RCNP EXPERIMENT E215

PROPOSAL FOR EXPERIMENT AT RCNP

22 July 2003

TITLE:

Three-nucleon force effects in the $\vec{d} + \mathrm{p} \rightarrow (\mathrm{pn})_{^1S_0} + \mathrm{p}$ reaction at 200 MeV

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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K. Fujita	RCNP Osaka University	M2
Y. Tameshige	RCNP Osaka University	M2
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K. Yako	Department of Physics, U. of Tokyo	RA
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K. Sekiguchi	RIKEN	Research Fellow
K. Sagara	Kyushu University	P
T. Wakasa	Kyushu University	AP
T. Kudoh	Kyushu University	M2
H. Ohira	Kyushu University	M1
M. Tomiyama	Kyushu University	M1
H. Witała	Jagiellonian University	Professor

RUNNING TIME:

Beam energy		200 MeV	
Beam intensity		1 - 10 nA	
Beam time	Total	12 days	
		1 day	Installation with beam
		2 day	Development of the polarized deuterons in the horizontal plane
		3 days	Measurements of A_{yy}
		3 days	Measurements of A_{xx}
		3 days	Measurements of A_{xz}

BEAM LINE: WS course + 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 250,000 yen

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SUMMARY OF THE PROPOSAL

Three-nucleon scattering 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 in a study of 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 necessary to investigate 3NF effects on other observables with various combinations of spin and isospin in outgoing channels. In this proposal, we measure the tensor analyzing power A_{yy} of the following reaction: $\vec{d} + p \rightarrow (pn) + p$ at 200 MeV. This process is a supplementary process at almost the same kinematics as the Nd elastic scattering but with a different relative role of 2N and 3NF. Large 3NF effects are predicted by a rigorous Faddeev calculation for A_{yy}. We also measure the tensor analyzing powers A_{xx} and A_{xz} for which according to theoretical predictions 3NF gives neglegible effects.