

microwave spectroscopy and nuclear quadrupole resonance spectroscopy. All these fields have in common the fact that they involve the absorption of electromagnetic radiation in the radio-frequency or microwave regions. Their techniques are therefore quite different from those employed in the older branches of infrared, optical and ultraviolet spectroscopy.

The level of treatment is intended to be suitable for a non-specialized but professional scientific audience and the authors have succeeded admirably in presenting the material clearly and yet concisely. They have also provided excellent coverage of the important applications of the two magnetic resonance techniques and of quadrupole spectroscopy.

Since only about three pages are devoted to the applications of gas phase rotational microwave spectroscopy, this chapter is not even an adequate summary and cannot be recommended to those who wish to acquire an idea of what can be accomplished with this technique. Thus the reader would scarcely even suspect that this field has become the most effective available tool for the determination of the molecular structure of vapors, dipole moments and their components, quadrupole coupling constants, barriers to internal rotation, molecular magnetic moments, molecular electrical quadrupole moments, etc. There are also some errors in this chapter.

Another error worth pointing out occurs at the end of Chapter 2 where it is stated that quadrupole resonance is applicable to solids and liquids whereas it is correctly stated elsewhere that it can be applied only to solids.

In general only simple mathematical results are quoted, without derivation. Typical experimental arrangements are briefly described, for each field, and a number of illustrative results are described. Each chapter ends with a short bibliography including references to books and review articles, quite adequate to permit the interested reader to proceed to a more detailed study of the subject.

In summary, this book can be recommended, except for the reservation made above, to those who wish to be introduced in a simple, clear and yet adequate manner to these newer fields of spectroscopy which have provided such revolutionary new tools for chemists. The French in which the book is written is in general quite simple and straightforward.

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**The Encyclopedia of Spectroscopy.** Edited by GEORGE L. CLARK, Research Professor of Analytical Chemistry, Emeritus, University of Illinois, Urbana, Illinois. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1960. xvi + 787 pp. 18.5 × 26 cm. Price, \$25.00.

After some consideration, this reviewer has decided to define a spectroscopist as one who uses a spectroscope or spectrograph, or one who uses results obtained from these instruments, for scientific purposes. The breadth of this definition may be disappointing to those who restrict the purpose to the elucidation of atomic and molecular spectra. But if this definition of a spectroscopist is accepted, then the definition of spectroscopy can be made so general that an Encyclopedia of Spectroscopy may be justified.

The present encyclopedia includes thousands of minute technical details, many of which are of limited interest to specialists. Many details are of more general interest but it is very hard to find them, in the absence of any system of cross-indexing or collaboration between individual authors of the articles. This volume also contains articles which discuss problems of general interest, such as structure of atoms and molecules, description and theory of basic optical instruments and basic methods of spectrochemical analysis. While these discussions are generally good, they are (perhaps necessarily) superficial in comparison with standard textual treatments.

This brings us to the question of utility of this book. This reviewer has concluded that actually it will be of little use to the spectroscopist, who will have his own technical library and reference cards. It will be of almost no use to the general reader. It may be of some interest to the scientifically trained reader who has ample leisure for browsing.

Some of the bypaths and odd bits of information are indeed fascinating and may stimulate further reading.

A better Encyclopedia could have resulted from the fully coordinated efforts of fewer contributors. At least much of the repetition could have been avoided and the details could have been recorded in a more systematic way. Also, one does not like to see signed articles, for which the contributors are presumably responsible, mixed in with unsigned articles contributed by a Corporation and with one article taken from "an official news release."

The volume is attractively printed and bound as should be expected. It could have been reduced in size, and presumably in price, by reduction of excessive duplication.

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**Annual Review of Nuclear Science. Volume 10.** EMILIO SEGRE, Editor, University of California, GERHART FRIEDLANDER, Associate Editor, Brookhaven National Laboratory, and WALTER E. MEYERHOF, Associate Editor, Stanford University. Annual Reviews, Inc., Palo Alto, California. 1960. vii + 617 pp. 16.5 × 23 cm. Price, \$7.00 (U.S.A.), \$7.50 (elsewhere).

This, the tenth volume of the "Annual Reviews of Nuclear Science," follows well in the path of its predecessors in the clarity and comprehensiveness of the various articles. There are fifteen separate articles, covering a wide spectrum of nuclear science from certain aspects of high energy particle physics down through several different areas of classical nuclear physics, cosmic radiation, chemical and geophysical applications, and certain aspects of biophysics. Almost without exception the contributions are very up to date, eminently readable, even to the uninitiated in the field, and quite authoritative in tone. In the order of their appearance they are: "Neutrino Interactions" by Frederick Reines; "Nuclear Interactions of Heavy Ions" by A. Zucker; "Cosmic Ray Showers" by Kenneth Greisen; "Bubble Chambers" by Hugh Bradner; "Optics of High Energy Beams" by Owen Chamberlain; "Nuclear Structure Effects in Internal Conversion" by E. L. Church and J. Weneser; "Recoil Techniques in Nuclear Reaction and Fission Studies" by B. G. Harvey; "Labeling of Organic Compounds by Recoil Methods" by Alfred P. Wolf; "Nucleon-Nucleon Scattering Experiments and Their Phenomenological Analysis"—"General Formalism" by H. P. Stapp, "Experimental Data" by M. H. MacGregor and "Phenomenological Analysis" by M. J. Moravcsik; "Theoretical Interpretation of the Energy Levels of Light Nuclei" by I. Talmi and I. Unna with an appendix by F. Ajzenberg-Selove and T. Lauritsen; "Nuclear Methods for Subsurface Prospecting" by J. G. Beckerley; "Experiments on Cosmic Rays and Related Subjects During the International Geophysical Year" by E. P. Ney; "Cellular Radiobiology" by Tikvah Alper; "Vertebrate Radiobiology: Metabolism of Internal Emitters" by Roy C. Thompson and "Vertebrate Radiobiology: Late Effects" by J. B. Storer and D. Grahm.

This reviewer was particularly impressed by Reines' article on Neutrino Interactions and Ney's article on Cosmic Radiation and the IGY. Both are extremely lucidly written, enormously informative and about as up to date in their respective fields as one could hope to attain in a finite space. Reines takes the reader quite carefully up to an understanding of the very latest ideas in the theory of weak interactions and in a short but elegant final section explores the new and fascinating field of neutrinos and cosmology. Ney's article is one of the most succinct presentations of the basic experimental facts that have emerged about our cosmic ray environment and the current thoughts that exist about their interpretation. In a more practical vein Chamberlain introduces the reader to the problems involved in beam transport with high energy machines and in wonderfully clear article gives sufficient theory and practice to enable a neophyte to do his own planning. Zucker's article on the interaction of heavy ions is an excellent introduction to this expanding field and Wolf's article on the Labeling of Organic Compounds is an excellent exposition of the wedding of nuclear techniques to chemical problems; it should be noted that the major emphasis in this article is on the use of carbon-14 and tritium.