Observation of light nuclei formation as nuclear coalescence in the $C^{12}C$-interactions at 4.2 A GeV/c.

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- the centrality dependences of the multiplicity for light nuclei and π^--mesons produced in the $He^{12}C$- and $C^{12}C$-interactions at 4.2 A GeV/c

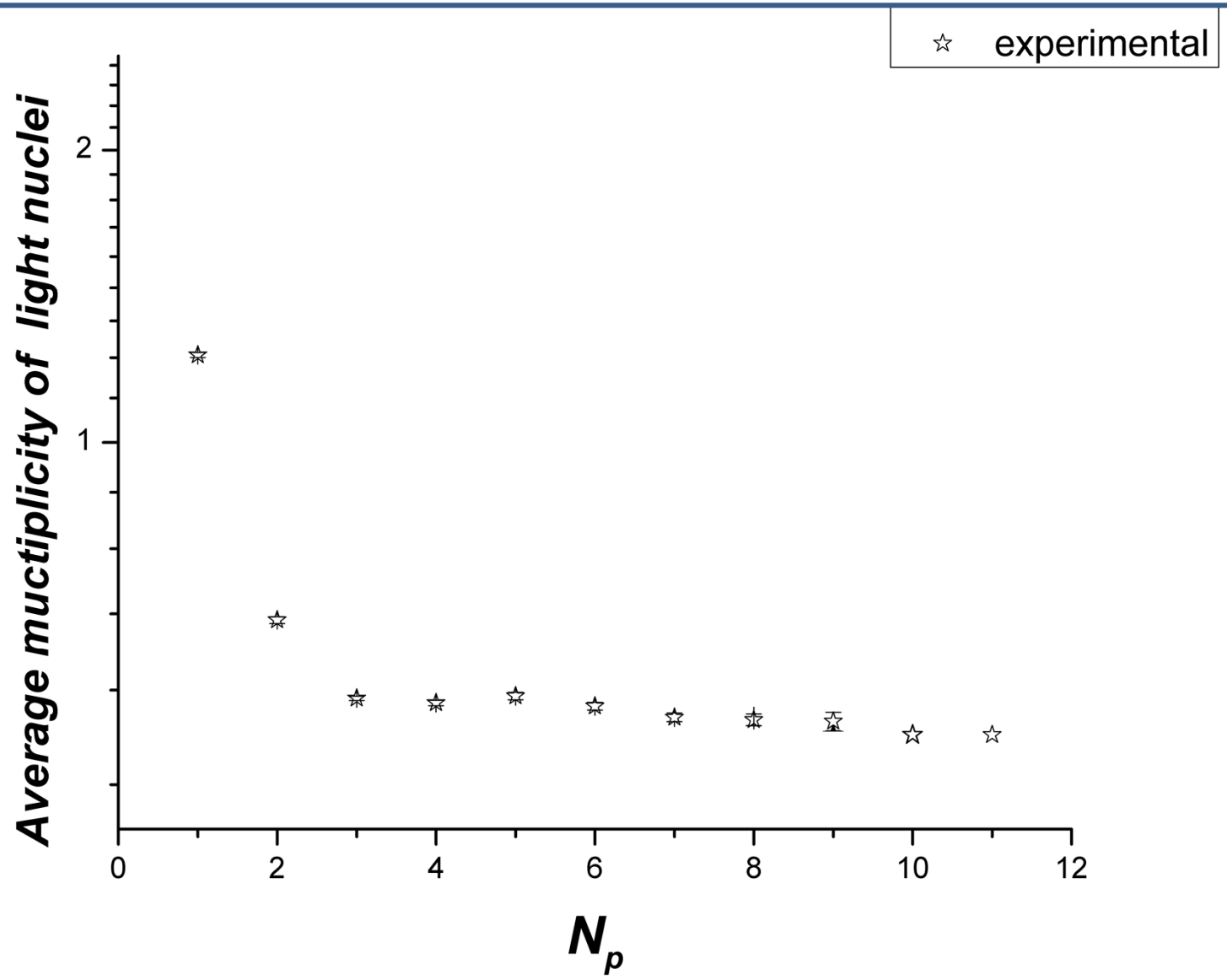
- the centrality was fixed using a number of identified protons in an event -Np

- the obtained experimental results were compared with the ones coming from the Dubna version of cascade model;

EXPERIMENTAL DATA

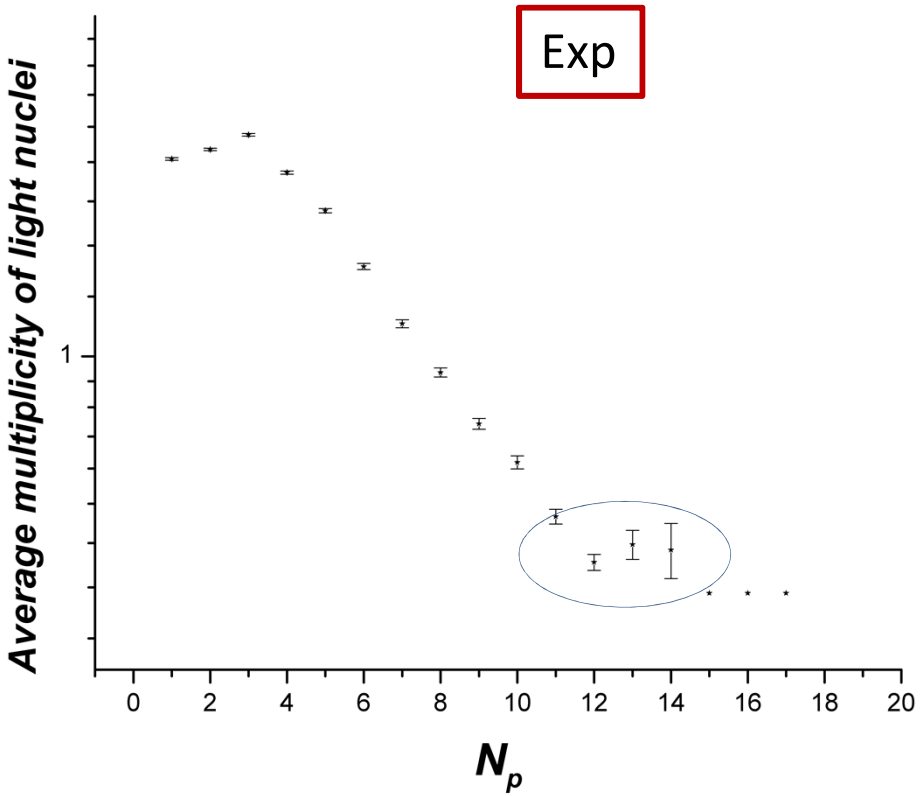
- the experimental data were obtained from the 2-m propane bubble chamber of Joint Institute for Nuclear Research (JINR, Dubna)
- The chamber placed in a magnetic field of 1.5 T
- was exposed to beams of light relativistic nuclei
- practically all secondaries emitted at a 4π total solid angle were detected in the chamber.
- pion registration threshold 70 Mev/c.
- proton registration threshold 150 Mev/c.
- ~4000 $He^{12}C$, ~ 30000 $C^{12}C$ interactions @ 4.2 A GeV/c

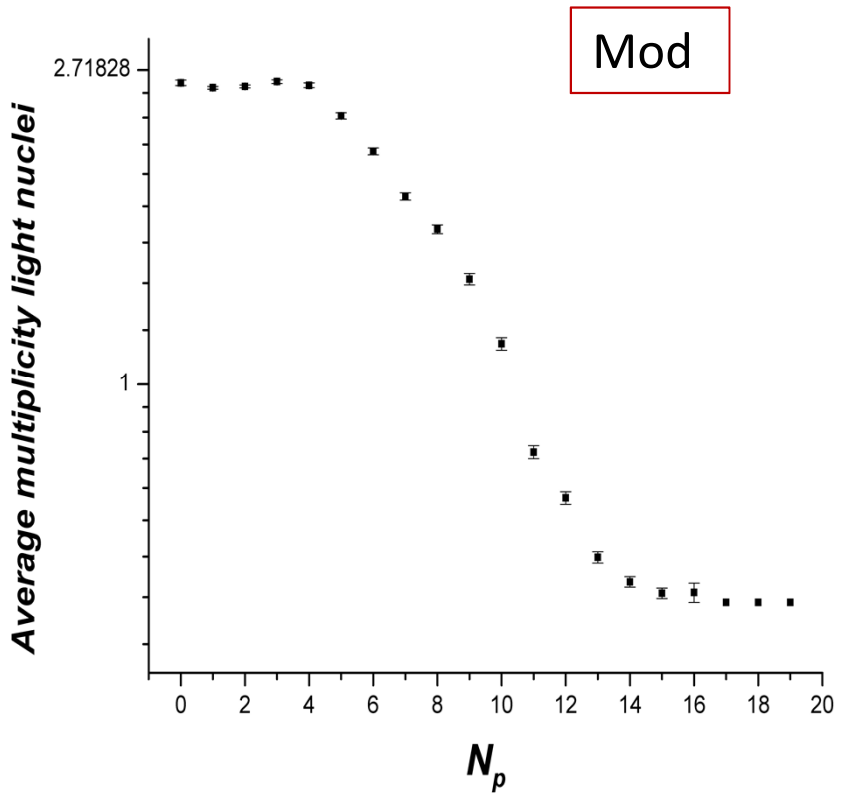
there are two regions on the behavior of light nuclei multiplicity: Np=1-3; 4-11; in the fist region the multiplicity decrease; in the second one it saturates.



The average multiplicity of light nuclei produced in the $He^{12}C$-interactions as function of a number of identified protons

there are 4 regions Np=1-3; 4-11; 12-14 ; 15-17





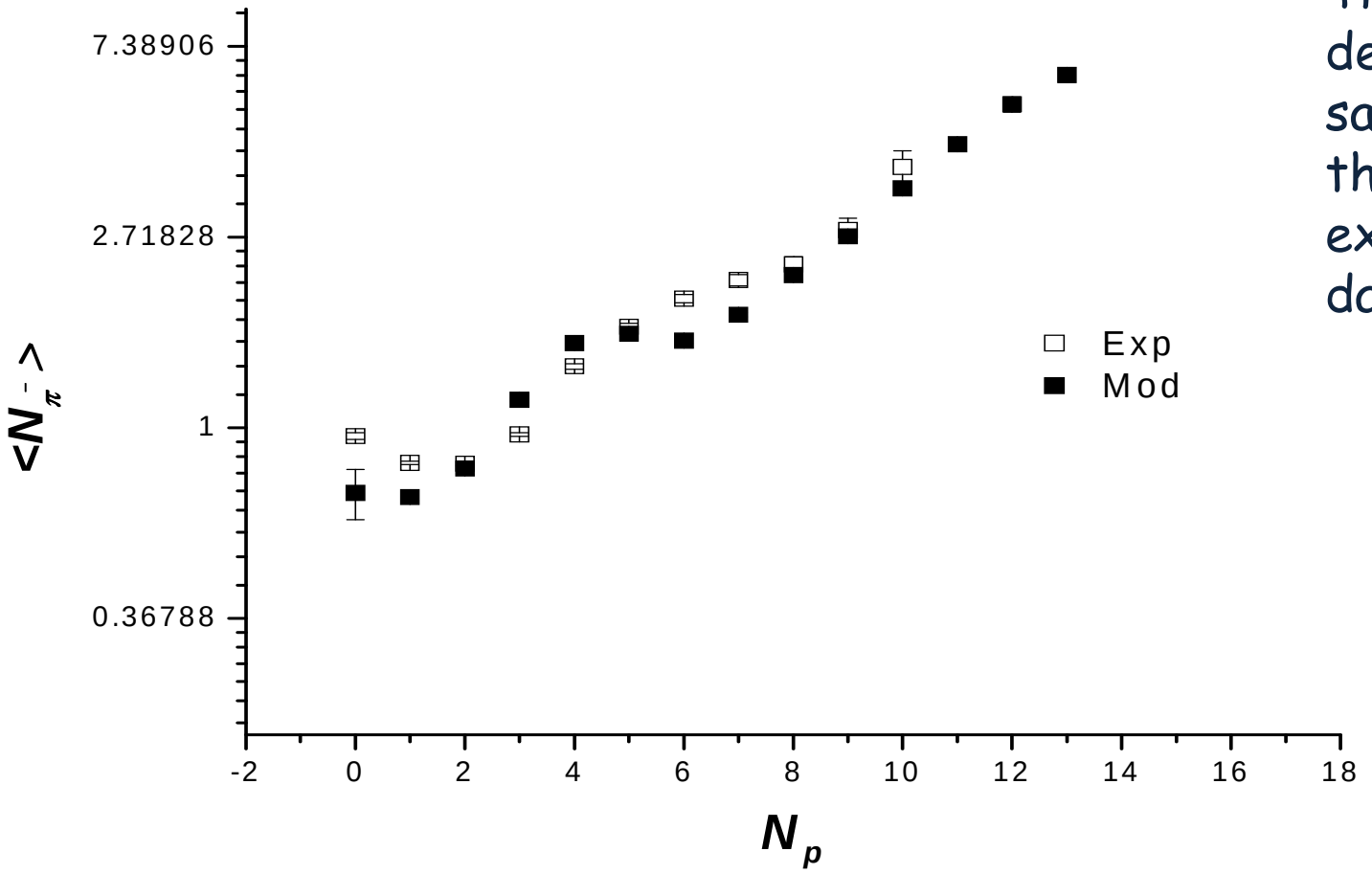
in the first region the multiplicity increases weakly: in the second region it decreases sharply: III region - some strange behavior ("region of peak"): saturation in the IV region.

the strangeness is that with centrality the multiplicity of the light nuclei must decrease or saturate having behavior like one coming from the model (the left panel). It should not give peak in most central events

- the reason of the appearance of the "peak" could be an additional formation of light nuclei may be due to coalescence effect;
- in the most central events due to high baryon density in medium the protons and neutrons with close 4 momentum could be exist together and form the light nuclei.

to get an additional information the negative pion's multiplicity distributions were analyzed as a function of a number of identified protons in an event.

π^--mesons' multiplicity as a function of a number of identified protons in $He^{12}C$&4.2 AGeV/c

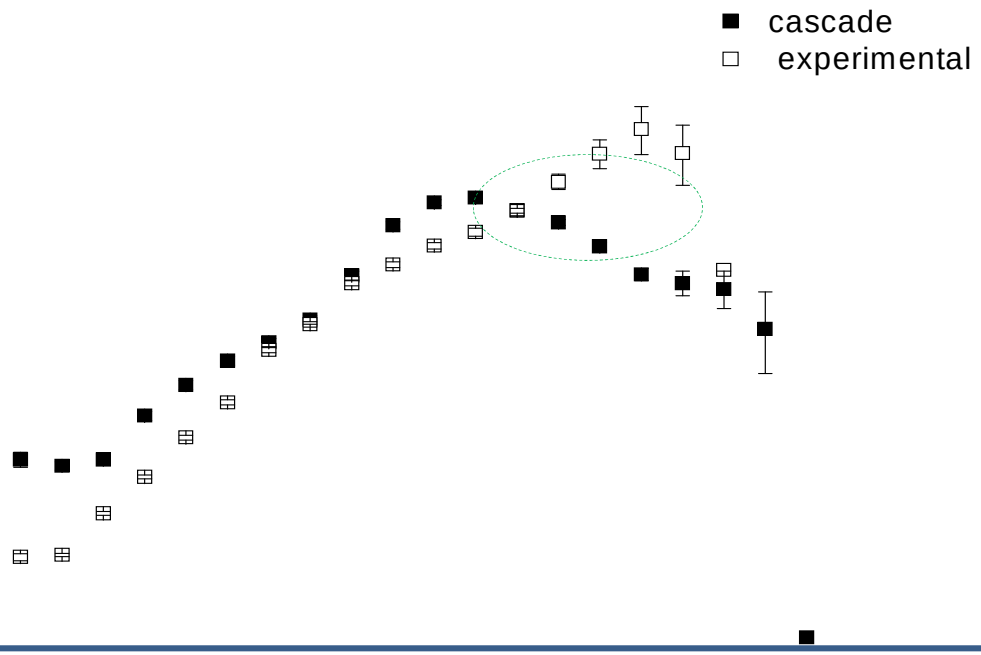


The model can describe satisfactorily the experimental data

The average multiplicity of π-mesons produced in $He^{12}C$-interactions at 4.2 A GeV/c as a function of number of protons.

Experimental: 3 regions:Ng=0-1; 2-15; 16-17: in the first region the multiplicities don't depend on the centrality, in the second one the values increase and they decrease in the third region .

Model: 3 regions: Ng=0-2; 3-11; 12-19:in the first region the multiplicity don't depend on the centrality, in the second one it increase and decrease in the third one. the model could not describe the behavior of the experimental results for the multiplicity in the "region of peak" at 12-14.



because one of the sources of negative pions in the area of "peak" could be reaction n + n→D+ π^- , so increasing the number of deuteron nucleus accompanies with increasing the number of negative pions. So the result could be considered as additional evidence that we really see some sign of coalescence effect.

Conclusion

- the behavior of the average multiplicity for light nuclei produced in the $C^{12}C$ –interactions at 4.2 *A GeV/c* as a function of a number of identified protons demonstrates some "peak" - additional light nuclear production in the most central events;

- the behavior of negative pions average multiplicity as function of the centrality in $C^{12}C$-interactions demonstrates some extra pion production in 'region of the peak' (due to $n + n \rightarrow D + \pi^-$);

- the result could be considered as additional evidence that we really see some sign of coalescence effect;

- it is possible that "the peak" in the most central events connects with nuclear coalescence effect-in most central event due to high density medium formation the protons and neutrons with close 4 momentum could be exist together and form the light nuclei;

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- comparison with other models can give more clean information , it is in process


THANKS