RCNP EXPERIMENT E204

PROPOSAL FOR EXPERIMENT AT RCNP

27 January 2003

TITLE: **Structure and decay of the s-hole state in ^{6}He**

SPOKESPERSON:

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RUNNING TIME:	Installation time without beam	2 days
	Test running time for experiment	0.5 days
	Data runs	6.0 days
BEAM LINE:		Ring : WS course
BEAM REQUIREMENTS:	Type of particle	(polarized) p
	Beam energy	392 MeV
	Beam intensity	$\geq$ 50 nA
	Other requirements	energy resolution $\leq$ 200 keV (halo-free, small emittance)
BUDGET:	Experimental expenses	300,000 yen
	Travel plans - 16 participants should be supported by RCNP	

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SUMMARY OF THE PROPOSAL

It is proposed to study the structure and fragmentation of the s-hole state in ^{6}He via the quasifree ^{7}Li$(p, 2p)$ reaction at 392 MeV incident energy. Charged particles decaying from the s-hole state in ^{6}He will be 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 ^{6}He will be also measured in order to investigate the reaction mechanism and to estimate the non-quasifree background around the excitation energy region of the s-hole state.

In the previous E110/E148 experiments, we measured the particle decays of the s-hole states in ^{11}B and ^{15}N and triton-decay probabilities were found to be large compared to α-decay for both s-hole states despite their smaller Q-values than those of α-decay. This supports the selection rule for fragmentations of doorway s-hole states in light nuclei predicted by the microscopic SU(3)-cluster model. In the case of ^{6}He, the mean free path of an s-hole is much larger than the nuclear radius and, therefore, the direct decay process is expected to be dominant, while the statistical decay was deduced to be more than half for the decay of the ^{15}N(s-hole). Moreover, the threshold energy of t+t decay (12.3 MeV) is much larger than that of the $\alpha + 2n$ decay (0.97 MeV) in ^{6}He. Thus, to study the partial fragmentation widths of the ^{6}He(s-hole) is much interesting because the escape and spreading widths are expected to be clearly separated.

Since the ^{6}He(s-hole) state is given as the $(s)^3(p)^3$ configuration according to the simple shell model, the special attention is paid to the t+t decay that is considered to be dominant by the selection rule due to the spatial SU(3) symmetry. On the other hand, in the recent measurement of the ^{6}Li(^{7}Li,^{7}Be) reaction, a resonance with large binary triton decay was found at $E_x(^{6}\mathrm{He}) \approx 18$MeV, which suggests a di-triton cluster structure. It is, however, not clear if this resonance has the same origin as the s-hole state because the peak energy of the resonance is a few MeV higher than the central energy of the s-hole state. One of the main purposes of the present work is to elucidate the relevance between the di-triton cluster structure and the s-hole state in ^{6}He.