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Charge-changing cross section measurement of neutron-rich carbon isotopes at 50A MeV and determination of their proton distribution root-mean-square radii by using Glauber model

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Root-mean-square (rms) radii and charge (proton) density distribution of proton in atomic nuclei are good observable for testing nuclear structure model. The proton distribution rms radius is important in extracting the neutron skin thickness, which provides guidance to constrain the theoretical description of the equation of state of asymmetric nuclear matter[1]. The electron scattering is a precise method to determine charge distribution rms radii[2], but could be applied only to stable nuclei. For unstable nuclei with $Z < 5$ and $Z > 10$, the isotope shift technique has been applied. However, it is difficult to extend to the drip line because of beam intensity limitation. This technique also become challenging for nuclei with $4 < Z < 11$ due to the uncertainty in atomic physics calculation. The recent result on neutron-rich Be isotopes from charge changing cross section (CCCS) measurements at high energy were shown to be consistent with the isotope shift measurements[3], thus suggesting the possibility to determine proton density distribution as well as rms radii from CCCS using Glauber model. Recently, extended Glauber-type calculations were developed and applied to calculate the interaction/reaction cross sections. The calculated results show systematic agreement with experimental data over a wide range of energies[4, 5], suggesting possibility of applying the method to extract the rms of proton distribution radii from CCCS measurements at low energy region. We have measured the CCCSs of 12–18C isotopes at 50A MeV at RCNP, Osaka University. In this talk, the results of experiment is presented, and the feasibility of using our CCCS results to extract proton distribution rms radii via Glauber model will be discussed.

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