

tion to the serious student of coordination chemistry. Such a criticism cannot be levelled at this book by Professor Jørgensen. The contributions that he has made to ligand field theory and related areas of chemistry, coupled with his style as a writer, ensure that this book, besides containing a great deal of relevant information, makes stimulating and sometimes amusing reading. Indeed, the book itself contributes much to this area of chemistry.

Jørgensen asserts that the electrostatic view of ligand field theory is no longer tenable, that metal-ligand interactions should be considered as covalent in nature and that the former theory has prevailed much longer than it should have done. To paraphrase the author, it seems that the corpse is not yet ready for the funeral cortège. Accordingly, the two chapters (13 and 14) devoted to realistic models of metal-ligand bonding involving the d or f group metals discuss the angular overlap and the equi-consequential contact potential theories. These theories are applied to the most common stereochemistries involving ligands which exhibit chiefly σ and π antibonding effects, topics such as the orbital energy differences in cubic MX_4 , MX_6 , MX_8 , and MX_{12} chromophores are also discussed.

The book is divided into five parts, the first of which deals with single electron properties in atoms and molecules. Included here are ligand field aspects of the bonding in diatomic molecules such as the hydrides formed by the elements lithium to fluorine, the effects of molecular vibrations on band shapes and intensities, and a discussion of some of the problems of orbital energies. The first part of the book also includes chapters devoted to various approximate molecular orbital schemes. The second part deals with two-electron properties, especially the difficulties arising from inter-electron repulsion, the nephelauxetic effect and the classification of energy levels in the Russell-Saunders coupling scheme. The third part is essentially a survey of pertinent work which either illustrates points or supports arguments made elsewhere in the book. Thus Jørgensen discusses the spectrochemical series, the shapes of molecules and the occurrence of unusual oxidation states. A chapter on photo-electron spectroscopy stresses the importance of this new technique and illustrates how the variation of measured ionization energies can give information about bonding. The effects of electron spin are discussed in the fourth part of the book, which also includes an interesting chapter on the chemistry of the elements 114, 126, 164 and 184. The short final section is devoted to aspects of ligand field theory, science and life in general. That the author has "more belief in armchairs and blackboards than in great computers . . ." sums up his

personal view of the way to tackle many of the problems discussed in the book.

Not all of his views about metal-ligand bonding will be accepted by all coordination chemists—whether they are fixists or not. Professor Jørgensen, in building a case in favour of one particular approach to bonding, perhaps overstates his arguments against the electrostatic model on certain points. Thus, the effects of the crystal field potential term involving $\langle r^2 \rangle / R^3$ in the D_{4h} symmetry of MA_4B_2 molecules cannot be argued to be small on the basis of measured Ds values (page 333) since Ds is connected with the difference between the second order radial integrals of the ligands A and B (as Dt measures the difference between the fourth order integrals). Also, the work of Perkins and Crosby suggests that the electrostatic model is more applicable than the contact ligand field model in discussing the energy levels of trivalent ytterbium and thulium chelates.

Inevitably, some printing errors are to be found, trivial examples such as $Z_2\langle r_2^{-1} \rangle$ written as $Z_2\langle r_2^{-2} \rangle$ (page 127), trisbidentate written as $\text{M}(\text{XX})_6$ (page 161) and the first inert gas compound quoted as $\text{XeF}^+ \text{PtF}_6^-$; more seriously, my own name is spelt incorrectly on two occasions (pages 413 and 416). Nevertheless, the book can be recommended to practitioners of the art and science of ligand field theory and to other breeds of inorganic or theoretical chemists who will find something of interest in its pages. Finally, the price of the book, although a little high, is not unreasonable in comparison with the exorbitant prices of many recent textbooks.

R. C. SLADE

Laplace Transforms

Guide to the Applications of the Laplace and Z-Transforms. By Gustav Doetsch. With 43 Figures and a Table of Laplace Transforms by Rudolf Herschel. Second edition. Translation Editor: W. M. Fairbairn. Pp. xi+238. (Van Nostrand Reinhold: London and New York, January 1971.) £4.50.

THE second English edition of this book is a translation of the third German edition of 1967. There are three main changes compared with the first English edition. First, many of the proofs have been omitted so as to make the work suitable for those wishing to use the results obtained, rather than to develop the theory. This makes the book very useful, for it now gives a good comprehensive view of the possible uses of Laplace transforms in a comparatively short space. For example, the important nine page chapter 2 is devoted to ten rules for the manipulation of the transform. Second, there is now an eleven page appendix summarizing the theory of distributions and its use in connexion

with Laplace transforms. Third, more space has been devoted to the \mathcal{Z} -transform (chapter 8, 37 pages). To explain its occurrence, consider a function whose values f_n are known at specified times $t_n = n$. Then a piecewise continuous function can be defined by

$f_0(t) = f_n$ for $n \leq t < n+1$ ($n=0, 1, 2, \dots$) whose Laplace transform is

$$\begin{aligned} \mathcal{L}\{f_0(t)\} &= \sum_{n=0}^{\infty} \int_n^{n+1} e^{-st} f_n dt \\ &= \frac{1-e^{-s}}{s} \sum_{n=0}^{\infty} f_n e^{-ns} \\ &\equiv \frac{1-e^{-s}}{s} \mathcal{D}\{f_n\} \end{aligned}$$

The "discrete Laplace transformation" has been denoted by \mathcal{D} . The \mathcal{Z} -transformation is obtained from it by introducing the new variable $\mathcal{Z} \equiv e^s$, whence

$$\mathcal{Z}\{f_n\} \equiv \sum_{n=0}^{\infty} f_n z^{-n}$$

The book is written with much care, and great trouble is taken to explain the various steps in the arguments. It can be thoroughly recommended.

P. T. LANDSBERG

Dynamic Astronomy

Dynamic Astronomy. By Robert T. Dixon. Pp. xvi+368. (Prentice-Hall: Englewood Cliffs, New Jersey, 1971.) n.p.

UNLIKE some of the recent publications which have seemed solely designed to cash in on the interest in astronomy kindled by the successful Apollo missions, this book makes a real contribution to popular astronomy without making any exaggerated narcissistic claims. Presented unostentatiously and relatively cheaply, *Dynamic Astronomy* is particularly aimed at the undergraduate arts student, using very little mathematics and explaining clearly any which must be used. To some extent, therefore, it fills the need for an introductory text which can be used as a bridge to make arts students more aware of the scientific approach—it is widely accepted that astronomy courses provide an excellent bridge between the disciplines, but there is a sad lack of suitable books to aid in the presentation of such courses.

But it is not only in academic circles that this volume will be read. The clear presentation, excellent figures, and use of "flip page sequences" to provide moving pictures of such astronomical features as the motion of a comet around the Sun combine to make it suitable for children of all ages. It is to be hoped that works of this kind could help to stem the unfortunate flow of students away from science subjects, which begins when they are faced with the irrevocable decision of specialization at the age of fifteen or less.

JOHN GRIBBIN