THE RESONATING GROUP MODEL DESCRIPTION OF THE RADIATIVE CAPTURE REACTION ^{3}He(α,γ)^{7}Be

Solovyev A.S.[1], Igashov S.Yu.[1], Tchuvil'sky Yu.M.[2]
[1]*All-Russia Research Institute of Automatics, Moscow, Russia;*
[2]*Scobeltsyn Institute of Nuclear Physics, Lomonosov Moscow State University, Russia*
E-mail: alexander.solovyev@mail.ru

The radiative capture reaction ^{3}He(α,γ)^{7}Be plays an important role in the stellar kinetics and significantly contributes to ^{7}Li production in the Big Bang nucleosynthesis. Abundance of this isotope, in turn, is an important indicator of barion-photon ratio in the Universe. Capability of various experiments to measure the cross sections, *S*-factors, and branching ratios of population of ^{7}Be levels at astrophysical energies is limited because of the smallness of the cross sections. Therefore, calculations of these values are one of the hottest points of theoretical nuclear astrophysics.

A microscopic approach to the discussed problem using the algebraic version of the resonating group model (AVRGM) [1, 2] is built. The modified Hasegawa-Nagata *NN*-potential [3] is involved in the calculation. Two adjustable parameters – the oscillator radius r_0 and the intensity of central Majorana forces g_c were tuned to reproduce the energies of ^{4}He, ^{3}He, and ^{7}Be (in the ground and first excited states) nuclei [4, 5] together with the experimental data for the *S*-factor [6–8]. As these results as the ones concerning reaction ^{3}H(α,γ)^{7}Li obtained by us earlier [9] demonstrate a good agreement with the experimental data and confirm a capability of the AVRGM to be used to account the properties of astrophysical fusion reactions.

1. G.F.Filippov, I.P.Okhrimenko // Phys. Atom. Nucl. 1980. V.32. P.480.
2. G.F.Filippov // Phys. Atom. Nucl. 1981. V.33. P.488.
3. H.Kanada *et al.* // Progr. Theor. Phys. 1979. V.61(5). P.1327.
4. D.R.Tilley *et al.* // Nucl. Phys. A. 2002. V.708. P.3.
5. G.Audi *et al.* // Nucl. Phys. A. 2003. V.729. P.337.
6. A.DiLeva *et al.* // Phys. Rev. Lett. 2009. V.102. 232502.
7. M.Carmona-Gallardo *et al.* // Phys. Rev. C. 2012. V.86. 032801(R).
8. C.Bordeanu *et al.* // Nucl. Phys. A. 2013. V.908. P.1.
9. A.S.Solovyev *et al.* // Bull. Rus. Acad. Sci. Phys. 2014. V.78(5) (to be published).