physics of internal reflection. There is a table of contents and a subject index that make the material readily accessible. The photographs and diagrams are superb.

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Electron technology

SPACE-CHARGE FLOW. By Peter T. Kirstein, Gordon S. Kino, William E. Waters. 509 pp. McGraw-Hill, New York, 1967. $22.50

by J. Arol Simpson

Wandering through the scientific-technical community in obvious disarray is a small band. Members carry tattered banners identifying themselves variously as "electron opticians," "electron-gun designers," "accelerator engineers" and even "electron physicists." Since they have created useful artifacts such as the electron microscope, the family of microwave beam tubes, and that heart of the television industry, the cathode-ray tube and its derivatives, the band is tolerated by both the electrical-engineering and the physics community. The engineers find writings by this small group rather arcane, and the physicists find the writings rather "infra dig" and lacking in elegance and generality, and worst of all, solidly wedded to classical physics. *Space-Charge Flow* will stand for a long while as an honored totem for this nameless band and as a new landmark telling others of the progress the band has made. The book consists of a unified treatment of the mathematical methods that have proved useful for the design of dense electron beams and the guns to produce them. The book is in a sense a greatly expanded and updated version of J. R. Pierce's classic *Theory and Design of Electron Beams* (D. Van Nostrand, New York, Second Edition, 1954). The mathematical sophistication of the new work reflects the progress made in almost 20 years since the first edition of Pierce's text. Much of this progress is the result of the authors' own efforts although no parochialism is evident. Some of the methods presented have relevance for the design of electron spectrometers and microscopes even though the emphasis is on cases where space-charge forces are strong. Treatment of the methods applicable to use on large-scale digital computers also fills a very definite need.

The book is admirably organized with excellent chapter introductions and summaries that separate for the reader the "trees from the forest." It is a book that is essential for anyone who, for whatever reason, finds it necessary to join the wandering band, even for a short time. The book also will be of interest to applied mathematicians who are interested in the progress being made in the solution of the barely tractable problems that arise in today's technology.

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J. Arol Simpson, Chief, Electron Physics Section, National Bureau of Standards, has been working with electron beams for 20 years and says that he is "still hoping some day to understand them."

Life insurance for the nuclear age

PRINCIPLES OF RADIATION PROTECTION: A TEXTBOOK OF HEALTH PHYSICS. Karl Z. Morgan, James E. Turner, eds. 622 pp. Wiley, New York, 1967. $13.95

by John W. Baum

This book is addressed to the students and professional workers who concern themselves with the multiple facets of radiation protection or health physics in the nuclear age. The book has been in preparation for roughly 20 years, has 19 authors, and covers a profession that attracts persons with such diverse backgrounds as physics, biology, chemistry, mathematics and engineering. The subject matter included in a text that prepares such people for their careers must be equally diverse and must present a principal challenge to authors in this field; no doubt this difficulty is part of the explanation for the length of time and number of authors required.

Karl Z. Morgan has been one of the principal leaders in the field since its beginning. His contributions are well illustrated by the chapters he wrote himself. The other authors are all recognized authorities in one or more aspects of the profession of health physics.

Morgan's first chapter on the "History of Damage and Protection from Ionizing Radiation" is very thorough and provides an excellent introduction for newcomers, as well as a detailed survey and summary useful for those familiar with the field. Both natural and man-made sources of exposure are tabulated and discussed in relation to early recommendations for radiation protection. This chapter is followed by 15 others on interaction of radiation with matter; principles of radiation dosimetry, detection and measurement; methods of calculation of dose from both external and internal sources; radiation biophysics and radiation biology; maximal permissible exposure levels; and prevention of criticality accidents.

R. H. Ritchie and G. S. Hurst describe well the physical basis and ionization methods of radiation dosimetry, including their important development of "a general principle of radiation dosimetry." W. S. Snyder's chapter on internal exposure outlines methods of dose calculation for various organs as well as the relation of these doses to the setting of maximal permissible concentration values for air and water. The chapters on radiation biophysics and radiation biology provide excellent up-to-date summaries of developments and thinking in these areas. An additional chapter on evaluation of human-exposure data includes an important section on medical management of radiation overexposure.

Other subjects covered are, in general, treated thoroughly and in a manner that should serve well the needs of the intended audience. The approximately 1000 references to the technical literature add considerably to the value of the book for those wishing greater depth or additional information on specific subjects. Similarly, about 300 questions and problems following the chapters serve a very important function in the academic use of the book.

The book emphasizes principles of physics and radiation biology and tends to avoid many of the practical problems of an engineering and managerial nature. For example: x-ray safety, neutron shielding, respiratory protection, laboratory design, bio-assay and whole-body monitoring techniques, atmospheric dispersion, waste disposal and related environmental problems and surveys, and problems peculiar to accelerators, reactors, and chemical-processing plants all receive little attention. Also, the important regulatory roles of the US Atomic Energy Commission (AEC), the Department of Transportation, and state agencies are not discussed and related