RCNP EXPERIMENT E182

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE: Study of the Spin Dependent ^{3}He-Nucleus Interaction at 450 MeV

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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Y. Kitamura	RCNP, Osaka University	M
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Y. Yasuda	Department of Physics, Kyoto University	D
T. Noro	Department of Physics, Kyushu University	P

RUNNING TIME: 12 days

BEAM LINE: Ring: WS course, Grand Raiden

BEAM REQUIREMENTS:

Type of Particle	^{3}He
Beam Energy	450 MeV
Beam Intensity	1 - 30 pnA
Energy Resolution	$\leq$ 200 keV

BUDGET:

Experimental expenses	500,000

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SUMMARY OF THE PROPOSAL

Interactions between complex nuclei are most fundamental and important subjects in nuclear physics. The spin dependence of the nucleus-nucleus interaction is of special interest because it is closly related to the nuclear strucure and reaction mechanism as well as to the spin dependence of the interaction between constituent particles. Spin dependence in proton-nucleus and deuteron-nucleus interaction has been well studied owing to developments of polarized proton and deuteron ion sources. For heavier particles, study of spin dependent interaction is limitted to lower energies due to the difficulty of developments of polarized ion sources. Thus it is important to study spin dependence interaction between ^{3}He, which consists of three nucleons, and nuclei at intermediate energy for the next stage.

The advantage of studying the spin dependent interaction between ^{3}He and nuclei at intermediate energy region is that the reaction mechanism is simple. That simplicity comes from the smaller effect of the breakup processes that make the approach at lower energies difficult. There are theoretical investigations based on folding models which is a starting point to understand the ^{3}He-nucleus interaction microscopically at intermediate energies. The spin-orbit interaction predicted by the folding models plays an important role in cross sections for the elastic scattering and produces large values of vector analyzing power. This effect is significant enough to affect the results of the optical-model analysis of the cross-sectional data using the central potential alone. It is strongly demanded to measure the polarization observables of ^{3}He-nucleus collisions in order to understand ^{3}He-nucleus interaction and reaction mechanism.

In E157 experiment, we measured the angular distribution of the induced polarizations for ^{3}He elastic scattering off ^{58}Ni at 450 MeV using double scattering method. Angular range covered from 5° to 16° in the center of mass system. The preliminary result shows the large values of the polarizations at angles of local minimam values of the cross sections. The focal plane polarimeter(FPP) of the Grand Raiden was calibrated with 8mm thickness plastic scintilattor with the absolute value of the polarization of ^{3}He+^{12}C elastic scattering at $\theta_{lab} = 7°$.

In this experiment, we measure polarization for ^{3}He elastic scattering from ^{208}Pb and ^{12}C (and ^{58}Ni for more statistics). An energy map of effective analyzing power for FPP system is also measured to calibrate ^{3}He polarimeter system. The results will be studied in the framework of SF and DF model calculations.