

G Parity Irregular Current in the β Decays of the Mass $A = 12$ System - with the Refined Empirical Value of the Weak Magnetism -

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G-parity is one of the important symmetries to be tested to clarify the validity of the symmetry between β decays of mirror pair or fundamentally between up and down quarks. In order to extract the *G*-parity violating induced tensor coefficient $2Mf_T/f_A$, the alignment correlation terms in the β -ray angular distributions of the nuclear-spin aligned ^{12}B and ^{12}N have been precisely re-measured [1] as shown in fig. 1. Here f_A is the main axial vector coefficient and M the nucleon mass. A new timing program for the β -ray detection and the spin manipulation to artificially create alignments was employed so that the systematic error was reduced to 1/2 of the previous result [2]. Also a refined value of the weak magnetism a as well as the possible asymmetry in the mirror β decays Δy were properly taken into account in the extraction of the final result.

If we neglect higher order terms in the impulse approximation, f_T is given by the difference between the alignment correlation terms B_2/B_0 of mirror pair as $[B_2/B_0]_{^{12}\text{B}} - [B_2/B_0]_{^{12}\text{N}} = 4E(a - f_T/f_A + \Delta y/2M)/3$, where E is the β -ray energy. As shown in the equation, only when a is given in a good precision, f_T can be reliably extracted. The best quantity to determine a is the transition strength Γ_γ of the $M1 - \gamma$ ray decaying from the 15.11-MeV excited state in ^{12}C to its ground state, which forms an isospin triad together with the ground states of ^{12}B and ^{12}N . Using the experimentally known values of Γ_γ , we determine a to be $a = (4.04 \pm 0.03)/2M$ where the isospin mixing from the $T = 0$ component and ratios of the Gamow-Teller matrices of the β^+ and β^- decays to that of the $M1-\gamma$ decay were properly taken into account theoretically, in which the nucleon binding energy effect was included. Details of the extraction of a will be shown in the presentation.

Finally, f_T was determined to be $2Mf_T/f_A = -0.15 \pm 0.12 \pm 0.05$ (theory) at a 90% confidence level [1]. f_T turns out to be small and *G*-parity symmetry maintains well. The result is consistent with the prediction based on QCD [3] in the framework of which $2Mf_T/f_A$ is proportional to the mass difference between up and down quarks.

References

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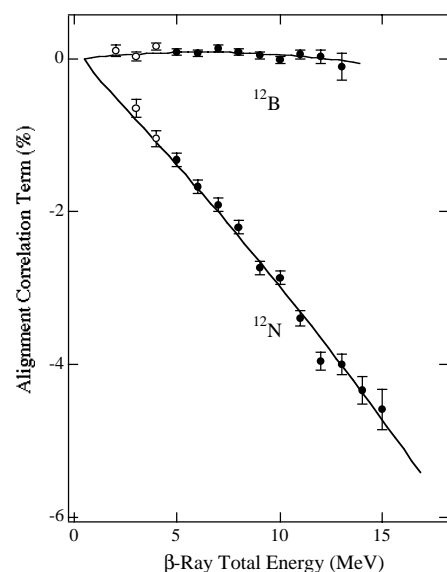


Figure 1. Alignment correlation terms. Full circles were used to extract the final result and open were not. Solid lines are the theoretical best fit.