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PROTON AND LIGHT ION INTERACTIONS IN COSMIC RAY EXPERIMENT "STRATOSPHERE" IN COMPARISON WITH RECENT COLLIDER RESULTS

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Estimation of physical properties of exited fireball from complex final pattern of produced particles is key challenge in nucleus-nucleus collisions at high energies. Effective way to better understanding and interpretation of results consists in analyses of interaction of smaller systems, created in proton-proton or in proton-nucleus collisions.On the basis of such approach interactions of cosmic ray light nuclei and protons with different targets have been studied in the experiment "Stratosphere"at energies above10 TeV in Lab system[1]. Results have shown that in rare events, produced by alpha-particles and light nuclei, transverse momentum spectra of secondary ɣ-quantain soft region (up to 2 GeV/c) have exponential character with large values of inverse slope of the distributions: TA ˜ 0,8 GeV/c. On the contrary, in the proton interactions the slope is essentially smaller Tp˜ 0,2 GeV/c. For charged secondary particles the high order intermittency analyses have again demonstrated the large difference between events produced by protons and nuclei. So, the essential system size dependence in forward production dynamics has been obtained on limited statistics. Similar events were observed by JASSE and Concorde cosmic ray collaborations. New instanton-induced interpretation has been suggested for explanation. Obtained result is an important issue to be tested at collider experiments.
The launch of the Large Hadron Collider (LHC) open broad new possibilities for high energy physics at TeV scale. Previous RHIC exploration on soft physics at midrapidity [2] were developed in the work of the ALICE collaboration [3].
In the very forward region the new experiments have been performed at LHC forward detector –LHCf. In proton-proton collisions at 900 GeV and at 7 TeV transverse momentum distribution for inclusive neutral pions has been measured in 2010 [4] and in p-Pb collisions at 5.02 TeV in 2013 [5]. All proton induced data (with antiproton–proton collisions at 630 GeV from UA 7 experiment)have shown that there is the weak dependence of average value of the neutral pion PT distribution from CMS energy [6]. The exponential fit for the spectra [4, 5] well enough coincide with the correspond estimation from our Stratosphere experiment.
In the proposal [7] a new forward particle production experiment PHENIX-RHICf has suggested, in which p-p, proton-Nitrogen, and Nitrogen-Nitrogen, Fe-Nitrogen, - as a future options, - are considered. Realization of the direct collider measurements of light ion collisions will be very important both for frontier problems of high energy heavy ion physics and foractualhigh energy cosmic ray problems.

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Collaboration

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199

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