

DETERMINATION OF THE ASYMPTOTIC NORMALIZATION COEFFICIENTS FOR ${}^7\text{Li}+p\rightarrow{}^8\text{Be}$ FROM THE PERIPHERAL DIRECT CAPTURE ${}^7\text{Li}(p,\gamma){}^8\text{Be}$ REACTION AND THE ASTROPHYSICAL S FACTOR AT LOW ENERGIES

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The reaction ${}^7\text{Li}(p,\gamma){}^8\text{Be}$ is part of the pp-chain in the Sun, leading to the formation of ${}^8\text{Be}$. In the present work, the analysis of the experimental astrophysical S factors $S^{exp}(E)$ for the nuclear-astrophysical ${}^7\text{Li}(p,\gamma){}^8\text{Be}$ reaction in the off-resonance energy region measured in [1] are performed within the modified two body potential approach [2], and assuming that, in this energy region ($E \leq 200$ keV) radiative proton capture by ${}^7\text{Li}$ nucleus is direct.

The method involves two additional conditions that verify the peripheral character of the direct radiative capture reaction ${}^7\text{Li}(p,\gamma){}^8\text{Be}$ in the off-resonance energy region: 1) $R(E, b) = const$ for arbitrary variation of the single particle asymptotic normalization coefficient b for each fixed experimental value of the energy E ; 2) the ratio $C_{p{}^7\text{Li}}^2 = S^{exp}(E)/R(E, b)$ must not depend neither from b and nor from the energy E for each experimental point of the energy ($E=98.3, 147.6$ and 198.3 keV), where $R(E, b) = S^{(sp)}(E)/b^2$ in which $S^{(sp)}(E)$ is a single-particle astrophysical S factor. Fulfillment of the conditions above, it allows to determine "experimental" values of ANC's $C_{p{}^7\text{Li}}^2 [= (C_{p{}^7\text{Li}}^{exp})^2]$ for ground and first excited states of ${}^8\text{Be}$ with their uncertainty. The obtained values of ANC's $(C_{p{}^7\text{Li}}^{exp})^2$ can be used in the expression $S(E) = (C_{p{}^7\text{Li}}^{exp})^2 R(E, b)$ for obtaining the extrapolated values of $S(E)$ and its uncertainties within the energy range $E < 98.3$ keV, including $E = 0$.

Variation of values of the parameters of the Woods-Saxon potential r_0 and a is done in the wide range ($1.1 \leq r_0 \leq 1.4$ fm, $0.59 \leq a \leq 0.72$ fm) and it is shown that the reaction is strongly peripheral. As a result, the new values of ANC's $(C_{p{}^7\text{Li}}^{exp})^2$ with their uncertainties for ${}^7\text{Li}+p\rightarrow{}^8\text{Be}$ were obtained. The obtained values of ANC's are used for calculation of the astrophysical S factor of the radiative resonance capture ${}^7\text{Li}(p,\gamma){}^8\text{Be}$ reaction within the modified R-matrix method [3].

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The speaker is a student or young scientist

No

Section

1. Experimental and theoretical studies of nuclear reactions

Primary author: TURSUNMAKHATOV, Kakhramon (Institute of Nuclear Physics, Academy Sciences of Uzbekistan)

Presenter: TURSUNMAKHATOV, Kakhramon (Institute of Nuclear Physics, Academy Sciences of Uzbekistan)

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