

XXV International Baldin Seminar on High Energy Physics Problems "Relativistic Nuclear Physics and Quantum Chromodynamics"



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Relativistic Nuclear Physics & Quantum Chromodynamics

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The golden age of Dubna emulsion experiments.

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Review of Dubna emulsion experiments performed all the time since 1972 is presented. Different characteristics of 1H , 2H , 4He , 12C , 20Ne , 28Si , 32S , 84Kr , 197Au and 208Pb induced interactions with emulsion nuclei were investigated at $\sim (1-200) \text{ A GeV/c}$. The stacks of NIKFI BR-2 4π nuclear detector were irradiated horizontally by nuclear beams at the JINR Synchrophasotron and Nuclotron, the GSI SIS, the BNL AGS and the CERN SPS accelerators. The experimental results were compared with the values calculated by the cascade-evaporation and Fritiof models.

Thanks to its unique spatial resolution, the emulsion detector also enables the fragmentation of relativistic nuclei to be studied in detail. The fragmentation of light relativistic nuclei is also currently being intensively investigated at JINR (not presented here).

In first experiments, the multiplicity and angular spectra of charged secondaries were investigated depending on the impact parameter, which characterizes the degree of centrality of the nuclear collision. The latter was measured in three different ways: according to the size of the total charge of non-interacting fragments of the primary nucleus and according to the numbers of relativistic particles with $\beta > 0.7$ or slow, target associated fragments.

In order to test the collective behavior of nuclear matter the medium-impact nuclear interactions with heavy $108\text{Ag}(80\text{Br})$ targets were investigated. The transverse-momentum approach, the flow-angle analysis using principal vectors, the azimuthal correlation functions, the method of the azimuthal correlations between the charged secondaries, and the method of the Fourier expansion of the azimuthal angle distributions were applied. The evidence of the directed flow of spectators and the signal of the elliptic flow of participants were observed.

Emission of relativistic particles produced in central interactions with $108\text{Ag}(80\text{Br})$ targets was investigated using scaled factorial moments. An evidence for nonstatistical fluctuations was shown using horizontal factorial moment method in pseudorapidity phase space. The comparative study was done for different beam energies and masses and for different centrality selections. Search for the event-by-event fluctuations was performed. Nonstatistical ring-like structures of s-particles in azimuthal plane of a collision were obtained and their parameters were determined.

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