Some experimental approaches to search of alpha-particle condensation in nuclei

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Recently it was supposed [1] that nα light nuclei may have structures resembling the diluted gas of α-particles which could be considered as Bose-Einstein condensate (αBEC) in nuclear systems. If found it would constitute a new form of nuclear matter. At present time the only more or less definite candidate for αBEC state predicted by theory is the second 0^+ - state of ^{12}C (Ex = 7.65 MeV) located near the threshold $^{12}C \rightarrow 3\alpha$. Getting evidence that this particular level really possesses of some properties of αBEC is of vital importance to the whole hypothesis of the possibility of BEC formation in nuclear systems and would stimulate the search of other examples in different nuclear mass regions.

We discuss several possible experimental approaches to study the properties of interest of the 7.65 MeV level of ^{12}C. Among them are:

* Shift of the positions of the rainbow minima in the inelastic scattering to this level (as it was originally proposed in [2]).

* Extraction of the empirical inelastic form-factor from the α- and ^3He- scattering and comparison it with theoretical predictions.

* Getting information on the ^8Be transfer reactions form-factor.

We used some of existing data for the analysis and proposed a new experiment.

The possibility of observation of αBEC effects in heavier nα nuclei is also discussed. In particular, ^{112}Ba is of great interest due to possible existence of alpha-particle "halo" outside Z = N = 50 core [3].

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