E369

RCNP EXPERIMENT E

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:

Systematic measurement of the inelastic alpha scattering exciting the low-lying monopole states.

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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Y. Maeda	Department of Engineering, Miyazaki University	RA
H. Miyasako	Department of Engineering, Miyazaki University	M1
S. Sakaguchi	RIKEN	PD

RUNNING TIME:

Installation time without beam	2.0 days
Setup and beam tuning time	2.0 days
Data runs	5.0 days

BEAM LINE: Ring : WS course

BEAM REQUIREMENTS:

Type of particle	$^4He^{++}$
Beam energy	150 MeV
Beam intensity	$\leq$ 10 pnA
	Energy resolution $\leq$ 50 keV
	halo-free, small emittance

BUDGET:

Experimental expenses	500,000 yen

Travel plans - 7 participants should be supported by RCNP

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Systematic measurement of the inelastic alpha scattering exciting the low-lying monopole states.

SPOKESPERSON: Kawabata Takahiro

SUMMARY OF THE PROPOSAL

Inelastic alpha scattering at intermediate energies and at forward angles is one of the most useful probes to measure isoscalar natural-parity excitation strengths in atomic nuclei because of its simple reaction mechanism. The inelastic alpha scattering was successfully utilized in nuclear spectroscopic studies, but one serious puzzle remains unsolved.

The single folding model calculation using the density-dependent interaction significantly overestimates the cross sections for the inelastic alpha scattering exciting the 0_2^+ state in ^{12}C. D. T. Khoa *et al.* claimed this puzzle should be attributed to the exotic nature of the 0_2^+ state. The loosely bound dilute structure of the this state significantly enhances absorption in the exit $\alpha+^{12}\mathrm{C}^*(0_2^+)$ channel, and the strong absorption, thus, suppresses the cross section for this state. However, the similar discrepancy between the measured cross section and the calculation was found in the other isoscalar transitions in ^{11}B, ^{13}C, and ^{24}Mg at RCNP. It is, therefore, natural to suspect that this puzzle in the isoscalar transitions might be a universal problem.

We propose a systematic measurement of the inelastic alpha scattering exciting the low-lying monopole states in ^{12}C, ^{28}Si, ^{40}Ca, ^{58}Ni, ^{90}Zr, and ^{114}Sn, for which the electromagnetic excitation strengths are known. The measured cross sections will be compared with the electromagnetic transition strengths on the basis of the distorted-wave Born-approximation calculation in order to quantitatively examine the relation between them and to solve the puzzle in the inelastic alpha scattering.