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# Indirect techniques in nuclear astrophysics - ANCs and THM

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A puzzle in gamma ray astronomy has been the lack of a signal from the decay of 22Na in novae sites. The isotope should be produced in the Ne-Na cycle following the proton capture reaction 21Na(p,gamm)22Mg and then the beta decay of 22Mg to 22Na. A reaction that could play a role in understanding the lack of a signal gamma-ray astronomy is 22Mg(p,gamma)23Al. Depending on the stellar conditions, this reaction could reduce the amount of 22Na that occurs in a novae. Little is known about the reaction rate for proton capture on 22Mg. Furthermore there is a question about the spin-parity of the ground state of 23Al which can change the reaction rate by more than an order of magnitude depending on whether the ground state is 1/2+ or 5/2+. Two separate experiments have been carried out at the Texas A&M University Cyclotron Institute to better understand this reaction rate. We have obtained the asymptotic normalization coefficient for 22Mg+p to 23Al using the 13C(22Ne,23Ne)12C reaction and mirror symmetry. We also have determined the spin-parity for the ground state of 23Al by observing its beta decay to 23Mg. With this new information, we can now determine the direct capture rate for this reaction which fixes the stellar reaction rate and provides a basis for evaluating the importance of the capture reaction in depleting 22Na in novae.

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