Mécanique Quantique et Causalité. D’après M. Fermi par André George.

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 ψ-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 defi-
nitely 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 simul-
taneous measurements of canonically conjugate quantities. L. de Broglie adds
parenthetically the observation that knowledge of the present value of a physi-
cal 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 under-
standing 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. Bril-

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 determin-
ants, and the treatment is heuristic, no convergence questions being discussed.
A short section is devoted to non-conservative systems and Dirac’s applica-
tion 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.

F. D. MURNAGHAN