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The level Structure of ^{30}S and its Astrophysical Implications[1]

S. ALMARAZ-CALDERON, Physics Division, Argonne National Laboratory, A. APRAHAMIAN, G.P.A. BERG, W.P. TAN, M. WIESCHER, Department of Physics, University of Notre Dame, Notre Dame, IN — The level structure of ^{30}S plays a fundamental role in understanding the nucleosynthesis processes of proton-rich nuclei in explosive scenarios. Thermonuclear runaway processes like Novae and X-ray bursts are driven by the rp- and αp- processes, transferring proton-rich material from the Hot CNO cycle up to mass 40. Two of the key reactions in such processes, the $^{26}Si(\alpha,p)^{29}P$ and $^{29}P(p,\gamma)^{30}S$ are expected to proceed through resonance states in ^{30}S, making the reaction rates very sensitive to the structure of ^{30}S. We studied the level structure of ^{30}S via the $^{28}Si(^{3}He,n)$ and $^{32}S(p,t)$ reactions. Important experimental information on energy levels, decay branching ratios and tentative spin assignments were extracted to calculate the $^{29}P(p,\gamma)^{30}S$ and $^{26}Si(\alpha,p)^{29}P$ reaction rates. Several levels between the proton- and alpha- thresholds were observed for the first time. The $^{29}P(p,\gamma)^{30}S$ reaction rate was re-evaluated using the new experimental information and compared with previous estimates. Levels above the alpha threshold have been measured for the first allowing us to calculate the experimental $^{26}Si(\alpha,p)^{29}P$ reaction rate and to compare it with theoretical calculations.

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