SHELL-MODEL CONFIGURATION MIXING - PHENOMENOLOGY AND FOUNDATIONS*

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The phenomenological methods that have evolved for large-basis shell-model calculations over the last 40 years [1] will be outlined. They are applicable to all regions of nuclei, and provide a quantitative understanding of a wide range of experimental data. The applications can be expanded as the computational power and techniques improve. They provide the required input for nuclear properties that cannot be measured directly for use in nuclear astrophysics and weak interaction physics. The methods can be used to make extrapolations to new regions of nuclei. Failure in the extrapolation can be traced to an inadequacy of the assumed model space or to incorrect single-particle properties. The renormalized G matrix provides an essentially starting point for the hamiltonian. However, this must be supplemented by experimental data on single-particle energies and by adjustments to the two-body matrix elements. I will focus on an example of how shell-model configuration mixing has been applied to the oxygen isotopes out to the neutron drip line [2]. Comments on the foundations of the methods and the connections with no-core shell model and Hartree-Fock methods will be made.

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[1] B. A. Brown, Prog. in Part. and Nucl. Phys. **47**, 517 (2001).
[2] M. Stanoiu et al., Phys. Rev. C **69** 034312 (2004).