E417

PROPOSAL FOR EXPERIMENT AT RCNP

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TITLE:
Search for cluster and molecular states of neutron-rich C isotopes with transfer reactions.

SPOKESPERSON:

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EXPERIMENTAL GROUP:

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D. Perez-Loureiro	GANIL	Researcher
B. Fernandez-Dominguez	GENP, USC	Researcher
M. Caamano	GENP, USC	Researcher

RUNNING TIME: Installation time without beam 2 days Data runs 12 days
BEAM LINE: EN course, active target at F3.
BEAM REQUIREMENTS:

Type of particle	^{18}O
Beam energy	50A MeV
Beam intensity	50 pnA

BUDGET: Development of Si detectors for the active target 1,800 kYen

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SPOKESPERSON: Y. Ayyad (RCNP), I. Tanihata (RCNP) and H.J. Ong (RCNP)

SUMMARY OF THE PROPOSAL

We propose an experiment to search for cluster and molecular states in unstable C isotopes, namely ^{16}C, by means of transfer reactions. For this purpose we plan to use a radioactive beam of ^{8}He impinging onto an active target filled with isobutane gas (C_4H_{10}). In this scenario, the reaction of interest is ^{12}C(^{8}H,^{4}He)^{16}C at energy enough (12A MeV) to populate the highest excited states where these cluster and molecular states (characterized by their large deformation) are expected. It is known that close to the cluster decay threshold the cluster structure manifest. In the case of the ^{16}C, it is predicted that this nucleus is disposed in linear fashion where alpha particles are bound by valence neutrons, but other structures may appear at different energies. Although several experiments have been carried out to search for such molecular states in ^{16}C, no strong evidence has been found yet.

The use of an active target will allow us to use low intensity radioactive beam and a proper target thickness enough to provide an excellent resolution to disentangle the different reaction channels open at such energy. A long enough running time will provide enough statistics to obtain a good precision and low uncertainty, and in addition we will be able to investigate other C isotopes, such as ^{18}C, ^{17}C and ^{15}C produced in the same reaction. By measuring the energy spectra of the reaction partners one can infer shell-model and rotational excited states arising from the particular arrangement of the underlying cluster structures of such isotopes. Moreover, the differential cross section as a function of the angular momentum also yields relevant information about clusterization. Usually, these results are interpreted on basis of different models describing the clustering phenomena, such as molecular-orbit microscopic model or antisymmetrized molecular dynamics (AMD). The data obtained in this work would help to benchmark such models as well as provide a deeper insight in these complex nuclear structures.