Joint Institute for Nuclear Research
BOGOLIUBOV LABORATORY OF THEORETICAL PHYSICS

Seminar
"THEORY OF HADRONIC MATTER UNDER EXTREME CONDITIONS"

Chairmen: E.-M. Ilgenfritz and O. V. Teryaev

Wednesday, June 3, 2015
at 16.00
in Blokhintsev Lecture Hall (4th floor)

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Relativistic Heavy-Ion Collisions within Alternative Scenarios: Directed and Elliptic Flow

Analysis of the directed flow (v_1) and transverse-momentum integrated elliptic flow (v_2) in heavy-ion collisions is performed in the range of collision energies $\sqrt{s_{NN}} = 2.7$–39 GeV. Simulations have been done within a three-fluid model employing a purely hadronic equation of state (EoS) and two versions of the EoS with deconfinement transitions: a first-order phase transition and a smooth crossover transition. High sensitivity of the proton directed flow to the EoS is found. The directed flow indicates that the crossover deconfinement transition takes place in semicentral Au+Au collisions in a wide range of collision energies $4 \lesssim \sqrt{s_{NN}} \lesssim 20$ GeV. The crossover EoS is unambiguously preferable for the description of the most part of experimental data in this energy range. The obtained results suggest that the deconfinement EoS's in the quark-gluon sector should be stiffer at high baryon densities than those used in the calculation. The latter finding is in agreement with that discussed in astrophysics. Simulations demonstrate low sensitivity of v_2 of charged particles to the EoS. All considered scenarios equally well reproduce recent STAR data on v_2(charged) for mid-central Au+Au collisions and properly describe its change of sign at the incident energy decrease below $\sqrt{s_{NN}} \approx 3.5$ GeV. The predicted integrated elliptic flow of various species exhibits a stronger dependence on the EoS. A noticeable sensitivity to the EoS is found for anti-baryons and, to a lesser extent, for K^- mesons. In particular, the v_2 excitation functions of anti-baryons exhibit a non-monotonicity within the deconfinement scenarios that was predicted by Kolb, Sollfrank and Heinz. However, low multiplicities of anti-baryons at $\sqrt{s_{NN}} \leq 10$ GeV result in large fluctuations of their v_2 which may wash out this non-monotonicity.