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Models and Theory

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Preface to the reprinted edition

Much has happened in nuclear physics since this book was published in 1970. However, the remarkable fact is that this book is as useful today as it was at that time. Bohr's macroscopic collective model continues to provide the language and physical concepts for the description of nuclear collective dynamics; the shell model continues to provide the underlying microscopic framework for the theory of nuclear structure in terms of interacting neutrons and protons; and the unified model, in a variety of manifestations, continues to provide an interpretation of collective phenomena in terms of nucleons in a mean field with collective degrees of freedom.

One thing that has changed dramatically is the development of accelerator and detector techniques which have made it possible to study a vastly wider range of nuclei in more detail and with greater precision. As a result, a much deeper understanding of what is going on in different regions of the nuclear periodic table has been achieved. Nevertheless, the dominant nuclear phenomena continue to have an explanation in terms of the model concepts outlined in this 1970 book.

On the theoretical side, a major advance is the recognition of what can be achieved with the use of dynamical symmetries and spectrum generating algebras. Algebraic methods have made it possible to carry out collective-model and shell-model calculations in many situations. The shell model has been put on a more solid basis and, most importantly, the variety of nuclear collective motions have been shown to be associated with dynamical symmetries and corresponding shell-model coupling schemes. These many advances and the consequent unification of the collective model and shell-model descriptions of nuclear structure are described in the recently published book *Fundamentals of Nuclear Models* coauthored with J.L. Wood.

Practicing nuclear physicists, already familiar with the standard nuclear structure methods described in this book, will progress very naturally to an easy appreciation of the deeper treatment of the subject given in *Fundamentals of Nuclear Models*. However, while little advance knowledge is essential for an understanding of this more recent book,