small in number, whose spectra are related to the normal classes but exhibit some peculiarities. Although the basis for labelling a star "Pec" has shifted over the years, yet the designation carries with it recognition of abnormalities in the physical and chemical properties of the stars' atmospheres.

"The Spectra of the White Dwarfs" is the title of the article by Jesse L. Greenstein, professor of astrophysics, California Institute of Technology. White dwarfs are stars of low luminosity, of small volume and mass, but of exceedingly high density, which tells us that the material composing them is in a very unusual state. Although more than 200 of these objects are known, yet owing to their faintness, spectroscopic data are available for fewer than half of them. These have proved sufficient, however, to set up several classes with distinctive spectral features, and differing in temperature and color.

Tenuous clouds of gas surrounding very hot stars appear under telescopic scrutiny as disk-shaped or ring-shaped objects. This has led to their designation as planetary nebulae. Two articles in German, "The Spectra of the Planetary Nebulae" and "Theory of the Planetary Nebulae", by Karl Wurm, professor and observer in the Hamburg-Bergedorf Observatory, are devoted to them. Logically these thorough articles belong together and should be read together, but, for some reason not apparent, the editor has separated them by more than 200 pages.

The spectral features of stars with surface temperatures above 7000° are those of gases in the atomic state. At lower temperatures some atoms combine to form diatomic molecules, hydrides and oxides, and their spectra will appear together with the atomic spectra. In the atmospheres of the coolest stars these molecular features become so prominent that their strengths and chemical nature are criteria for the classification of the cool, red stars. These and related topics are fully discussed by P. Swings, professor in the University of Liège, in his article, written in French, "Molecular Bands in the Stellar Spectra".

The spectral features described in the foregoing articles are the consequences of the interaction between the energy generated in the stellar interiors and the matter in the outer gaseous layers. How does this interaction take place? The attempt to answer this question has led to a vast amount of theoretical work which is thoroughly presented in the article "General Theory of Stellar Atmospheres", written in French by Daniel Barbier, astronomer at the Paris Observatory.

The second group of articles, written in English, deals with the mechanical and physical properties of binary stars—pairs of stars that revolve around a common center of gravity. Some of these pairs are separated widely enough to be seen telescopically as double stars. The problems concerning them are treated in the article "Visual Binaries" by Peter van de Kamp, professor of astronomy, Swarthmore College. The subject of "Spectroscopic Binaries" and their problems are discussed by Otto Struve, professor of astrophysics, and his colleague Su-Shu Huang, research fellow, in the Department of Astronomy, University of California. Both articles are comprehensive in content and provide ample references to pertinent literature for further study.

The article remaining for consideration is "The Eclipsing Binaries" by Sergei Gaposchkin, astronomer at the Harvard College Observatory. It is offered by him "in condensed form (as) a summary of the multifarious known data on eclipsing binaries". As such it lacks the comprehensiveness that should be the main attribute of an encyclopedic article. Although the authorities for the tabulated data are named, there are only seven specific citations to the extensive literature covering this subject, none of them, however, referring to the epoch-making work, at the Princeton Observatory, that initiated this branch of astrophysics more than four decades ago.

In composition, illustrations, and presentation of tabular matter, this book maintains the high standard for which the Springer-Verlag is noted. The trilingual indexes are detailed and run to nearly 40 pages. On the whole the standard set by the articles in this volume is high; and one hopes that it will be maintained in the succeeding volumes of the series.

Nuclear Reactions III. Vol. 42 of Handbuch der Physik. Edited by S. Flügge. 626 pp. Springer-Verlag, Berlin, Germany, 1957. DM 135.00 (subscription price DM 108.00). *Reviewed by E. R. Rae, A.E.R.E., Harwell, England.*

The latest volume of this well-known reference series contains six monographs on important topics in nuclear physics in a text of 610 pages, together with an English-German and German-English subject index. The articles included in the present volume are as follows:

(1) Nuclear Isomerism, by D. E. Alburger, 108 pages. The author starts with an account of the historical development of the idea of nuclear isomerism and proceeds to discuss the methods available for obtaining information about the isomeric states from their lifetimes and from the radiations emitted in the decay of those states. The account is followed by fifty pages of level diagrams and tables describing the present state of knowledge of isomeric states. The review is completed by a brief discussion of the systematics of the lifetimes of the isomeric states.

(2) Alpha Radioactivity, by I. Perlman and J. O. Rasmussen, 96 pages. This article considers first the systematics of alpha-decay energies, the type of spectra observed from even-even and from odd nuclei and the interpretation in terms of nuclear models. This is followed by a consideration of the theory of the lifetimes of alpha-emitters for even-even and odd nucleon types and the article is rounded off with some illustrative examples of individual decay schemes.

(3) The Transuranium Elements, by E. K. Hyde and G. T. Seaborg, 104 pages. The place of the heaviest

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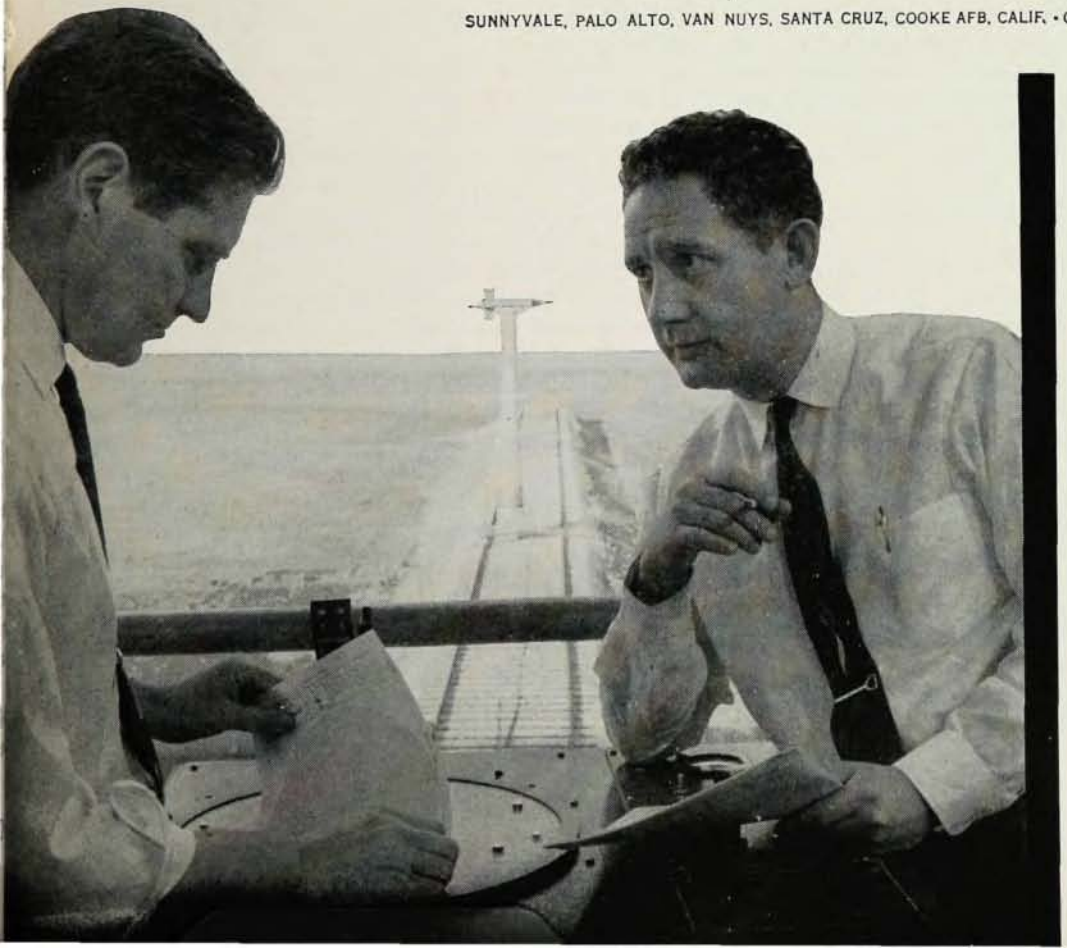

Mr. Emmanuel A. Blasi, right, Manager of Antenna and Propagation Department, discusses results of radiation performance after antenna pattern measurements with staff scientist Allen S. Dunbar. Column bearing missile in background is operated automatically from laboratory.

elements in the periodic system is outlined and the chemical and physical evidence for the concept of the actinide series is discussed. The chemistry and physics of the individual elements are then described in detail and the last 23 pages are devoted to the study of the systematics of the transuranium elements.

(4) The Nuclear Photoeffect, by G. R. Bishop and Richard Wilson, 53 pages. This review starts with an account of the sources of γ rays and x rays available for the study of the nuclear photoeffect. The theory and experimental results for the photodisintegration of the deuteron are then considered, followed by an account of the photodisintegration of heavier nuclei and the theoretical interpretation of the results.

(5) Angular Correlations, by S. Devons and L. J. B. Goldfarb, 193 pages. This is the longest review. A short introduction and a section on notation are followed by an account of the general theory of directional correlation for processes involving states of well-defined symmetry. Particular processes are then considered for the case where the states involved possess well-defined symmetry, γ-γ, α-γ, and resonance reactions being discussed as well as experiments where polarization, in addition to the direction of propagation of the emitted or absorbed radiation, can be observed. The authors then consider the application of the theory to processes involving states not having well-defined symmetry, to the study of internal conversion electrons, and to processes involving the simultaneous emission or absorption of two radiations. The effect of extra-nuclear fields is considered and the application of the theory to mesons, heavy mesons, and hyperons is discussed.

(6) Oriented Nuclei, by R. J. Blin-Stoyle and M. A. Grace, 56 pages. The authors first define an oriented assembly of nucleons. They then consider the experimental methods of producing oriented nuclei, the methods of detecting them, and the properties of such systems. The experimental results obtained with systems of oriented nuclei from the measurement of the direction and polarization of incident and emergent radiations are discussed, and the review is completed by a discussion of the methods of production and detection of polarized particles.

All of these review articles are of the high standard one would expect from contributors to the *Handbuch*. The authors are all well known in their respective fields and each article contains copious illustrations and tables together with extensive references to the original literature up to and including 1956. The topics discussed are all related, in the sense that they describe phenomena observed in the study of the atomic nucleus and attempt to relate them to current nuclear theories. The reviews are, however, inevitably highly specialized, which means that the people who will read them will be mainly those working, or about to work in the particular fields described. This is perhaps a sad reflection on the increasing trend towards specialization in modern physics, but since this trend exists it seems a pity that the individual articles are not published separately so that a reader might obtain one or two articles in which he has a particular interest without incurring the considerable expense of purchasing the whole volume.

Radiobeobachtungen des ersten künstlichen Erdsatelliten. By Wolfgang Priester, Hans-Gerhard Bennewitz, Peter Lengrüsser. 38 p. Westdeutscher Verlag, Köln & Opladen, Germany, 1958. DM 8.50. *Reviewed by S. F. Singer, University of Maryland.*

This slim 38-page volume gives results of radio observations of the first Russian satellite. The reduction of Doppler effect measurements and application to the determination of orbit is discussed. The authors give an atmospheric density of 4.7×10^{-12} g/cm^3 at 215 km. This density is slightly higher than that derived by the Smithsonian Astrophysical Laboratory from optical observations and is about five times the density adopted by the Rocket Panel.

Principles of Electrical Measurements. By H. Buckingham and E. M. Price. 600 pp. Philosophical Library, Inc., New York, 1957. $15.00. *Reviewed by Joseph G. Hoffman, University of Buffalo.*

A wealth of practical information is presented here as a result of careful planning by the authors. As they point out in the preface, they deliberately omitted theory of circuits, electrostatics, and electromagnetism. Also, they omitted photographs and detailed schematics on the assumption that these are available from manufacturers' catalogs and brochures. They have succeeded in writing a text for advanced engineering students which has also a certain appeal to experimental physicists as a reference handbook. The latter often solve problems in electrical engineering incidental to experimental procedures. Time and again recourse must be had to engineering or electronics handbooks.

This book is a commendable addition to the experimentalist's library because of its description of interesting and diverse methods known to be practicable. The first twelve of the thirteen chapters make a handy compendium of methods for the measurement of electrical entities. A pleasing aspect of the collection is the fairly detailed description along with references. For those who have leaned on handbooks this detail provides an agreeable relief from the cursory style imposed by lack of space.

Deflection instruments and deflectional methods are extensively described in the first two chapters. Potentiometer methods and associated galvanometers are detailed in Chapter 3, which along with the chapters on systems, dimensions, and standards and bridge methods seems to cover the subject of basic measurement thoroughly.

Applications of electronic vacuum tubes to basic procedures are discussed in Chapters 6, 7, and 8 under Oscillations and Vibrations, Methods Using Thermionic Valves, and Resonance and Heterodyne Methods. To some extent these chapters might seem outmoded to those who have come to use transistors and more recent