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Shell model description of the spectroscopic properties of the Aluminum isotopes of astrophysical interest

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The Al-Mg cycle is a crucial pathway in stellar nucleosynthesis. In this cycle, various aluminum (Al) isotopes are synthesized through several nuclear reactions onto magnesium (Mg) isotopes, followed by subsequent nuclear transformations within stellar environments. One of these reactions is the rp-process, in which, spin-parity assignments play an essential role in determining the rates at which reactions occur.
In the context of calculating reaction rates for the rp-process, the spin and parity assignments derived from the shell model are crucial inputs.
We are interested in our work to the study, within the shell model framework, of the structure of the Al isotopes (with A= 24 to 27) produced through rp-process.
A complete spectrum has been calculated, using the PSDPF interaction, for each isotope and has been compared to available experimental data. Prediction of spin-parity assignments for the unknown states in all isotopes has been proposed, particularly, at excitation energies of astrophysical relevant. A detailed discussion of our study will be presented in our contribution.

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