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Improved Search for Tensor Interactions in Nuclear Beta Decay

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Improved Search for Tensor Interactions in Nuclear Beta Decay

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Precision measurements in nuclear beta decay are sensitive probes to search for New Physics in the electroweak sector. In particular, the measurement of the beta-particle energy spectrum gives direct access to the Fierz interference term, the most sensitive parameter to search for phenomenological scalar or tensor couplings involving left-handed neutrinos. The goal of the bSTILED (b: Search for Tensor Interactions in nuclear bEta Decay) project is to measure the beta energy spectrum in the pure Gamow-Teller transition of ${}^6\text{He}$ and extract the Fierz interference term with a precision at the permil level. The choice of the ${}^6\text{He}$ nucleus ensures that the theoretical description of the beta energy spectrum does not limit the sensitivity goal. Using a 4π calorimetry technique with the ${}^6\text{He}$ nuclei implanted in the bulk of a detector, or confined between two detectors, also fully suppress the main instrumental effect associated with electron backscattering. Within the first phase of the project, two experiments have been carried out at GANIL, one with a low-energy (25 keV) and the other with a high-energy (312 MeV) beam of ${}^6\text{He}$. The analysis of both experiments are in progress and should each provide competitive constraints on tensor couplings. The second phase of the project will rely on the careful study of the pros and cons of the two techniques in order to improve the most promising approach and achieve so a level of sensitivity beyond the reach of the LHC.

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