THE HOYLE STATE IN ^{12}C AND ^{16}O DISSOCIATION

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Events of dissociation of relativistic light nuclei observable in detail in the nuclear track emulsion (NTE) contain holistic information on ensembles of lightest nuclei which is of interest to the nuclear cluster physics [1]. The best spatial resolution provided by the NTE technique turns out to be a decisive factor for recognition relativistic ^{8}Be and ^{9}B decays among the projectile fragments [2]. The decays are identified by the invariant mass M^* defined by the sum of all products of 4-momenta P_i of relativistic fragments He and H. Subtracting the sum of the residual masses M is a matter of convenience $Q = M^* - M$. The components P_i are determined by the fragment emission angles under the assumption of conservation a projectile momentum per nucleon.

Production of α-particle triples in the Hoyle state (HS) in dissociation of ^{12}C nuclei at 3.65 and 0.42 A GeV in nuclear track emulsion is revealed by the invariant mass approach [3]. Contribution of the HS to the dissociation $^{12}\text{C} \rightarrow 3\alpha$ is (11 ± 3) %. Reanalysis of data on coherent dissociation $^{16}\text{O} \rightarrow 4\alpha$ at 3.65 A GeV is revealed the HS contribution of (22 ± 2) %. These observations indicate that it is not reduced to the unusual ^{12}C excitation and, like ^{8}Be, is a more universal object of nuclear molecular nature. The analysis of the NTE layers exposed to relativistic ^{14}N nuclei is resumed in the HS context. Video records of events of dissociation of relativistic nuclei in NTE obtained using a microscope and a digital camera can be found [4].

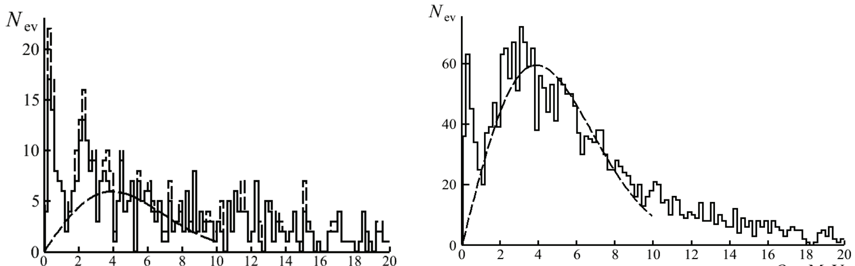

Fig. Distribution over invariant mass $Q_{3\alpha}$ of α-triples in dissociation of $^{12}\text{C} \rightarrow 3\alpha$ GeV (left) and 3α combinations in "white" stars $^{16}\text{O} \rightarrow 4\alpha$ at 3.65 A GeV (right).

1. P.I.Zarubin // Lect. Notes in Physics, Clusters in Nuclei, 2014. V.875(3) P.51; arXiv: 1309.4881.
2. D.A.Artemenkov, A.A.Zaitsev, P.I. Zarubin // Phys. Part. Nucl. 2017. V.48 P.147; arXiv:1607.08020.
3. D.A.Artemenkov *et al.* // Rad. Meas. 2018. V.119. P.119; arXiv:1812.09096.
4. The BECQUEREL Project. http://becquerel.jinr.ru/movies/movies.html.