# Book Reviews

## Toward a Unification of Nuclear Physics

**Nuclear Structure**. Vol. 2, Nuclear Deformations. AAGE BOHR and BEN R. MOTTELSON. Benjamin, Reading, Mass., 1975. xviii, 748 pp., illus. $37.50.

Nuclear structure physics has become a vast subject of bewildering variety, lacking a small set of dominant problems about which research and progress can be centered. There are many different kinds of nuclei and a remarkable range of properties and excitations by which they can be studied. A study of a class of reactions such as single-nucleon transfer will exaggerate the single-particle aspects of nuclear behavior; a study of electric-quadrupole gamma transitions will focus on one mode of collective excitation; in some processes hydrodynamical behavior is exhibited whereas in others the nucleus behaves as a Fermi gas; symmetries—rigid-body symmetries, which operate in the space in which we live, as well as symmetries in abstract spaces of many types—are often significant; some features of nuclear behavior follow statistical laws, both at high excitation energy, which is not surprising, and in the ground-state domain, which is. Many of these phenomena, moreover, show up in the same nucleus, and often the same nuclear property or reaction can be understood in several ways, the relationship between them then becoming a matter of interest. With interest in heavy-ion reactions and nuclear physics at higher energies increasing, we can look forward to even greater variety and complexity.

The great work of Bohr and Mottelson beginning in the early 1950's was directed toward a partial unification of the subject, and the "unified model," in which the nucleus was represented in terms of the rotation of an intrinsic structure, was astonishingly successful in correlating and "explaining" an enormous range of experimental results. The first two chapters of this book, on rotations and on some aspects of intrinsic structure, give an extensive, and of course entirely authoritative, account of the interplay between the rotational and the instrinsic degrees of freedom. It is good to be reminded of the great precision with which the macroscopic concept of rigid-body rotation is applicable to a system in which the number of particles is small, the interactions are fairly strong, and there is no fixed center of force.

The final chapter, which takes up more than half the book, is directed toward a further unification, through a systematic development of nuclear vibrational motion, considered especially in terms of the fields produced by collective distortions of the average nuclear density. Here, of course, the variety and complexities mentioned above imply a great variety of modes and couplings, and the book introduces a notation and point of view that make it possible to treat them in a uniform way. The methods used connect well with methods used in other many-body domains (plasmas and metals, for example), which is quite appropriate since nuclear behavior itself exhibits such connections. It seems probable that the point of view extolled in this chapter will prevail, and those who are interested, for example, in giant resonance and similar phenomena may as well begin to talk in these terms. It remains to be seen, however, to what extent the present treatment of collective modes will lead to major advances in understanding. It is not clear to the reviewer that the almost direct transcription of nuclear data into theoretical terms, which is involved here, will be successful in establishing all the important collective modes, or that all the significant behavior can in any case be described in terms of a small number of such modes.

The book, with its precursor volume, can serve as a textbook, reference book, and research companion, as well as being a good source for those working in other many-body domains who wish to learn how their own subjects relate to nuclear physics. The writing is graceful, the discussion is for the most part satisfying, and the examples are enlightening. At many points reference is made to analogs found in other domains of physics.

It is not a criticism to say that the book is by no means a complete account of nuclear structure or of nuclear theory; it could not be, nor was it intended to be. One need not be much concerned that little attention is paid to the methods and results of conventional theoretical spectroscopy or to abstract-space symmetries, for there are many sources for the first of these, and the subject of symmetries has recently fallen into some disfavor (though it may revive with new experimental results on multi-particle transfer and new theoretical techniques). It does seem unfortunate, though, that so little consideration is given to the question *why* nuclei exhibit simple behavior and to the connection of such behavior with the properties of the nucleon-nucleon force (or at least of the effective interaction between nucleons in a nucleus, which is also reasonably well known). In fact, my only real criticism of this important book is that it does not often enough seek a more fundamental basis for the beautiful concepts with which it deals.

J. B. FRENCH
*Department of Physics and Astronomy, University of Rochester, Rochester, New York*

## Polymer Chemistry

**Molecular Behaviour and the Development of Polymeric Materials.** A. LEDWITH and A. M. NORTH, Eds. Halsted (Wiley), New York, and Chapman and Hall, London, 1975. xii, 554 pp., illus. $37.50.

C. E. H. Bawn, whose retirement after decades of major accomplishment is commemorated in this book, wrote one of the early comprehensive texts on modern polymer chemistry. That text was the first overview of the subject seen by this reviewer, and its style and insight have kept it on my shelves for 25 years, albeit now also in honored retirement.

The present book, a festschrift by colleagues mainly from the United Kingdom, was presumably not conceived as a text. But it might well serve that purpose for the graduate student or fresh Ph.D. who has dutifully read the chapters on polymers in his organic and physical chemistry books and now finds himself drawn to this science.

In 14 chapters that virtually span the subject, broad and authoritative reviews are given of topics in polymerization kinetics and the structure and properties of materials from the phenomenological and molecular points of view. With very few exceptions, a conscientious attempt is made to survey the historical development of the subject. Of the 17 contributors, six are listed as having predominantly industrial research affilia-