

**E372**

## PROPOSAL FOR EXPERIMENT AT RCNP

February 2011

**TITLE:**

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

**SPOKESPERSON:**

N. T. Tho (CNS, Institute of Physics, VAST, Hanoi - Vietnam)

nttho@iop.vast.ac.vn, (84) 04 3756 4317

M. Fukuda (Faculty of Science, Osaka University)

mfukuda@phys.sci.osaka-u.ac.jp

I. Tanihata (RCNP, Osaka University)

tanihata@rcnp.osaka-u.ac.jp, (06) 6879 8918

**EXPERIMENTAL GROUP:**

RCNP, Osaka University : H. J. Ong, T. Suzuki, A. Tamii, K. Hitora

Faculty of Science, Osaka University: K. Matsuta, M. Mihara, D. Nishimura

Tsukuba University: A. Ozawa

Kochi University of Technology: S. Momota

Kyoto University: T. Kawabata

CNS, Institute of Physics, VAST: L. H. Khiem, N. Q. Hung, P. V. Cuong, N. T. Vinh, T. D. Trong, N. N. Duy

**RUNNING TIME:**

7 days of  $^{22}\text{Ne}$  beam

12 days of  $^{40}\text{Ar}$  beam

2 days of contingency

21 days in total

**BEAM LINE:**

EN course, Reaction target is at F2.

**BEAM REQUIREMENTS:**

$^{22}\text{Ne}$ : 79A MeV or highest

$^{40}\text{Ar}$ : 70A MeV or highest

**OTHER REQUIREMENTS:**

Nothing special

**BUDGET:**

9.5x9.5cm<sup>2</sup> 100μm ΔE Si detectors, 2 sets. 2x500,000 = 1,000,000 yen = 1 M yen.

**TITLE:****Determination of proton radii of p-sd shell nuclei by Charge Changing Cross Section (CCCS) measurements (extension request)****SPOKESPERSON:**

N. T. Tho (Center for Nuclear Physics, IOP, Hanoi-Vietnam), M. Fukuda (Faculty of Science, Osaka University) mfukuda@phys.sci.osaka-u.ac.jp and I. Tanihata (RCNP)

**SUMMARY OF THE PROPOSAL**

We propose to measure the charge-changing cross sections (CCCS,  $\sigma_{cc}$ ) of C, N, O and F isotopes using radioactive beams of energy  $\sim 50A$  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 change 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 skins from differences of the radii of nucleon distributions and the proton distributions. Present proposal aim 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 the EN course to produce beams of the radioactive nuclei. The  $\sigma_{cc}$  will be determined by the change of projectile atomic number in a target using MUSIC detector and Si telescope placed down stream of the target. The  $\sigma_{cc}$  will be determined with precision better than 1% thus allow to determine the proton radii with small uncertainties.

*The first proposal that proposed to measure the Be, B, C isotopes have been approved January 2009 and we had two runs of beam time, one in September 2009 and another in September-October 2010. We have been analyzing the data and getting close to obtain the final data for Be isotopes (Group in Osaka University is taking care of Be isotopes). The data of B isotopes are under analysis in Tsukuba University, the data of C isotopes are also under analysis in Osaka but have some necessary improvements. The present program aim to confirm the data of C-isotopes and to extend the experiment for other nuclei in p and p-sd shell.*