

## Study of light nuclei within the SS-HORSE-NCSM approach

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We present investigations of resonant states of exotic  ${}^7\text{He}$  nucleus and calculations of bound states and resonances of  ${}^9\text{Li}$  nucleus. Our results are obtained within an analysis of the  $S$ -matrix based on calculations within the no-core shell model (SS-HORSE-NCSM approach [1, 2]) using the realistic nucleon-nucleon interaction Daejeon16 [3].

Results for the  $5/2^-$  and low-lying  $3/2^-$  resonances in  ${}^7\text{He}$  are in reasonable agreement with experiment. There is a contradictory experimental information about energy and width of the  $1/2^-$  resonance in  ${}^7\text{He}$ . In our calculations, the energy  $E_r$  of this resonance is 2.7 MeV and the width  $\Gamma$  is about 4 MeV. We predict in  ${}^7\text{He}$  also wide overlapping resonances  $3/2^-$ ,  $3/2^+$  and  $5/2^+$  with energies around 4-5 MeV which are supposed to form an experimentally observed wide resonance at 6 MeV of unknown spin-parity.

The binding energy of the  ${}^9\text{Li}$  ground state is in reasonable agreement with experimental data. The calculated excitation energy of the first excited state of  ${}^9\text{Li}$  is 3.54 MeV which is larger than the experimental value of 2.691 MeV. We predict in our approach also the asymptotic normalization coefficients for these bound states. Experimentally there are  ${}^9\text{Li}$  resonances of unknown spin-parity with  $E_r = 0.232$  MeV and  $\Gamma = 0.1$  MeV and  $E_r = 1.316$  MeV and  $\Gamma = 0.6$  MeV; we obtain  ${}^9\text{Li}$  resonant states  $5/2^-$  ( $E_r = 0.27$  MeV,  $\Gamma = 0.21$  MeV) and  $3/2^-$  ( $E_r = 1.53$  MeV,  $\Gamma = 2.39$  MeV).

### References:

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