BOOK REVIEWS

La Thermodynamique de la Particule isolée (ou Thermodynamique cachée des Particules). By Louis de Broglie. 125 pp. Gauthier-Villars, Paris, 1964. $7.50.
Reviewed by R. B. Lindsay, Brown University.

It is no news that Louis de Broglie continues to be dissatisfied with the current probabilistic interpretation of quantum mechanics, according to which indeterminism is fundamentally built into the behavior of matter on the microphysical level. In this book he sets forth again with commendable clarity a review of his attempts to provide what he feels is a more rational approach, with special emphasis on a thermodynamic interpretation. The volume takes the form of the lectures de Broglie delivered in his final course at the Institut Henri-Poincaré prior to his retirement in 1962.

The first five chapters of the book constitute a summary of the background on which de Broglie's ideas are based, including a brief review of Hamiltonian mechanics, relativity dynamics, statistical thermodynamics, relativistic thermodynamics, together with the Helmholtz and Boltzmann analogies between mechanical and thermodynamic quantities. These topics are presented with the elegance for which the author has long been justly famous. The real meat of the volume is found in the last four chapters. Here the author reviews his interpretation of quantum mechanics involved in the theory of the double solution, in accordance with which the ordinary Ψ function, which is the solution of the Schrödinger equation, cannot be the whole story of the behavior of the particle being described. Rather, according to de Broglie, there must be another wave equation whose solution is the physical wave that represents the particle in the sense that in a certain region at a given instant of time the amplitude of the wave is very large, thus corresponding to the physical presence of the particle, while on all sides of this region the amplitude becomes very small. De Broglie realized that to insure this result the wave equation would have to be nonlinear and imply the existence of a special "quantum force."

Louis de Broglie

The author abandoned the double-solution theory in the late twenties but resurrected it a dozen years ago, when he recognized that the introduction by Bohm and Vigier of a subquantic medium with "hidden" variables would enable him to put his theory on a statistical basis, provide for the existence of the physical wave for the particle, and justify the assumption that $|\Psi|^2 d\tau$ gives the probability of finding the particle at a given point of space in the volume element $d\tau$. The picture that emerges is that of a particle conceived as a highly localized nonhomogeneity in a wave whose propagation equation contains the proper mass of the particle. In the absence of perturbing forces the particle moves along one of the streamlines or rays associated with the wave. However, the particle is assumed to be in contact with a subquantic medium which exerts a perturbing influence on it by exchanging energy with it. This medium thus acts as a kind of hidden thermostatic reservoir. Because of the perturbations the proper mass of the particle is subject to fluctuations and the particle itself is subject to a kind of Brownian motion, which provides a rational background for the probability picture of the conventional interpretation of quantum mechanics.

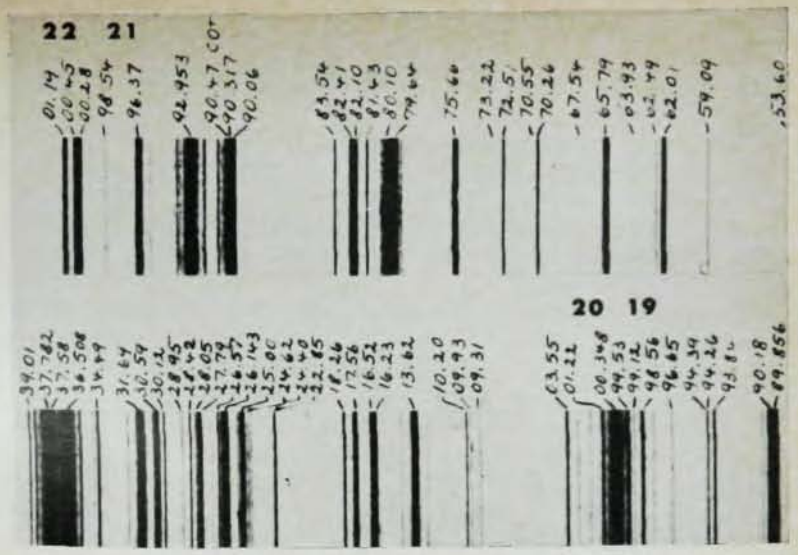
But de Broglie goes further and, by introducing the entropy of the hidden reservoir as a function of the proper mass of the particle, is able to show that along the actual path of the particle the entropy is a maximum. In this way he establishes for quantum mechanics a connection between Hamilton's principle and the second law of thermodynamics, which is analogous to that which Helmholtz strove to introduce into classical statistical mechanics in the last century.

Opinions will obviously differ as to the value of these ideas of de Broglie. He himself confesses that some of the notions are artificial and that the whole subject needs more detailed exploration, which he hopes will be continued by his students. The important point is not that these ideas may change the current interpretation of quantum mechanics, but rather that they demonstrate the value of the free use of the imagination of theoretical physicists in the construction of theories which may provide suggestive insight into the new experience which the experimentalists are steadily creating. It would be highly unwise to ignore such points of view.

Two-Dimensional Problems in Hydrodynamics and Aerodynamics. By L. I. Sedov. Transl. from Russian and edited by C. K. Chu, H. Cohen, and B. Seckler. 427 pp. Interscience, New York, 1965. $16.50.
Reviewed by J. Gillis, Weizmann Institute of Science, Rehovoth, Israel.

This new translation from the Russian is a series of articles on various topics in hydrodynamics. The unifying feature is the approach through the theory of functions of a simple complex variable. Indeed the main purpose of the book is to present and illustrate this approach, and the problems have been chosen largely with this end in view.

Some of the work presented is quite classical, e.g., the Blasius-Jonkowski



A portion of the Specola Vaticana spectogram of copper, same size as original. Full chart is 10½ x 14 in.

calculation of the forces on two-dimensional airfoils or the Helmholtz-Kirchhoff theory of free streamlines. But in each case the classical work is only the first step in the development of a more powerful theory. Thus the airfoil analysis is extended to deal with time-dependent flows, and leads up to an entire chapter devoted to effective and constructive approximate methods for dealing with thin airfoils.

The analysis of cascade theory leads to some very beautiful problems of function theory which are elegantly solved, and there is also an interesting chapter on the related question of planing motion.

The last part of the book deals with problems of gas dynamics, potential gas flow, and gas jets. Here too the semiclassical methods are presented (e.g., Pandth-Meyer expansions), but always as the starting point for further developments.

Each chapter begins with a "problem formulation" explaining the physical background of the problem to be discussed. On the other hand very little space is given to the actual derivation of the equations, which are more or less taken for granted.

The English translation is good. The reviewer knows of no similar book in English and strongly recommends it to anyone who wants to become acquainted with the techniques created by the Moscow school for solving problems in the mechanics of nonviscous fluids.

Atomic Spectra in the Vacuum Ultraviolet from 2250 to 1100 Å. Part One: Al, C, Cu, Fe, Ge, Hg, Si, (H_2). By J. Junkes, E. W. Salpeter, and G. Milazzo. 124 pp. plus 9 charts. Specola Vaticana, Vatican City, 1965. Paper, $10.00.
Reviewed by C. C. Kiess, Georgetown College Observatory.

The spectroscopists of the Specola Vaticana have set for themselves the problem of mapping ultraviolet atomic spectra in the region where vacuum techniques are required down to 1100 Å. The work was undertaken, and is being continued, to satisfy the growing needs not only of physicists and spectrochemists but also of astronomers and space scientists, for spectral data in the region to which our atmosphere is opaque.

Part One, which is the subject of this review, is primarily a set of maps of the short-wave spectra emitted in hollow-cathode discharges of the elements aluminum, carbon, copper, iron, germanium, mercury, and silicon. Other parts of the completed *Atlas of Atomic Spectra in the Vacuum Ultraviolet* will appear in due course. The elements treated in the first installment were chosen because many of their spectral lines have been measured accurately and are suitable standards of comparison for wavelength measurements. An additional map in the present lot portrays the spectra of the Lyman and Werner bands of molecular hydrogen (H_2), of which some lines persistently appear in spectra excited in hollow cathodes.

The maps are eighteen-fold enlargements of original spectrograms that were obtained with a concave grating of 1200 grooves/mm set up in an Eagle mounting. Each map consists of seven strips covering a range of 160 or 170 Å, with sufficient overlap at the ends to join with the preceding and following strips. The wavelengths of all lines, including those of impurities, are marked in the margin above each strip. Most of them are wavelengths taken from the literature, but if these are lacking, wavelengths derived from the new spectrograms are given. In format the maps are nearly twice the size of those previously published by the Specola Vaticana for iron and thorium, and in quality they conform to the high standards adopted for the earlier work.

Accompanying the charts is a paperbound text with a foreword stating the purpose of the work and an introduction describing various details of the experimental procedures. The remainder of the textual matter presents individually for each element and for H_2 an account of and references to previous work; and a list of known lines, including those newly measured, with their wavelengths, estimated intensities, excitation state, and source. These parts of the text are independently numbered so that "after the whole work is completed, the charts can be arranged alphabetically, according to elements, and all sheets of text and wavelengths can be taken apart and rebound together as one desires." These maps and texts greatly supplement existing descriptive material, and supply valuable tools for the practical spectroscopist.

Mathematical Theory of Optics. By R. K. Luneburg. 448 pp. University of California Press, Berkeley, 1965.
Reviewed by Harold Mendlowitz, National Bureau of Standards.

Optics can be considered a very broad field in which many somewhat related disciplines are studied, often quite independently. One might be