New result for the $p^7\text{Be} \rightarrow ^8\text{B} \gamma$ astrophysical $S$-factor from 10 keV to 5 MeV and reaction rate from 0.01 to 10 $T_9$

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Abstract

The astrophysical $S$-factor for the process $p^7\text{Be} \rightarrow ^8\text{B} \gamma$ of radiative capture by the $^8\text{B}$ ground state is described up to 5 MeV, within the modified potential cluster model. The signatures of the $S$-factor resonances at 0.632, 2.18 and 3.36 MeV due to $M1$ and $E2$ transitions from the scattering of resonance $^3P_1$, $^3F_3$ and $^3D_2$ waves to the ground $^3P_2$ state are illuminated using total cross sections, astrophysical $S$-factors and reaction rates at temperatures from 0.01 to 10.0 $T_9$. Experimental data on the $S$-factor are reproduced well in the range 100 keV to 3 MeV. The importance of the input of the 0.632 MeV resonance to the reaction rate is proved. Our calculations (performed in advance) confirm the latest data for the $S$-factor at 19 keV.

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