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Exploring chirality structure in nucleon decay

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Baryon number is an accidental symmetry in the Standard Model, but its violation is theoretically anticipated, making the search for such processes a promising avenue for discovering new physics. We explore how measurements of different nucleon decay channels can reveal the structure of the underlying theory. We investigate the chirality structure of baryon-number violating interactions through lifetime measurements of strangeness-conserving nucleon-decay channels. By employing an effective field theory approach, we demonstrate that the ratio of partial decay widths of proton decay channels, $\Gamma(p \longrightarrow \eta l+)/\Gamma(p \longrightarrow \pi 0 l+)$, where l+ denotes a positron or anti-muon, is sensitive to this chirality structure. Furthermore, we find that in certain new physics models, both anti- lepton and anti-neutrino channels provide valuable insights into the model ' s structure. Our results highlight the importance of searching for various decay channels in upcoming nucleon decay experiments.

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