PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:
Three-nucleon force effects in 2H(p,p)np reaction

SPOKESPERSON:

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RUNNING TIME:	Installation time without beam	2 days(for each beam time)
	Test running time for experiment	2 days
	Data runs	6 days

BEAM LINE: Ring : WS course

BEAM REQUIREMENTS:	Type of particle	polarized p
	Beam energy	250 MeV
	Beam intensity	$\leq$ 10 nA
	Beam size	$\leq$ 2mm in diam

BUDGET:	Experimental expenses	1,000,000 yen
	Travel plan	500,000 yen
	Total	1,500,000 yen

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SUMMARY OF THE PROPOSAL

Since Witala et al. explained in 1998 that 2π exchange three-nucleon force (2π3NF) is the origin of the large discrepancy in the Nd cross section minimum, new experimental evidences for the 2π3NF have been searched in $3N$ systems. However, new clear evidences have not been found out yet.

Recently Witala has predicted that large effects of the 2π3NF remarkably appear in the cross section and A_y of D$(n,n)pn$ reaction at E_n = 250 MeV- 400 MeV. There are no experiments to be compared with his prediction. Therefore, we plan to measure the cross section and A_y of D$(p,p_1)np_2$ and D$(p,p_1p_2)n$ reactions at 250 MeV at 3 angles. The effects of Coulomb force, which are not included in the theoretical prediction, are expected to be well estimated from the difference between the present D$(p,p_1p_2)n$ experiment and D$(p,n_1n_2)p$ calculation.

We use a liquid D_2 target, which we have developed and have successively used for our H$(d,^{3}$He$)\gamma$ experiment at RCNP. Since C(p,p') cross section is about an order of magnitude larger than D$(p,p)pn$ cross section at the kinematical condition of interest for the 3NF, use of a liquid D_2 target is very effective to reduce the number of unfavorable protons from C and other materials in the target. The present liquid target needs a slight improvement for this experiment. The improvement and test operation are made at Kyushu University.

Protons from the $d+p$ breakup reaction are detected by using LAS. The energy range of the detected protons of interest is covered by three momentum bins defined by the magnetic fields of LAS. Measurements of D$(p,p_1)np_2$ reaction and D$(p,p_1p_2)n$ reaction are made simultaneously.

The examination of the 2π3NF effects is made at different three angles. The time necessary for the data taking at three angles is 4.5 days, excluding the time for starting up and checking the data taking system.

Expected experimental errors for the D$(p,p_1)np_2$ reaction are estimated to be about 0.003 for A_y and 3%-5% for the cross section. The predicted 2π3NF effects in the reaction are about 0.02 for A_y and about 30% for the cross section. Therefore, the 2π3NF effects can be well distinguished if they are large as predicted.