every point of them is affinely-related to its neighborhood, employing the principle of transference of direction, that is, of vectors; and (3) manifolds which are such that every point of them is metrically-related to its neighborhood, employing the principle of transference of distance or length, in addition to the existence of a measure determination.

The usual exposition, more or less following original historical development (before Weyl), totally or tacitly slides over the second stage without comment. Professor Schrödinger carefully does not, and carefully examines how far one can make physical progress at the affine stage only, and notes the implications of the fact that an affine relationship is inherent in metrical space.

The treatment and interpretation of conservation laws and variational principles is interesting for its own sake and integral to Schrödinger's formulation of the generalized Einstein field theory via the method of Palatini in deriving the original Einstein field equations. The immediately apparent issues here are, of course, the lifting of the usual symmetry conditions in the two basic connections of the space-time manifold: the one, the quasi-metrical one by the metrical coefficients, the other the affinity or coefficients of affine connection. Relaxing the symmetry requirements on the former leads to apriori problems as to the symmetry requirements on the latter; this is, so to speak, left open by Palatini's variational formulation—from which it evolves that attempting to uphold the usual symmetry leads to failure. The original and generalized Einstein equations are elegantly obtained; though, as is well-known, the latter have not led to any as yet identifiable or interpretable new results. It may be particularly interesting to note that within the frame of the less ambitious theory the purely affine approach leads automatically to Einstein's field equations *with cosmological term.*

The book is divided into the three stated parts, according to chapters: (1) Invariance, Vectors and Tensors; (2) Integrals, Densities, Derivatives; (3) Invariant Derivatives; (4) Some Relations between Ordinary and Invariant Derivatives; (5) The Nature of Parallel Transfer; (6) The Curvature Tensor; (7) The Geodesics of an Affine Connection; (8) The General Geometric Hypothesis about Gravitation; (9) Metrical Affinities; (10) The Meaning of the Metric According to the Special Theory of Relativity; (11) Conservation Laws and Variational Principles; and (12) Generalizations of Einstein's Theory.

The whole subject of space-time structure holds a peculiar fascination for almost everyone and, even when passing through familiar territory, many readers will find that making this short journey with Professor Schrödinger will reveal familiar concepts in sharper outline and in a sense will lead to a new awareness of the necessary and sufficient bases of all too often casually accepted results. The entire attitude is one which will most appeal to the graduate student and theoretical physicist, and follows that curiously easy and elegant vein which is Schrödinger's own.

The format and typography are of the excellence which one takes for granted in books appearing under the Cambridge colophon.

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200 Miles Up. By J. Gordon Vaeth. 207 pp. The Ronald Press Company, New York, 1951. $4.50.

The great interest in upper atmosphere research on the part of military and civilian scientists of a number of nationalities in the past decade has resulted in enormous improvement in the classic vehicles for such investigations, rockets and balloons. Rocket techniques may be said to have come of age in 1942, when the first successful V-2 flight was made in Germany, and, similarly, the development in 1947 of the single-cell polyethylene balloon, made famous by Project Skyhook, represents a turning point in balloon work. *200 Miles Up,* subtitled "The Conquest of the Upper Air," is an attempt to describe the operation and applications of the several modern high altitude vehicles in the two categories that have come into prominence since these dates.

In addition to investigations concerned primarily with the properties of the atmosphere itself, such as temperature, composition, and winds, high altitude research deals with phenomena which, because of their atmospheric interactions, cannot be satisfactorily measured at the earth's surface. The solar ultra-violet spectrum in the region below about 2,900 angstroms, for instance, must be determined above the absorbing ozone layer of the stratosphere. Cosmic rays, whose composition and properties vary considerably with altitude, necessitate the attainment of extreme elevations in the evaluation of their primary component. Also, the possibility of space travel calls for extensive experimentation into the biological effects of cosmic rays and enormously high accelerations, to name but two factors involved, and rockets and balloons are being actively utilized in this work.

200 Miles Up starts with a discussion of the various properties of the upper atmosphere, followed by a brief consideration of the general principles behind the instrumentation designed to provide information on them. The remaining eight chapters of the eleven in the book are devoted to a short account of the fundamentals of rocket flight and detailed descriptions of (1) flights of 72-foot polyethylene balloons by the General Mills group, (2) White Sands Proving Ground, and (3) the V-2, Aerobee and Viking rockets. The language employed is, for the most part, clear and graphic, as exemplified by the recounting of the incidental aspects of rocket launchings which brought back vivid memories to this reviewer. However, despite the author's skillful writing and technical competence, this book suffers from the selection of material used and is actually misleading in several respects.

In the first place, from the point of view of the non-

technical reader for whom the book is intended, the mass of constructional and individual flight details on the rockets might more successfully have been condensed from the five chapters it occupies into one. Some of the space thus saved might then have been profitably devoted to an account of the colorful historical development of rockets and balloons, and perhaps also to some educated guesses as to future trends in this field.

A far more serious objection must be entered on behalf of the many organizations and individuals who have played important parts in pioneering upper air research and whose work, while sometimes mentioned, has not been properly acknowledged. Credit is given several of the various military units involved, the Applied Physics Laboratory of Johns Hopkins, and the General Mills balloon group, while the other universities and industrial organizations involved are left unmentioned. For example, to the ordinary reader one conclusion possible from this book is that the only balloon launchings and investigations in this country are made by Skyhook, which has, according to Vaeth, been solely responsible for this activity. Entirely omitted, to give an instance close to home, has been the original development work of C. B. Moore and others at New York University and subsequent work here on high level, constant altitude (Moby Dick) balloons, as well as the flight operations by other groups.

The available published literature on high altitude research is badly in need of a comprehensive survey of the techniques and limitations of the existing instrumentation in this field for the information of personnel in other fields desiring to conduct or interpret such research. *200 Miles Up,* although unquestionably interesting and informative, does not really satisfy this need.

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Briefly Noted

Plastic Deformation

Progress in understanding how the atomic arrangements within a metal determine its structural properties is summarized in a symposium volume, *Plastic Deformation of Crystalline Solids,* now available to the public, according to the Office of Technical Services of the Commerce Department. Sponsored jointly by the Carnegie Institute of Technology and the Office of Naval Research, the symposium consists of nineteen papers by specialists in the subject. The volume (PB 104 604; 226 pp., $3.50) may be ordered through the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Orders should be accompanied by check or money order payable to the Treasurer of the United States.

National Electronics Conference

Publication has been announced of the *Proceedings* of the Seventh National Electronics Conference, held in Chicago last October under the sponsorship of the American Institute of Electrical Engineers, the Institute of Radio Engineers, the Illinois Institute of Technology, Northwestern University, and the University of Illinois. The Proceedings of the 1951 conference (736 pp.) include a total of seventy-nine papers covering electronic research, development and application of audio systems, components, computers, high frequency measurement, information theory, magnetic amplifiers, medical and industrial applications, microwave propagation servo theory, signal detection, television, and tubes. The volume may be obtained for $5.00 per copy from S. R. Collis, Chairman, NEC Publicity Committee, 208 W. Washington St., Chicago, Illinois.

Industrial Use of Fission Products

Industrial Uses of Radiological Fission Products (102 pages, illustrated) is a report of the findings of the Stanford Research Institute's 1951 study for the Atomic Energy Commission of technological and economic questions concerned in the industrial use of fission products. Management considerations of safety, public relations, liability and insurance, and regulations covering the use of radioactive materials are discussed. A potential process using fission product radiations is outlined from preliminary operating design through engineering and economic evaluation. A bibliography on radioactivity is included, as are the methods of calculation and formulae derivations used in preparation of the report. Copies of the report may be obtained for $1.50 from Project 361, Stanford Research Institute, Stanford, California.

Numerical Calculation

Problems for the Numerical Analysis of the Future (NBS Applied Mathematics Series 15, 21 pp.) contains four papers among those presented at the symposia on modern calculating machinery and numerical methods held during the dedicatory exercises for the Institute for Numerical Analysis of the National Bureau of Standards on the campus of the University of California at Los Angeles. The papers included are: "Some Unsolved Problems in Numerical Analysis" by Douglas R. Hartree of the Cavendish Laboratory; "Numerical Calculations in Nonlinear Mechanics" by S. Lefschetz of Princeton; "Wave Propagation in Hydrodynamics and Electrodynamics" by Bernard Friedman of NYU's Institute for Applied Mathematics and Mechanics; and "Linear Programming" by George B. Dantzig of the U. S. Air Force Comptroller's Office. The report can be ordered (20¢ per copy) from the Government Printing Office, Washington 25, D. C.

Physics as a Career

Guidance on avenues of training which lead to professional recognition as a physicist in England, together with information on employment in British industrial, university, government, and other posts, is given in *Physics as a Career,* by Norman Clarke, deputy secretary of the Institute of Physics. (70 pp. The Institute of Physics, London, 1952. 6s.)