

Book Reviews

Molecular Spectroscopy of the Triplet State. By S. P. MCGLYNN, Department of Chemistry, Louisiana State University, T. AZUMI, The Institute for Solid State Physics, University of Tokyo, and M. KINOSHITA, Department of Chemistry, University of Tokyo. Prentice-Hall, Inc., Englewood Cliffs, N. J. 1969. xiii + 434 pp. 15.5 × 23 cm. \$16.95.

"Molecular Spectroscopy of the Triplet State," by S. P. McGlynn, T. Azumi, and M. Kinoshita, is a very timely book indeed. The subject has been partially covered previously in a number of books, review articles, and research papers. The book is 434 pages long and is composed of eleven chapters and three short appendices. The first two chapters are an introduction to the field of the spectroscopy of large molecules. The definitions of the different terms used by molecular spectroscopists are given in the first chapter. In the second chapter, the authors describe a number of observations which substantiate the triplet nature of the phosphorescent state. The authors intended this chapter to be introductory and thus qualitative. Most unfortunately, however, some of the phenomena discussed, *e.g.*, magnetic rotation spectra and magnetic circular dichroism, are so difficult that qualitative discussion of their principles sounds very artificial. In the third and fourth chapters, the authors discuss the energies of the triplet state. Theoretical and experimental results are given in these chapters. Simplified but illustrative diagrams explaining Hund's first rule are given in Chapter 3. More quantitative calculations are discussed in Chapter 4. A large number of references and values of known triplet energies are given in these two chapters (3 and 4). The organization of the material covered in these two chapters could be improved, but there is no doubt that the collection of references, correlations, and values of the different triplet energies these chapters contain should be most useful to researchers in the field.

Spin-orbit interactions in organic molecules are discussed in Chapters 5 and 6. Chapter 5 contains a theoretical discussion of spin-orbit interaction. The primitive model given in this chapter is very instructive and clearly shows the dependence of the spin-orbit interaction energy on the size of the nuclear charge. The application of the spin and orbital angular momentum operators is done in a very clear and systematic manner. It is most unfortunate that the spin functions discussed throughout the book are for triplet molecules in the high-field limit. A discussion of the spin functions that are eigenfunctions of the spin Hamiltonians of some symmetrical-type molecules would be useful and would make the discussion in Chapter 5 more complete.

A comparison of the theoretical and the experimental results of the spin-orbit interactions is given in Chapter 6. The various criteria used to differentiate the type of electronic excitation of the lowest triplet state are discussed. Here again, the number of references, and the tables containing numerical values of lifetimes and yields of phosphorescence of different types of organic molecules, add significantly to the value of the chapter. In Chapters 7 and 8, a discussion is given of the spin-orbit interactions involving heavy atoms, either as a part of the molecule being studied (internal heavy-atom effects, Chapter 7) or as a part of the solvent molecule

(external heavy-atom effects, Chapter 8). The proposed theories explaining these effects are discussed and examined. The last three chapters in the book deal with electron spin resonance spectroscopy of the triplet state and its various applications.

Research on the spectroscopy of the triplet state has been active for a number of years, and there is no doubt that there has been an obvious need for such a book as this. The authors have done an excellent job in focusing on the important research areas in the field. The material is presented very well, and the fact that three authors were involved does not detract from its presentation. There is some repetition, but not to a serious degree. It is most regrettable, however, that the authors decided to leave out the discussion of nonradiative processes. This has undoubtedly left the book incomplete.

The book is written more like a review article than like a classroom text. As a result, it will be more useful to researchers in the fields than to a student seeking only spectroscopic knowledge. The summary of known properties of the triplet state in tabular form or in a correlation diagram for different types of compounds is not only useful but also stimulating. A large number of well-selected references is given throughout the book. There is no doubt that this book will have a very favorable impact on the field of triplet-state spectroscopy.

M. A. El-Sayed

*Chemistry Department, University of California
Los Angeles, California 90024*

BOOKS RECEIVED, October 1969

- H. A. FLASCHKA, A. J. BARNARD, JR., and P. E. STURROCK. "Quantitative Analytical Chemistry." Volume I. "Introduction to Principles." Barnes and Noble, Inc., 105 Fifth Ave., New York, N. Y. 1969. 594 pp. \$5.95.
- H. A. FLASCHKA, A. J. BARNARD, JR., and P. E. STURROCK. "Quantitative Analytical Chemistry." Volume II. "Short Introduction to Practice." Barnes and Noble, Inc., 105 Fifth Ave., New York, N. Y. 1969. 290 pp. \$2.95.
- C. K. INGOLD. "Structure and Mechanism in Organic Chemistry." Second Edition. Cornell University Press, 124 Roberts Place, Ithaca, N. Y. 1969. 1266 pp. \$32.50.
- SCOTT L. KITTSLY. "Physical Chemistry." Third Edition. Barnes and Noble, Inc., 105 Fifth Ave., New York, N. Y. 1969. 257 pp. \$1.95.
- J. MAURICE PATUREAU. "By-Products of the Cane Sugar Industry. An Introduction to Their Industrial Utilization." American Elsevier Publishing Co., Inc., 52 Vanderbilt Ave., New York, N. Y. 1969. 274 pp. \$30.00.
- DONALD E. SANDS. "Introduction to Crystallography." W. A. Benjamin, Inc., 2 Park Ave., New York, N. Y. 1969. 165 pp. \$12.50.