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Application of the Isobaric Mass Multiplet Equation to the rp process in Nuclear Astrophysics

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Abstract content
   (Max 300 words)

In many cases levels of proton-rich nuclei participating in rp processes have not been measured and one has to rely on theory to estimate the reaction rates. However, the Isobaric Mass Multiplet Equation (IMME) affords a more reliable method of obtaining levels in the final T=1 nucleus of a (p,gamma)reaction in terms of experimental energies of the isobaric analog partners and a small coefficient c (typically about 200 keV) that can be calculated [1]. The power of the IMME method, which is mainly empirically based with a small theoretical component, to estimate energies of nuclei participating in the rp process is emphasized by way of illustrating favorable cases where the method works particularly well. In the case of 26Si it is demonstrated that that the theoretical component can be calculated with considerable accuracy, and in the case of 30S it is shown that a large number of states can be predicted when only a small number have been experimentally measured. However, because of the semi-empirical nature of the method, it should be stressed that its application depends on knowing energies of the analog states adjacent to the nucleus in question. Alternatively, one has to resort to shell-model calculations with reliable two-body interactions. As a further illustration the method is applied to the 35Ar(p,gamma) 36K reaction.

[1] W. A. Richter, B. A. Brown, A. Signoracci and M. Wiescher, Phys. Rev.C 83, 065803 (2011)

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