THEORETICAL EXPLORATION OF THE STRUCTURE OF THE MIRROR NUCLEI ^{22} F AND ^{22} AL

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Abstract

Nuclei in the sd-shell provide an ideal testing ground for nuclear structure theory, as full shell-model calculations are feasible across this mass region. However, many odd-odd nuclei remain less well thoroughly explored. Among them, the odd-odd nucleus ^{2}2F (Tz=+2) constitutes a particularly valuable case for studying shell evolution in light nuclei.

In this work, we present a theoretical shell-model analysis of ^{2}2F and its proton-rich mirror partner ^{2}2Al, performed using large-scale calculations using the $(0+1)\hbar\omega$ PSDPF effective interaction and the Nathan code. We calculated excitation energies, electromagnetic transition strengths, magnetic and quadrupole moments, and half-lives, and systematically compare them with the available experimental data.

Our results show excellent agreement with measurements, demonstrating the predictive power of the PSDPF interaction. Furthermore, the calculations provide spin–parity assignments for several states with previously uncertain or unknown configurations, offering valuable guidance for future experimental work.