The text would be suitable for a course for advanced undergraduates if the chapters on the electromagnetic field and on quantum mechanics are not used, and the book also would be suitable for a graduate course if it is used in its entirety and is supplemented by the instructor. It can be well recommended as a textbook and would certainly be useful reading for graduate students and working physicists as a self-study introduction to special relativity.

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Handbook of radio-wave propagation

ENCYCLOPEDIA OF PHYSICS, Vol. 49/2, Geophysics III, Part II. S. Flügge, ed. 596 pp. Springer-Verlag, New York, 1967, $42.00

by Jules Aarons

Predominately a monograph on radio observations of the ionosphere, this volume of the *Handbook of Physics* fulfills its title in part; it delves with great detail into the physics, the experimental equipment and the data of its subject matter. The 546 page section on "Radio Observations of the Ionosphere" is jointly written by K. Rawer of the Ionospheric Institute of Breisach, Germany and by K. Suchy, who wrote his section when he was at the University of Maryland. The second article in the volume (approximately 50 pages) by S. Matsushita of the National Center for Atmospheric Research and the University of Colorado is on "Lunar Tides in the Ionosphere."

To graduate students and beginning research workers in the field, "Radio Observations of the Ionosphere" is a second book; it must come after mastery of such volumes as Ratcliffe's *Physics of the Upper Atmosphere* or at a more elementary level, Davies's *Ionospheric Radio Propagation.* Suchy, who is listed as the principal author of the introductory theoretical section, has developed his subject matter very completely. The advanced student can utilize the text in theoretical studies. Rawer, who has ranged in his research from experimental observations and instrumentation of rockets to synoptic studies of ionosoundings, describes in great detail both the theory of individual distinct experiments, the equipment used and the resulting data. At times the details wander into such items as the schematics of pulse-power generators and resulting wave forms at specified power lugs (with photos); at this stage the handbook nomenclature is carried too far. At other times, however, the detailing is important; rather than presenting an idealized freehand drawing, for example, the authors have shown particle precipitation as a function of latitude and particle energy.

From the viewpoint of those who use a handbook for often needed graphs, diagrams and tables, this volume does not satisfy. The material is not oriented for the nonspecialist.

For advanced students or those seeking details on a facet of radio-wave propagation, the volume is excellent. A listing of symbols, general references and an excellent index make up a well-edited volume. However, the English is faulty; is appears as if there were no editor to "monitor" the grammar. Many sentences are awkwardly formed ("A complete theory is not yet existing"), but this fault detracts only slightly from the erudition of the text.

The review by Matsushita is careful and succinct. The author, a leading expert in ionospheric current systems, has written an excellent review paper on lunar tides in the ionosphere.

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For relativists and cosmologists

RELATIVITY THEORY AND ASTROPHYSICS, PART 1: RELATIVITY AND COSMOLOGY. Conf. Proc. (Cornell, July–Aug. 1965) Jürgen Ehlers, ed. 289 pp. American Mathematical Society, Providence, R. I., 1967. $9.40

by Wolfgang Rindler

In the summer of 1965 some 30 fortunate graduate students and recent PhD's met at Cornell for the Fourth Summer Seminar on Applied Mathematics, organized by the American Mathematical Society. Students and graduates were joined by a distinguished group of lecturers. The backgrounds of the participants were divided between relativity and astrophysics, and the intention was to exhibit and further stimulate the already considerable interaction between these two fields of research. The three-volume record of the formal lectures, actively and ably edited by Jürgen Ehlers (his excellent introduction makes it hard for a reviewer to be original), attests to the beautiful job that was done. We are concerned here with the first volume on relativity and cosmology; the other two deal with galactic and stellar structure respectively. These lectures will hardly serve as a substitute for a textbook, although Alfred Schild's ten-lecture introduction to modern general relativity (occupying over a third of the book) comes closest to doing so. On the whole, this volume could be regarded as a "sampler" of modern activity in relativity and cosmology, slanted toward astrophysics. It should be of great benefit to students who wish to pick up basic ideas quickly and authoritatively, often brilliantly presented and always well-referenced. Teachers, too, should be interested in these methods of presentation.

Schild discusses very clearly and with the aid of over 30 diagrams such important topics as Lie derivatives, Killing vectors, Fermi coördinates, Kruskal's extension of Schwarzschild space, the contributions of the various terms in the metric to the "crucial effects," the deduction of the field equations from a variational principle and the deduction of the law of motion from the field equations (with a particularly elegant application to spinning test particles—soon, perhaps, another "crucial" effect). Also covered are such prerequisites to the study of gravitational radiation as jump conditions and the Cauchy problem, the weak-field approximation, spinors and Petrov classification. I was baffled by only one minor item, namely the unusually strong formulation of the equivalence principle as relating whole world *tubes* (rather than just *cubes*) with similar objects in Minkowski space.

The book continues with two short lectures on new observational tests of general relativity. In the first lecture, Leonard Schiff discusses orbital gyroscopic precession (a test originally proposed by him in 1960), the second-order stellar red shift (concluding that this is not only unfeasible but uninter-