

E446

PROPOSAL FOR EXPERIMENT AT RCNP

10 July 2014

TITLE:Search for alpha condensed states in ^{36}Ar **SPOKESPERSON:**

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EXPERIMENTAL GROUP:

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Nasser Kalantar	KVI	(Professor)
Masatoshi Itoh	Cycotron Radiation Center, Tohoku University	(Assistant Professor)
Takahiro Kawabata	Department of Physics, Kyoto University	(Associate Professor)
Atsushi Tamii	RCNP, Osaka University	(Associate Professor)
Mamoru Fujiwara	Japan Atomic Energy Agency	(Guest Scientist)
Martin Freer	Birmingham Centre for Nuclear Education and Research	(Professor)
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Tatsuya Furuno	Department of Physics, Kyoto University	(D1)
Miho Tsumura	Department of Physics, Kyoto University	(D1)
Motoki Tamura	Department of Physics, Kyoto University	(M2)
Yuki Ishii	Department of Physics, Kyoto University	(M2)

RUNNING TIME: Installation time without beam 3 days Beam tuning 1 days
 Data runs 5 days

BEAM LINE:

Ring : WS course

BEAM REQUIREMENTS:

Type of particle ^{36}Ar (+11)
 Beam energy 50 MeV/u (1.8 GeV)
 Beam intensity ~ 10 pnA
 Beam conditions $\Delta E \leq 200$ keV

halo-free, small emittance

BUDGET:

Experimental expenses (1,850,000) yen
 see section 4

TITLE:**Search for alpha condensed states in ^{36}Ar** **SPOKESPERSON:** Hidetoshi Akimune**SUMMARY OF THE PROPOSAL**

The purpose of this experiment is to study the nuclear structure of possible α condensed states with many α particles as building-blocks in excited states in medium-heavy nuclei. Alpha condensed states are theoretically predicted in even-even $N=Z$ nuclei. Experimentally, almost no detailed nuclear structure information about such states is obtained except for light nuclei such as ^8Be , ^{12}C and ^{16}O . The aim of the present experimental study is to obtain the information on the existence of the alpha cluster state at high excitation energies in ^{36}Ar by means of inverse kinematics reactions of alpha inelastic scattering from ^{36}Ar , and by detecting subsequently emitted many alpha particles in the ($^4\text{He}(^{36}\text{Ar}, n-\alpha)$) reaction at 50 MeV/u .

We proposed this experiment to the B-PAC at RCNP in February 2012 as the E391. In that B-PAC, the beam time for test experiment to prove the feasibility was approved for 3 days out of the requested 9 days. We performed the test experiment in May 2013. In this proposal, we request full acceptance of the beam time for the data production run on base of the results of the test experiment. In the analysis of the E391 experimental data, it is found that high-multiplicity alpha decay with $M = 8$ happens from the excited state in ^{36}Ar , although the statistic is not enough. We succeeded to measure alpha particles in coincidence in a small momentum region relative to the incident ^{36}Ar with the Large Acceptance Spectrometer (LAS) set at 0 degrees. We insist that we wish to prove the experimental feasibility for detection of multi alpha decay from ^{36}Ar by means of the inverse kinematics method performed in the E391 experiment.