RCNP EXPERIMENT E232

PROPOSAL FOR EXPERIMENT AT RCNP

25 January 2004

TITLE: **Three-nucleon force effects in the $\vec{d}$ + p → system at 200 MeV**

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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K. Fujita	RCNP	D1	Y. Tameshige	RCNP	M2
H. Sakai	University of Tokyo	P	K. Yako	University of Tokyo	RA
Y. Maeda	University of Tokyo	D3	H. Kuboki	University of Tokyo	M2
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T. Wakasa	Kyushu University	AP	T. Kudoh	Kyushu University	M2
H. Ohira	Kyushu University	M1	M. Tomiyama	Kyushu University	M1
K. Sekiguchi	RIKEN	Res. Fellow			
J. Blomgren	TSL, Uppsala University	Professor			
H. Witała	Jagiellonian University	Professor			

RUNNING TIME:

Beam energy		200 MeV	
Beam intensity		1 - 10 nA	
Beam time	Total	10 days	
		1.5 day	Installation with beam
		2.5 day	Measurements of the cross section of the elastic scattering
		3 days	Measurements of A_{xx} of the breakup reaction
		3 days	Measurements of A_{xz} of the breakup reaction

BEAM LINE: WS course, GR + LAS

BEAM REQUIREMENTS:

Type of particle	polarized deuteron
Beam energy	200 MeV
Beam intensity	1-10 nA
Energy resolution	< 0.2 MeV (FWHM)
Beam polarization	> 0.7 (in vertical & horizontal plan)

BUDGET: Experimental expenses 150,000 yen

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SUMMARY OF THE PROPOSAL

Study on three-nucleon scatterings based on modern NN forces has matured in recent years, and computationally accurate solutions of the three-nucleon (3N) Faddeev equation can be achieved. In addition to the first signal on 3NF effects resulting from discrete states, strong 3NF effects were observed around the minima of the *Nd* elastic scattering cross section at incoming nucleon energies higher than about 60 MeV. This discrepancy between the data and predictions based exclusively on NN forces could be largely removed by including the 2π-exchange TM 3NF, properly adjusted to reproduce the ^{3}H binding energy in the 3N Hamiltonian. A recent study at RIKEN shows that the inclusion of the 3NF does not always improve the description of precise data taken at intermediate deuteron energies. In the E146 at RCNP, we measured the angular distributions of the cross section, the proton analyzing power and all proton polarization transfer (PT) coefficients of $\vec{p}d$ elastic scattering at 250 MeV. Experimental data were compared with rigorous Faddeev calculations. Overall, these results clearly indicate that the spin structure of 3NF is not properly described by present day models.

It is important to investigate 3NF effects on other observables with various combinations of spin and isospin in outgoing channels. In the E215, we proposed to measure the tensor analyzing powers, A_{xx}, A_{yy} and A_{xz}, of the breakup reaction: $\vec{d}+p \rightarrow (pn)_{^1S_0}+p$ at 200 MeV. This reaction is a supplementary process at almost the same kinematics as the Nd elastic scattering but with a different relative role of 2NF and 3NF. The last B-PAC partly approved the beam time to measure A_{yy} and to develop the deuteron beam with the polarization axis in the horizontal plane. We measured A_y and A_{yy} of the process and also showed we can manipulate the deputeron spin in the horizontal plane. In this proposal, we measure the tensor analyzing powers A_{xx} and A_{xz}. The angular distribution of the elastic scattering cross section is also measured to complete the data base at the present incident energy. The absolute value of the cross section is obtained with a gas target and a double slit system.