HK 3: Heavy Ion Collision and QCD Phases II

Zeit: Montag 14:00–16:00 Raum: S1/01 A4

Gruppenbericht HK 3.1 Mo 14:00 S1/01 A4

Vergleich von hydrodynamischen und mikroskopischen Rechnungen für p+A und A+A Stöße — •Kai Gallmeister, Harri Niemi, Carsten Greiner und Dirk Rischke — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

Die gute Übereinstimmung von Ergebnissen aus Rechnungen auf Grundlage dissipativer Hydrodynamik mit experimentellen Daten in p+Pb Stößen scheint auf ein stark kollektives Verhalten und eine schnelle Thermalisierung zu deuten. Allerdings sind schon in Schwerionenstößen große dissipative Korrekturen nötig. Wir untersuchen durch einen Vergleich von hydrodynamischen Rechnungen mit Rechnungen, die mit dem kinetischen Parton-Transportmodell BAMPS durchgeführt werden, ob dissipative Hydrodynamik in der Tat noch für kleine Stoßsysteme anwendbar ist.

HK 3.2 Mo 14:30 S1/01 A4

Pinning down QCD-matter shear viscosity in A+A collisions via EbyE fluctuations using pQCD + saturation + hydrodynamics — •Harri Niemi[1], Kari Eskola[2,3], Risto Paatelainen[4], and Kimmo Tuominen[3,5] — [1]Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität, Max-von-Laue-Str. 1, D-60438 Frankfurt am Main, Germany — [2]University of Jyväskylä, Department of Physics, P.O. Box 35, FI-40014 University of Jyväskylä, Finland — [3]Helsinki Institute of Physics, P.O.Box 64, FI-00014 University of Helsinki, Finland — [4]Departamento de Fisica de Particulas, Universidade de Santiago de Compostela, E-15782 Santiago de Compostela, Galicia, Spain — [5]Department of Physics, University of Helsinki, P.O. Box 64, FI-00014 University of Helsinki, Finland

We compute the initial energy densities produced in ultrarelativistic heavy-ion collisions from NLO perturbative QCD using a saturation conjecture to control soft particle production, and describe the subsequent space-time evolution of the system with hydrodynamics, event by event. The resulting centrality dependence of the low-p_T observables from this pQCD + saturation + hydro ("EKRT") framework are then compared simultaneously to the LHC and RHIC measurements. With such an analysis we can test the initial state calculation, and constrain the temperature dependence of the shear viscosity-to-entropy ratio η/s of QCD matter. Using these constraints from the current RHIC and LHC measurements we then predict the charged hadron multiplicities and flow coefficients for the 5.023 TeV Pb+Pb collisions.

HK 3.3 Mo 14:45 S1/01 A4

Hydrodynamic bubbles in a transport approach — Dmytro Oliinychenko[1] and •Hannah Petersen[1,2,3] — [1]Frankfurt Institute for Advanced Studies, Ruth-Moufang-Strasse 1, 60438 Frankfurt am Main, Germany — [2]Institute for Theoretical Physics, Goethe University, Max-von-Laue-Strasse 1, 60438 Frankfurt am Main, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt, Germany

Hybrid approaches are very successfully applied for the description of the dynamics of heavy ion collisions. In the high density regime one takes advantage of relativistic hydrodynamics, while at lower density non-equilibrium transport models are applied. Handling the transitions between fluid dynamics and the transport description includes uncertainties, both when generating the initial condition by turning particles into fluid and in the final stages, when particles are sampled from the fluid.

We suggest a way to avoid these uncertainties by generating hydrodynamical behaviour directly in the transport approach. In the regions of high density we perform a forced thermalization, which effctively simulates the result of N-particle collisions. The effect of these hydrodynamic bubbles on bulk observables such as elliptic flow is investigated by comparing the results to pure transport and traditional hybrid approach.

HK 3.4 Mo 15:00 S1/01 A4

The effect of longitudinal fluctuations in (3+1)D viscous hydrodynamics — •Long-Gang Pang[1], Hannah Petersen[1,2,3], Pasi Huovinen[6], Xin-Nian Wang[4,5], and Yuri Karpenko[1] — [1]FIAS, Frankfurt, Germany — [2]ITP, Goethe University, Frankfurt, Germany — [3]GSI, Darmstadt, Germany — [4]CCNU, Wuhan, China — [5]LBNL, Berkeley, USA — [6]ITP, University of Wroclaw, Poland

The energy density fluctuations of the quark gluon plasma (QGP) in the transverse plane are studied in detail and found to be important to explain the high order harmonic flow v_n at RHIC and LHC. However, the energy density fluctuations along longitudinal direction (space-time rapidity η_s) have not been fully investigated yet, even though they should exist as well. Previous studies show that the longitudinal fluctuations strongly depend on the initial entropy deposition mechanisms. In this work AMPT initial conditions are used where HIJING introduces longitudinal fluctuations originating from the asymmetry between forward and backward going participants, string length fluctuations and finite number of partons at different collision energies. The longitudinal fluctuations have been found to be responsible for the decorrelation of anisotropic flow and twist of event planes along rapidity. We study the effect of longitudinal fluctuations on the QGP expansion in both transverse and longitudinal direction within CLVisc, a (3+1)D viscous hydrodynamic code parallelized on GPU using OpenCL, to check whether the anisotropic flow is affected by longitudinal fluctuations and to determine appropriate shear viscosity over entropy density coefficients η/s in comparison with experiments at RHIC and LHC.

HK 3.5 Mo 15:15 S1/01 A4

Investigations about the effects of magnetic fields on QGP in Heavy Ion Collisions — •Inghirami Gabriele[1,2], Del Zanna Luca[3,4,5], Haddadi Mohsen[6], Bleicher Marcus[1,2], Becattini Francesco[3,5], Beraudo Andrea[7], and Rolando Valentina[8,9] — [1]FIAS, Frankfurt am Main, Germany — [2]Goethe Universität, Frankfurt am Main, Germany — [3]Universita' degli Studi di Firenze, Firenze, Italy — [4]Osservatorio Astrofisico di Arcetri - INAF, Firenze, Italy — [5]INFN, Sezione di Firenze, Italy — [6]Hakim Sabzevari University, Sabzevar, Iran — [7]INFN, Sezione di Torino, Italy — [8]Universita' degli Studi di Ferrara, Ferrara, Italy — [9]INFN, Sezione di Ferrara, Italy

Numerical hydrodynamic simulations of heavy ion collisions are constantly refined through the addition of effects that may significantly improve the matching with experimental data, like viscosity or fluctuating initial conditions, but, so far, electromagnetic interactions have been almost completely neglected. However, recent lattice QCD computations and classical electrodynamics estimates both suggest that the magnetic fields produced immediately after the collisions between nuclei may live long enough and with a strength sufficient to produce measurable effects. We would like to present the results of some preliminary investigations about the influence on the properties of the medium due the presence of a strong magnetic field.

HK 3.6 Mo 15:30 S1/01 A4

Studies of the suppression of inclusive and b-tagged reconstructed jets within a partonic transport approach — •Florian Senzel[1], Zhe Xu[2], and Carsten Greiner[1] — [1]Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität Frankfurt, Germany — [2]Department of Physics, Tsinghua University, Beijing, China

While the nuclear modification factor R_{AA} of charged hadrons measures jet quenching in terms of the suppression of single inclusive particle spectra, studies employing reconstructed jets additionally allow the investigation of medium modifications to the initial parton shower as a whole and thereby provide information about the angular dependence of jet quenching. Furthermore, due to mass effects the energy loss of jets is expected to be sensitive to the flavor of the shower-initiating parton. For investigating the medium modification of parton showers, we employ the transport approach BAMPS, which numerically solves the 3+1D Boltzmann equation for gluons, light and heavy quarks based on pQCD cross sections for both $2 \to 2$ and $2 \leftrightarrow 3$ processes. While employing an improved Gunion-Bertsch matrix element together with a running coupling, BAMPS simulations show a good agreement with data for both R_{AA} and the elliptic flow v_2. We present recent results about the R_{AA} of inclusive and b-tagged reconstructed jets and the modification of the underlying jet shapes. We show that the suppression of b-tagged jets is dominated by elastic energy loss of the bottom quark, while radiative processes of gluons and light quarks additionally broaden the distribution of momentum within the inclusive jets.

HK 3.7 Mo 15:45 S1/01 A4

Soft-Hard Event Engineering (SHEE) — •Barbara Betz — Goethe-Universität Frankfurt, Frankfurt am Main, Germany

The wide distributions of low-pT vn's measured experimentally have proven that any medium background model used must not only render the mean value of the low-pT vn's but also the correct amount of fluctuations within a centrality class. In the study presented, we investigate if the eccentricity selection of the background medium within a given centrality class influences the high-pT v2. For this, we couple the BBMG pQCD jet-energy loss model with the event-by-event, viscous hydrodynamical model v-USPhydro and determine the high-pT v2 and v3 for three different e2-eccentricity selections of the background medium. We find that the high-pT v2 is directly proportional to the low-pT v2 and that the width of the low-pT v2 distribution influences the value of the high-pT v2 while the RAA is independent of the e2-eccentricity distribution of the background medium.