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Precision measurements of the beta-asymmetry parameter in nuclear beta decay as a probe for tensor-type weak currents.

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Correlation measurements in nuclear and neutron beta-decay are a powerful tool to probe the structure of the weak [Sev2006]. While neutron decay experiments mainly focus on the determination of the V_ud matrix element[Abe2008], correlation experiments in nuclear beta-decay concentrate on exotic weak interaction types [Beh2009][Sev2006]. The main advantage of nuclear beta-decays is the wide variety of transitions. For example, the beta-asymmetry parameter of a pure Gamow-Teller transition is well suited to search for a tensor-type weak interaction. Here, we will present the beta-asymmetry parameter of the pure Gamow-Teller decays of 114In and 60Co. Our results are the most accurate available today for nuclear decays. They are in agreement with the Standard Model and set limits on tensor-type charged weak currents.
After being implanted or diffused into a metallic host foil, the radioactive 114In and 60Co nuclei were polarized with the Low-Temperature Nuclear Orientation (LTNO) method. A 3He/4He dilution refrigerator was used to cool the nuclei to milliKelvin temperatures, while an external magnetic in combination with an internal magnetic hyperfine field provided the polarizing field. The beta-particles were observed using Si or high-purity Ge detectors, which were mounted on the inside of the 4 Kelvin radiation shield, directly facing the sample foil[Wau2009c]. Extensive GEANT4 simulations were performed to gain control over the systematic effects, mostly scattering of beta-particles, which used to limit the precision of these type of experiments to several percent[Wau2009d]. The recoil corrections on the beta-asymmetry parameter of these isotopes were addressed for the first time, enabling us to interpret our results in terms of non-Standard Model physics.

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