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Astrophysical S-factor for the 11B(p,γ)12C radiative capture reaction

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Recently we presented new calculated data on the astrophysical S –factor of the radiative capture reaction 11B(p,γ)12C [1]. The radiative decay of the resonance states 16.10 (2+), 16.57 (2—) and 17.23 MeV (1—) into the ground (0+) (γ0 transitions) and the first excited 4.44 MeV (2+) (γ1 transitions) states have been taken into account in the calculations. The calculations were carried out within the framework of the modified R-matrix method, previously proposed by us and successfully applied in [1,2].
The basic idea of the modified R-matrix approach is that when the radiative capture of an incident particle by a target nucleus occurs through compound nucleus stages, the amplitude of the radial wave function of the final nucleus can be expressed through the resonance parameters and asymptotic normalization coefficient (ANC) of the proton coupling in populated state. The use of a priori known values of the ANC in calculations of the astrophysical S-factor significantly simplifies the task of establishing such parameters as the width and energy of resonance states, the radius of the channel, etc., by fitting to experimental S –factors data, which significantly increases the reliability of the calculations.
In this work, in addition to the main channels investigated in [1], the contributions of the subthreshold states E^*=15.11 MeV (1+, Γγ>Γα) and E^*=15.440 MeV (2+) are analyzed, as well as transitions through the state E^*=12.71 MeV (1+), which has a relatively noticeable radiative width.
The astrophysical S-factor of the 11B(p,γ)12C reaction was recalculated taking into account the additional channels mentioned above. The experimental values of the astrophysical S-factor were taken from Refs. [3-7]. Preliminary calculation results show a sensitive change in the behavior of the astrophysical S-factor to taking into account the additional channels at astrophysically important low energies.

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