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Beta Decay Study Using Shell Model

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Beta decay is one of the fundamental weak interaction processes in nuclear physics that is crucial in shaping our understanding of nuclear structure. It also provides important insights into various astrophysical phenomena like r–process which is responsible for forming about half of the heavy elements in the universe beyond iron [1]. In this talk, I will discuss the beta decay properties which includes Fermi and Gamow Teller transitions, phase-space factor, $\log ft$ and half-life. These concepts help to explain which transitions are allowed, how strong they are and how likely they occur. They are also essential for calculating decay rates and comparing theoretical predictions with experimental data. Studying nuclei in the lighter mass region with Z= 8–15 are particularly important because these nuclei are relatively simple, well understood, making them ideal for testing nuclear models like the shell model [2]. Our work focuses on studying the allowed beta decay properties in sd-shell nuclei, such as Gamow Teller matrix elements, their transition strengths (B(GT)), $\log ft$ values, and branching ratios..etc. Our preliminary results obtained for several transitions like ^{21}O $\rightarrow^{21}$F, ^{21}F $\rightarrow^{21}$Ne and ^{24}Ne $\rightarrow^{24}$Na are in good agreement with available experimental data. We aim to address these fundamental properties in nuclei that are of current experimental interest and relevant to astrophysical nucleosynthesis processes.

References

[1] I. N. Borzov, "Beta-decay rates", Nucl. Phys. A 777, 645 (2006).

[2] A. Kumar, P. C. Srivastava, and T. Suzuki, "Shell model results for nuclear β−-decay properties of sd-shell nuclei, "Prog. Theor. Exp. Phys. 2020, 033D01 (2020).

Research field of your presentation

Theoretical Low-energy nuclear physics

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