SHORTER NOTICES

Mécanique Analytique et Théorie des Quanta. By G. Juvet. Paris, Blanchard, 1926. 6+153 pp.

Two-thirds of this book deal with general mechanical principles and perturbation theory. The opening chapters are concerned mainly with the Hamiltonian canonical equations and the Hamilton-Jacobi partial differential equation. The style and method of demonstration are usually varied enough from those given in the standard texts on dynamics so that even the discussions and proofs of the standard theorems do not seem hackneyed, but occasionally one feels that the mathematical framework is a bit more elaborate than necessary for understanding most of the literature of the quantum theory. A happy feature is the emphasis that the canonical equations furnish the "characteristic curves" of the Hamilton-Jacobi partial differential equation, for this observation to a certain degree bridges the gap that usually exists between the physicist's presentation of the Hamiltonian dynamical technique and the analysis of general first-order partial differential equations found in such treatises as those of Goursat, Jordan, etc. In Chapter V the separation of variables is considered at some length. The two following chapters are devoted to perturbation theory and the methods of successive approximation developed by Delaunay, Lindstedt, and Bohlin. No attempt is made to delve into the intricate question of the convergence of the trigonometric series. One admires the candor with which Juvet acknowledges that his treatment in Chapter VII follows closely that in Poincaré's *Méthodes Nouvelles de la Mécanique Céleste.* One might wish that all authors were equally frank, for to quote Juvet, "Nous ne croyons pas qu'il suffice de citer un auteur lorsqu'on lui prend tout ce qu'on dit, il convient de dire que tout lui revient." Nevertheless this chapter is of distinct value because it summarizes and brings together material which is rather widely scattered through the various chapters of volume II of Poincaré's treatise. It is indeed interesting that the perturbation technique of the astronomer has lent itself with so little modification to the Bohr theory of atomic structure.

The last third of the book deals with application of dynamics to the quantum theory of atomic structure. The analysis is, of course, entirely on the basis of the old Bohr theory, as it was written before advent of the new matrix dynamics of Born, Heisenberg, and Jordan, or of the wave mechanics of Schrödinger. Chapter XII presents Burgers' first method of proving the principle of adiabatic invariance, and no mention is made of his second method (summarized in an appendix of Sommerfeld's *Atombau*), which in our opinion is simpler once the transformation theory of dynamics has been established. The last few pages contain an interesting discussion of the relative utility of the various perturbation methods developed in Chapters VI and VII, but these methods are not illustrated by applications to specific problems such as the anharmonic oscillator, helium atom, or dispersion. The quantum theory is replete with problems of this type which can be handled only by successive approximations, and it seems unfortunate that no space could be found for their inclusion after such careful development of the general perturbation theory. In fact, not even the appropriate references to the literature are given. The separation of variables, however, is illustrated by the conventional examples of the Stark effect and relativity corrections in hydrogen.

Professor Juvet's book covers a field quite distinct from most other treatises, and is written with characteristic French smoothness of style. The general flavor is mathematical rather than physical, for, to quote from the preface, "The aim is simply to put a mathematical instrument at the disposal of those who are interested in physics, and at the same time to acquaint mathematicians with one of the most elegant applications of analytical mechanics."

J. H. VAN VLECK

The Quantum Theory of the Atom. By George Birtwistle. Cambridge University Press, 1926. 236 pp.

Just what form the quantum theory of the atom will take by the time this review appears in print it is impossible to say; but whatever the quantum theory may become, its original form will always be a matter of interest. This theory assumes a definite model of the atom—the Rutherford atom—and applies to this the laws of classical dynamics. From the continuous manifold of dynamically possible orbits, the quantum theory allows only a discreet manifold.

Mr. Birtwistle has written an excellent account of the quantum theory based on these ideas. He first shows how the quantum theory was introduced by Planck in obtaining his formula for the distribution of radiant energy; he then describes Bohr's original theory of the hydrogen spectrum, Einstein's photo-electric equation and his deduction of Planck's formula. Then follow a number of chapters on the general dynamical theory, which is needed in the applications of the quantum theory that follow: to the fine structure of spectral lines, to the Stark and the Zeeman effects. A brief account is given of spectral series together with Bohr's theory of the building up of atoms and the theory of band spectra. The classical theory of perturbations of dynamical systems is next given, with an application to the anharmonic oscillator. The last chapter contains a sketch of the dispersion theory of Kramers.

This book was published while the quantum mechanics of Heisenberg was in process of development, and this theory is just mentioned at the end of the volume. At the present time the undulatory mechanics of de Broglie and Schrödinger is attracting much attention. But whatever may be the fate of these recent speculations, there can be no question as to the value of the older form of the quantum theory in view of its achievements; and it would be difficult to find a better account of it than in this book.

E. P. ADAMS