*Mécanique Quantique et Causalité.* D'après M. Fermi par André George. Paris, Hermann, 1932. 18 pp.

The present booklet, which appeared as the fifth publication of the well known series *Exposés de Physique Théorique,* is an illustrative commentary on a memoir by Enrico Fermi (Nuovo Cimento, new series, vol. 7, 10, pp. 361–366).

Causality is interpreted as determination of future events. After a brief review of the status of classical causality, the author proves, in a very elegant manner, the equivalence of the two quantum mechanical methods of defining states: (a) in terms of instantaneous values of physical quantities, (b) by means of $\psi$-functions. He then shows that if a physical quantity is measurable with precision at a given time, the value of that quantity can be calculated definitely for any later time. This fact is illustrated by a detailed consideration of a simple special case: one-dimensional uniform motion.

The restrictions of the causality principle spring mainly from Heisenberg's theorem of related indeterminacies, which claims the impossibility of simultaneous measurements of canonically conjugate quantities. L. de Broglie adds parenthetically the observation that knowledge of the present value of a physical quantity permits of no conclusion regarding its value at a time prior to the measurement, since the physical system may not have been in a pure state. In the conclusion it is pointed out in what manner the recent ideas of Bohr, Landau, and Peierls impose further restrictions upon the conventional understanding of causality.

The discussion is lucid and convincing; it makes no pretense to solve the causality problem in its entire complexity, but adds a few interesting side lights.

HENRY MARGENAU

*Notions de Mécanique Ondulatoire; les Méthodes d'Approximation.* By L. Brillouin. Paris, Hermann, 1932. 34 pp.

This is No. 39 of the series Actualités Scientifiques et Industrielles and the first of a "sub-series" devoted to quantum theory under the general direction of L. Brillouin. The connection between the wave-equation and the Hamilton first-order equation by which solutions of the latter may be used to furnish approximations to solutions of the former is carefully developed. A problem in one degree of freedom involving the method of steepest descent (*méthode de col*) for the approximate evaluation of definite integrals is worked out in detail. An account is given of Schrödinger's method of perturbations, and a theory applicable to large perturbations is sketched; this involves infinite determinants, and the treatment is heuristic, no convergence questions being discussed. A short section is devoted to non-conservative systems and Dirac's application of the method of variation of constants. The treatment assumes familiarity with the methods of wave-mechanics and is very useful in giving concreteness to questions which often remain very abstract in more elaborate treatments.

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