Reformulating quantum mechanics

QUANTUM MECHANICS AND PATH INTEGRALS. By R. P. Feynman and A. R. Hibbs. 365 pp. McGraw-Hill, New York, 1965. $12.50.

by George H. Weiss

Some years ago, when Feynman first introduced the path-integral formulation of quantum mechanics it was hoped that the new technique held the answer to many of the outstanding problems in that field. Since then, this hope has slowly diminished as it became evident that the solution of problems by path integrals was considerably more difficult than by the usual differential-operator techniques. In fact, most of the soluble problems are those in which the path integrals can be shown to be equivalent to a Schrödinger equation. It is with this background in mind that we must evaluate the book by Feynman and Hibbs.

In essence this monograph is an expanded version of Feynman's earliest papers on the subject. It is shown that a quantum-mechanical "action" can be defined and the laws of quantum mechanics set forth in terms of a path integral over a function of this "action." Next it is demonstrated that in many cases the detailed evaluation of the path integral can be reduced to the solution of a Schrödinger equation. The following chapter on perturbation methods is just about the same as one would expect in a more orthodox treatment of quantum mechanics. Other topics covered in the book include the theory of harmonic oscillators (the only physical system for which the evaluation of path integrals is relatively easy), elementary quantum electrodynamics, statistical mechanics, and selected topics in the theory of probability.

Even though a considerable portion of the theories of quantum mechanics and statistical mechanics can be reformulated in terms of path integrals, a complete translation would be difficult to make. There is, for example, no satisfactory treatment of systems with spin. Furthermore, the intuitive picture provided by forty years of the development of quantum mechanics has provided an insight into many applications that would be difficult to translate into path-integral terms. For this reason Feynman and Hibbs' book seems to be more of an extended proof of the possibility of reformulating quantum mechanics rather than a demonstration of the desirability of doing so. It would make interesting supplementary reading in a course in quantum mechanics, but could not be used as a main text.

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Nonrelativistic two-body problem

POTENTIAL SCATTERING. By V. de Alfaro and T. Regge. 205 pp. (North Holland, Amsterdam) Interscience, New York, 1965. $8.00.

by Geoffrey Chew

It might seem late in the history of quantum mechanics for a book to be appearing on the nonrelativistic two-body problem, a dynamical system presumed for more than thirty years to be completely understood. In 1958, however, Tullio Regge uncovered a major aspect of this familiar problem that had eluded earlier investigators. Regge's discovery has since had enormous influence on thinking about the general (relativistic) strong interaction problem—giving powerful impetus to the concept described sometimes as the "bootstrap" and sometimes as "nuclear democracy." In collaboration with V. de Alfaro, Regge has now written a monograph entitled *Potential Scattering*, giving a detailed mathematical description not only of his personal contribution to the nonrelativistic model but of nearly all other related contributions.

TULLIO REGGE