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Beta decay studies for Physics beyond the Standard Model

The study of weak interaction nuclear processes in general, and nuclear β-decay in particular, plays a key role in multiple avenues of searches for physics beyond the standard model. The search for the rare neutrinoless double β-decay(0νββ) and exotic dark matter in nuclear laboratory-scale experiments are among such searches that aim to answer foundational questions in physics. In the searches for exotic dark matter, unknown forbidden electron-capture decay can appear as an irreducible internal background. Therefore, giving theoretical estimates for branching ratios of such unknown decays is of utmost importance in experimental confirmation of the detection of exotic dark matter. On the 0νββ decay front, understanding the phenomenology of effective axial vector coupling (□□□□□) is key for determining the sensitivity of underground experiments designed to detect this rare decay. In particular, the understanding of □□□□□ is terra incognita in the case of forbidden non-unique β+/electron capture decays, it being key for 0νββ decays searches on the β+/electron capture side. The novel Branching Ratio Method (BRM) is introduced to explore this uncharted territory. The talk aims to walk through these novel facets of physics that lie at the forefront of weak interaction physics.

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