Effective interactions for the nuclear shell model

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An overview of the theory of effective interactions [1] with applications to shell model studies will be presented, with emphasis on the present status of the derivation of two and three-body interactions.

Results from large-scale shell model studies for nuclei with mass numbers $A \sim 88 - 146$ will be discussed. Especially, the importance of core degrees of freedom through multi-shell calculations are addressed.

For neutron rich isotopes such as the chain of tin isotopes, we present also an analysis of pairing correlations and link this to specific partial waves of the underlying nucleon-nucleon interaction itself. Connections to studies of superfluidity in dense neutron star matter [2] will also be highlighted.

[1] M. Hjorth-Jensen. T. T. S. Kuo and E. Osnes, Phys. Rep. **261**, 125 (1995).
[2] H. Heiselberg and M. Hjorth-Jensen, Phys. Rep. **328**, 237 (2000).