RCNP EXPERIMENT E308

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:
Search for α-condensed state in ^{24}Mg

SPOKESPERSON:

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RUNNING TIME:	Installation time without beam	3.0 days
	Setup and beam tuning time	2.0 days
	Data runs	4.0 days
BEAM LINE:		Ring : WS course
BEAM REQUIREMENTS:	Type of particle	^{4}He^{++}
	Beam energy	400 MeV
	Beam intensity	$\leq$ 10 pnA
	Energy resolution	$\leq$ 50 keV
	Dispersive beam transport, halo-free, small emittance	
BUDGET:	Experimental expenses	2,500,000 yen
	Travel plans - 10 participants should be supported by RCNP	

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SUMMARY OF THE PROPOSAL

Alpha particle clustering is an important phenomenon in nuclear physics for light nuclei. On the basis of the Ikeda diagram, the α cluster structure is expected to emerge near the α-decay threshold energy. For example, it was suggested that the 7.65-MeV 0_2^+ state in ^{12}C, which locates at an excitation energy higher than the 3α-decay threshold by 0.39 MeV, has an 3α cluster structure. Recently, it was proposed that this 0_2^+ state is theoretically described by introducing a novel concept of the nuclear structure, i.e., this state is an α-condensed state where three α particles are weakly interacting and are condensed into the lowest s-orbit. The next natural question addressed is whether such an α-condensed state exists in the heavier self-conjugate $N = 4n$ nuclei or not.

Based on a microscopic α-cluster model, N. Itagaki *et al.* demonstrated a possible answer to the question that an α-condensed state around a strongly bound core of ^{16}O may appear near the $2\alpha + {}^{16}$O decay threshold energy in ^{24}Mg.

We propose to search for the α-condensed state in ^{24}Mg by a high-resolution measurement of the inelastic alpha scattering at forward angles including 0°. To achieve the highest energy resolution, the dispersion matching technique should be used. In addition, the decaying particles from the excited states should be measured, since the decay branches from the excited states are expected to provide an insight into the cluster structure.