

from it primarily in a somewhat greater emphasis on the theoretical as opposed to the experimental side of the problem of thermal conductivity.

The three remaining articles, "Wave Packets and Transport of Electrons in Metals" by H. W. Lewis, "Study of Surfaces by Using New Tools" by J. A. Becker, and "The Structures of Crystals" by A. F. Wells, can also be regarded as possessing a common feature, that of novelty. In the case of the article by Becker this is exemplified by a presentation of new results regarding the nature of surfaces and of surface processes obtained through the use of two new tools, the fast-responding ion gauge and the field emission microscope. The remaining reviews take problems which have been extensively studied in the past and re-examine them from a new viewpoint. Thus Lewis through an application of degenerate perturbation theory and the mean value theorem offers a new resolution of the problem of reconciling the usual treatments of transport properties in metals which are dominated by impurity scattering with the fact that the assumption regarding the magnitude of the collision time in terms of the absolute temperature is usually not satisfied. Similarly, in a fascinating article Wells discusses the problem of crystal structures from a topological point of view in which it is attempted to determine and explain the structures from the bonding arrangements of the atoms or other structural units rather than by starting from the symmetry of the crystal.

The usefulness, and hence success, of such a series of review articles depends critically on the choice of topics and reviewers. The success of the editors with the preceding volumes is repeated in the present volume. The only criticism that this reviewer can make with respect to the series as a whole concerns the relatively high cost per volume which coupled with the rapid rate at which successive volumes are turned out means that the purchase of these books eats rather deeply into one's yearly book budget.

Corpuscules et Champs en Théorie fonctionnelle.
By Jean-Louis Destouches. 163 pp. Gauthier-Villars, Paris, France, 1958. Paperbound 4000 fr. *Reviewed by R. Bruce Lindsay, Brown University.*

UNDoubtedly one of the great methodological problems in modern physical theory is the appropriate relation of the particle and field schemes of description. The author of this book has long been interested in this matter and in 1956 published a book *La Quantification en Théorie fonctionnelle des Corpuscules* in which he developed the view that a physical particle should not be represented by a point as in classical physics or the ordinary wave mechanics but by a function of space and time obeying a nonlinear equation. He applied this theory to the nonrelativistic case of particles without spin. In the present treatise he extends the theory to particles of various spins and treats the relativistic case. He also discusses the photon and obtains a nonlinear theory of electromagnetism.

Finally he develops a unitary nonlinear theory of gravitation and electromagnetism.

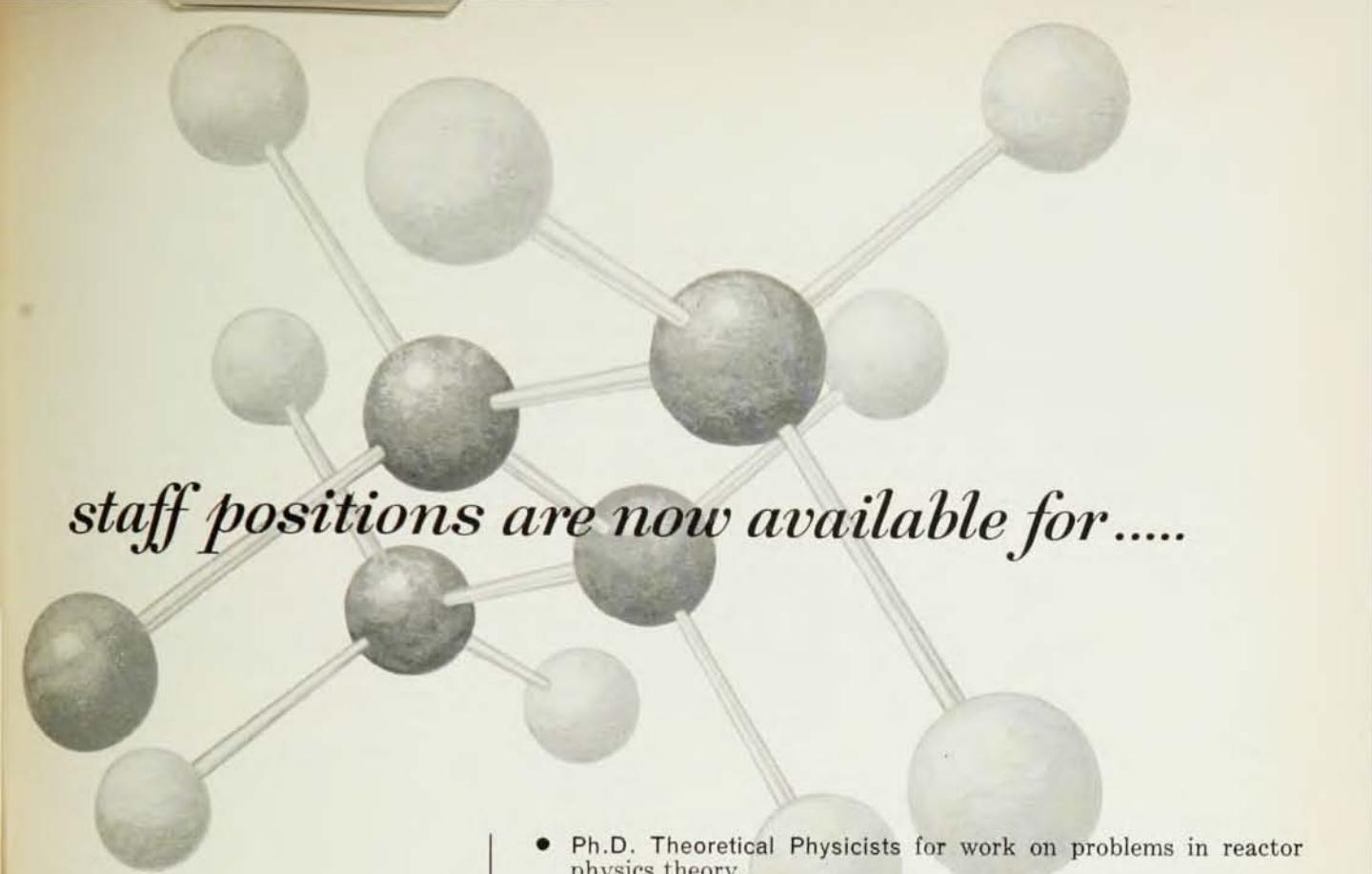
The idea in essence appears to be that since the point particle represents a purely artificial attempt to abstract a single physical system from the universe as a whole, a much more adequate picture will result if one represents such a particle by a function or perhaps more appropriately even by a set of functions constituting a point in function space. Only in this way, the author feels, can one expect to give a sufficiently detailed representation of the proper characteristics of the particle or system. The function in general is taken to be complex. For mathematical convenience, with the function there is associated a continuous fluid with density, velocity potential, etc. defined in terms of the function. In the simplest case the fluid is assumed to obey the principles of classical mechanics. One then establishes that the fundamental function satisfies a nonlinear equation in space and time coordinates. For more complicated particles the fluid equation is modified accordingly, with appropriate extra terms.

The analysis is complicated and the reviewer is not in a position to judge the success of the program. However, in view of the present unhappy state of theoretical particle physics, any program of this kind should be viewed with hospitable interest.

Internal Conversion Coefficients. By M. E. Rose. 194 pp. (North-Holland, Holland) Interscience Publishers, Inc., New York, 1958. \$6.25. *Reviewed by W. H. Kelly, Michigan State University.*

THE process of internal conversion has played and is continuing to play an important role in the study of nuclear structure. As the role of internal conversion in nuclear decay became better understood the physical model on which the calculations are based was modified a number of times. The theory has progressed to such a point that the present internal conversion coefficients have been calculated to an accuracy better than that obtained experimentally. A real disagreement between certain experimental and theoretical coefficients may be due to effects of nuclear structure. For this reason, as Rose points out, the next step in the calculations will have to bring in details of nuclear structure. The present tables include, in a way, a first step in this direction in that the K , L_I , and L_{II} coefficients have been calculated to include static effects of a finite size nucleus by using electron wave functions modified to include the finite spread of the nuclear charge distribution. (These effects have been taken into account in a slightly different manner than that done by Sliv although the results obtained are not too different from Sliv's.)

The internal conversion coefficients in these tables contain many of those circulated privately by Rose and many not available before. These tables include coefficients for the K shell and for the L and M shell with their subshells for all atomic numbers from 25 to 95 and for a wide range of energies. In addition to the



staff positions are now available for.....

Argonne provides a unique combination of basic and applied research . . . effective interdisciplinary approach to major problems . . . dedication to knowledge of interest and significance to the individual . . . atmosphere and facilities conducive to creativity . . . opportunity for professional growth and individual expression. The positions described represent some of the Laboratory's specific opportunities.

However, staff positions are available in virtually all of the major scientific and engineering disciplines.

- Ph.D. Theoretical Physicists for work on problems in reactor physics theory.
- Ph.D. Physicists or Mathematicians to work on mathematical formulations of reactor physics problems for machine computation. Previous reactor experience or numerical analysis desirable. Physicists should have strong mathematical background . . . Mathematicians should have strong physics background.
- Ph.D. Physicists to work in medium energy neutrons and fission physics research. Individuality and creativity are facilitated through an excellent, fully equipped Van de Graaff laboratory.
- Ph.D. Experimental Physicist to participate in critical assembly program. Reactor physics experience desirable.
- Ph.D. or M.S. Physicist to assist in design, testing, and construction of magnets for the 12.5 Bev proton synchrotron. Experience in magnet design desirable.
- Ph.D. or M.S. Physicist for work in area of irradiation effects and studies on glasses and other materials. Requires good knowledge of solid state physics.
- Ph.D. Solid State Experimental Physicists for basic studies in metal alloy theory, high temperature ceramics, plasticity and high temperature strength, crystal structure and interjections, diffusion and irradiation effects. Several positions available at group leader level.
- Ph.D. Experimental Reactor Physicist to provide post-university training, instruction and guidance to groups in reactor physics experiments on the Argonaut. Provides association with national and international reactor development scientists.
- Ph.D. or M.S. Physicist to assist in development, design, and construction of equipment for extracting, focusing, and separating charged particle beams from Argonne 12.5 Bev proton synchrotron.
- Ph.D. Physicist to assist in design of reactor instrumentation, accessories and preparation of reports and procedures related to reactor tests and measurements. Eventual supervising responsibilities.
- Ph.D. or M.S. Physicists for design of experimental scintillators. Requires experience in this field or related areas or in the area of luminescence of solids. Some experience in optics desirable.

Argonne
NATIONAL LABORATORY

Operated by the University of Chicago under
contract with the United States Atomic Energy Commission.

Direct Inquiries To:
DR. LOUIS A. TURNER
DEPUTY DIRECTOR
P.O. BOX 299-Q3 • LEMONT, ILL.

inclusion of finite size nucleus effects the *K* and *L* shell coefficients contain corrections for screening by atomic electrons.

Appended to the tabulation of internal conversion coefficients is a group of tables of radial matrix elements for the *K* shell which are not corrected for finite nuclear size or screening. These can be used, for example, in studies of the so-called dynamic effects of nuclear structure in internal conversion and in studies where the direction of motion of the conversion electron is observed.

In addition to the tables themselves the book contains a historical account of the calculations and a rather lucid description of the physical models and the method of calculation used. The bibliography appears to be fairly complete.

The only unfavorable comment this reviewer can make of this book concerns its binding. A book that has trouble surviving the shipping, as the reviewer's copy did, will no doubt find it difficult to stand up under a lot of use. The relatively high cost of the book is offset by the convenience of having all the conversion coefficients under one cover.

Astrophysics II: Stellar Structure. Vol. 51 of *Handbuch der Physik*. Edited by S. Flügge. 831 pp. Springer-Verlag, Berlin, Germany, 1958. DM 175.00 (subscription price DM 140.00). *Reviewed by C. C. Kiess, National Bureau of Standards.*

THREE decades ago Eddington's *Internal Constitution of the Stars* opened a field of research to a new generation of astronomers for whom the book was required reading toward an advanced degree. How well this field has been cultivated, and how abundant the harvest, is revealed by this fifty-first volume of the *Encyclopedia of Physics*, with stellar structure as its theme. It is the second volume of the series devoted to astrophysics. Eddington's thesis that the relationships among the spectra, luminosities, masses, and volumes of the stars, and their variations, are the outward manifestations of vast stores of internal energy due to subatomic processes is now generally accepted as verified. The book under review presents the evidence. Of its eleven sections one is in German, one in French, and nine are in English.

The first article, "Stellar Interiors", by M. Wrubel of Indiana University, describes the use of stellar models, of known constituents distributed according to specified patterns, for calculating the observable characteristics of stars. The closeness of fit of the calculated with the observed features is regarded as a measure of the agreement of the model with the actual structure of the star. Successful models must account satisfactorily also for the known correlations between the colors, or spectral types, of stars and their temperatures. Such correlations are discussed by H. C. Arp, of the Mt. Wilson Observatory, in his article on "The Hertzsprung-Russell Diagram". These diagrams, drawn for various clusters and classes of stars as well as for

the general system of stars, give graphical portrayals of their ages and evolutionary development.

The actual course of stellar evolution is not an easy one to trace; but with knowledge of the ages of the stars and the processes by which their energies are generated and dissipated, a satisfactory picture is attained of their life-histories. This is presented in the article "Stellar Evolution", almost of book-length proportions, by E. M. and G. Burbidge of the Yerkes Observatory. The extent to which evolutionary processes can go is prescribed by the relative abundances of the chemical elements in the different celestial objects. In "Die Häufigkeit der Elemente in den Planeten" the problem is discussed by H. E. Suess and H. C. Urey, University of California; and in "The Abundances of the Elements in the Sun and Stars" the discussion is by L. H. Aller, University of Michigan.

That the course of stellar evolution does not run smoothly for all classes of stars is shown by the fact that many are of intrinsically variable luminosity, some in regular periods measured by hours or a few days, others in more or less irregular periods of hundreds of days or even years. A book-length article on "Variable Stars" by P. Ledoux, University of Liège, and T. Walraven, Leiden Southern Station, South Africa, offers a detailed account of these stars, of their types of variation, and of the theoretical explanation of their characteristic behavior. This article is followed by one closely allied to it, written by Ledoux, on the subject of "Stellar Stability", with the purpose of discovering the "sources of incipient instabilities which must be responsible for the observed variability of a great number of stars".

Certain white stars, which undergo only small variations in brightness, show rather striking variations in the strengths of the lines of some ionized metals in their spectra. Nearly all these stars have magnetic fields that vary also, some regularly, others irregularly. The observational data pertaining to them, and the theoretical interpretations are given in the article "Magnetic Fields of Stars" by A. J. Deutsch, Mt. Wilson Observatory.

Stars that have practically exhausted their resources of nuclear energy and have degenerated to a state of low luminosity, with masses near that of the sun, and volumes approximately that of the earth, are known as white dwarfs. Their properties are described in the article by J. L. Greenstein in Vol. 50 of this *Encyclopedia*. In the present volume the theory that accounts satisfactorily for their present status and their numbers in our galactic system is given in "Théorie des naines blanches" by E. Schatzman, Institut d'Astrophysique, Paris.

Sometimes stars explode. If an explosion is limited to the outer layers of the star it becomes a nova, or a nova-like variable. If the outburst is more deep-seated, attended with an enormously greater outpouring of energy and almost complete disruption of the star, it is a supernova. These types of stellar behavior are