How does nucleus shrink by participation of a Λ hyperon?

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Abstract

We shall discuss whether nucleus shrinks or not by participation of a Λ hyperon. Recently we predicted that if we inject a Λ particle into a ^{6}Li nucleus, size of the resulting hypernuclei $^7_\Lambda$Li becomes smaller than that of the core nucleus ^{6}Li by some 22 % due to the attractive $\Lambda - N$ interaction. We then proposed experimentalists to observe size of hypernucleus for the first time in this system by measuring the $B(E2 : 5/2^+_1 \rightarrow 1/2^+_1)$ in $^7_\Lambda$Li and compare it with $B(E2 : 3^+_1 \rightarrow 1^+_1)$ in ^{6}Li. This calculation was done with the $\alpha + n + p + \Lambda$ four-body model based on Jacobian-coordinate Gaussian-basis coupled-channel method which has been very useful for various types of three- and four-body calculations. Recently, this prediction was really confirmed by the high-resolution gamma-ray experiment BNL-E930; the size contraction was by 19 %. We shall also discuss, on the basis of $3\alpha + \Lambda$ four-body model, how largely ^{12}C nuclear states shrink by the participation of a Λ particles: the α-clustering states shrinks drastically but the shell-like states do not.