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BOOK OF ABSTRACTS



nucleus. Protons, if they are formed as a result of reaction (1), lose their original kinematic parameters and their energy spectrum is strongly smeared.

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PERIPHERICAL INTERACTIONS OF NUCLEUS ^{12}N WITH THE MOMENTUM $2 A \text{ GeV}/c$ IN NUCLEAR EMULSION

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The present work is dedicated to studying of nucleons clustering in a little studied a proton-rich nucleus ^{12}N , explored in the extremely peripheral interactions (coherent) in a nuclear emulsion. It is a logic step in development of cluster structures researches of light nucleus ^7Be [1], ^8B [2] and ^9C [3]. The nucleus ^{12}N prolongs this chain of nuclei in fusion reactions by grab of protons. It provides «expectation station» for process $^{11}\text{C} + p$ and conducts to the alternative scenario of formation of a nucleus ^{12}C in prompt astrophysical pp -processes.

The experimental material is obtained by means of a nuclear emulsion irradiated in the mixed beam of the relativistic nucleus ^{12}N , ^{10}C and ^7Be with an momentum $p_0 = 2 A \text{ GeV}/c$, generated at a recharge and a fragmentation of primary nucleus ^{12}C [4]. The statistics of the selected interactions with participation of nucleus ^{12}N makes 72 "white" stars, satisfying to requirement $Z_{\text{pr}} = 7$ and $\sum Z_{\text{fr}} = 7$.

For the "white" stars formed in peripheral interactions of nucleus ^{12}N with nucleus of an emulsion, with a high probability dissociation channels $^{12}\text{N} \rightarrow ^{11}\text{C} + p$ (a threshold 0.6 MeV), $^{12}\text{N} \rightarrow ^8\text{B} + ^4\text{He}$ (a threshold 8 MeV) and $^{12}\text{N} \rightarrow p + ^7\text{Be} + ^4\text{He}$, and also the channels related with clustering by a dissociation of a nucleus-basis ^7Be should be implemented. The contribution of decays of such uncoupling nuclei as ^8Be , and ^9B can become feature of a coherent dissociation of a nucleus ^{12}N , unlike lighter nucleus on boundary of proton stability. In particular, the channel threshold $^3\text{He} + ^9\text{B}$ makes 10 MeV, and $p + ^8\text{Be} + ^3\text{He}$ all on 0.185 MeV above. The small odds in bond energy in comparison with the channels containing fragments with charge $Z_{\text{fr}} > 2$, conducts to the guess about possible cluster nucleus dualities ^{12}N . On the one hand its bottom can be presented stable nucleus ^7Be and ^8B , and with another - unstable ^8Be and ^9B .

Selection of events of the coherent dissociation containing only fragments-spectators of nucleus ^{12}N is made on their critical angle of emission $\theta_{\text{fr}} \leq 6^\circ$. This quantity is determined by the "soft" restriction on momentum of Fermi-motion of nucleons. In the table a distribution of number of "white" stars on channels of a dissociation with a boundary space charge of fragments $\sum Z_{\text{fr}} = 7$ and the measured charge beams track $Z_{\text{pr}} = 7$ is given; a medial line – the selection with a requirement $\theta_{\text{fr}} < 11^\circ$ (72 events); the inferior line - the selection with a requirement $\theta_{\text{fr}} < 6^\circ$ (45 events). In the distribution of 45 selected events (tab.) the share of channels with heavy fragments $Z_{\text{fr}} > 2$, makes more than 64 %, and the contribution of the channels containing only light fragments He and H, remains to significant enough. It is interesting to note, that the greatest number of events is observed in the channel of disorder of a nucleus $^{12}\text{N} \rightarrow 2\text{He} + 3\text{H}$. Proceeding from the fact of approximate equality of probability of channels 2He and $\text{He}+2\text{H}$ at a

nucleus dissociation ${}^7\text{Be}$ [1], an also bottoms ${}^7\text{Be}$ in nucleus ${}^8\text{B}$ [2] and ${}^9\text{C}$ [3], followed expect for a nucleus ${}^{12}\text{N}$ approximate equality of probabilities of channels $2\text{He} + 3\text{H}$ and $3\text{He} + \text{H}$.

He + 5H	2He + 3H	3He + H	${}^7\text{Be} + 3\text{H}$	${}^7\text{Be} + \text{He} + \text{H}$	${}^8\text{B} + 2\text{H}$	${}^8\text{B} + \text{He}$	C + H	Bcero
9	24	2	10	9	11	3	4	72
2	12	2	5	8	9	3	4	45

Identification of fragments H and He on their total momentum $p\beta c$, carried out routinely in a nuclear emulsion a method of measuring of multiple scattering, has yielded following values for singly charged $\langle p\beta c_H \rangle = 1.9 \pm 0.1$ GeV and the two-chared fragments $\langle p\beta c_{3\text{He}} \rangle = 5.2 \pm 0.1$ GeV, $\langle p\beta c_{4\text{He}} \rangle = 7.2 \pm 0.1$ GeV. Distribution specifies to approximately equal relation of isotopes ${}^3\text{He}$ and ${}^4\text{He}$, that also it was expected for ${}^{12}\text{N}$ nucleus.

In 45 "white" stars, satisfying to measure of selection $\theta_{fr} < 6^\circ$, angles of an emission of fragments have been measured. As a whole angular distributions of fragments H and He in channels He+5H, 2He+3H and 3He+H are relatives under the shape to the channels containing fragments with $Z_{fr} > 2$. In particular, average values θ_{fr} in first case for H are equal $\langle \theta_H \rangle = (51 \pm 6)$ mrad, and for He - $\langle \theta_{He} \rangle = (24 \pm 4)$ mrad. In the presence of fragments $Z_{fr} > 2$ these quantities make $\langle \theta_H \rangle = (44 \pm 5)$ mrad and $\langle \theta_{He} \rangle = (23 \pm 4)$ mrad.

Events C + H are interpreted as ${}^{11}\text{C} + p$ because of a low threshold. The threshold of the possible channel ${}^{10}\text{C} + d$ makes 11.5 MeV. The average value $\langle P_T ({}^{11}\text{C} + p) \rangle = (300 \pm 52)$ MeV/c specifies on the nuclear-diffractions character of a dissociation and effect presence «bounce-off». Approximate doubling $\langle p_t \rangle$ fragments ${}^7\text{Be}$ and ${}^8\text{B}$ in the channels related to split of a cluster ${}^4\text{He}$, which threshold approximately on 16 MeV above is observed.

The important question is the contribution of an unstable nucleus ${}^8\text{Be}$ among fragments $Z_{pr} > 2$. Thanks to extremely small energy of decay of a nucleus ${}^8\text{Be}$ it is possible to bypass identifications of the relativistic He isotopes. At momentum $2A$ GeV/c decays of the relativistic nucleus ${}^8\text{Be} \rightarrow 2\alpha$ from the basic state 0^+ are identified on accessories of pairs α -particles to field of the least angles of scattering $\Theta_{2\alpha}$, restricted to a requirement $\Theta_{2\alpha} < 10.5$ mrad [4]. For nucleus ${}^9\text{Be}$ on angles of scattering in the field of 15 mrad $\langle \Theta_{2\alpha} \rangle < 45$ mrad nucleus decays ${}^8\text{Be}$ from the first excited state 2^+ [5-8] are identified. For a dissociation of the relativistic nucleus ${}^{10}\text{C}$ at the same value of an initial momentum reliable identification of decays of nucleus ${}^8\text{Be}$ and ${}^9\text{B}$ [6-8] is executed.

In case of a nucleus ${}^{12}\text{N}$ in an angular dependence of scattering $\Theta_{2\alpha}$ (He + He) for "white" stars 2He+3H and 3He+H it is found out two candidates for nucleus decay ${}^8\text{Be}$ from the basic state 0^+ . Thus the contribution of nucleus ${}^8\text{Be}$ is estimated at level 4 ± 2 %. For the next nuclei ${}^{12}\text{C}$ [9], ${}^{14}\text{N}$ [10], ${}^{10}\text{B}$ [11] and ${}^{10}\text{C}$ [6-8] it made the order of 20 %. Data on $\Theta_{2\alpha}$ (He + He) do not exclude dissociation possibility on the channel ${}^2\text{He}$ through nucleus decay ${}^8\text{Be}$ from the first excited state 2^+ .

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