Description of the Spectroscopic Properties of ²⁴AI

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The nuclear shell model plays a crucial role in predicting and describing the nuclear structure of nuclei close to the valley of stability, such as the sd shell nuclei region. Certain of these nuclei have astrophysical interest. The proton rich ²⁴Al nucleus plays a crucial role in the comprehension of nucleosynthesis. The ²³Mg(p, γ)²⁴Al reaction is an important link between the Ne-Na and Mg-Al cycles in O-Ne classical novae [1]. Its level structure is important for determining the ²³Mg(p, γ)²⁴Al reaction rate, which involves the determination of the spin/parity level assignments, which are only well-known for the first four states.

Our work focuses on the study of the spectroscopic properties, complete energy spectrum, and electromagnetic transitions, of ²⁴Al in the shell model framework using the PSDPF interaction [2]. The energy spectrum of this nucleus, up to excitation energies of astrophysical interest, as well the electromagnetic transitions have been compared with the most recent experimental data [3].

The obtained results show a good agreement theory versus experiment, therefore numerous predictions were proposed. A detailed discussion of our work will be presented in this contribution.

References

- [1] L. Erikson et al., Phys. Rev. C 82 (2010) 045808 1-12.
- [2] M. Bouhelal et al., Nucl. Phys. A 864 (2011) 113-127.
- [3] http://www.nndc.bnl.gov/nudat2/.