CGSM and MBPT calculations with realistic nuclear forces

Furong Xu
School of Physics, Peking University, Beijing 100871, China

Starting from realistic nuclear forces, we have developed the core Gamow shell model (CGSM) calculation. The Gamow basis in the Berggren framework provides a good representation to include bound, resonance and scattering continuum states on an equal footing. Realistic nuclear forces are softened by using the $V_{low\ k}$ method. The folded diagram has been used to generate the effective interaction within a non-degenerated model space. We have calculated oxygen isotopes with taking ^{16}O as a core. The calculations can well describe the excitation energies and decay widths (against particle emissions) of excited states [1].

The many-body perturbation theory (MBPT) has been applied to the structure of closed-shell nuclei, ^{4}He and ^{16}O. The two-body N^{3}LO interaction is softened by using the similarity renormalization group transformation. The MBPT calculations are performed within the Hartree-Fock (HF) bases which provide superior convergence properties relative to the harmonic oscillator bases. The angular momentum coupled scheme is used, which can reduce the computational task. Corrections up to the third order in energy and up to the second order in radius are considered. Using the anti-symmetrized Goldstone diagram expansions of wave function, we directly correct the one-body density for the calculation of the radius, rather than calculate corrections to the occupation propabilities of single-particle orbits as done in the literatures. Calculations are compared with experimental data, showing reasonable convergence [2].

Collaborators: Z. H. Sun, B. H. Hu, Q. Wu, Z. H. Zhao, T. Li, and J.P. Vary.

References:

[1] Z. H. Sun, Q. Wu, Z. H. Zhao, F.R. Xu, to be submitted.
[2] B. S. Hu, F.R. Xu, Z. H. Sun, J.P. Vary, T. Li, to be submitted.