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A ~ 80 systems: shell structure and astrophysical implications

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With their few proton and neutron particles, the A=80 isobars, numbering about twelve nuclei distributed from the proton-rich side to the neutron-rich one, are of a great importance in nuclear structure studies. These nuclides are found along rapid proton capture (rp) process. They make it possible to develop our knowledge about the nucleon-nucleon interaction close to the astrophysical processes pathways. Consequently, the experimental and theoretical determination of their properties and their decays permits to simulate and to model the astrophysical explosive phenomena.
In order to compute the spectroscopic properties of A=80 isobars, we have performed shell model calculations in the framework of nuclear shell model by means of NuShellX@MSU nuclear structure code. The used valence space consists of the (f7pg9) proton and neutron orbitals outside of 56Ni doubly magic core with new single particles energies. The investigation study is based on the use of several effective interactions taking into account the core polarisation, the nuclear monopole effect and the similarity with 100Sn and 56Ni mass regions. The gotten results are in good agreement with the measured and available data. This agreement makes it possible to validate the effective theoretical approach.

Keywords: A=80 isobars, rapid proton capture process, NuShellX@MSU nuclear structure code, spectroscopic properties.

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