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Nuclear Beta Decay: Using the Atomic Nucleus to Probe Symmetries of the Weak Interaction

DAN MELCONIAN, Texas AM

The study of how atoms radioactively decay has played a critical role in developing the standard model of particle physics, our modern understanding of the forces and particles governing our universe. In particular, beta decay has led to a number of revolutionary developments regarding fundamental symmetries of the weak interaction, not the least of which was the demonstration that parity is violated. Modern technologies have advanced to the point where beta decay may be measured to the astounding precision of $<0.1\%$, at which point the sensitivity to new physics is complementary to other searches such as at the LHC. I will explain how beta decay can be used to search for physics beyond the standard model, and how atom-trapping and optical-pumping techniques provide us with the tools required to reach the precision needed.