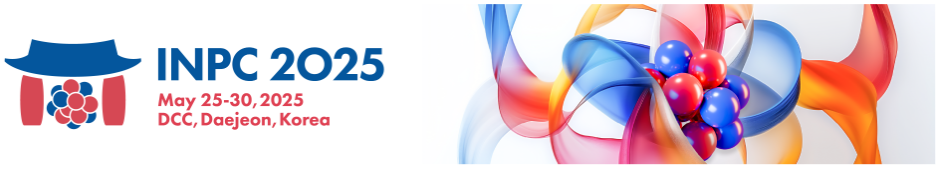

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Spectroscopy of shell-model nuclei around A = 90

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Abstract

The investigation of nuclei in the mass-90 region provides insight into various aspects of both single-particle and collective excitations. Large-scale shell-model calculations have demonstrated good agreement with experimental data across both low- and high-spin states. High-spin states in the mass-90 region have been observed with multiquasiparticle configurations. The $g_{9/2}$ orbital plays a crucial role in generating both low- and high-spin states. The lower energy part of the level scheme is primarily dominated either by the excitation of fp protons to the $g_{9/2}$ orbital or by proton occupancy in this orbital. In contrast, the high-spin states are mainly driven by the coupled excitation of $\nu g_{9/2}$, particularly to
$\nu d_{5/2}$, along with proton excitation across the Z = 40 shell gap. In the N = 50 isotones—^{86}Kr, ^{87}Rb, ^{88}Sr, ^{89}Y, ^{90}Zr [1], ^{91}Nb [2], ^{92}Mo [3], ^{93}Tc, ^{94}Ru, and ^{95}Rh—shell-model calculations have successfully explained neutron excitations from the $g_{9/2}$ orbital to $d_{5/2}$.

The odd-odd nuclei in the mass 90 region are equally interesting because both the odd nucleons span the same Z∼40, N∼50 subshell space, providing a good testing ground to study the role of proton-neutron residual interaction and its influence on both the single-particle as well as collective motion. The odd-odd nucleus ^{90}Nb, with one proton particle and one neutron hole outside the Z = 40 and N = 50 shells, respectively, can provide us
valuable information about the particle-hole interaction at low as well as high-spin states. In-beam gamma-ray spectroscopy of ^{90}Nb was carried out using fusion-evaporation reaction ^{65}Cu(^{30}Si, 3n2p) at a beam energy of 120 MeV [4]. The gamma rays were detected using the Indian National Gamma Array (INGA [5]) having sixteen Compton-suppressed HPGe clover detectors at the TIFR, Mumbai. In the present study, 15 new transitions were found. The positive parity sequence was modified based on triple gamma-ray coincidence conditions. We found an E3 transition decaying from 11^- to the ground state, 8^+. However, the experimental B(E3) = 0.020(4) W.u. indicates that the 11^- is not collective.

The odd-odd, odd-even, and even-even nuclei, ^{90}Nb, ^{91}Nb, and ^{92}Mo, were studied in the framework of shell-model with GWBXG interaction. The deviations of shell-model calculation with the experimental data suggest the scope for improvement in the interaction.
The experimental results for ^{90}Nb and the shell model comparison for ^{90}Nb, ^{91}Nb, and ^{92}Mo will be presented.

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References

[1] P. Dey *et al.*, PRC 105, 044307 (2022).
[2] P. Dey *et al.*, PRC 109, 034313 (2024).
[3] Vishal Malik *et al.*, JPhysG accepted.
[4] Vishal Malik *et al.*, under review.
[5] R. Palit *et al.*, NIM A 680, 90 (2012).

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