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Superallowed Fermi Beta Decay Studies at TRIUMF-ISAC

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High-precision measurements of the $f t$ -values for superallowed Fermi beta decays between nuclear isobaric analogue states provide a number of demanding tests of the electroweak Standard Model, including confirmation of the Conserved Vector Current (CVC) hypothesis at the level of 1.3 parts in 10,000, the most stringent limits on weak scalar current contributions, and the most precise determination of the Cabibbo-Kobayashi-Maskawa (CKM) quark-mixing matrix element V_{ud} . In addition to high-precision experimental measurements, these tests rely on small (order 1%) theoretical corrections for radiative effects and the breaking of isospin symmetry by Coulomb and charge dependent forces in the nucleus. The latter, in particular, depend strongly on nuclear structure, motivating further studies by a wide variety of theoretical approaches, as well as continued high-precision experimental tests.

At the Isotope Separator and Accelerator (ISAC) facility at TRIUMF, 500 MeV proton beams of up to 100 microamps have been used to generate high-quality ISOL beams of several of the superallowed emitters with world record intensities. Superallowed half-lives have been measured with record precision using a 4pi gas proportional beta counter and tape transport system, the 8pi gamma-ray spectrometer at ISAC has been used to perform both superallowed branching ratio measurement and high-precision half-life measurements via gamma-ray counting, and the TITAN Penning trap mass spectrometer has demonstrated the first high charge-state mass measurement for a short-lived superallowed emitter. In this presentation, recent highlights from the superallowed program at ISAC, including high-precision measurements for ^{10}C , ^{14}O , ^{18}Ne , ^{26}Al , and ^{74}Rb superallowed decay, will be presented. The impact of these measurements on tests of isospin symmetry breaking in superallowed decays will be discussed and future developments in the superallowed program at ISAC, including the installation of the new GRIFFIN gamma-ray spectrometer, will be presented.

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