RCNP EXPERIMENT E256

PROPOSAL FOR EXPERIMENT AT RCNP

20/01/2005

TITLE:

Study of Nuclear Correlation Effects via $^{12}\mathrm{C}(\vec{p},\vec{n})^{12}\mathrm{N}(g.s.)$

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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M. Dozono	Kyushu Univ.	M	H. Takeda	Kyushu Univ.	M
Y. Yamada	Kyushu Univ.	M	K. Hatanaka	RCNP	P
Y. Sakemi	RCNP	A.P.	A. Tamii	RCNP	A.P.
Y. Shimizu	RCNP	D	K. Fujita	RCNP	D
Y. Tameshige	RCNP	D	H. Matsubara	RCNP	M

RUNNING TIME:

Calibration of NPOL3	1.5 days
Measurement of σ and A_y	2.5 days
Measurement of D_{ij}	13.0 days
Total	17.0 days

BEAM LINE: N0 (NTOF facility + NPOL3)

BEAM REQUIREMENTS:

Type of particle	Polarized Protons
Beam energy	295 MeV
Beam intensity	$>$ 500 nA on target before pulse selection
Time resolution	$<$ 200 ps (FWHM)
Beam polarization	$>$ 0.7
Injection Mode	High Current Mode
Pulse selection	1/5 or 1/1

BUDGET:

Summary of budget request	3,600,000
Experimental expenses	2,600,000
Travel plan	1,000,000

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SUMMARY OF THE PROPOSAL

The Gamow-Teller (GT) and M1 transitions on ^{12}C are said to be ''pion-like" in that the transfer of a virtual pseudoscalar pion requires both spin and isospin transfers ($\Delta S = \Delta T = 1$). If nuclei are sufficiently close to the critical point for pion condensation, enhancements of the cross sections for these transitions are expected at large momentum transfers of $q \sim 1.7$ fm^{-1}. Existing data for these transitions show the enhancement from the results of conventional distorted wave impulse approximation (DWIA) calculations. Although the enhancement could be considered as precursor phenomena for pion condensation, the effects of the spin-transverse (rho-mesonic) contributions are ambiguous.

In order to exclude this ambiguity, we propose to measure a complete set of polarization transfer (PT) coefficients for the $^{12}\mathrm{C}(p,n)^{12}\mathrm{N}(g.s.)$ reaction at $T_p = 295$ MeV. We separate the cross section into the spin-longitudinal (pionic) and spin-transverse (rho-mesonic) polarized cross sections by using the PT coefficients. The data will be compared with DWIA calculations employing random phase approximation (RPA) response functions in order to assess the nuclear correlation effects at large momentum-transfer region.