mental apparatus, and—should you react to unexpected ideas) Why? (—does anybody pay for research, and—do you like science)." The discussion is always uncomplicated, the level is kept from becoming deep. You may enjoy reading the book; perhaps you even will learn a point or two.

Emphasis on scattering

ADVANCED QUANTUM THEORY. An Outline of the Fundamental Ideas. By Paul Roman. 735 pp. Addison-Wesley, Reading, Mass., 1965. $17.50.

by D. B. Lichtenberg

By far the largest topic treated in this full and important text is the theory of scattering. The section devoted to this subject alone (Part Two of the book) is large enough to constitute a good-sized volume. In addition, there are introductory chapters on the principles of quantum mechanics and on the Dirac and Klein-Gordon equations (Part One), and two concluding chapters on symmetry principles (Part Three). Appendices on group theory, vector spaces, Dirac matrices and Green's functions complete the volume.

The section on scattering theory invites comparison to the well-known treatise of Goldberger and Watson, *Collision Theory*. Although the present work is not as complete as the work of Goldberger and Watson, it is less formidable and, is more suitable for the graduate student encountering for the first time the problems arising in scattering theory. However, this book is by no means a substitute for Goldberger and Watson.

Roman gives ample discussion to the fundamental concepts arising in the theory of scattering, such as the scattering S matrix, the transition or T matrix, and Möller's wave matrix. Such topics as partial wave analysis and effective range theory are also treated. The author rightfully devotes much attention to dispersion-relation methods and Green's-function techniques.

Disappointing is Roman's rudimentary treatment of the scattering of particles with spin. Although spin is mentioned in various places in the book and although helicity is defined, nowhere does the author use the concept of helicity amplitudes to give an adequate treatment of the scattering of particles with spin. Since one or both of the particles have spin in most problems in nuclear and elementary particle physics, this omission is unfortunate.

On the other hand, Roman has chosen to include a detailed description of the many-body problem, including the treatment of Hugenholtz and methods based on Green's functions. This material is very complicated, perhaps necessarily so. I therefore feel that this topic is too specialized for a text such as this and could have been left out to make room for the material on spin that was omitted. But of course this is a matter of taste.

The section on symmetry principles contains some material borrowed by Roman from his earlier book, *Theory of Elementary Particles*, but the point of view is broader in the present work. The fundamental connection between symmetry and conservation laws is emphasized, as it should be. This treatment is given within the Hamiltonian formalism, but a careless reader may get the impression that the discussion is more general.

Roman discusses how the methods of group theory may be applied to a problem in which a part of the Hamiltonian of a system is invariant under a certain transformation, but a small part is not. Since most of the symmetries in nature are apparently only approximate, this treatment of broken symmetry is useful.

However, the author puts too much stress on the difference between so-called accidental degeneracy and essential degeneracy of quantum mechanical states. For example, in a problem in atomic physics, Roman regards a deviation from the Coulomb potential as one which causes a breaking of an accidental degeneracy. He considers the degeneracy to be accidental because the perturbing term in the Hamiltonian has the same symmetry as the Coulomb term: namely symmetry under the three-dimensional rotation group. But there is another way of looking at the problem. In this second picture, which Roman mentions but does not emphasize, the Coulomb Hamiltonian is regarded as having a hidden higher symmetry: the symmetry of the rotation group in four dimensions. It is this higher symmetry that is related to the extra degeneracy, in which the energy of a state does not depend on its orbital angular momentum. The perturbing term, in this point of view, breaks the higher symmetry, and there remains only the degeneracy of states with the same orbital angular momentum and different spatial orientation.

But most of my criticisms of this work are minor and do not seriously mar this serious, well-thought-out and well-written book.

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What is QED?

QUANTUM ELECTRODYNAMICS. By A. I. Akhiezer and V. B. Berestetskii. Translated from Russian by G. M. Volkhoff. 868 pages. Interscience, New York, 1965. $22.50.

by Howard H. C. Chang

Since the beginning of the Space Age on 4 October 1957, Russian books on science and mathematics have been translated into English at a great rate. This practice is not an unalloyed bonanza, for poorly written and obsolete Russian books have been foisted on the unsuspecting public. Additionally, since the USSR is not a signatory of the Berne Convention regarding copyrights and there are no restraints on the publication of translations of Russian books, the practice has led in recent years to the appearance of two, and even more, translations of the same book. It is not all chaos, though, for Mezhkniga in Moscow keeps a detailed and up-to-date account of Western publishers preparing translations. When properly approached, Russian authors gladly assist their translators, providing them not only with errata, but often with an enlarged or revised edition.

Quantum Electrodynamics has a

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