RCNP EXPERIMENT E272

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:
Precise determination of Gamow-Teller β^- strengths on double beta decay nuclei

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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RUNNING TIME:

Setup runs	1 day
Data runs	15 days
Total	16 days

BEAM LINE: Ring : N0 course

BEAM REQUIREMENTS:

Type of particle	protons
Beam energy	300 MeV
Beam intensity	$\geq$ 100 nA after the pulsing of 1/5
Any other requirements	time width $\leq$ 250 ps halo-free, small emittance

BUDGET:

Experimental expenses	100,000 yen
Travel plan	600,000 yen
Total	700,000 yen

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SUMMARY OF THE PROPOSAL

We propose to measure the (p,n) reactions at 300 MeV on ^{48}Ca, ^{76}Ge, ^{100}Mo and ^{116}Cd with the new neutron detection system NPOL3 at the neutron time-of-flight (NTOF) facility to extract the Gamow-Teller (GT) β^- strengths in a wide excitation energy region up to 50 MeV by using a multipole decomposition analysis (MDA).

The purpose of this proposal is two folds. One is to obtain the GT strengths by the (p,n) reaction from parent to intermediate daughter nuclei of the double beta decay for understanding the intermediate structure of the daughter nuclei. The (n,p) measurement from the grandchild to daughter nuclei will be followed in future. These data will be used to deduce the nuclear matrix elements of the $2\nu\beta\beta$ decay.

Another is to test the proportionality relation between a $B(\mathrm{GT})$ value and a differential cross section at 0° for the charge exchange reactions. Recently we found a large discrepancy in the deduced $B(\mathrm{GT})$ value for ^{58}Cu($E_x = 1.051$ MeV) between the (^{3}He$,t$) ($B(\mathrm{GT}) = 0.265 \pm 0.013$) and the (p,n) ($B(\mathrm{GT}) = 0.414 \pm 0.006$) reactions. It has been pointed out that the $B(\mathrm{GT})$ value for the ^{116}In(gnd) state deduced by the (^{3}He$,t$) reaction, 0.032 ± 0.005, is largely different from that obtained from a β-decay experiment by a factor of 15. This discrepancy can be examined by the present proposed ^{116}Cd(p,n) measurement and we can see whether the discrepancy of ^{58}Cu($E_x = 1.051$ MeV) is just a peculiar case or not.