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Highlights of unstable states in relativistic dissociation of light nuclei

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The 8Be and 9B nuclei and a number of excitations of light isotopes near the binding thresholds constitute a whole class of unusually long-lived states at the lower limit of nuclear density and temperature. In the concepts of molecular-like or α-condensate structures, they are represented as associations of the lightest nuclei and nucleons separated in space. Identification of the known unstable states allows studying their dynamics and searching for analogs decaying into them. The report summarizes the key results on unstable states in relativistic dissociation of the isotopes 9,7Be, 10B, 12,11,10C, 14N and 16O in a nuclear emulsion. Determination of invariant masses of α-particle ensembles from fragment emission angles in the approximation of conservation of momentum per nucleon of the parent nucleus allows identification of decays of 8Be(0+), 8Be(2+), 9Be(1.7), 9B, 6Be, 12C(0+2), 12C(3-) and 7Be(7.2) [recently in 1,2 and references therein]. Their identification indicates that the duration and cross-section of the fragment interaction are sufficient for low-energy reactions of nuclear astrophysics. Progress in intelligent microscopy and image recognition allows, based on the record spatial resolution and sensitivity of the nuclear emulsion method, to impart new quality and scope to these studies.

1.D.A. Artemenkov et al., IJMP E 24410155 (2024) https://doi.org/10.1142/S0218301324410155; arXiv: 2409.14814.
2. A.A. Zaitsev, P.I. Zarubin "On formation of the 12C(0+2) and 12C(3-) states in relativistic dissociation of light nuclei"to be published in Phys. At. Nucl.; arXiv:2411.18394.

Primary author: ZARUBIN, Pavel (JINR)

Presenter: ZARUBIN, Pavel (JINR)

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