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DETERMINATION OF ZERO ENERGY ASTROPHYSICAL S-FACTOR OF THE 16O(p,γ)17F CAPTURE REACTION

Model-independent determination of the astrophysical S-factor value at zero energy for reactions involving light nuclei is very important in nuclear astrophysics [1,2]. The radiative capture 16O(p,γ)17F reaction is one of the key sequence in the carbon-nitrogen-oxygen (CNO) cycle of the evolution in the stellar nucleosynthesis. The aim of this work is to determine the zero energy value of the S(0)-factor of direct nuclear capture 16O(p,γ)17F reaction within the framework of the two-body potential model in the single channel approach. In Table 1 we demonstrate the obtained values of the astrophysical S(0)-factor of the direct 16O(p,γ)17F capture process at the zero energy and asymptotical normalization coefficients (ANCs) for the ground 17F(5/2+) and first excited 17F(1/2+) bound states. The zero-energy astrophysical S(0)-factor was estimated by using the asymptotic expansion method [1, 2]. As can be seen from the table, the result of the VM2 model is in very good agreement with the result of the ANC method of Ref.[3] S(0) = 9.45 ± 0.40 keV b and with the NACRE compilation data S(0) = 9.3 ±2.8 keV b [4].

Table 1. Values of ANC for the ground 17F(5/2+) and first excited 17F(1/2+) bound states and S(0)-factor for the supposed potentials VMi in Ref.[5].

Model 2S+1LJ C, fm-1/2 S(0), keV b
VM1 2S1/2
2D5/2 73.404
1.012 8.809
VM2 2S1/2
2D5/2 75.484
1.043 9.321
VM3 2S1/2
2D5/2 80.450
1.038 10.521
VM4 2S1/2
2D5/2 84.025
1.056 11.461

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Section

Nuclear physics (Section 1)

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