RCNP EXPERIMENT E148

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE: Neutron and γ Decay from Hole States in Light Nuclei

SPOKESPERSONS:

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EXPERIMENTAL GROUP:

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Taiichi Yamada	Kanto Gakuin University	(AP)

RUNNING TIME:

Installation time without beam	3 days
Test running time for experiment	2 days
Data runs	8 days

BEAM LINE: Ring : WS course

BEAM REQUIREMENTS:

Type of particle	unpolarized p
Beam energy	392 MeV
Beam intensity	$\geq$ 20 nA
Any other requirements	energy resolution $\leq$ 300 keV
	halo-free, small emittance

BUDGET:

Experimental expenses	2,800,000 yen
Travel plans	14 participants should be supported by RCNP

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SUMMARY OF THE PROPOSAL

In order to understand microscopic structures of deep-hole states and their fragmentation mechanism, we have measured the ^{12}C$(p,2p)^{11}$B* and ^{16}O$(p,2p)^{15}$N* reaction at $E_p =$ 392 MeV together with decay charged particles from s-hole states in ^{11}B and ^{15}N under the previous E81 and E110 experiments. Our results can not be reproduced by the statistical model calculation using the code CASCADE but are qualitatively consistent with the calculation in the microscopic cluster model with the $SU(3)(\lambda\mu) = (04)$ wave function for the ^{11}B(s-hole) and the $SU(3)(\lambda\mu) = (00)$ for ^{15}N(s-hole).

A recent shell model calculation shows that the s-hole states split into two or more components. In the case of ^{11}B(s-hole), some bump structures are observed in our experimental excitation spectrum, while those are not clear for the ^{15}N(s-hole). As each bump has approximately a different configuration, e.g., $SU(3)[4421](04)$ or $SU(3)[443](04)$ component for the ^{11}B(s-hole), it is predicted that the relative ratio of decay particles is different in each bump. The branching ratio of neutron decay in different excitation energy region is one of the key points to study those bump structures as well as it makes the measurement of fragmentation of deep-hole states complete. Whether the particles decay to the ground states or to excited states of the residual nuclei is another interesting issue. In our E110 results, the decay to ground state is dominant for each particle in the ^{11}B(s-hole) case, while the decay to excited states are mainly occurred in the ^{15}N(s-hole). However, experimental decay ratios between the ground state and excited states have suffered large effects due to the rather high threshold of the detection energy. Measurements of deexcitations from the residual daughter nuclei help to reduce above ambiguities.

In the present proposal, we would like to measure neutron and γ decays from the proton s-hole state in ^{11}B and ^{15}N. The γ decay of ^{15}N s-hole state is also related with the nucleon decay measurement using water Čerenkov detectors. The probability of the high-energy ($\geq$ 15 MeV) γ decay can especially give useful information for the search of invisible nucleon decay ($n \to \nu\nu\bar{\nu}$) mode.