BOOK REVIEWS

Many-Body Introduction

Many Body Problems. By G. E. Brown. Pp. vii+232. (North-Holland: Amsterdam and London; American Elsevier: New York, 1972.) Dfl. 40; \$12.50.

THIS new book, from a distinguished author, adds to the swelling ranks of books on many-body problems. Like many of the others it introduces the subjects of second quantization for Fermions, perturbation theory, Green's functions for Fermions and the random-phase approximation. A distinguishing feature is the liberal amount of attention given to the theory of Fermi liquids including nearly ferromagnetic ones. Other topics to which the general theory is applied are phonons and electrons and, very briefly, the theory of superconductivity.

Most of the topics are treated with great care and thought; the reader is led in gently and shown a concept from several different points of view. I particularly liked the introduction of second quantization and the discussions of Wick's theorem, of quasi-particles and of Landau's theory of a Fermi liquid. One place where the book falls from this high standard is, unfortunately, the opening section which is not as clear as the rest. For example, it is not stated there that the single particle wave functions which make up a Hartree product are orthogonal, a lapse which could cause a student considerable trouble. In spite of this, the book's strength is as an introduction. It is, therefore, a pity that it contains no problems.

Any author of a book of this length on many-body problems is bound to be very selective in his choice of material. Some of the general topics omitted in the present case are temperature-dependent perturbation theory and Green's functions, Kubo's formula for a response function and its applications and systems of Bose particles. These omissions will make the book less useful than it might be for workers in the fields of solid state physics and of superfluid liquid helium.

Apart from the fact that for half the contents the page numbers are missing,

the book is well and clearly printed and set out, a great advantage in a subject where the symbols bristle with subscripts. Although not the book that one cannot be without, it is, especially as an introduction, a useful addition to the literature. The price is also quite reasonable.

G. RICKAYZEN

Spectra of Atoms

Introduction to the Theory of Atomic Spectra. By I. I. Sobel'man. Pp. xvi+609. (Pergamon: Oxford and New York, June 1972.) £18.

THE very first sentence of the preface of this book indicates that Professor Sobel'man sees it as a successor to the famous work of Condon and Shortley published almost 38 years ago. To invite comparison with this masterly monograph is both courageous and dangerous. Yet it is by the high standard set by Condon and Shortley that we must judge the present work.

Condon and Shortley has three chief merits: at the time it was written it was comprehensive; it is accurate; and it is readable. It would be too much to expect the present book to be comprehensive. The sheer volume of accumulated material in the theory of atomic spectra is now too great to incorporate into a single treatise. An account of the theory of angular momentum and of the systematics of the levels of many-electron atoms forms the core of the book, and here the methods evolved by Racah have been exploited to the full. (An important concession to the mathematically illiterate reader has been made in that no knowledge of group theory is required.) The interaction of atoms with radiation is also dealt with fully and systematically, as is hyperfine structure, with good coverage of work up to the late 1950s. Isotope shifts, on the other hand, are given only very sketchy treatment. A most welcome chapter is that on the broadening of spectral lines (one of the few topics which received less than justice from Condon and Shortley). The author has, of course, himself made distinguished contributions to this field, and

the account of this difficult subject is excellent; but I feel that it was an error of judgment not to revise this chapter for the English edition, produced 10 years after the Russian. An unusual feature for a book on atomic spectra is the chapter entitled "Excitation of Atoms". This chapter, which is mainly concerned with excitation by collisions with electrons, has been extensively revised for the present edition, and represents an excellent review of present knowledge. It also contains material about elastic scattering of electrons by atoms, including a much needed account of the broadening of highly excited states by collision with foreign gas atoms ("Fermi broadening"). A surprising and regrettable omission from the book is any serious account of quantum electrodynamic effects. The Lamb shift is given half a page in the elementary and introductory part of the book and thereafter no more is heard of it.

The book seems to achieve a high standard of accuracy. A small number of sample checks uncovered no errors, and only a very small number (none serious) of misprints.

The readability which is so marked a characteristic of Condon and Shortley is only sporadically present in Sobel'man's book. At times, as an experimentalist, I felt overwhelmed by the mathematics, a sensation which is not produced by Condon and Shortley for all its mathematical complexity. If the whole of this book had been written with the same sensitivity and insight as the chapter on line broadening it would indeed have been an astonishing achievement.

Perhaps, though, in the end the comparison with Condon and Shortley is unfair. It may well be that the latter book is one of those landmarks in the writing of physics which can only be erected when the time is ripe, and that to look for repetition is as fruitless as expecting a Beethoven symphony to be written now. This is a good and much needed book—it will be read and used with profit and enlightenment by all who wish to be guided through the intricacies of atomic spectra.

W. R. HINDMARSH