

PROPOSAL FOR EXPERIMENT AT RCNP

06 July 2004

TITLE: Continuing study of the structure and decay of s -hole states in light nuclei: Measurements of $^5\text{He}(s\text{-hole})$ and $^8\text{Li}(s\text{-hole})$ states

SPOKESPERSON:

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RUNNING TIME: Installation time without beam 2 days
 Test running time for experiment 0.5 days
 Data runs 6.5 days

BEAM LINE:

BEAM REQUIREMENTS: Type of particle Ring : WS course
 (polarized) p
 Beam energy 392 MeV
 Beam intensity ≥ 50 nA
 Other requirements energy resolution ≤ 200 keV
 (halo-free, small emittance)

BUDGET: Experimental expenses 1,600,000 yen
 Travel plans - 15 participants should be supported by RCNP

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SUMMARY OF THE PROPOSAL

The purpose of the proposed experiment is to aim at systematic investigations on the fragmentations of s -hole states in light nuclei. In the previous E110/E148/E204 experiments, we measured the particle decay of the s -hole states in ${}^{11}\text{B}$, ${}^{15}\text{N}$ and ${}^6\text{He}$, and triton-decay probabilities were found to be large compared to α -decay for all s -hole states despite their smaller Q -values than those of α -decay. As for the ${}^{11}\text{B}$ and ${}^{15}\text{N}$, this supports the selection rule for fragmentations of doorway s -hole states in light nuclei predicted by the microscopic $\text{SU}(3)$ -model calculations. In the case of ${}^6\text{He}$, however, neither the $\text{SU}(3)$ -model nor the shell-model calculation predicts the enhancement of triton-decay, mainly due to the large difference of the Q -value between t -decay and α -decay, while the experimental branching ratio of $t+t$ decay from the ${}^6\text{He}(s\text{-hole})$ state has been obtained as about 70 %. If the ground state of ${}^7\text{Li}$ is well described by the $t+\alpha$ cluster structure and the s -hole state in ${}^6\text{He}$ is considered to correspond to the one-nucleon knockout state from an α -cluster in ${}^7\text{Li}$, the experimental dominance of $t+t$ decay can naturally be understood.

Since the ground states of ${}^6\text{Li}$ and ${}^9\text{Be}$ are known to have large cluster-structure components of $\alpha+d$ and $\alpha+\alpha+n$, respectively, it is interesting to continue our measurements for the ${}^6\text{Li}$ and ${}^9\text{Be}$ targets. We propose to study the structures and fragmentations of the s -hole states in ${}^5\text{He}$ and ${}^8\text{Li}$ via the quasifree ${}^6\text{Li}(p, 2p)$ and ${}^9\text{Be}(p, 2p)$ reactions at 392 MeV incident energy. Charged particles decaying from the hole states are measured in coincidence with two emerging protons of the $(p, 2p)$ reaction. The recoil momentum dependence of the cross sections of the p - and s -hole states in ${}^5\text{He}$ and ${}^8\text{Li}$ will also be measured in order to investigate the reaction mechanism and to estimate the non-quasifree background around the excitation energy region of the s -hole states.