

Antiprotonic atoms - a tool for the investigation of the nuclear periphery

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The antiprotonic atoms are useful tool for study of the nuclear periphery. Antiprotons captured onto the atomic orbits cascade down emitting X rays. In the vicinity of a nucleus the strong interaction reveals its presence: antiprotonic levels are shifted compared to the pure electromagnetic energy and are broadened. The width and shift of the levels give an information on the nuclear matter density on the nuclear periphery.

The antiprotonic cascade ends with the annihilation on a peripheral nucleon: a neutron or a proton. Two kinds of residues are produced: with one neutron or one proton less than the target nucleus, respectively. The yields of the products are proportional to the neutron to proton density ratio at the nuclear surface.

Neutron densities in 26 isotopes were studied using antiprotonic X rays. The information on the nuclear matter density at relatively large radii was then converted to rms radii by the use of a two-parameter Fermi-function form factor [1]. The obtained systematics of differences of the neutron and proton rms radii is in a fair agreement with theoretical calculations and results of other experimental methods [2].

A detailed analysis is in progress. In particular the model dependency of the results are studied.

References

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