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Exploring Nuclear Clusters Through Relativistic Nucleus Fragmentation

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The discovery of atomic Bose-Einstein condensation (BEC) has prompted investigations into its potential manifestation in nuclear systems. The concept of α-conjugate nuclei, such as ^{12}C, ^{16}O, and ^{20}Ne, as ensembles of α particles has been proposed, though it represents a simplified model. Extensive studies have demonstrated that α clustering plays a fundamental role in the structure of light nuclei. In this context, the BECQUEREL experiment aims to address critical questions in nuclear physics by examining the dissociation of relativistic light nuclei with high precision in nuclear track emulsion (NTE), providing detailed insights into nuclear cluster dynamics [1]. The decays of ^{8}Be and the Hoyle state are considered signatures of αBEC states. Relativistic fragmentation studies reveal these states through narrow angle correlations of helium and hydrogen fragments, with accompanying neutron emission [2]. By analyzing fragmentation events of ^{84}Kr and other nuclei, this investigation probes correlations between α-clustering, nuclear fragmentation, and unstable states such as ^{8}Be as a candidate for 4αBEC. The study also involves investigating neutron multiplicities and the decay processes of carbon nuclei under relativistic muon interactions, providing insights into nuclear dissociation mechanisms.

References
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Summary

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