E402

RCNP EXPERIMENT E

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:
Search for α-condensed state in ^{20}Ne

SPOKESPERSON:

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RUNNING TIME:	Installation time without beam	3.5 days
	Setup and beam tuning	2.0 days
	Data runs	4.5 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
	RF timing resolution	$\leq$ 1 ns
	Dispersive beam transport halo-free, small emittance	
BUDGET:	Experimental expenses	800,000 yen

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SUMMARY OF THE PROPOSAL

Alpha particle clustering is an important phenomenon in nuclear physics especially for light nuclei. On the basis of the Ikeda diagram, the α cluster structure has been expected to emerge near the α-decay threshold energy. 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, is found to be an 3α cluster structure. This 0_2^+ state is theoretically described that three α particles are weakly interacting and are condensed into the lowest s-orbit.

The next natual question addresssed is whether such an α-condensed state exists in the heavier self-conjugate $A = 4n$ nuclei or not. Although some experiments on $A = 4n$ nuclei ^{16}O and ^{24}Mg aimed at the study of this condensed state were performed, there is no experiment on ^{20}Ne. Recently, much theoretical works are devoted to the α condensed state in ^{20}Ne. They predict that the 5α-condensed state apears above a few MeV from the 5α decay threshold in ^{20}Ne. Therefore, it is important to confirm the existence of the α-condesed state.

We propose to search for the α-condensed state in ^{20}Ne by high-resolution measurement of the inelastic alpha scattering at forward angles including 0°. To achieve the highest energy resolution, the dispersion matching technique is indispensable because the level density is high at the region of interest. In addition, the decaying particles from the excited state should be measured since the decay branches from the excited state are expected to provide an insight into the cluster structure.