BOOK REVIEWS

Magnetic Resonance

The Theory of Magnetic Resonance. By Charles P. Poole, junior, and Horacio A. Farach. Pp. xv+452. (Wiley: New York and London, September 1972.) £7.10.

It is important to emphasize at the outset that this book has a somewhat more limited scope than its title implies. The text is almost entirely concerned with the construction and solution of the Hamiltonian matrices which arise in magnetic resonance problems. There is only cursory discussion of such topics as the physical origins of the various terms in the spin Hamiltonian, the group theory of crystal-field splittings and the origins of linewidth in magnetic resonance spectra. For each system treated, the aim is to get to grips as quickly as possible with the Hamiltonian matrix based on spin product states. The matrix is then diagonalized and the eigenvalues and transition intensities are derived and discussed in great detail. This is an important part of magnetic resonance theory, and often the part of most immediate interest to an experimentalist with magnetic resonance data to interpret. The student with more general interest in the fundamental aspects of the subject, however, will need to consult other treatments.

The book begins with brief introductions to the spin Hamiltonian and to the properties of matrices and angular momentum operators. The product-state wavefunction representation is introduced, and is applied, as a first example of the basic techniques to be used throughout the book, to a pair of spins placed in a magnetic field and coupled by an exchange-type interaction. This problem is subsequently specialized to typical situations which occur in nuclear and electron spin resonance. There are generalizations to treat anisotropic g -factors and hyperfine interactions, larger numbers of interacting spins, larger spin magnitudes, quadrupole and crystal-field effects. In all these calculations, the energy levels are derived and the resonance spectra are calculated and discussed for various ranges of the parameter values. Later chapters deal with optical transitions of atoms, calculation of g -factors, and the inclusion of linewidth effects in the calculation of resonance spectra.

The book is produced in a readable format and the results of calculations are illustrated by a very full range of diagrams. There are eleven pages of

problems and an extensive bibliography of books and review articles. The book will be useful to the research worker who needs to interpret magnetic resonance spectra but does not require the detailed theoretical justifications for the spin Hamiltonian and lineshape formalisms.

RODNEY LOUDON

Bode's Law

The Titius-Bode Law of Planetary Distances: Its History and Theory. By M. M. Nieto. Pp. xii+161. (Pergamon: Oxford and New York, 1972.) £3.50.

THE exact status of Bode's law (as it is still usually called in the United Kingdom) has been a matter of dispute amongst astronomers for many years. Does the existence of an approximate numerical relationship for the distances of the planets from the Sun have a deep physical significance, or are we dealing simply with a piece of numerology? Certainly most makers of solar systems have felt the need to give the law at least a passing mention when they have tested out their models against the observable world.

This book provides a comprehensive survey of criticisms, developments and explanations of Bode's law. It consists essentially of two parts—an historical survey followed by an assessment of recent work. The first part contains a clear statement of the relative roles of Titius and Bode in the enunciation of the law, including facsimile reproductions of the relevant passages in their writings. The main weight of the book is, however, in its second part, which makes up some two-thirds of the whole. The author's emphases here seem very reasonable. He rightly stresses that the existence of numerical relationships for the satellites of the major planets is as important, and deserves as much attention, as the more generally considered relationship for the planets themselves. The interesting suggestion is made that the basic regularity in the spacing of the planets derives from their original formation in the protoplanetary nebula, whereas the deviations from this basic regularity result from interactions between the planets subsequent to their formation. Perhaps as a consequence of this belief, the author tends to be relatively unenthusiastic about the most important recent attempts to explain Bode's law, for these have invoked computer modelling of the gravitational interactions between point masses.

There is a good bibliography which provides a fairly full listing of relevant articles (though a few additional references to the secondary literature on the historical side might have been inserted). In general, although the style occasionally leaves something to be desired—we are, for example, introduced to “the (Hermann Ludwig Ferdinand von, 1821–94) Helmholtz—(William Thomson Lord, 1824–1907) Kelvin contraction time”—this book should be a useful source of information for astronomers interested in the origin and evolution of the solar system.

A. J. MEADOWS

Planetary Physics

Mantle and Core in Planetary Physics. Edited by J. Coulomb and M. Caputo. (Proceedings of the International School of Physics, “Enrico Fermi”, Course 50, Varenna on Lake Como, July 13–15 1970.) Pp. xii+277. (Academic: New York and London, June 1972.) \$17.50.

THE course, some of the lectures from which are published in this volume, is the first one of the Enrico Fermi School which has been devoted to geophysics. This internationally famous School, founded in 1953, and held each summer, is devoted to modern physics. The period during which it has operated coincided with a renaissance of research in geophysics, which has transformed knowledge of the Earth. The devotion of course 50 to geophysics is, one hopes, a further sign of a growth of interest among physicists generally in problems of the physics of the Earth and planets. The volume makes enjoyable and refreshing reading, although the subject matter of the chapters contributed by various authors is rather heterogeneous. I particularly enjoyed reading papers by Malkus on convection associated with floating heat sources (are continents such sources?), by Vicente on the influence of the core on the Earth's nutations, by Thomsen on the equations of state of the interior of the Earth, by Knopoff on attenuation of seismic waves, and by Keilis-Borok on the inversion of seismological observations. The paper by Keilis-Borok is particularly important for any branch of geophysics, and will repay careful study. It shows the way in which limits may be placed on the uncertainties inherent in any model of the Earth based on remote sensing.

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