PROPOSAL FOR EXPERIMENT AT RCNP

22 July 2003

TITLE:
Measurement of the α-decay from the states around E_x=10.3 MeV in ^{12}C

SPOKESPERSON:

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RUNNING TIME: Installation time without beam 3 days Development of device 0 days
Test running time for experiment 1 days
Data runs 7 days

BEAM LINE: Ring : WS course

BEAM REQUIREMENTS:
Type of particle α
Beam energy 400 MeV
Beam intensity ≤ 5 nA
Any other requirements
energy resolution ≤ 200 keV
halo-free, stable beam position, small emittance

BUDGET: Experimental expenses 2,000,000 yen

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SUMMARY OF THE PROPOSAL

The ^{12}C nucleus is one of the most widely investigated nuclei in the entirely nuclear chart. However, there are still many unanswered questions. Among them, questionable the multipolarity of the broad level at E_x=10.3 MeV in ^{12}C. This state has been tentatively assigned to be 0^+. According to the 3-α RGM calculation by Kamimura, a 2^+ level should co-exist in this excitation energy region which should be a 2^+ member of the β band beginning with the 7.654 MeV 0^+ level in ^{12}C as the band head. These states has been predicted to be the molecule-like states consisting three α-particles.
In the E133 experiment, we found that the 2^+ state actually exists around E_x=10.3 MeV by the multipole decomposition analysis. However, we did not well reproduce the angular distribution obtained for the α-cluster 0^+ state at E_x=7.654 MeV. Therefore, the ambiguties still remain to distinguish the 2^+ state from the 0^+ state.
We wish to measure the decay α-particles from the state at E_x=10.3 MeV for ^{12}C to solve the long-standing question concerning the multipolarity. Decay studies add an important, and highly desirable dimension to investigation of the structure of the α-cluster state in that they provide information on their microscopic structure which is not obtainable from "inclusive" inelastic scattering experiments alone.