Effective matter radii of ^{10,11,12}Be nuclei determined from their total reaction cross sections on ^{28}Si target

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In this work, we studied the total reaction cross sections for the ^{10,11,12}Be nuclei on the ^{28}Si target by the 4π method based on the registration of the prompt γ quanta and neutrons accompanying the interaction using the multidetector spectrometer. It was found that the total reaction cross sections for the ^{11}Be nuclei are significantly larger than those for ^{10}Be. Along with the low value of the neutron separation energy (0.5 MeV) for ^{11}Be, it is an indication of its halo structure. The total reaction cross sections for the ^{12}Be nuclei are larger than those for ^{10}Be. Along with the pairing of two outer neutrons and the larger value of the neutron separation energy (3.2 MeV) for ^{12}Be, it is an indication of its more compact outer shell (compared to a halo) which can be called a skin.

Using the measured values of the total reaction cross sections and the phenomenological optical model, the effective matter radii of the ^{10,11,12}Be nuclei were determined. A new theoretical approach based on the combination of the optical model with the modified optical potential and classical trajectories was applied to the calculations of the effective matter radii of the colliding nuclei (details are given in [1]).

References

1. Yu. G. Sobolev, V. V. Samarin, Yu. E. Penionzhkevich, S. S. Stukalov, and M. A. Naumenko, Phys. Rev. C **110**, 014609 (2024).