tations by the late James E. McDonald, first published in the *American Journal of Physics*, on the classical thermodynamics and kinetic aspects of vapor–droplet condensation. In thirty pages, the novice will find a well written account of what is a prerequisite to a serious study of nucleation.

It should be understood that the book summarizes theoretical developments according to the author's predilections. Yet these developments are masterfully compared to those of other and earlier approaches. Experimental methods and results are only briefly discussed, yet what is given is directly to the point. For an excellent review of experimental research in homogeneous nucleation in pure vapors, the reader is directed to G. M. Pound's presentation in *J. Phys. Chem. Ref. Data* **1**, 119 (1972).

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Quantum Mechanics: Principles and Applications

M. Alonso, H. Valk
641 pp. Addison-Wesley, Reading, Mass., 1973. $16.95 hardcover, $9.95 paperback

Quantum Mechanics: New Approaches to Selected Topics

H. J. Lipkin
465 pp. Elsevier, New York, 1973. $37.50

There are now many good textbooks on graduate-level (or senior-level) quantum mechanics such as those by Schiff, Messiah, Dicke and Wittke, Merzbacher, Gottfried, and Bethe and Jackiw. Even though no single one of these texts can be said to be completely satisfactory, I know from my own experience in teaching quantum mechanics over the past thirteen years at the University of Chicago and UCLA that one can give, without too much effort, a fairly decent course on quantum mechanics by taking a proper "linear combination" of the existing textbooks. Anybody who embarks on the time-consuming task of writing yet another book on quantum mechanics may first ask: Is it really worthwhile? This review concerns two very different 1973 additions to the plethora of quantum mechanics textbooks with this question in mind.

Let us begin with *Quantum Mechanics: Principles and Applications* by Marcello Alonso and Henry Valk. As the title suggests, the book covers fairly standard topics with emphasis on applications. The beginning part is rather elementary—at the level of undergraduate seniors in most US institutions—while towards the end of the book the authors treat many topics that are normally covered in second-year graduate-level courses. Seldom do we find *under a single cover* elementary topics such as one-dimensional barrier problems and the hydrogen-atom wave functions, intermediate topics such as the Wigner–Eckard theorem and scattering by spin-dependent forces and advanced topics such as high-density Fermi fluids à la Brueckner and Goldstone and the derivation of the Feynman rules from Wick's theorem. Throughout the book we often encounter topics normally covered in courses in nuclear physics and atomic structure; for example, there is a treatment of the static properties of the deuteron with tensor force in all its glory and a rather detailed discussion of term energies in complex atoms.

The main defect of the book is that it does not explain in sufficient depth some of the difficulties the student is likely to face in learning quantum mechanics seriously for the first time. For example, nowhere in the book do the authors discuss the quantum theory of measurements, by far the most difficult subject for both students and instructors alike. This omission can be contrasted, for instance, with an excellent treatment of measurement processes found in Kurt Gottfried's *Quantum Mechanics* (W. A. Benjamin, 1966) where the concept of quantum-mechanical measurement as a selection or projection process is expounded using the elegant measurement algebra of Julian Schwinger. Where the $+i\eta$ prescription (or the $+i\epsilon$ prescription) appears for the first time in time-dependent perturbation theory (page 367), the authors casually remark, "the + sign is required for causality"; to the extent that the book is meant for advanced undergraduates and beginning graduate students who may be mystified by such a remark, a more complete discussion on this point appears desirable.

It is regrettable that the book contains some sloppy and misleading (if not totally wrong) statements. For example, the authors state, "Since energy and time are canonically conjugate quantities, we may assume that they satisfy the uncertainty relation $\Delta E \Delta t \approx \hbar$." If there is anything I teach to my students in this connection, it is that in nonrelativistic quantum mechanics, time is not a dynamical variable in the same sense as the coordinates—who has ever heard of the "time operator" in quantum mechanics?—hence the $\Delta E \Delta t$ uncertainty relation is not on the same footing as the $\Delta x \Delta p$ uncertainty relation, which is derivable from the basic commutation relation between momentum and coordinate. As another example, the authors remark in italics, *"If two operators have*

the same eigenvectors, then they commute"; an s state electron is a simultaneous eigenstate of L_x and L_z, yet L_x and L_z do not commute; a free particle at rest is a simultaneous eigenstate of momentum and parity, yet the momentum and the parity operator *anticommute*.

In summary the whole book looks like somewhat hastily put-together lecture notes covering a tremendously wide range of topics. When judged as lecture notes rather than as a textbook, I feel that the excellent set of notes, *Lectures on Quantum Mechanics* by Gordon Baym (W. A. Benjamin, 1969) has a considerable edge over this book.

The second book under consideration in this review is Harry Lipkin's *Quantum Mechanics: New Approaches to Selected Topics.* This book is completely different from any of the standard textbooks as far as the selection of topics is concerned. It is more like a collection of special-topics monographs to supplement the usual texts listed at the beginning of this review.

Lipkin attempts essentially two things. First, the book is written in such a way that some of the elementary concepts the reader presumably has learned in an earlier course in quantum mechanics are reviewed, more or less automatically, in a very original and refreshing manner as he goes through the book.

The second object of this book is to introduce the reader, at a relatively early stage, to some "advanced" topics such as the BCS theory, collective excitations in many-body systems and the Lorentz group. As the author states in the preface the book grew out of lectures he gave at the University of Illinois and the Weizmann Institute, where he realized that many of the recent developments such as neutral K mesons and the Mössbauer effect can be taught at an elementary level to first-year graduate students. He presents these advanced topics using what he calls "pedestrian approaches." Indeed, each part of the book has a heading, "something for pedestrians"—scattering for pedestrians, the many-body problem for pedestrians, Feynman diagrams for pedestrians. (Incidentally, the author has previously written *Lie Groups for Pedestrians* (North-Holland, 1965) as well as a number of review articles with titles like "Quarks for Pedestrians" and "The Middle East for Pedestrians.")

The book devotes nearly half of its space to many-body quantum mechanics. This part of the book (chapters 5, 6, 9, 10 and 11) can be regarded as a self-contained monograph, which can be studied profitably especially by those who have neither time nor strength to go through such standard textbooks on many-body theory as *Quantum Theory of Many Particle Systems* by A. Fetter

and J. D. Walecka (McGraw-Hill, 1971). In the chapter on identical composite particles, there is a nice discussion on the question of at what stage bound fermion pairs like deuterons cease to behave like simple bosons, and the author then demonstrates how BCS-type energy gaps may arise in a hypothetical deuteron model. Here we see once again another example of the author's remarkable ability to invent simplified models that have many features of realistic physical situations. Pairing correlations are treated again in chapter 10 where the basic equation of the energy-gap parameter is discussed in some detail.

One of the pleasing aspects of this book is that many parts of the book can be regarded as completely independent and self-contained expositions of specialized topics. For example in chapter 12, which deals with Feynman diagrams, there is a seven-page section on polarons that can be understood by anybody with a rudimentary knowledge of creation and annihilation operators; to profit from this section it is not at all necessary to go through the 365 pages that precede it. In this sense the book is ideal for instructors and students of quantum mechanics who want to get into something a little different from the "standard" topics covered in conventional textbooks.

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new books

Elementary Particles and Fields

Phenomenology of Particles at High Energies. (Proc. of 14th Scottish Univ. Summer School, 1973). R. L. Crawford, R. Jennings, eds. 744 pp. Academic, New York, 1974. $46.75

Proc. of the Fifth Hawaii Topical Conf. in Particle Physics (1973). P. N. Dobson Jr, V. Z. Peterson, S. F. Tuan, eds. 710 pp. U. Press of Hawaii, Honolulu, 1974. $15.00

Nuclei, Nuclear Physics

Nuclear Physics. (Springer Tracts in Modern Physics 71). H. Überall, P. Singer, J. S. Levinger. 245 pp. Springer-Verlag, New York, 1974. $37.80

Q-Values and Excitation Functions of Nuclear Reactions. (Landolt–Börnstein New Series Group I, Vol. 5, Part C). H. Münzel, J. Lange, K. A. Keller. 257 pp. Springer-Verlag, New York, 1974. $65.30

Chemical Physics

Low Energy Electron Diffraction: The Theory and its Application to Determination of Surface Structure. J. B. Pendry. 407 pp. Academic, New York, 1974. $22.25