RCNP EXPERIMENT E333

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:

Determination of proton radii of p-sd shell nuclei by Charge Changing Cross Section (CCCS) measurements.

SPOKESPERSON:

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EXPERIMENTAL GROUP:

Name	Institution	Title or Position
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A. Ozawa	Dep. of Physics, Tsukuba University	Associate Professor
S. Momota	Kochi University of Technology	
T. Kawabata	Dep. of Physics, Kyoto University	Associate Professor

RUNNING TIME:

9 days of ^{18}O beam
7 days of ^{40}Ar beam
2 days of contingency
18 days in total

BEAM LINE: **Ring : EN course.**

BEAM REQUIREMENTS:

^{18}O: 79A MeV highest
^{40}Ar: 70A MeV highest

BUDGET:

9.5 × 9.5 cm^2 μm Δ E Si detectors:
4 sets × 500,000 = 2,000,000 yen + initial cost 1,000,000 yen = 3 M yen

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Determination of proton radii of p-sd shell nuclei by Charge Changing Cross Section (CCCS) measurements.

SPOKESPERSON: Mitsunori FUKUDA, Isao TANIHATA

SUMMARY OF THE PROPOSAL

We propose to measure the charge-changing cross section (CCCS) of Be, B, C isotopes using radioactive beams of energy above 50A MeV. The CCCS is the total cross section of the change of the atomic number of projectile nucleus. We have been studying interaction cross sections, that is the total cross section of nucleon changing in a projectile, and have been determining the radii of nucleon distribution as well as the nucleon density distributions. Similarly, CCCS is closely related to the distribution of protons in a nucleus. We consider that the recent progress of Glauber model analysis of the CCCS enable the extraction of the proton distribution radii of neutron rich nuclei. The validity of the Glauber analysis for CCCS now can be tested using the recently measured root-mean-square radii of Li-isotopes. We present that the charge radii can be obtained with good precision from the CCCS.

One can deduce the thicknesses of neutron skin from differences of the radii of nucleon distributions and the proton distributions. Present proposal aims to study the systematic change of the neutron skin thickness in these isotopes. Such data would provide a mean to distinguish nuclear models at lightest region of nuclei where ab-initio type nuclear models are being introduced. Particular interests exist in Be, C and O isotopes in which interplay between cluster structure and shell model structure plays an important role. Different shapes between proton and neutron distributions are also among the interests from a view point of nuclear structure.

For the experiment, we plan to use EN course to produce beams of the radioactive nuclei. The σ_{CC} will be determined by the change of projectile atomic number in a target using Si telescope placed down stream of the target. The σ_{CC} will be determined with precision better than 1 % thus alow to determine the proton radii with small uncertainties.