RCNP EXPERIMENT E317

PROPOSAL FOR EXPERIMENT AT RCNP

13/02/2008

TITLE:

Study of spin dipole strengths in ^{12}N and ^{16}F via complete polarization transfer measurements

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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Y. Yamada	Kyushu Univ.	D	T. Imamura	Kyushu Univ.	M
K. Sagara	Kyushu Univ.	P	S. Kuroita	Kyushu Univ.	M
H. Shimoda	Kyushu Univ.	M	T. Sueta	Kyushu Univ.	M
K. Hatanaka	RCNP	P	H. Okamura	RCNP	P
A. Tamii	RCNP	AP	Y. Tameshige	RCNP	D
H. Matsubara	RCNP	D	D. Ishikawa	RCNP	D
K. Suda	RCNP	R	Y. Sakemi	CYRIC	P
T. Nagano	CYRIC	M			

RUNNING TIME:

Beam tuning for N, S, and L-type beams	1.5 days
Calibration of NPOL3	1.5 days
Measurement of σ and A_y	1.5 days
Measurement of D_{ij}	12.0 days
Total	16.5 days

BEAM LINE: N0 (N0 + NPOL3)

BEAM REQUIREMENTS:

Type of particle	Polarized Protons
Beam energy	$\simeq$ 300 MeV
Beam intensity	$>$ 500 nA on target before pulse selection
Time resolution	$<$ 300 ps (FWHM)
Beam polarization	$>$ 0.6
Injection Mode	High Current Mode
Pulse selection	1/5 or 1/1

BUDGET:

Summary of budget request	4,700,000
Experimental expenses	3,900,000
Travel plan	800,000

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SUMMARY OF THE PROPOSAL

We have recently observed a missing spin-dipole (SD) 0^- state in ^{12}N via the ^{12}C$(\vec{p},\vec{n})$ reaction at T_p=296 MeV and $\theta_{\rm lab}$=0°. In the shell-model (SM) calculations, two major 0^- states are predicted in ^{12}N, and the observed state corresponds to the lower one. Thus there is still a missing 0^- state in the higher continuum region. Furthermore, our data have confirmed that the SD resonance at $E_x \simeq 7$ MeV consists mainly of the 2^- component, which was suggested by the ^{12}C$(\vec{d},{}^2$He$)^{12}$B and ^{12}C$(^{12}$C$,{}^{12}$N$)^{12}$B experiments. Because the SD state at $E_x \simeq 4$ MeV is also 2^-, this 2^- dominance at $E_x \lesssim 7$ MeV has aroused the problem of the missing 1^- strength. The missing 1^- strength is also expected to be in the higher continuum region.

The 0^- strength in ^{16}F is also missing by comparing with the SM calculations and the sum rule value. The evidence of the missing 0^- state predicted by the SM calculations was suggested by the ^{16}O$(\vec{p},\vec{n})^{16}$F reaction at T_p=135 MeV, however, it is not settled. It should be noted that the SD excitations in ^{16}O have been discussed recently in relation with the neutrino detection from supernova with the Superkamiokande water Cherenkov detector. Thus the quantitative information on the distribution of the SD strengths in ^{16}F is very important.

Thus, in order to identify missing SD strengths in the continuum region, we propose to measure the cross sections and complete sets polarization transfer observables for ^{12}C$(\vec{p},\vec{n})^{12}$N and ^{16}O$(\vec{p},\vec{n})^{16}$F reactions. The measured polarization transfer observables are used to separate the cross sections into spin-longitudinal ID_q and spin-transverse ID_p polarized cross sections. These polarized cross sections enable us to separate the $L = 1$ SD cross section in the continuum into the 0^-, 1^-, and 2^- components. The deduced strength distributions and their sums will be compared with the SM calculations and the sum rule values in order to investigate the tensor correlation effects in nuclei.