in British Universities and Colleges (published by HMSO), but it is much better on telephone numbers. It includes the names of professors, but not of other academic staff. It also includes a very good list of technical colleges, libraries, and journals covering industrial research in Britain.

The book is supplied with three indexes, covering names, organizations, and subjects. These are easy to use. The book, in short, is indispensable to all those interested in research and development in Britain. By avoiding irrelevant and unnecessary information, it manages to pack into a small space what other reference books take three volumes to cover. But it is to be hoped that the sixth edition will not be expected to hold its own for as long as the last—ideally, it should be brought up to date annually.

NIGEL HAWKES

Physical Science

QUANTUM SCATTERING THEORY

Introduction to the Quantum Theory of Scattering

(Pure and Applied Physics: A Series of Monographs and Textbooks.) By Leonard S. Rodberg and R. M. Thaler. Pp. xi + 398. (New York: Academic Press, Inc.; London: Academic Press, Inc. (London) Ltd., 1967.) 92*s*.

IN a certain sense, scattering phenomena are at the heart of the whole of elementary particle physics, and much of our knowledge of the forces between free atoms and free atoms and electrons and other projectiles also derives from collision experiments. In addition, the behaviour of assemblies of large numbers of atoms, nuclei, electrons and so on can or ought to be deduced from the so-called scattering amplitudes characteristic of the two-body problem. The forces between, say, pions and nucleons are very different in character from the simple Coulombic forces, screened or unscreened, which dominate atomic and molecular physics, and not solely because of their differing ranges. Nevertheless, it has been an aim of theoreticians to provide a formal framework for scattering theory, sufficiently elastic and comprehensive to deal with all collision events. A fairly standard and mathematically formal treatment of scattering phenomena came into vogue some years ago and has more recently been subsumed under general theorems which emphasize the connexion to the perturbation theory of continuous spectra and the use of functional analysis. The idea of the operator norm, not necessarily in Hilbert—but more generally in Banach—space has become a tool of power and has led to very striking developments, in particular in the three-body problem.

A number of monographs are now available, which give a comprehensive account of the more recent developments and also provide mathematical foundations simultaneously rigorous and of sufficient generality. These texts are fairly heavy going and hardly constitute an introduction to the subject. Then there is an old classic which has recently been overhauled and pursues an encyclopaedic tendency all of its own through a piecemeal development of the formalism which sticks very closely to the physical requirements, but will not appeal to the high energy theoretician because of its emphasis on atomic and low energy nuclear physics. While every book on nuclear or high energy physics brings some of the standard ingredients of the scattering theory, what has been lacking, perhaps rather surprisingly, is an introductory textbook on the subject, conceived as a separate discipline. Rodberg and Thaler have written such a book.

It is a completely formal and mathematical treatment of the subject in the expository textbook style. But the mathematics is in fact of a fairly elementary kind and the calculus of operators and states which is indispensable in quantum mechanics is explained from the beginning. About half of the book relies entirely on the Schrödinger equation in configuration space and its equivalent integral equation. Some attention is paid to wave packets but their diffusion lengths are not estimated with rigour. Considerable space is devoted to the resolvent of the radial wave equation, also with the radiation condition imposed at a finite radius. This would be very helpful if the Kapur-Peierls treatment of resonance reactions were expounded, but as it is not, students will not see the significance of the development, which in its painstaking detail is quite turgid. The entire material of these first chapters is then worked over once more from the time-dependent and representation free, formal point of view. Of course the aim is the generality of a formalism which can deal with any reaction whatever so long as it is initiated by two colliding systems. But as there are absolutely no detailed physical applications—a graph of a differential cross-section in the Fraunhofer diffraction limit is about the only instance when a real physical situation is illustrated—it will need a mature student to digest the formalism. And if this is so, one is entitled to reflect whether a student of that level should not be exposed to a more sophisticated and mathematically demanding version of the same theory.

The applications of the theory are altogether given rather scant attention. There is a heavily condensed account of the impulse approximation with reference to multiple scattering, rearrangement collisions and some resonance theory, but never in relation to specific models or studies of this or that physical system. On the other hand the use of invariance arguments and conservation laws in the determination of the parameters of the scattering matrix is deservedly discussed at some length and similarly there is a balanced treatment of the complications of spin, and polarization in scattering reactions. There are absolutely no references to published papers or books—one might have expected some suggestions for collateral reading at least. The entire treatment is non-relativistic and the book will not therefore appeal directly to high energy physicists.

The level of presentation is painstaking and normally all calculations are performed very explicitly. If in my opinion the book fails in its avowed aim then this lies in the subject, which becomes excessively formal if divorced from concrete physical applications, unless mathematical precision in the manner of axiomatic field theory is aimed at. Nevertheless, the book will be useful to many people who want an introduction to the formalism of scattering theory at an intermediate level of mathematical sophistication. These readers, one hopes, will not be put off by a rather large number of minor misprints in the mathematical formulae.

S. ZIENAU

MANY BODY PROBLEM

The Many-Body Problem in Quantum Mechanics

(Cambridge Monographs on Physics.) By N. H. March, W. H. Young and S. Sampanthar. Pp. ix + 459. (London: Cambridge University Press, 1967.) 90*s*. net; $16.50.

THIS is an introductory textbook on the many body problem in quantum theory, with an emphasis on applications to the physics of metals. Perturbation theory is