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PROPOSAL FOR EXPERIMENT AT RCNP

23 January 2012

TITLE:
Study of the tensor correlation in ^{4}He via the ^{4}He(p, dp)d and ^{4}He(p, dp)pn reactions

SPOKESPERSON:

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RUNNING TIME:	Installation time without beam	2 days
	Data runs	13 days
BEAM LINE:		Ring : WS course
BEAM REQUIREMENTS:	Type of particle	p
	Beam energy	400 MeV
	Beam intensity	$\leq$ 1000 nA
	Other requirements	energy resolution $\leq$ 300 keV halo-free, small emittance
BUDGET:	Experimental expenses	850,000 yen

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SUMMARY OF THE PROPOSAL

The tensor correlations in nuclei draw increasing attention in the modern nuclear physics. Nevertheless, the experimental method of probing the tensor correlations in nuclei has not been established well. Although the effect of the tensor correlation should have characteristic dependence on the channel spin S of the pairing nucleons, those spin states have not been experimentally investigated at the high-momentum region, where the tensor force effect is expected to be dominant.

In the proposed experiment, we measure the ratio of the cross sections between the ^{4}He(p, dp)d and ^{4}He(p, dp)pn[^{1}S$_0$] reactions at the large momentum-transfer region 300–400 MeV/c. By utilizing the double-arm spectrometer at RCNP, we can obtain a sufficient missing-mass resolution to identify the final states of the residual pn pair, and eventually the channel spin of the correlated pn pair. In the ^{4}He(p, dp)d and ^{4}He(p, dp)pn[^{1}S$_0$] reactions at the proposed geometrical configuration, the correlated pn pair has the channel spin $S = 1$ and 0, respectively. Their yield ratio must be a good measure of the tensor correlation in nuclei, because the tensor force favors only the $S = 1$ state.

This experiment provides a first glance at the spin degree of freedom of the correlated pn pairs in nuclei.