Contribution ID: **53** Type: **20 min.**

MANIFESTATION OF ANISOTROPIC HYDRODYNAMICS BASED ON THE LATEST DATA ON PION AND KAON EMISSION IN HEAVY-ION COLLISIONS IN THE BM@N EXPERIMENT

Thursday 18 September 2025 17:00 (20 minutes)

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In the BM@N collaboration experiment, double differential distributions of transverse momentum and rapidity of positively charged pions and kaons have recently been found for collisions of ^{40}Ar ions with different targets at 3.2 GeV per nucleon [1]. The distributions of secondary particles in transverse momentum can be described using a Boltzmann distribution by fitting different temperatures at different rapidities [1]. One can say that the "transverse temperature" is approximately half the "longitudinal temperature".

In our opinion, this can be considered on the basis of anisotropic nonequilibrium hydrodynamics. In our works [2,3,4] a quantum nonequilibrium hydrodynamic approach is developed, in which the nonequilibrium state of the nuclear medium is described by a joint solution of the kinetic equation and the hydrodynamic equations. In works [3,4] we established a connection between the hydrodynamic equations and the effective Schrödinger and Klein-Fock-Gordon equations. In such an approach, many features of inclusive differential spectra of emitted secondary particles in heavy ion collisions can be described, including the cumulative effect [5,6]. In this description, the selection of the resulting hot spot is significant and an advantage was found in comparison with standard cascade calculations in describing the available experimental data.

In our nonequilibrium hydrodynamic approach applied to the data of [1], it turns out to be possible to represent the nucleon distribution function in the form depending on an ellipsoid in momentum space with semi-axes proportional to the longitudinal and transverse temperatures in the proper frame of reference. Thus, in accordance with the solution of the kinetic equation, the effective temperature can depend on the particle emission angle. Such anisotropic hydrodynamics with the selection of a hot spot is in agreement with the experimental data [1] for pions and kaons. Calculations using cascade models, as shown in [1], give an overestimated yield of kaons. The first comparison of our approach with experimental data obtained for the differential yields of protons, deuterons and tritons in the BM@N collaboration experiment [7] with the same nuclei as in [1] turned out to be quite successful.

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Session Classification: Relativistic heavy ion collisions

Track Classification: Dynamics of multiparticle production