RCNP EXPERIMENT E273

PROPOSAL FOR EXPERIMENT AT RCNP

October 4, 2005

TITLE:

High-resolution study of Gamow-Teller transitions starting from ^{13}C and ^{9}Be as test cases for *ab initio* shell-model calculations with realistic three-nucleon interaction and for the width study

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EXPERIMENTAL GROUP:

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RUNNING TIME: ^{9}Be and ^{13}C data taking runs 0.5 days $\times 2$

BEAM LINE: Ring : WS course, high resolution mode

BEAM REQUIREMENTS:

Type of particle	^{3}He
Beam energy	420 MeV
Beam intensity	10 nA
Energy resolution	$\Delta E \leq 100$ keV, small emittance

BUDGET: For making a target container, we request 200k yen.
Support to the researchers from South Africa is appreciated.

SCHEDULE: We request the beam time in November or December, 2005.

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SPOKESPERSON: Yoshitaka Fujita

SUMMARY OF THE PROPOSAL

High energy-resolution (^{3}He$,t$) experiments on ^{9}Be and ^{13}C targets are proposed at forward angles and an beam energy of 140 MeV/nucleon. The aim is to study the Gamow-Teller (GT) strength with an energy resolution less than 30 keV. We want to study the particle bound part as well as the particle unbound part of the spectrum. The topics of the latter part is the observation of the narrow unbound states i.e., the narrow $T = 3/2$ states up to about 15 MeV excitation energy. Narrow widths are expected due to the isospin-forbidden particle-decay of these states.

The GT strengths are very crucial observables and will be compared with different modern shell model calculations. In particular we want to compare with *ab initio* no-core shell model (NCSM) calculations which include a three-nucleon interaction (TNI). It was found in a previous investigation at RCNP that the B(GT) data for the $A = 11$ system are rather sensitive to the strength of the TNI and we expect a similar sensitivity to the TNI also for the $A = 9$ and 13 data. Further quantitative tests of the three-nucleon interaction are crucial as the TNI is apparently necessary for the description of the structures and transitions in light nuclei yet little is known about the TNI.

In the experiment a high energy resolution of less than 30 keV is important in order to determine the widths of states. Also important is the good angle resolution and the capability of reconstructing the scattering angle. The ion-optical conditions *dispersion matching* and *angular dispersion matching* will be realized between the spectrometer and the WS beam line to achieve a high energy resolution and good angle resolution, respectively. The over-focus mode of the spectrometer is essential in realizing good angle resolution in vertical direction and also in correcting kinematic aberrations.