Alpha clustering near the proton drip line: the case of ^{14}O

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Alpha clustering is a well-known effect in light nuclei. It has been essentially observed in nuclei close to the valley of stability, where the ratio of the neutron number N to the proton number Z of the nucleus equals to 1. Cluster states are characterized by a large amplitude of the wave function at large distance. One of the most direct methods to observe cluster states in a nucleus A is to measure the α + (A-4) elastic scattering. Nowadays, exotic nuclei, which are close to the driplines and are the ratio N/Z of them are very different from 1, represent one of the main topics in current nuclear physics and it is effective to research unstable nuclei in terms of alpha clustering as with stable nuclei.

One crucial issue is the charge symmetry in cluster states. Recently, α + ^{10}Be scattering at CRIB facility showed a clear evidence of an alpha clustering in ^{14}C. Therefore, we need to measure the mirror symmetric α + ^{10}C system to research how strong the charge symmetry is breaking in cluster states. We have performed very preliminary calculations within a microscopic cluster model, known as the Resonating Group Method (RGM), and the properties (spin/parity, energy and width) of the α + ^{10}C resonances have been predicted. For this case, several cluster states in ^{14}O are predicted and a significant Coulomb shift is suggested. It is related to the reduced width, in short, evidence of the strong clustering effect in ^{14}O, which is close to the proton drip line.

We plan to measure the elastic cross section of the resonant scattering reaction with a thick target method by using a ^{10}C beam (E=42MeV) produced via the ^{10}Be(p, n) reaction and a Helium gas chamber at 1 atm as a target available at CRIB facility. We will conduct the experiment from May 26th to June 9th and report the result in the talk.