RCNP EXPERIMENT E180

PROPOSAL FOR EXPERIMENT AT RCNP

15 January 2002

Study of the $\vec{p} + {}^{3}\vec{He}$ Elastic Backward Scattering at 200 - 400 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 or Position
Y. Sakemi	RCNP, Osaka University	AP
T. Wakasa	RCNP, Osaka University	RA
H. Yoshida	RCNP, Osaka University	D3
J. Kamiya	RCNP, Osaka University	D2
Y. Shimizu	RCNP, Osaka University	M2
K. Fujita	RCNP, Osaka University	M1
N. Sakamoto	RCNP, Osaka University	M1
A.P. Kobushkin	RCNP, Osaka University	P(COE)
E.A. Strokovsky	RCNP, Osaka University	P(COE)
H. Ueno	RIKEN	Researcher
H. Okamura	Department of Physics, Saitama Univ.	AP
T. Uesaka	Department of Physics, Saitama Univ.	RA
K. Suda	Department of Physics, Saitama Univ.	D2
K. Sagara	Department of Physics, Kyushu Univ.	AP
T. Ishida	Department of Physics, Kyushu Univ.	M2
S. Ishikawa	Hosei Univ.	AP

Running Time: 12 days

Beam Line: Ring: WS course, Grand Raiden, LAS

Beam Requirements:

Type of Particle	$\vec{p}$
Beam Energy	200, 250, 300, 350, 400 MeV
Beam Intensity	1 - 10 nA
Energy Resolution	$\leq$ 250 keV

Budget:

Experimental expenses 3,100,000 yen

Study of the $\vec{p} + {}^3\vec{He}$ Backward Elastic Scattering at 200 - 400 MeV

SPOKESPERSON: Kichiji Hatanaka

SUMMARY OF THE PROPOSAL

We propose to measure the differential cross section and the spin-spin correlation C_{yy} of the p-^{3}He elastic backward scattering at 200 - 400 MeV. There are several cross section data on the elastic backward scattering and mainly at energies higher than 400 MeV. Our calculations show that at the energy region of the RCNP Ring Cyclotron, the cross section and spin-spin correlations are sensitive to the ^{3}He wave function and the reaction mechanisms (see [**?**] and Appendix to this proposal), namely:

(1) There are three kinematical regions where different mechanisms determine the proton-^{3}He backward elastic scattering: up to $T_p \sim 200$ MeV the *one deuteron exchange* (ODE) dominates; between $200 < T_p < 1000$ MeV the reaction is dominated by *rescattering of the intermediate pion off the intermediate deuteron* (PI) and at higher energies the dominating mechanism is *direct proton interaction* (DIR). The same must be true also for other backward scattering reactions with the lightest nuclei at intermediate energies.

(2) The results obtained here give a confirmation that the intermediate $\pi d \to d\pi$ resonance scattering is responsible for the enhancement observed in the differential cross section at $0.4 < T_p < 0.8$ GeV.

(3) All the mechanisms, ODE, DIR and PI, are deeply connected with the ^{3}He structure. Elastic backward scattering of protons off ^{3}He can be used as a source of the information about the ^{3}He structure at short distances.

¿From this experiment, definite conclusions can be drawn about the structure of 3N system at short distances, in particular about the role of 3N force in ^{3}He. Experimental confirmation of the sharp structure in the cross section and C_{yy} predicted by our calculations is also important to understand the reaction mechanism and to derive general conclusions concerning use of this reaction as a source of the information about ^{3}He wave function at short distances.

Proposed measurements will contribute to the world data base for study of spin dependent NN and 3N forces at intermediate energies significantly, since they will cover the large range of momentum between two nucleon pair and a nucleon in the ^{3}He wave function.