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Extrapolation of bound state energies obtained in the oscillator basis

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An extrapolation of *ab initio* results to get more accurate observables became a trend in nuclear physics [1-4]. We consider calculations of binding energies in oscillator basis, which depend on two
basis parameters, the oscillator frequency, $\hbar\Omega$, and the oscillator quanta, N. We study general convergence patterns of these calculations. We use the SS-HORSE (single-state harmonic-oscillator representation of scattering equations) approach [5], extended to the case of bound states. Within this method, we extract the S-matrix from the results obtained in oscillator basis, and locate S-matrix poles associated with bound states. The respective binding energies improve the variational results obtained by the pure diagonalization in oscillator basis [6]. In this way we can extrapolate binding energies to the infinite basis and eliminate the dependence on basis parameters. By calculating the S-matrix pole, we can also calculate the asymptotic normalization constant. Till now we use a two-particle model problem with known exact solution to verify our method with an idea to apply it later to many-body shell-model afterwards. We compare also our method with approaches of Ref. [1-3].

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Author: KULIKOV, Vasily (Skobeltsyn Institute of Nuclear Physics, Moscow State University, Moscow, Russia)

Co-authors: SHIROKOV, A. M. (Skobeltsyn Institute of Nuclear Physics, Moscow State University, Moscow, Russia; Department of Physics and Astronomy, Iowa State University, Ames IA, USA; Pacific National University, Khabarovsk, Russia);   MAZUR, A. I. (Pacific National University, Khabarovsk, Russia)

Presenter: KULIKOV, Vasily (Skobeltsyn Institute of Nuclear Physics, Moscow State University, Moscow, Russia)

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