Level Structure of $^{30}$S of Astrophysical Importance in rp Reaction $^{29}$P(p,γ)$^{30}$S

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The structure of proton-unbound $^{30}$S states is a key to understand the αp and the rp processes, as it plays a crucial role in the calculation of the $^{29}$P(p,γ) and $^{26}$Si(α,p) reaction rates. The spin-parity assignments of $^{30}$S strongly determine the thermonuclear $^{29}$P(p,γ)$^{30}$S reaction rate at temperatures characteristic of explosive hydrogen burning in classical novae and type I x-ray bursts. Specifically, the rate had been previously predicted to be dominated by two low-lying, unobserved, levels in the Ex = 4.7-4.8 MeV region, with spin and parity assignments of $3^+$ and $2^+$. Recent experiments were performed to study the structure of $^{30}$S. The $^{30}$S J$^\pi$ values were inferred from also a comparison to the known decay schemes of the corresponding mirror states in $^{30}$Si.

We present, in our contribution, results for levels in $^{30}$S that are used for the $^{29}$P(p,γ) rp reaction rate calculations. The levels are calculated using the (0+1)ℏω PSDPF interaction, which is charge-independent Hamiltonian. The γ-decay lifetimes of $^{29}$P and $^{30}$S are also calculated. Based on experimental information on the $^{30}$S energy spectrum as well as for the mirror nucleus $^{30}$Si, the levels of excited states that are used to determine the $^{29}$P(p,γ)$^{30}$S reaction rates are proposed.