RCNP EXPERIMENT E171

PROPOSAL FOR EXPERIMENT AT RCNP

May 28, 2001

TITLE: Study of breakup mechanism of a loosely bound projectile in a region of Coulomb-breakup dominance

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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Y. Maeda	Dept. of Physics, Univ. of Tokyo	D1
T. Saito	Dept. of Physics, Univ. of Tokyo	M2
T. Ishida	Dept. of Physics, Univ. of Tokyo	M1

RUNNING TIME:

Test running time for experiment	2 days
Data runs	3 days

BEAM LINE: Ring: ES course (East experimental hall)

BEAM REQUIREMENTS:

Type of particle	deuteron, H_2^+ (singly charged hydrogen molecule)
Beam energy	70 MeV/A
Beam intensity	2 nA on target

BUDGET:

Travel expense 500,000 yen

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SUMMARY OF THE PROPOSAL

Studies of Coulomb-breakup of composite nuclei have been of constant interest in nuclear physics. The recent discovery of very extended halo nuclei has generated renewed interest in methods for the calculation of Coulomb-breakup. It also has attracted attention in relation to the astrophysical interest. While an exciting application is in the study of such exotic nuclei, the low intensity currently available of secondary beams of these new nuclear species means that present data carry significant experimental uncertainty and are still very limited. Such data inevitably do not challenge sufficiently between different theoretical descriptions.

In the previous study, we proposed to pursue the problem by using a light-ion primary beam. The deuteron can be considered as the simplest example of an "exotic" nucleus, because of its small breakup-energy and the dominance of the S-wave in the ground state having no ambiguity in the wave-function. The (d, pn) elastic breakup was measured at $\theta_p = \theta_n = 0°$ and at $E_d = 56$, 140, and 270 MeV on various targets ranging from $Z = 6$ to 82. The data were expected to provide a ground for critical tests of proposed various models. However, the angular resolution was found to be insufficient for the data to be directly compared with theoretical calculations, which predict steep and complicated angular distributions at $\theta \simeq 0°$. Calculations also suggest a need to measure the angular correlation up to fairly large angles.

The proton angular resolution was seriously deteriorated and the neutron angle was fixed only at 0° because of the use of quadrupole-dipole-type magnetic spectrometer. In this experiment, we propose to re-measure the reaction newly fabricating a spectrometer to eliminate those limitations. We aim at obtaining the angular correlation in a range of $\pm 10°$ with angular resolution of 0.3°, both for proton and neutron. The target dependence is obtained on ^{12}C, ^{40}Ca, ^{90}Zr, and ^{208}Pb, but the beam energy is fixed at 140 MeV due to instrumental limitations. This time the data should be truly useful to establish a theoretical treatment of Coulomb-breakup of loosely bound projectiles.