role of experiment—the imbalance can reach the point of outright mythologizing, as with the allegedly crucial relevance to Einstein's work on special relativity of the Michelson-Morley experiment, which Holton shows to have been, in actual fact, quite marginal in its significance. Another example is an exposition of the history of science in which the technicalities of some limited area are totally abstracted from their wider context—as though the religious speculations of a Kepler or a Newton, the musical theories of a Galileo, or Bohr's interest in the philosophical psychology of William James were connected in no more than an accidental way with his work in physics, instead of being a further, connected expression of the same mind at work.

The other, more specific, novel idea around which this book is organized has to do with the notion of *themata*, which is embodied in its very title. The missing link in too many accounts of science, Holton argues, is the role played by certain leading patterns of ideas—notably by certain pairs of contrasted ideas—most of which were introduced into the scientific debate as early as the pre-Socratic philosophers of the 6th century BC, and which have continued to guide the development of our ideas about Nature (of our scientific *Bild*, or "intellectual representation") throughout the subsequent eras. Anyone who studies the transformations of natural science down the centuries with any perceptiveness is forced to recognize that there can never be a final or definitive choice between (say) an atomistic and a continuum view of matter, or between a static, structural and a dynamic, evolutionary view of physiological form. Rather, the thema *atom* and the thema *continuum* represent poles between which the continuing debate about matter or form moves, pendulum-like—both elements in any such pair of "conjugate notions" have continuing parts to play in a comprehensive account of the theories involved. (There is thus a deep *epistemological* wisdom embodied in Bohr's theory of complementarity. This fact, quite as much as its physical significance, commended the theory to Bohr himself.)

As a crowning merit of this book, Holton writes with an easy, readable style. There is nothing in these essays beyond the grasp of the average *Scientific American* reader, and the actual manner has a bite and elegance that the *Scientific American* house-style rarely permits. Minutiae apart, one can have no complaints about the book, except those of Tantalus—that Holton whets our appetites at a hundred points for more explorations along the same lines that he has opened up here. His book deserves to have a permanent influence on the work of historians, philosophers and sociologists of science, as well as on educationists and intellectual historians, but it can also be most strongly recommended to the general reader.

HOLTON

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An Introduction to Statistical Mechanics

P. Dennery
118 pp. Halsted, New York, 1972. $9.75

Philippe Dennery is a French high-energy elementary-particle and field theorist at the University of Paris at Orsay, having previously been at CERN and at the University of Pennsylvania. He is the co-author with André Krzywicki of "Mathematics for Physicists" (Harper and Row). That book is rather formal and mathematical but well put together, and corresponds to a well defined text for American use in graduate courses. The present book does not cross the Atlantic so readily.

The dust jacket states that *An Introduction to Statistical Mechanics* is for undergraduates or for graduate students, while the introduction talks of first- or second-year graduates. It is very slim and is indeed only an introduction, so that its most likely use would be for undergraduates. However, it is far more concerned with the formulation than the applications and physics of statistical mechanics.

Dennery attempts to bypass all the usual postulates of statistical mechanics, for example, equal *a priori* probabilities, the definition of the state of thermodynamic equilibrium, and the Gibbs postulate that thermodynamic properties should be obtained by taking ensemble averages. In place of all this, he follows a treatment originally given by Henry Primakoff and A. Sher. He commences by postulating the master equation, which governs the time variation of the probability p_i that a micro-system is in a state "i." I had looked forward with interest to studying this alternative approach to the basis of statistical mechanics, but found myself very disappointed.

No discussion of the master equation is given, though a four-page appendix presents Pauli's original proof. The author does present a four page mathematical solution of the master equation for very long times $t \to \infty$, where it is found that $p_i(\infty)$ is a universal constant, for each state that is accessible to the system for a total energy given as $\mathcal{E}$ with a small uncertainty $\Delta\mathcal{E}$. Or in other words, equal probabilities for all states in a microcanonical distribution.

At this point the development merges with any standard development that simply "postulates" the microcanonical distribution for an energy isolated system. Dennery next considers a super-system made up of a system plus heat reservoir, with the super-system in a microcanonical distribution, and by doing the standard Taylor expansions he "obtains" the canonical and grand canonical distributions. (All in three pages with no physical discussion in contrast to the thorough undergraduate-level discussion given in F. Reif's *Statistical and Thermal Physics* or the graduate-level presentation with several different "derivations" given in Ryogo Kubo's *Statistical Mechanics*.) After simply defining the statistical entropy S of a supersystem, the author uses the master equation once more to "prove" that $dS/dt > 0$.

The rest of the book gives a very sketchy and brief treatment of several standard topics. There is a chapter on the various classical and quantal perfect gases, with essentially no physical discussion, and no plotted graphs. This is rather surprisingly followed by a fairly thorough introduction to the imperfect classical gas, using the method of Van Kampen and ending with a calculation of the third virial coefficient for a hard-sphere gas. This material is certainly not included in most introductory texts, even for graduates.

The level of the text then jumps

back drastically, and attempts to introduce the phonon theory of solids from scratch, commencing with second quantization of the harmonic oscillator. The Debye theory is presented with very little discussion, but one actual graph of C_v versus T. After which there appears a discussion of the effective mass of electrons in a crystal, which leads into a final brief discussion of the Boltzmann transport equation for electrical conductivity.

Regretfully, I cannot see any likely American market for such a book for any typical audience. I would hazard the guess that it originated as a brief set of lectures to a very special audience, but I find it hard to imagine that audience.

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Many-Body Problems

G. E. Brown
232 pp. Elsevier, New York, 1972. $13.75

The Many-Body Problems in Quantum Mechanics

N. H. March, W. H. Young and S. Sampanthar
459 pp. Cambridge U. P., New York, 1967. $7.50

The quantum-mechanical many-body problem and the physical concepts that emerge from its mathematical methods certainly are central to modern physics. Several proceedings, survey articles and many monographs on this topic have appeared over the last ten to twelve years, but few, if any, of these could really serve as a course text. It is, therefore, with great anticipation that the physics teacher opens each new treatise on the many-body problem, hoping to find a text that can guide the graduate student wanting to learn the techniques and language of many-body physics.

Both of the books reviewed here give accounts in varying detail and of different scope of such topics as Fermi fluids, many-body perturbation theory, superconductivity and Green's function theory. While the two texts cover the same topics, they are sufficiently different in style, aim and origin to warrant separate reviews.

There is a tendency in books on many-body theory to emphasize the treatment of extended systems as the electron gas and nuclear matter and almost exclusively work in a plane-wave basis. The books reviewed here are no exception in this regard and therefore do no attempt to fill the need for texts emphasizing many-body techniques applied to finite systems as atoms, molecules and atomic nuclei.

The Many-Body Problem in Quantum Mechanics by N. H. March, W. H. Young, and S. Sampanthar, published in 1967 by Cambridge University Press, is a deliberate treatise giving considerable detail in both formalism and physical arguments. Its pedagogical style and illustrative problems in each chapter make it highly suitable as a text for an advanced graduate course. *Many-Body Problems* by G. E. Brown, published by North-Holland/American Elsevier in 1972, follows closely from lectures given by the author at Copenhagen, Princeton and Stony Brook over a period of several years. The style of presentation has the captivating flavor of the immediacy of the classroom lecture, but the transcription of the lectures into a text seems to have left out many of the clarifying side remarks of the lecturer. The effort necessary to follow many of the mathematical steps in detail is unduly great for the many-body novice, and makes the book less suitable for a course text. Parts of this book still are enjoyable reading for the physicist who has already some familiarity with the ideas of many-body theory.

The authors have outstanding qualifications to write about the many-body problem both with insight and engagement. Norman H. March, presently professor of physics at Imperial College, London, has written numerous research papers in the field of many-electron physics, some together with W. H. Young and S. Sampanthar. Gerald E. Brown is professor at the State University of New York at Stony Brook and has made distinguished contributions to the field of many-body theory, particularly in nuclear physics.

The Many-Body Problem in Quantum Mechanics contains ten chapters with the material divided about half and half between mathematical methods on the one hand and applications to physical systems on the other.

The ideas of the Fermi hole and the correlation hole are introduced in a brief chapter on atoms and molecules, which also presents the Hartree–Fock method and the Fermi–Thomas theory. The only molecular system considered is the hydrogen molecule, and the treatment is more qualitative than quantitative.

The formalism developed includes

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