

**Determination of the nuclear vertex constants (asymptotic normalization coefficients)
for the ${}^7\text{Be} \leftrightarrow {}^3\text{He} + {}^4\text{He}$ vertex from the N/D equations and astrophysical
factor for the ${}^4\text{He}({}^3\text{He},\gamma){}^7\text{Be}$ reaction**

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Our consideration is based on the fundamental principles of the scattering theory – analyticity and unitarity of the S matrix, i.e. the partial wave scattering amplitude is an analytical function in the momentum (energy) plane with the poles due to the bound states and cuts generated by these poles due to the unitarity conditions in all open channels. In such an approach the information about the bound state poles and their residues (nuclear vertex constants (NVCs) or asymptotic normalization coefficients (ANCs)) can be obtained from the analytical continuation of the scattering amplitudes (phase shifts) from the upper part of the right (unitary) cut in the energy plane to the bound state pole. The key point here is the analytical structure of the partial Coulomb-modified nuclear scattering amplitude. On the first energy sheet this amplitude has a right (unitary) cut, the bound state poles at negative energies and the left (dynamical) cut generated by the exchange processes. At low energies the impact of the inelastic channels is small and has been neglected. Analytical structure of the Coulomb modified nuclear scattering amplitude allows one to determine the Coulomb renormalization of the ANC: $C = \Gamma(l+1+\eta)\tilde{C}$. Here, η is the Coulomb parameter of the bound state, l is the orbital momentum of the bound state, and \tilde{C} is the renormalized ANC, which does not contain the main Coulomb effect generated by the Gamma function. We find for the ANCs ${}^7\text{Be} \leftrightarrow {}^3\text{He} + {}^4\text{He}$ for the ground and first excited states of ${}^7\text{Be}$ $3.87 \text{ fm}^{-1/2}$ and $2.95 \text{ fm}^{-1/2}$, correspondingly. These ANCs determine the overall normalization of the astrophysical factor for the direct radiative capture reaction ${}^4\text{He}({}^3\text{He},\gamma){}^7\text{Be}$ in the pp-chain because this reaction is totally peripheral at astrophysically relevant energies. To calculate the astrophysical factor it is sufficient to use the hard-sphere approximation with the channel radius of 4.0 fm. Our calculated astrophysical factor at zero energy is $S(0) = 0.47 \text{ keVb}$.