DEUTRON-EQUIVALENT PHASE-EQUIVALENT TRANSFORMATION AND ITS MANIFESTATION IN MANY-BODY SYSTEMS.

A.M. Shirokov[1,2,3], V.A. Kulikov[1], J.P. Vary[2], A.I. Mazur[3], P. Maris[2]
[1]*Skobeltsyn Institute of Nuclear Physics, Moscow State University, Moscow, Russia;*
[2]*Department of Physics and Astronomy, Iowa State University, Ames IA, USA;*
[3]*Pacific National University, Khabarovsk, Russia;*
E-mail: kulikov@nucl-th.sinp.msu.ru

Phase-equivalent transformations (PETs) are well known in quantum scattering and inverse scattering theory [1]. PETs do not affect scattering phase shifts and bound-state energies of a two-body system but are conventionally supposed to modify two-body bound-state observables such as the rms radius and electromagnetic moments. In order to preserve all bound-state observables, we propose a new particular case of PETs, a deuteron-equivalent transformation (DET-PET), which leaves unchanged not only scattering phase shifts and bound-state (deuteron) binding energy but also the bound-state wave function. We apply the simplest cases of DET-PETs to the JISP16 *NN* interaction [2] and use the transformed *NN* interactions in calculations of ^{3}H and ^{4}He binding energies in the *ab initio* no-core full configuration (NCFC) approach [5] based on extrapolations of the no-core shell model (NCSM) [6] basis space results to the infinite basis space.

We demonstrate the DET-PET modification of the *np* scattering wave functions and study the DET-PET manifestation in the binding energies of ^{3}H and ^{4}He nuclei and their correlation (Tjon line). It is shown that some DET-PETs generate modifications of the central component while the others modify the tensor component of the *NN* interaction. DET-PETs are able to modify significantly the *np* scattering wave functions and hence the off-shell properties of the *NN* interaction. DET-PETs give rise to significant changes in the binding energies of ^{3}H (in the range of approximately 1.5 MeV) and ^{4}He (in the range of more than 9 MeV) and are able to modify the correlation patterns of binding energies of these nuclei.

1. R. G. Newton, *Scattering Theory of Waves and Particles*, 2nd ed. (Springer-Verlag, New York, 1982).
2. A. M. Shirokov, J. P. Vary, A. I. Mazur, T. A. Weber // Phys. Lett. B, 2007, V. **644**, P. 33.
3. P. Maris, J. P. Vary, A. M. Shirokov // Phys. Rev. C, 2009, V. **79**, 014308.
4. P. Navrátil, J. P. Vary, and B. R. Barrett // Phys. Rev. Lett. 2000, V. **84**, 5728; Phys. Rev. C, 2000, V. **62**, 054311.