SHELL-MODEL STUDIES OF ^{22}Mg and ^{30}S AT EXCITATIONS OF INTEREST FOR THE THERMONUCLEAR RADIATIVE CAPTURE REACTIONS

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In explosive stellar environments, such as classical novae and x-ray bursters, thermonuclear radiative capture reactions on unstable nuclei determine the path of nucleosynthesis towards the proton drip line. These processes are often dominated by resonant capture to excited states above the particle-emission threshold and therefore depend critically on the nuclear structure properties of the levels involved.

We are interested in the two rp reactions 21Na(p,γ)22Mg and 29P(p,γ)30S, for which the reaction-rates will depend on spin-parity assignments of the daughter states around the proton-emission thresholds.

Shell model results using our (0+1) $\hbar\omega$ PSDPF interaction [1] for the mirrors 22Mg and 22Ne will be presented and discussed. A complete spectrum of positive and negative parity states will be proposed for 22Mg. In particular what the negative parity states are concerned, three states are identified in 22Ne: 2- at 5.146 MeV, 3- at 5.910 MeV and 0- at ~ 6.234 MeV, they correspond to the mirror states in 22Mg : 2- at 5.006 MeV, 3- at 5.838 MeV and 0- at 6.046 MeV. In the same way as it was done in Ref. [2] for the positive levels, we calculated the complete spectra of the mirrors 30S and 30Si. Here, we confirm the proposed 1$\hbar\omega$ states at 6.225, 6.242 and 6.435 MeV as 4-, 1- and 2-, respectively.

[1] M. Bouhelal et al., Nucl. Phys. A 864, 113 (2011).
[2] W. A. Richter and B. Alex Brown, Phys. Rev. C 87, 065803 (2013).