Study of the chapter on electron transfer reactions is likely to aid recognition of such reaction pathways and lead to an appreciation of these processes as synthetic routes. Elsewhere the non-photochemist may find much that surprises and is of interest.

The standard of presentation varies a little from chapter to chapter but it is generally very good and the text is illustrated with clear diagrams. Errors are infrequent, which testifies to careful editing.

Whilst the absence of some topics may disappoint, the book is nevertheless to be recommended for its excellent coverage of the subject matter.

J. HILL

Advances in Quantum Chemistry, Vol. 17

edited by J.-L. Calais; published by Academic Press, 1985; 344 pp.; price, £89.00

The series *Advances in Quantum Chemistry* began in 1964, and volumes have been published at approximately yearly intervals since that date. This volume continues the tradition of the series in that it is not confined to a single area but instead provides a set of reports on the current state of selected areas of quantum chemistry. The main part of the volume comprises two long chapters each of about 100 pages, the first dealing with some general problems in theoretical chemistry and the other with the theory of diatomic interactions. The remainder of the book (about one third of the total) comprises three short reviews on approaches to electron correlation in extended systems, the conductivity of certain conjugated polymers and the connection between the hamiltonian and liouvillian formalisms in the quantum theory of matter.

The first chapter, by G. LeRoy, starts with a general study of the electronic structure of molecules, in which an attempt is made to find a quantum mechanical interpretation of the Lewis and Linnett theories of chemical bonding. There then follows a section on the calculation of thermodynamic properties of molecules in which the concept of strain energy is developed and applied to substituted hydrocarbons. In the final section of this review certain aspects of 1,3-dipolar cycloadditions and cycle–chain isomerizations are considered, the emphasis being on the changes in geometry and electronic structure of the supermolecule along the reaction path rather than the energetics of the reaction.

The next chapter, by E. S. Kryachko and T. Koga, presents a comprehensive review of diatomic interaction theory. The authors' concern for completeness occasionally results in the inclusion of rather familiar work which is adequately covered in numerous other reviews of this topic — the simple coverage of the RKR method, for example, adds little to a review of

this nature. Nevertheless, the authors have skillfully collected together the modern trends developing in this subject. Much of the review is of a highly mathematical nature, particularly in the discussion of power series expansions of the potential and of Padé approximants to these series. However, the authors do not neglect the qualitative aspects of diatomic interaction theory, and present an excellent discussion on the virial theorem and the way in which it can be used to determine the range of validity of widely used potential functions. The qualitative implications of the Hellmann–Feynman theorem are also well discussed. The review is at its most pedagogic in its treatment of the momentum space approach to diatomic interactions, carefully introducing the concept of the momentum wavefunction and momentum density and its relation to the Compton profile before dealing with more modern work on the relation between diatomic interactions and the momentum distribution.

Chapter 3, by J.-L. Calais, deals with the problem of the treatment of electron correlation in extended systems, where conventional methods such as configuration interaction are not appropriate. The chapter presents an alternative approach to electron correlation based on a single determinant wavefunction with no restrictions on the spin orbitals. Unfortunately the article does not attempt to review the history of the method or to give a detailed account of the concepts employed, but merely seeks to stress the utility of an approach which has yet to be fully exploited in the chemistry of extended systems. Because of the brevity of the treatment, a good deal of background knowledge is assumed on the part of the reader, particularly in the areas of general Hartree–Fock theory and of group theory.

Chapter 4 presents a timely review of electrically conducting polymers by K. Tanaka and T. Yanabe. Much of the article is concerned with polyacetylene and discusses, amongst other things, the influence of perturbations, such as doping, on the electronic structure, and the soliton model of electrical conductivity in polymers. Finally, the last chapter, by the series editor P.-O. Löwdin, deals with aspects of quantal statistics and the solutions of the Liouville equation for systems in thermal equilibrium at finite temperature.

The book is well produced and remarkably free of errors, and maintains the tradition of the series in providing informative and timely reviews in major areas of theoretical chemistry.

B. H. WELLS

Higher Excited States of Polyatomic Molecules, Vol. III

by M. B. Robin; published by Academic Press, Orlando, FL, 1985; 488 pp.; price $49.50/£49.50; ISBN 0-12-589903-3

Covering the period from 1974 - 1985, Vol. III is a supplement to Vols. I and II rather than a revised edition. The author has provided the book with an excellent preface on which I shall draw heavily in the following review.