独立行政法人理化学研究所　仁科加速器研究センター
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The 89th RIBF Nuclear Physics Seminar

Measuring the radii of particle unstable nuclear states and search for the signatures of alpha condensation in light nuclei

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Two methods based on use of inelastic diffractive and rainbow scattering were proposed [1, 2] for search of the alpha condensate signatures in the states of some light nuclei near the nα-thresholds. They were tested by studying the inelastic scattering of ^{2}H, ^{3}He, ^{4}He, ^{6}Li and ^{12}C on ^{12}C with the excitation of the Hoyle state and demonstrated that its radius is a factor 1.2 larger than that of the ground state. The similarly enhanced radii were observed for some other high lying levels of ^{12}C and for some states of ^{13}C and ^{11}B located close to the thresholds of their decay to 3α + n and 2α + t correspondingly. The 70 % probability of all three α-particles to be in the s-state was observed for the Hoyle state by ^{4}He(^{12}C,α)^{12}C* transfer reaction. On the other hand, the radius of the 0^{+}_{4} (13.6 MeV) state of ^{16}O occurred to be approximately of the same value as the ground state.

The proposed methods of the measuring the nuclear radii allowed to identify neutron halos in the excited states of nuclei as well. The radii of ^{9}Be and ^{13}C in the first $\frac{1}{2}^{+}$ states located close to the neutron emission thresholds of these nuclei occurred to be comparable with the radii of the usual halo nuclei like ^{11}Be or ^{11}Li.

References

[1] A. S. Demyanova *et al.*, Int. J. Mod. Phys. E **17**, (2008) 2118
[2] A. N. Danilov *et al.*, Phys. Rev. C **80** (2009) 054603

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The seminar will be given in English.

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