troducing topics such as the Thomas precession, and some *qualitative* indications of the few spectacular successes of relativistic quantum mechanics.

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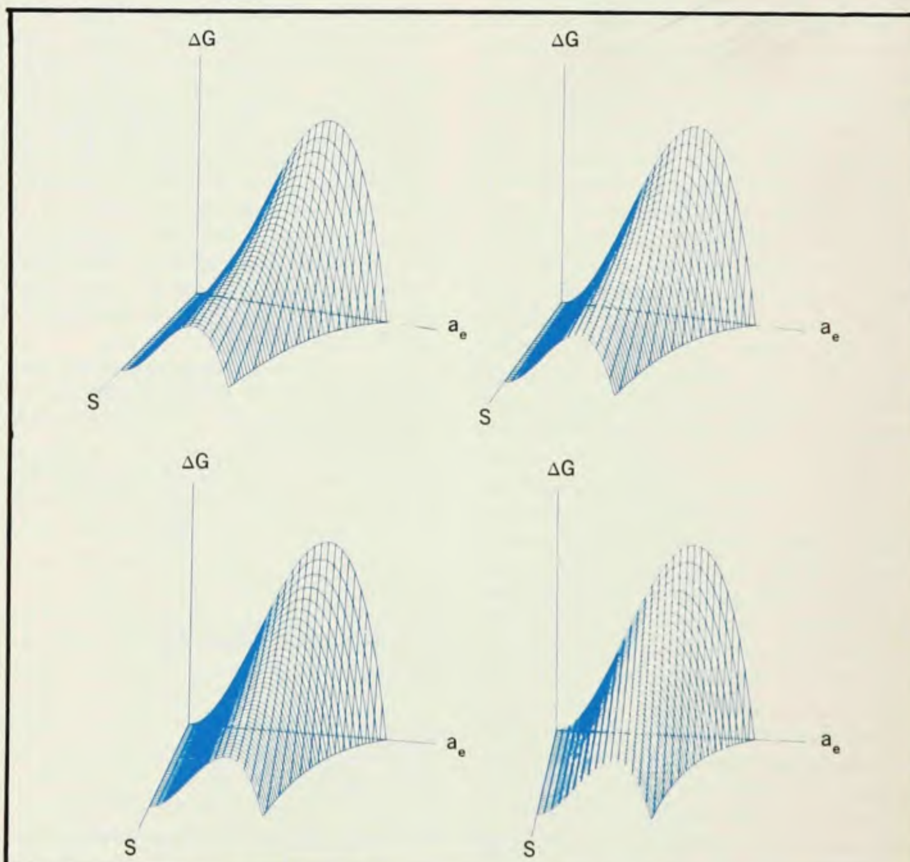
Homogeneous Nucleation Theory

F. F. Abraham
263 pp. Academic, New York, 1974. $23.00

Nucleation has become a major subject for scientific investigation throughout the world. Some of the subfields undergoing vigorous investigation, both theoretically and experimentally include nucleation in the atmosphere (cloud formation and precipitation), from solution, in metals, in semiconductors, in glasses, in void and in bubble formation. The practical importance of nucleation phenomena is shown by the fact that industrial scientists, such as Farid Fadlow Abraham, as well as academic scientists, are important contributors. Phase changes occur with difficulty in homogeneous systems, but they are usually aided by heterogeneities—any housewife who has tried to boil water knows this. The detailed processes by which heterogeneities catalyze phase changes are little understood and remain a major challenge. Yet our understanding of heterogeneous nucleation must ultimately rest on our understanding of homogeneous nucleation. Thus the importance of Abraham's book, even beyond the phase change he describes becomes apparent.

Abraham dwells on the pretransition theory of vapor condensation following the historical order of his own studies. These studies began with the classical thermodynamics of homogeneous nucleation and continued with the statistical mechanics and multistate kinetics of this pretransition phenomenon. The physical cluster model of the imperfect vapor, that the author leads up to, has been the basis for most of Abraham's studies. The cluster model bridges the gap between the important strides that have been recently made in our understanding of both dense gases and condensed matter. The Monte Carlo simulation of physical clusters, which has been a recent contribution of Abraham and his co-workers, has helped to resolve some of the controversies. This is its first presentation in a monograph.

The book concludes with two presen-



"As the supersaturation becomes larger, the critical free-energy barrier decreases and shifts to smaller droplet sizes." These four perspectives show the free-energy surface as a function of supersaturation ratio S (for $2 \leq S \leq 8$) and droplet radius a_e for a vapor–drop system of water at 263.2 K. From F. F. Abraham's monograph *Homogeneous Nucleation Theory.*

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*