was named in memory of Benjamin W. Lee, a theoretical physicist at Fermilab who died at the age of 42 in June 1977 in an automobile crash. Lee was one of the original organizers of this conference, and his work and interests spanned all the topics discussed. This volume is a fitting tribute to him.

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Nonbiological Limnology

Lakes. Chemistry, Geology, Physics. ABRAHAM LERMAN, Ed. Springer-Verlag, New York, 1978. xii, 364 pp., illus. $39.80.

This is an attractive and unusual volume. It contains 11 chapters dealing with many of the topics currently of interest to nonbiological limnologists (and one would hope to biologists as well). Each chapter contains from three to more than ten pages of fundamental material followed by a more detailed discussion of recent advances. This format works exceptionally well, and I would like to see it employed more often.

The book is also remarkable in that most of the 19 authors consider themselves to be not limnologists but geochemists, sedimentary geologists, physical oceanographers, aquatic chemists, or mineralogists. As the number of practicing limnologists has doubled or tripled in the past 15 years, there has been a strong tendency toward specialization, and biological limnologists who consider physical and chemical limnology to be "uninteresting" are becoming increasingly common. One hopes that this book will contribute to a greater appreciation by biologists of the chemical and physical aspects of limnology.

The chapters on the geology of freshwater sediments—sedimentary processes (P. G. Sly); organic compounds (M. A. Barnes and W. C. Barnes); mineralogy and related chemistry (B. F. Jones and C. J. Bowser); carbonate sedimenta-