200 pages, the author has managed to proceed from wave mechanics to second quantization, modern quantum electrodynamics and the relation of the concepts of quantum theory to those of statistical mechanics and thermodynamics. The discussion is lucid and stimulating throughout. In chapters devoted to fundamentals, the author frequently presents his own point of view, but with sufficient references to the work of others to enable the reader to at least gain entrance to the voluminous literature. Though the diminutive size of the whole book enforced severe selectivity, I find the choices of topics sensitive and defensible. The book is not meant to be an introductory text but will be of considerable use as collateral material to the intermediate or advanced student of quantum mechanics.

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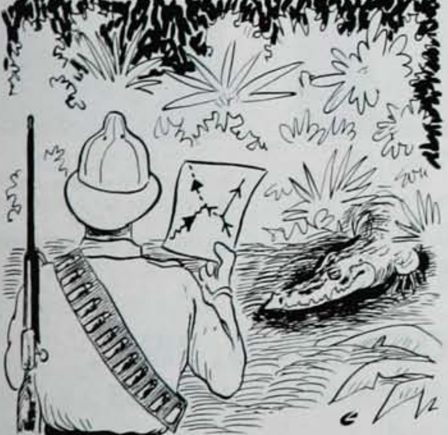
Find your way with Feynman

A GUIDE TO FEYNMAN DIAGRAMS IN THE MANY-BODY PROBLEM. By Richard D. Mattuck, 294 pp. McGraw-Hill, New York, 1967. $10.50

by HOWARD CHANG

The physics of the many-body problem (PMBP) is concerned with the effects of the interactions among the particles of a many-body system on its behavior. Without many idealizations and a powerful gimmick, progress in the PMBP would be impossible. To hope to follow the incredibly complicated motions of the myriad of particles composing the system is, of course, clearly out of the question.

A breakthrough in the PMBP occurred in the late 1950's when the methods of quantum field theory were applied with considerable success to solving problems that had previously resisted all the valiant attempts to crack them. They were usually based on either the semi-phenomenological theory devised by Lev Landau to handle collective excitations and quasiparticles in systems of many fermions, or the diagrammatic technique devised by Richard Feynman in his formulation of quantum electrodynamics. Feynman's technique extends the range of application of standard perturbation theory by facilitating the partial or selection summation of the perturbation series to avoid certain well known divergences.



The purpose of Richard Mattuck's pedagogical jewel is to help bridge the yawning gap between the usual graduate course in quantum mechanics and the previously available books and literature of the PMBP. These books were usually written on such a high level and in such a laconic style that they are completely unintelligible to the average experimenter or the mathematical physicist who is not a specialist in the PMBP. Mattuck's book is not intended to be a textbook but was specifically designed to be an elementary introduction to the handful of textbooks that are already available; it should be very useful as a reference in courses on solid-state and nuclear physics, or it can be used as a crutch for poorly prepared students in a course on the PMBP.

The field-theoretic technique, known as the propagator method, is expounded with great skill and clarity. The seminal idea is that to calculate the important physical properties of a system one need not know the detailed behavior of the particles of the system, but rather, only the average behavior of one or two typical particles. The desired information is contained in the one-particle propagator (or Green's function) and the two-particle propagator. The author uses the Feynman-diagram method to calculate these propagators. Elliott Montroll has observed that Feynman diagrams occupy a rather special place in theoretical physics in that they divide physicists into two distinct classes—those who use them and those who don't. To the first group Feynman diagrams are like a Rosetta stone, but they can never successfully explain the diagrams to the members of the second group, who find them repulsive and not worth learning. One must exercise a certain

amount of unpleasant labor to pass from the second to the first group. Most members of the second group feel that as everything that can be done with Feynman diagrams can probably be accomplished by more straightforward and civilized methods, one should devote the time and labor to something more useful. Mattuck's answer to the last charge is that it is, in principle, possible to do many-body perturbation theory without diagrams, just as it is possible to go through the jungles of the Amazon without a map. However, the probability of survival is much greater if we use them.

The book is divided into three parts: kindergarten (104 pages), elementary (126 pages) and intermediate (27 pages). In chapters 1–6 a clear introduction is given to the major concepts such as Feynman diagrams, elementary excitations, quasi-particles, Green's functions or propagators, the ground-state energy and the vacuum amplitude. The level is that of tutorials written for the *American Journal of Physics*. In chapters 7–16 the standard topics of other books on the PMBP such as occupation-number formalism, Dyson's equation, renormalization, random phase approximation and ladder approximation, the ground-state energy of the electron gas and nuclear matter, self-consistent perturbation theory and the existence of the Fermi surface, collective excitations and the two-particle propagator, Fermi systems at finite temperature and superconductivity are covered at a restricted and physically interesting level. Appendices A through J are devoted to a brief summary of Dirac's formalism and a more rigorous derivation of the rules for the diagrammatic technique that were assumed in the text. Problems are provided at the end of each chapter, and solutions are given at the end of the book. The necessary background for reading this book is a graduate course in quantum mechanics (Schiff, 3rd edition) and in electromagnetic theory (Jackson). Mattuck's fine sense of humor makes his book, which is a labor of love, a great delight to read. Additionally he knows the subject and literature very well and is a trustworthy and reliable Baedeker. A gifted expositor, he never allows the mathematics to obscure the physics. The reader is always given the grand view first; so one sees both the forest and the individual trees.

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H. Chang is Senior Mathematical Physicist, Stanford Research Institute. He says he learned PMBP the hard way "by reading the literature and the pre-Mattuck books."

For accelerator users

PARTICLE ACCELERATION. By J. Rosenblatt. 183 pp. Barnes & Noble, New York, 1968. $5.50

by NORMAN A. BAILY

The development and increasing availability of high-energy charged-particle accelerators has provided a valuable tool not only for nuclear physics, but also biology and medicine, space science and nuclear engineering. Accelerator users cover the spectrum of basic scientists and also include the engineer faced with producing hardware that must survive in nuclear and space environments. In addition cancer patients have been treated for many years with Van de Graaff generators, linear accelerators and even synchrocyclotrons; now there is interest in fast-neutron generators using the d,t reaction.

Although this book purports to serve not only the intermediate undergraduate student of physics but also accelerator users, it is, in my opinion, deficient from this second point of view. To provide insight into the operation and design, the author discusses principles, but they require more background in physics than the average nonphysicist user is likely to have. The book reviews the basic principles of particle physics and nuclear interactions and scattering; the author introduces the particles of high-energy physics and includes a chapter on the fundamental physics associated with particle acceleration. The book includes chapters on static machines, linear and circular accelerators, strong focusing, alternating gradients and azimuthally varying fields. The final chapter discusses recent and anticipated developments and some new principles for machine designs. The book would make an excellent text for a section of an undergraduate nuclear-physics course or can serve admirably