MEASUREMENT OF TOTAL DECAY ENERGIES OF T=1 AND T=1/2 NUCLEI AT LEBIT FOR THE SEARCH OF PHYSICS BEYOND THE STANDARD MODEL

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Superallowed nuclear beta transitions provide a sensitive test of the conserved vector current hypothesis (CVC) and thereby the standard model. Particularly crucial for testing its validity is probing the unitarity of the Cabibbo-Kobayashi-Maskawa matrix. Therefore, the dominating element V_{ud} has to be determined with high precision. Two complementary methods involve high-precision measurements of superallowed decay properties of T=1 nuclei and the newer approach of decay property measurements of T=1/2 isospin doublets. In both approaches V_{ud} is determined via corrected Ft values to which the total energy of the radioactive decay, Q_{EC}, contributes to the fifth power. The presence of scalar currents, indicating physics beyond the standard model, would be visible by non-constant corrected Ft values and were significantly enhanced for low-Z nuclei.

High-precision measurements of Q_{EC} values have been performed at the Penning trap mass spectrometer LEBIT located at the National Superconducting Cyclotron Laboratory by determining the free cyclotron frequencies of the respective nuclides in a 9.4-T magnetic field. The rare isotopes were produced by projectile fragmentation.

We report the first high-precision measurements of Q_{EC} of several decays of light T=1/2 nuclei and of the superallowed ^{14}O decay. The latter was the last one to be measured with high precision in a Penning trap. The Q_{EC} values of all nuclei were improved to the same order as the theoretical corrections.