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Proton distribution radii measurements of neutron-rich nitrogen isotopes

With large neutron-to-proton ratios far from the line of stability, nuclei develop exotic structures such as neutron skin and halo. Charge radius which is a fundamental nuclear ground-state property, seems to be changing with the increase of valence neutrons. As an example, the charge radius of ^{11}Li, where there are two valence neutrons in addition to the core ^{9}Li nucleus, is larger than that of ^{9}Li [1]. Therefore, to understand the structure of neutron-rich nuclei, it is important to know how the proton distribution of a nucleus is affected with large neutron-to-proton ratios. A new tool to determine the point-proton root-mean-square radii in exotic nuclei is to measure the charge-changing cross section. It can be used as a probe to measure the extent of the proton distribution in exotic nuclei through the framework of Glauber model analysis [2] of the reaction. Measurements to determine the charge-changing cross section have been done previously for neutron-rich Li, Be, B and C isotopes. Here, we focus on similar systematic studies for neutron-rich nitrogen isotopes. Charge-changing cross sections of stable ^{14,15}N isotopes and unstable $^{17-22}$N isotopes on a carbon target at relativistic beam energy of around 900 MeV/u have been measured precisely using the FRS fragment separator at GSI [3]. Neutron halo effects are signaled for ^{22}N as seen from the increase in the proton and matter radii. The radii indicate an unconventional shell gap for neutron number N = 14. In this presentation, the new data on proton distribution radii of neutron-rich nitrogen isotopes will be discussed along with theoretical predictions.

References

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