

Convergence of calculations in oscillator basis

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We study general convergence trends of binding energy calculations in oscillator basis depending on two basis parameters, the oscillator frequency, $\hbar\Omega$, and maximal oscillator quanta, N . We propose and test a new method which suggests extending the Hamiltonian matrix by the kinetic energy matrix elements. We study also convergence of calculations with smoothed potential matrix elements [1].

We use the SS-HORSE (single-state harmonic-oscillator representation of scattering equations) approach [2] extended to the case of bound states [3]. Within this method, we extract the S matrix from the results of variational calculations with oscillator basis and locate the S -matrix poles associated with bound states. The respective binding energies improve the variational results and provide an extrapolation of the variational binding energies to the infinite basis space. A great advantage of our approach as compared with other extrapolation techniques suggested in current literature [4–6] is that it makes possible to calculate also asymptotic normalization constants.

References:

1. J. Révai, M. Sotona and J. Žofka, *J. Phys. G* **11**, 745 (1985).
2. A. M. Shirokov, A. I. Mazur, I. A. Mazur and J. P. Vary, *Phys. Rev. C* **94**, 064320 (2016).
3. A. M. Shirokov, V. A. Kulikov and A. I. Mazur, *Phys. At. Nucl.* **82**, 285 (2019).
4. Yu. A. Lurie and A. M. Shirokov, *Ann. Phys. (NY)*, **312**, 284 (2004).
5. P. Maris, J. P. Vary and A. M. Shirokov, *Phys. Rev. C* **79**, 014308 (2009).
6. S. A. Coon, M. I. Avetian, M. K. G. Kruse, U. van Kolck, P. Maris and J. P. Vary, *Phys. Rev. C* **86**, 054002 (2012).
7. R. J. Furnstahl, G. Hagen and T. Papenbrock, *Phys. Rev. C* **86**, 031301(R) (2012).

Primary authors: SHIROKOV, Andrey (Lomonosov Moscow State University, Russia; Pacific National University, Khabarovsk, Russia; Iowa State University, Ames, USA); KULIKOV, Vasily (Lomonosov Moscow State University); MAZUR, Aleksandr (Pacific National University, Khabarovsk, Russia)

Presenter: KULIKOV, Vasily (Lomonosov Moscow State University)

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