RCNP EXPERIMENT E314

PROPOSAL FOR EXPERIMENT AT RCNP

14 February 2008

TITLE:
Search for Direct Evidence of Tensor Interaction: High Momentum Component in Nuclei

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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THEORETICAL GROUP:

Name	Institution	Title or Position
K. IKEDA	RIKEN Nishina Center	Emeritus Professor
H. TOKI	RCNP	Professor
T. MYO	RCNP	Researcher
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RUNNING TIME:

GR set up and tuning + change of target + contingency	1.5+0.5+1.0 days
(p,d) reaction runs for three targets	3.0 days
(p,pd) reaction runs for two targets	4.0 days

BEAM LINE: Ring : WS beam line and Grand Raiden Spectrometer.

BEAM REQUIREMENTS:

Type of particle	p
Beam energy	200 MeV, 300 MeV, 392 MeV
Beam intensity	10 nA

OTHER REQUIREMENTS:

Achromatic beam with resolution $\leq$ 80 keV

Single turn and halo-free beam with small emittance

BUDGET:

Assembly of proton detector system	3,000 kyen
Replacement of sliding membrane of the scattering chamber	300 kyen

Travelling expenses including accommodation of 7 participants are to be provided by RCNP

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SUMMARY OF THE PROPOSAL

Measurements of (p,d) and (p,pd) reactions on ^{12}C and ^{16}O targets using proton beams at 200 MeV, 300 MeV and 392 MeV are proposed in search of direct evidence of tensor interaction in high-momentum component in nuclei. The experiment will be performed using the Grand Raiden spectrometer at several finite angles between 1° and 30°. The main objective is to deduce the internal momentum distributions, specifically those of the s-wave neutrons in ^{12}C and ^{16}O, around 2 fm^{-1} where the effects of tensor force are expected to be different. For this purpose, excitation energy up to 4 MeV, with resolution about 100 keV sufficient to separate most of the low lying states, will be measured to cover the s-hole states in ^{11}C and ^{15}O. Calibration will be carried out by measuring the (p,d) reaction on deuteron target at similar beam energies and angular settings.

These measurements will be performed with natural carbon foils, thin ice H_2O targets and a thin foil CD_2 target. The proton beam will be stopped at a Faraday cup placed downstream of the Q1 magnet for the measurements at 1° and another Faraday cup placed inside the scattering chamber for the measurements at other angles. The standard focal plane detector system with two multi-wire drift chambers and two 10 mm-thick plastic scintillators will be used. For the (p,pd) reaction, a new ΔE-E detector system for the recoil protons will be installed in the backward angles with respect to the beam axis.

The cross sections for the (p,d) reaction at the measuring angles are expected to be about 20 μb/sr to 100 μb/sr. Assuming the cross section to be 20 μb/sr, we estimated the time required to obtain about 2000 counts of deuteron events.