

BOOK REVIEWS

Quantum Statistical Mechanics. Green's Function Methods in Equilibrium and Nonequilibrium Problems. By Leo P. Kadanoff and Gordon Baym. 203 pp. W. A. Benjamin, Inc., New York, 1962. Paperbound \$4.95, clothbound \$6.95. Reviewed by Stuart A. Rice, University of Chicago.

ONE of the most fascinating and difficult areas of theoretical chemistry and physics is the study of the many-body problem. Serious attention has been given to this subject by chemists for about thirty years and by physicists for about five years. The approaches used by chemists have often laid the foundations for current development—i.e., exact cluster expansions (Mayer), summation of the most divergent diagrams (Mayer), distribution-function descriptions of strongly interacting systems (Kirkwood), the use of Green's functions as propagators in transport theory (Kirkwood), studies of the relationship between singularities in distribution functions and phase transitions (Kirkwood, Mayer), and many others. In most, but not all cases, the early work was based on classical mechanics. The recent developments in the many-body problem have largely been in the study of systems when quantum statistics is required. Although many new techniques have been introduced, most can be traced to earlier classical developments, even when invented independently. Indeed, physicists might be advised to look at *The Journal of Chemical Physics* from time to time.

The book by Kadanoff and Baym is an excellent description of the use of Green's-function methods in quantum statistical mechanics. It is very clearly written, is precise and easy to follow, and can be wholeheartedly recommended as an introduction to one valuable approach to the many-body problem. There is, in my opinion, only one flaw, and it is related to the comments already made in the opening paragraph. It is almost always true that scientific methods develop slowly and have long roots. The book by Kadanoff and Baym gives no credit to any of the earlier workers in the field of statistical mechanics and, as a result, occasional comments of remarkable simplicity are made with an overpowering element of surprise and discovery. For example, on page 59 the authors seem breathless and excited in observing that the ordinary Boltzmann equation deals with particle-particle interactions only during close encounter. This aspect, though surely well known, is included, but the much more fascinating, difficult, and fundamentally important question of the introduction of irreversibility is passed over without comment. The authors comment (correctly) that an ordinary distribu-

tion function cannot be defined quantum mechanically, and although they mention the use of Wigner functions, which are analogous to classical distribution functions, they do not even cite the extensive studies made using these functions. In the description of the extended Boltzmann equation, no mention is made of the work of Prigogine, Kirkwood, Green, and others. Although it is noted that the equation derived (9.30, 9.31) is exact for all densities, one cannot avoid the feeling that one intractable equation has been transformed into a different intractable equation. This feeling could have been avoided by the inclusion of a nontrivial example—say the density corrections to the Boltzmann equation or an approximation describing the dense fluid state. (Of course, these have not been worked out and therefore could not be included in the text.) Similarly, the description of Coulomb interactions is much less elegant and less rigorous than the theory of Kirkwood and Poirier.

Other examples could be cited but I believe the nature of the book is clear. It is an excellent and very clear description of one valuable approach to the many-body problem, but it gives no credit to earlier workers and makes no real and significant mention of other approaches to the same problems. Despite this one drawback, it may be wholeheartedly recommended to anyone interested in the statistical theory of interacting particles.

Knowledge and Wonder. The Natural World as Man Knows It. By Victor F. Weisskopf. 222 pp. Doubleday & Co., Inc., Garden City, N. Y., 1962. \$4.95. Reviewed by Norman Feather, University of Edinburgh.

THE pupils of Buckingham School, Cambridge, Mass., who acted as guinea pigs for Dr. Weisskopf, must have found the experience richly rewarding: the book which has grown out of the lectures which he gave there, "before an audience with no special grounding in science", is proof enough of this conclusion. The title is taken from a judgment of Francis Bacon, Lord Chancellor of England, "... all knowledge and wonder ... is an impression of pleasure in itself ..." (there is a subsidiary judgment interwoven: "[wonder] is the seed of knowledge"). The "impression of pleasure" in these lectures shines from every page of the book.

Three centuries and a half ago, Francis Bacon prophesied the utilitarian benefits of inductive science; by contrast, Dr. Weisskopf regards the "scientific understanding of natural phenomena", partial though it still must be, as "the greatest cultural achievement of our