RCNP EXPERIMENT E346

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:
Measurement of neutron elastic scattering cross sections in intermediate energy region

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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Kichiji HATANAKA	Research Center for Nuclear Physics, Osaka Univ.	(P)

RUNNING TIME: Installation time without beam 1 day(for each beam time)
Data runs 4.5 days

BEAM LINE: Ring : N0 course

BEAM REQUIREMENTS:

Type of particle	p
Beam energy	140, 250, 400 MeV
Beam intensity	$\leq$ 700 nA
Any other requirements	halo-free, small emittance, beam pulsing

BUDGET:

Experimental expenses 1000,000 yen
(To construct an additional shielding of iron.)
Traveling expenses 500,000 yen
(If the experiment is performed in a continuous beam time with E323 and our another proposal, we can share the traveling expenses.)

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SUMMARY OF THE PROPOSAL

The purpose of this study is to establish an experimental method to measure elastic scattering neutrons in intermediate energy region, and acquire systematic data for angular differential elastic cross sections. The experiment is performed at neutron-TOF course. A quasi-monoenergetic neutron beam incident on a scattering sample is produced by bombarding protons on a lithium target using ^{7}Li(n,p) reaction. The scattering neutrons on the sample are detected by liquid organic scintillators, which have a 10^4 times lager detection efficiency than that of a typical proton-recoil telescope. The detection system with a high efficiency makes possible to measure the cross sections with sufficient statistical precisions at facilities with weak beam current. By measuring time-of-flight (TOF) of the scattering neutrons, elastic neutrons are distinguished from inelastic neutrons that have relatively long TOF.

A feasibility study has been carried out as the E310 experiment for a carbon sample by using 140-MeV proton beam. The experimental method including data-processing procedure was validated experimentally in this study. We are now stepping in the next phase of the study to measure the systematic cross-section data. Proton beams of 140, 250, and 400 MeV are required in this proposal. Cross sections are measured for carbon, aluminum, niobium, iron, and lead using 140-MeV protons, and a feasibility study to apply the detection system to higher incident energies is performed for carbon with 250-, and 400-MeV protons. The incident energies are determined to analyze an energy dependence of cross sections, and the scattering samples are selected to cover a wide mass range on a periodic table.

The beam requirement for data run with 140-MeV protons was estimated at 2.5 days. The test runs for 250- and 400-MeV protons take totally 2.0 days. Thus, the grand total time required in this proposal is 4.5 days.