Book Reviews

Theoretical Physics

General Relativity and Gravitation. One Hundred Years after the Birth of Albert Einstein. A. HELD, Ed. Plenum, New York, 1980. In two volumes. Vol. 1, xviii, 540 pp. $49.75. Vol. 2, xx, 598 pp. $49.75. A Publication of the International Society on General Relativity and Gravitation.

Of all the collections on relativity published in the Einstein centennial year, these two volumes stay closest to Einstein's classical general relativity. They contain historical papers by J. Stachel on the "missing link" in Einstein's discovery of general relativity and by H. Hora on stimulated emission of radiation, lasers and their applications in tests of relativity. Relativistic thermodynamics and electrodynamics of continuous media are surveyed by W. Israel and J. M. Stewart. I. I. Shapiro presents a timely and complete survey of experimental tests of general relativity. J. Weber gives what will probably be the most accessible and complete review of his original search for gravitational radiation by means of a sensitive elastic-wave antenna. Newer quantum and electromagnetic detectors are treated by L. P. Grishchuk and A. G. Polnarev and sources of gravitational collapse by J. C. Miller and D. W. Sciama.

Observational cosmology and Friedman models are reviewed by E. P. T. Liang and R. K. Sachs. In a few pages, they bring this fast-developing subject almost up to date, referring to chaotic and tepid cosmologies, particle and entropy production, and the generation of baryon asymmetry in hot models with initial baryon number zero.

In the spirit of canonical relativity are excellent reviews by J. Isenberg and J. Nester, by C. Teitelboim, by P. G. Bergmann and A. Komar, by J. N. Goldberg, by S. Benenti and M. Francaviglia, and by Y. Choquet-Bruhat and J. W. York, Jr. Algebraic computing and its applications bearing on general relativity are reviewed by R. A. d'Inverno. Because the catalog of analytic solutions is so quickly exhausted in general relativity, as in hydrodynamics and other intrinsically nonlinear theories, and because general relativity dynamics is now so important in astrophysics and cosmology, these applications of large electronic computers will certainly have decisive impact.

The book moves from classical general relativity to a group of reviews on developments in topology and field quantization that have become most important in attempts at a final unification of elementary particle physics. Recent years have seen a renewed interest in local problems of differential geometry and unified field theory and in global and topological problems, such as magnetic monopoles and instantons. These developments are reviewed by A. Trautman and by Y. Ne'eman in two papers that necessarily lean on more recent mathematics than do most of the other papers in *General Relativity and Gravitation.* Also rather mathematical are papers on isometric embedding of Riemannian manifolds by H. F. Goenner and on complex variables in general relativity by E. J. Flaherty, Jr., and by C. P. Boyer *et al.* The asymptotic structure of space-time is discussed by E. T. Newman and K. P. Tod and by A. Ashtekar. Twistors are reviewed by R. Penrose and R. S. Ward and singularities and horizons by F. J. Tipler *et al.* The latter paper contains an interesting historical survey, going back two centuries, of ideas about the global properties of space-time, particularly its large-scale causal structure and geodesic connectivity.

The other main thrust of recent research in general relativity has concerned its quantization. The semiclassical approximation in which matter is quantized but gravitation is treated as a classical background field is dealt with by P. C. W. Davies. His two-page summary of regularization methods is a gem, and his treatments of the Casimir effect, of black hole evaporation, and of the conformal anomaly are clear presentations for the reader not familiar with these subjects. Two papers on supersymmetry and supergravity by S. Deser and by S. Ferrara and P. van Nieuwenhuizen bring the reader to the frontiers of efforts aimed at the unification of fermions and bosons, of space and spin, and of relativity and quantization.

These two well-edited volumes are an enjoyable review of where general relativity is now and how it is moving to finally unify geometry with the rest of theoretical physics.

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Stellar Associations

Star Clusters. Papers from a symposium, Victoria, B.C., Canada, Aug. 1979. JAMES E. HESSER, Ed. Reidel, Boston, 1980 (distributor, Kluwer Boston, Hingham, Mass.). xxii, 516 pp., illus. Cloth, $63; paper, $31.50. International Astronomical Union Symposium No. 85.

Stars tend to begin their lives in the close company of other stars and spend much of their early lives near their cosmic siblings, usually in loose family groups that astronomers call stellar associations. A few stars are bound closely enough by the family ties of gravitation to remain in tightly knit groups called star clusters. Those that do remain clustered have provided astronomers with an immense amount of information that would otherwise have been difficult if not impossible to obtain. Our concepts of stellar evolution, especially, would be rudimentary and uncertain at best if star clusters were not available to show us how stars evolve.

The last 50 years have seen notable advances in our understanding of star clusters, but no book on the subject has been published during that time. This volume is therefore a valuable addition to the astronomical literature. It is the proceedings of an exciting meeting and captures that excitement. Most of the leaders in the field were present, and their voices are heard not only in the formal papers but also in the candid discussions that follow each paper.

The topics covered range from the youthful stellar associations and their relation to galactic structure to the ancient globular clusters and what they tell us about primordial conditions in our part