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Radiative α capture on ^{12}C in cluster effective field theory

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Radiative α capture on ^{12}C, ^{12}C(α,γ)^{16}O, is studied within the framework of cluster effective field theory (EFT). We constructed a low energy EFT for the ^{12}C(α,γ)^{16}O reaction and studied the related reactions to fix the parameters of the reaction amplitudes and estimate the astrophysical S factors of ^{12}C(α,γ)^{16}O at the Gamow-peak energy, $E_G = 0.3$~MeV; it is known that $E1$ and $E2$ transitions of ^{12}C(α,γ)^{16}O are dominant because of the sub-threshold 1^-_1 and 2^+_1 states of ^{16}O. The theory was applied to the studies of elastic α-^{12}C scattering at low energy, β delayed α emission from ^{16}N, and the $E1$ transition of ^{12}C(α,γ)^{16}O in which the S_{E1} factor was deduced at E_G. We report the study of $E2$ transition of ^{12}C(α,γ)^{16}O to estimate the S_{E2} factor at E_G and discuss the uncertainties of estimate of the S factors at E_G in the cluster EFT.

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