Determination of the astrophysical factor of the ^{3}He(α,γ)^{7}Be down to zero energy using the asymptotic normalization coefficient method

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The observation of neutrinos emitted in the pp chain and in the CNO cycle can be employed to test the Standard Solar Model. The ^{3}He(α, γ)^{7}Be reaction is the reaction of the 2nd and 3rd branch of the pp chain, so the indetermination of its cross section significantly affects the predicted ^{7}Be and 8B neutrino fluxes. Notwithstanding its relevance and the great deal of experimental and theoretical papers, information of the reaction cross section at energies of the core of the Sun (15 keV - 30 keV) is sparse and additional experimental work is necessary to attain the target (3%) accuracy. The precise understanding of the external capture component to the ^{3}He(α, γ)^{7}Be reaction cross section is pivotal for the theoretical assessment of the reaction mechanism. In this work, the indirect measurement of this external capture component using the Asymptotic Normalization Coefficient (ANC) technique is discussed. To extract the ANC, the angular distributions of deuterons yielded in the ^{6}Li(^{3}He,d)^{7}Be alpha-transfer reaction were detected with high precision at $E_{^{3}He}$=3.0 MeV and 5.0 MeV. The ANCs were then deduced from the juxtaposition of DWBA and CC calculations with the experimental angular distributions and the zero energy astrophysical S-factor for ^{3}He(α, γ)^{7}Be reaction was calculated to equal 0.534 keVb. Both our experimental and theoretical approaches were tested through the analysis of the ^{6}Li(p,γ)^{7}Be astrophysical implications.

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