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(I) BSM neutrino physics in weak nuclear decay

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Despite their relative complexity, unstable atomic nuclei are among the best physical systems to search for BSM neutrino physics. In particular, rare isotopes that undergo weak nuclear transitions such as β decay, $\beta\beta$ decay, or electron capture (EC) provide a sensitive probe of a wide range of topics including neutrino masses, Majorana nature of neutrinos, and lepton number violating processes. Several of these studies - particularly those on neutrino mass states (both light and heavy) - are able to be performed without any model dependencies in these systems. The experimental tools in these areas are broad, and leverage modern technological advancements in quantum sensing, atom/ion trapping, radioactive background control, and tonne-scale detectors. In this talk, I will describe the power of using weak nuclear decay for neutrino studies, and give examples of ongoing and future experiments that provide unprecedented sensitivity to various BSM physics scenarios.

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