final section on the theory of liquids deals with the problems of melting and of solutions of weak and strong electrolytes and more of solutions of macromolecules.

The book is distinguished by many recent references and by the inclusion of most of the significant modern work in this field. In particular, the author has given careful attention to the work of Kirkwood and his collaborators and has even included references to such an exotic item as Kirkwood's "Princeton notes of 1947". Great effort seems to have been made throughout to make the presentation both comprehensive and perspicuous and at the same time to avoid overwhelming the reader with inessential mathematical minutae. The book has the excellent typographic format which the readers are led to expect from this series and is a worthy addition to the Springer collection.

Annual Review of Nuclear Science. Vol. 6. Edited by J. G. Beckerley, M. D. Kamen, L. I. Schiff. 471 pp. Annual Reviews, Inc., Palo Alto, Calif., 1956. $7.00. *Reviewed by S. F. Singer, University of Maryland.*

The present volume is the sixth in the series and takes in nuclear physics from its astrophysical aspects to its biological aspects. The variations of primary cosmic rays are discussed by Sarabhai and Nerurkar with particular emphasis on the special interest of the authors, the solar diurnal variation. No universally accepted explanation exists, but the accumulation of data on the time variations, particularly during the forthcoming International Geophysical Year, should advance our understanding of their causes. The polarization of fast nucleons is discussed by Wolfenstein with emphasis in the region 100 to 400 Mev. The article develops a formalism which may be used in the analysis of experiments with polarized nucleons. Heydenburg and Temmer treat the Coulomb excitation or electric excitation due to a passing charged particle of low-lying nuclear excited states. Excitation by electrons is briefly touched upon but the main portion of the article is devoted to heavy particle excitation and includes a brief discussion of the theory as well as an account of experiments in the field. In particular the interpretation of the experiments in terms of the electric quadrupole moments of nuclei is described. Mack and Arroe give a brief discussion on the isotope shift in atomic spectra. Way, Kundu, McGinnis, and Lieshout have a lengthy paper on the properties of medium-weight nuclei giving much tabular material on their ground state, spins, magnetic moments, quadrupole moments, levels, and gamma-ray lifetimes. Horne, Coryell, and Goldring present a short paper on generalized acidity in radiochemical separations. Mattauch, Waldmann, Bieri, and Everling give a detailed discussion with much tabular material on the masses of light nuclides. Brooks gives a very topical and comprehensive paper on nuclear radiation effects in solids. It discusses the theory of atomic displacements and includes such items as thermal spikes due to intense heating in a region of atomic dimensions, phase changes, and cold working. The rest of the chapter deals with particular materials, such as graphite, uranium. The final portion discusses damage to various solids: semiconductors, metals, valence crystals, and alkali halides. Taube discusses some applications of oxygen isotopes in chemical studies. Oxygen unfortunately has no radioactive isotopes which makes the problem rather difficult. Recent advances in low-level counting techniques is the subject treated by Anderson and Hayes and deals with advances in the techniques for beta counting (C^{14} and H^3), gamma-counting, double beta-decay, and the problem of detecting the neutrino. One of the longest chapters is on nuclear reactors for electric power generation by Davidson, Loeb, and Young. It discusses a great variety of power reactor designs, 27 of them. Of interest is the economic discussion at the end of the chapter which compares the cost per kilowatt for different installations. Values as low as $250 per kilowatt are mentioned. The longest chapter is on cellular radiobiology by Gray. Over 380 papers are reviewed, most of them published in 1955, indicating the tremendous activity in this field. The review covers the radiobiology of the cell including the influence of various environmental factors and the genetic damage problem. The second part deals with the radiobiology of various tissues. O'Brien has a chapter on vertebrate radiobiology which deals with the effects of ionizing radiations on the embryonic development of fish, amphibia, birds, and mammals.

Relaxation Spectrometry. By E. G. Richardson. 140 pp. (North-Holland, Holland) Interscience Publishers, Inc., New York, 1957. $5.75. *Reviewed by J. G. Castle, Jr., Westinghouse Research Laboratories.*

In this pleasant little book, printed on soft white paper, Professor Richardson surveys the experimental spectrometry of acoustical relaxation. His historical discussions of experimental work, including much of his own, serve to outline the bibliographies and to occasionally describe the cardinal sample configurations, but are not often detailed enough to support the author's conclusions. Certainly the discussions serve well to outline the work in the various areas.

After an appropriate introduction of concepts of relaxational behavior and their illustration by models, the author covers in order spectra in the infrasonic, sonic, and ultrasonic regions. He points out the use of analog simulation of the physical sample's relaxation processes as a considerable aid in the parametric interpretation of observed relaxation phenomena. Then under Dielectric Relaxation he describes the strong similarity between viscoelastic behavior and dielectric behavior, concluding with graphs showing the "concurrence" of the dielectric and acoustic relaxation spectra of glycerin at $-28°$ C. In the final chapter, on Spectrum Analysis, he points up some of the roadblocks and useful detours on the way toward resolution and shape studies on relaxation spectra.

The book was read without conscious inspection for accuracy because the reviewer is not an expert in the

field. Yet Figure 84 was noted to have reversed captions, and the discussion on page 107 left a bit of confusion over finding "a peak . . . at about 45° K and a minimum . . . at about 75° K" by measurements "in the temperature range from 1.6°K − 8°K". The author states on page 102 that the experimental finding of ultrasonic scattering varying directly with frequency "is probably an approximation to the theoretical form of the scattering curve". Presumably an equivalent statement would be that the finding is in agreement with the theoretical scattering curve.

In brief, *Relaxation Spectrometry* should serve as a useful introduction to many before relaxation becomes a long lost art.

Optics. By Bruno Rossi. 510 pp. Addison-Wesley Publishing Co., Inc., Reading, Mass., 1957. $8.50. *Reviewed by V. Twersky, Sylvania Electronic Defense Laboratory.*

This well written and well organized text starts with elementary geometrical optics, and continues through diffraction, polarization, electromagnetic theory, and on to photons and complimentarity. The presentation more or less traces the evolution of the concepts basic to optics, and the progression from the early mechanical analogs to the more abstract mathematical models should leave the student with an appreciation of how a scientific discipline develops. The problems are well chosen to supplement the text and to give a quantitative appreciation for the magnitudes of various phenomena; answers are given to half. Using essentially elementary methods (only slight knowledge of calculus is assumed) the book goes rather deeply into various topics which are barely touched on in analogous texts; e. g., Huygens' principle, rays in nonhomogeneous media, Abbe's theory of image formation, the propagation of electromagnetic waves, and radiation from an accelerated charge. Although other topics could have benefitted from the same treatment, and although the utility of the material could have been increased by supplementary bibliographies, the book as it stands is perhaps the best available for an intermediate course.

Scientific Uses of Earth Satellites. Edited by James A. Van Allen. 316 pp. The U. of Michigan Press, Ann Arbor, Mich., 1956. $10.00. *Reviewed by Arthur Beiser, New York University.*

In January of last year the Upper Atmosphere Rocket Research Panel met in Ann Arbor to discuss experiments that could be performed with the aid of artificial satellites and to consider in some detail the specific instrumentation that would be required. Thirty-three of the papers presented there have been collected and edited by James A. Van Allen, the chairman of the panel, into a handsome volume which, while parts of it are already obsolete and some of the rest no doubt headed for a similar fate, still retains enough solid information to justify its publication. As might be expected, all sorts of topics are covered, from albedo to x-rays, but they have unfortunately not been indexed. The first dozen or so papers concern themselves with the flight of the satellite—its orbit and expected perturbations, drag, tracking, etc. The rest deal with phenomena for whose measurement a satellite might prove ideal—cosmic rays, ultraviolet radiation, auroral streams, geomagnetism, ionospheric structure, meteors, interplanetary dust, and the cloud cover of the earth. One may conclude from this book that the satellite program is in imaginative as well as thorough hands.

Relaxation Methods in Theoretical Physics. Vol. 2. By R. V. Southwell. 522 pp. Oxford U. Press, New York, 1956. $8.80. *Reviewed by R. B. Lindsay, Brown University.*

This is the second volume of a continuation of the author's book *Relaxation Methods in Engineering Science,* which appeared in 1940 and which was expanded in the first instance in a volume bearing the present title, published in 1946. The three books form, therefore, an extended treatise on the interesting method of approximate computation which the author has developed over a period of years for handling difficult boundary value problems in physics. Such problems involve in the main second and fourth order ordinary and partial differential equations.

The relaxation scheme of approximate solution stems from the so-called "Moment Distribution Method" of Hardy Cross in the solution of girder frameworks in engineering statics. However it has been extended by Southwell to problems in dynamics as well, including among others the vibrations of nonuniform membranes and electromagnetic oscillations in Klystron tubes. By and large the present volume is devoted to stress and strain analysis in two-dimensional continua, though three-dimensional problems are briefly touched on.

In essence the relaxation method replaces any continuum whose behavior is being studied by a discrete net of values of the independent variable or variables. In the differential equation describing the system the derivatives are replaced by finite differences involving values of the wanted function at various points in the net. If the correct solution were known (including of course the assigned boundary values) substitution into the sum of all derivative terms plus the known functions entering into the equation would naturally yield zero for all points of the net and its boundary. However, for arbitrarily chosen values of the wanted function at each net point the above expression has a *residual* nonvanishing value. The idea of the method is (by finding out how much change is produced in the values of the residuals when the value of the wanted function at a single net point is changed by a small but otherwise arbitrary amount) gradually by successive trials to "relax" the residual at every net point to zero.

The book contains a host of practical hints for facilitating this process in connection with numerous important problems. However, it is clear that any reader who desires to use the method must develop his own com-