

PROPOSAL FOR EXPERIMENT AT RCNP

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Measurement of A_{zz} in pd radiative capture at $E_{\vec{d}} = 200$ MeV**Spokesperson:**

Name Kichiji Hatanaka
 Institution RCNP, Osaka University
 Title Professor
 Address 10-1, Mihogaoka, Ibaraki, Osaka 567-0047
 Phone number +81-6-6879-8928
 FAX number +81-6-6879-8899
 E-mail hatanaka@rcnp.osaka-u.ac.jp

Experimental Group:

Name	Institution	Title
Y. Sakemi	RCNP, Osaka University	AP
A. Tamii	RCNP, Osaka University	AP
Y. Shimizu	RCNP, Osaka University	PD
Y. Tameshige	RCNP, Osaka University	D2
K. Sagara	Department of Physics, Kyushu Univ.	P
T. Wakasa	Department of Physics, Kyushu Univ.	AP
T. Kudoh	Department of Physics, Kyushu Univ.	D2
T. Kawabata	CNS, Univ. of Tokyo	RA
K. Sekiguchi	RIKEN	PD
H. Kamada	Department of Physics, Kyushu Institute of Technology	AP
H. Witala	Department of Physics, Jageronian Univ., Poland	P

RUNNING TIME: @	Setup with beam	2 days
@	Development of the P_{zz} beam	1 day
@	Data runs	6 days
	Total	9 days

BEAM LINE: Ring, WS course, LAS

BEAM REQUIREMENTS:	Type of particle	polarized d
@	Beam energy	200 MeV
@	Beam intensity	≤ 10 nA
@	Any other requirements	P_{zz} beam

BUDGET: Experimental expenses 1,500,000 yen

TITLE: Measurement of A_{zz} in pd radiative capture at $E_{\vec{d}} = 200$ MeV

SPOKESPERSON: Kichiji Hatanaka

SUMMARY OF THE PROPOSAL

Introduction of a 2π -exchange 3N force ($2\pi 3NF$) has succeeded in excellently eliminating large discrepancies between 3-nucleon (3N) experimental data and calculations based on 2-nucleon forces (2NF). Recent calculations reproduce 3N binding energies, the differential cross section around minima of the vector analyzing power of Nd scattering at intermediate energies quite well. However, remarkable A_y puzzle in Nd scattering below 30 MeV and some discrepancies in vector and tensor observables in Nd scattering above 60 MeV can not be explained by $2\pi 3NF$, indicating the existence of ingredients other than 2π exchange processes, for example new 3NF's or new reaction mechanisms. To elucidate the origins of those discrepancies, more experimental data are highly required including spin observables in a plenty of 3N systems as elastic scattering, breakup processes and radiative capture.

In our previous experiments (E126 and E206), we found a very large discrepancy in A_{xx} of pd radiative capture at $E_{\vec{d}} = 200$ and 140 MeV. It appears in the whole angular range and is much greater than the contribution of $2\pi 3NF$, and is the largest and clearest discrepancy in tensor observables so far found in 3N experiments. The radiative capture reaction is an interesting channel since it involves a large momentum transfer and probes high-momentum components of the wave functions. The coupling with a photon makes this reaction sensitive to electromagnetic currents involved in the 3N system. To investigate the effects of the short distance collision, i.e. large momentum transfer process, an experiment (E233) was proposed to measure A_{xx} of dd radiative capture. On the other hand, new experimental data were recently taken at the KVI on vector and tensor analyzing powers of the pd radiative capture at 55, 66.5 and 90 MeV/nucleon. They reported their data are described well by the Faddeev calculations. They measured A_{yy} and A_{zz} . From our data of A_{xx} and A_{yy} , A_{zz} is evaluated from the relation, $A_{xx} + A_{yy} + A_{zz} = 0$. There are discrepancies of almost factor two between RCNP and KVI results. Our data are being carefully reanalyzed independently and the first result is consistent with the previous one. It is badly required to experimentally clarify the origins of the discrepancies among data.

In the present proposal, we measure A_{zz} of the pd capture at $E_{\vec{d}} = 200$ MeV. Beam is longitudinally polarized and recoiled ^3He particles are detected by using LAS set at 0° . Since the cross section of the pd capture is very small, less than $0.3 \mu\text{b}/\text{sr}$, we increase the counting rates of ^3He and reduce backgrounds by using a liquid hydrogen target with thin windows. The target is 1.5 mm in thickness. A_{xx} is measured in the same geometry with the vertically polarised beam to confirm the consistency of the detection system. A_{yy} and A_{zz} of the dp elastic scattering are also measured to calibrate the beam line polarimeter by referring data taken at RIKEN. This experiment makes it possible to resolve the contradictions in experimental data and to establish the methods to make versatile measurements with polarized deuterons at intermediate energies at the RCNP.