HK 62: Schwerionenkollisionen und QCD Phasen

Zeit: Donnerstag 14:00–16:15 Raum: HSZ-201

Gruppenbericht HK 62.1 Do 14:00 HSZ-201

(Anti-)matter and hyper-matter production at the LHC with ALICE — •Nicole Martin for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — TU Darmstadt, Institut für Kernphysik, Darmstadt, Germany

ALICE is the experiment at the CERN LHC dedicated to the investigation of nucleus–nucleus collisions at the highest energies ever reached in the laboratory. The excellent particle identification capabilities and the ultralow momentum reach of ALICE allow for the reconstruction of a significant number of rare states or even exotic ones. In this talk we present results from a sample of Pb–Pb collisions at a center of mass energy of $\sqrt{s_{\rm NN}}$ = 2.76 TeV per nucleon–nucleon pair. Light nuclei up to ^{3}He and ^{4}He as well as the corresponding anti-nuclei have been identified based on their specific energy loss in the Time Projection Chamber and velocity information from the Time-Of-Flight detector. (Anti-)hyper-tritons have been reconstructed via their mesonic decay channel ($^3_\Lambda$H $\rightarrow$ ^{3}He+π) exploiting their secondary vertex decay topology. The (^{3}He, π) invariant mass spectrum are presented. In addition, searches for even lighter exotic hyper-matter states, i.e. Λ-Λ (also known as H-Dibaryon) and Λ-n bound states, are discussed. The results are compared with model expectations.

HK 62.2 Do 14:30 HSZ-201

The KFParticle Package for the Fast Particle Reconstruction in ALICE and CBM — •Maksym Zyzak[1,2,3], Ivan Kisel[1,2,3], Igor Kulakov[1,2,3], and Iourii Vassiliev[1,3] for the CBM-Collaboration — [1]Goethe-Universitaet Frankfurt, Frankfurt am Main, Germany — [2]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

Modern heavy-ion experiments operate with very high data rates and track multiplicities collecting petabytes of data, therefore the speed of the reconstruction algorithms is crucial both for the online and offline data analysis. The KFParticle package for short-lived particles reconstruction has been developed and is actively used both in the CBM and ALICE experiments. The package is based on the Kalman filter mathematics and has rich functionality. It is geometry independent and can be used in other experiments too.

Almost all modern servers are equipped with many or multi-core processors, which contain SIMD modules. The KFParticle has been SIMDized, which gives the additional speedup factor of 3-5. KFParticle allows to reconstruct about 50 decay channels achieving speed of 1.5 ms per Au+Au mbias collisions at 25 AGeV on a single core. The package has been parallelized between cores and shows strong linear scalability on servers with up to 80 logical cores.

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HK 62.3 Do 14:45 HSZ-201

Strange particle production in Pb–Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV with ALICE at the LHC — •Maria Nicassio for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

The ALICE Collaboration at the LHC has measured mid-rapidity transverse momentum spectra of the Λ, Ξ and Ω baryons and their anti-particles, as well as of the K^0_S meson. Results in Pb–Pb interactions at $\sqrt{s_{NN}}$ = 2.76 TeV will be presented as a function of centrality and compared to pp and lower energy nucleus–nucleus measurements. In particular, the strangeness enhancements and the baryon to meson ratio will be discussed.

HK 62.4 Do 15:00 HSZ-201

Elliptic Flow Measurement of Heavy Flavour Decay Electrons in Pb-Pb Collisions at $\sqrt{s}$ 2.76TeV with ALICE — •Theodor Rascanu for the ALICE-Collaboration — Institut fuer Kernphysik Frankfurt, Deutschanld

In heavy-ion collisions, charm and beauty quarks are produced in the initial hard scattering processes. They then propagate and interact strongly with the created medium, the Quark Gluon Plasma (QGP), and thus allow to probe its properties. One way to measure heavy-quarks is via electrons from the semileptonic decays of open charm and beauty hadrons. At low transverse momentum, the level of thermalization of heavy quarks can be studied via the azimuthal anisotropy of the heavy flavour electron emission in the transverse plane, the elliptic flow, v_{2}. At high pt, v_{2} provides insight on the path length dependence of parton energy-loss. In this talk we present v_{2} measurements of electrons from heavy flavour decays at mid rapidity with ALICE in semi-central (20-40%) Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV. The electrons are identified using the Time Of Flight detector and Time Projection Chamber at low momenta, as well as the Electromagnetic Calorimeter at higher momenta. The latter provides in addition the possibility to trigger on electrons in the collision. We report on the electron identification and explain how the non-heavy flavour electron background is subtracted. Finally the results are compared to different theoretical models.

HK 62.5 Do 15:15 HSZ-201

Dynamical freeze-out in hydrodynamics — •Hannu Holopainen and Pasi Huovinen — Frankfurt Institute for Advanced Studies, Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany

In hydrodynamical modeling of the ultrarelativistic heavy-ion collisions the freeze-out is typically performed at a constant temperature. In this work we introduce a dynamical freeze-out criterion, which compares the hydrodynamical expansion rate with the pion scattering rate. We present hadron spectra and elliptic flow calculated using (3+1)-dimensional ideal hydrodynamics, and show the differences between constant temperature and dynamical freeze-out criteria. First we discuss the systematics of the dynamical freeze-out, and for simplicity these calculations have been performed using smooth initial states. Finally dynamical freeze-out condition is applied to event-by-event calculations to evaluate v_2. We find that the differences caused by different freeze-out criteria are small in all studied cases.

This work was supported by the ExtreMe Matter Institute (EMMI) and by BMBF.

HK 62.6 Do 15:30 HSZ-201

Resolving substructures in the emission geometry using azimuthalsensitive HBT — •Gunnar Graef — Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Str. 1, D-60438 Frankfurt — Institute für Theoretische Physik, Goethe-Universität, Frankfurt am Main

We use the non-equilibrium transport approach Ultra-relativistic Quantum Molecular Dynamics (UrQMD) to compute the dynamics of heavy ion collisions up to LHC energies. From this model we obtain directly the full phasespace distribution of all particles at the kinetic freeze out. By performing a Hanbury-Brown Twiss analysis differential in azimuth angle we are able to extract a distortion and a tilt of the source away from the beam axis. In the freeze out distribution we do not only observe a tilt but also a substructure that originates from particles emitted at different collision times. We show that it is in principle possible to resolve the substructure with experimental methods.

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HK 62.7 Do 15:45 HSZ-201

Simulations of heavy ion collisions in a pQCD-based partonic transport model and a closer look on the Gunion-Bertsch approximation — •Oliver Fochler[1], Jan Uphoff[1], Zhe Xu[2], and Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Department of Physics, Tsinghua University, Beijing, China

The perturbative QCD-based partonic transport model BAMPS (Boltzmann Approach to Multi-Parton Scatterings) incorporates binary interactions of gluons and quarks based on leading order pQCD cross sections as well as 2<->3 processes that obey detailed balance and are based on the Gunion-Bertsch approximation of the radiative matrix element. The validity of the Gunion-Bertsch approximation and its application to Boltzmann transport is discussed and compared to the exact leading order matrix element by Berends et al. Based on this

analysis, improvements to the commonly used version of the Gunion-Bertsch approximation are discussed that are necessary when computing transport rates. First results on the implications on fully dynamic simulations of heavy ion collisions at RHIC and at LHC energies within our transport model BAMPS will be discussed.
Supported by BMBF.

HK 62.8 Do 16:00 HSZ-201

Molecular dynamics description of an expanding q/qbar plasmawith the NJL model and applications to heavy ion collisions. — •Rudy Marty and Elena Bratkovskaya — Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany

We present a relativistic molecular dynamics approach based on the Nambu-Jona-Lasinio Lagrangian. We derive the relativistic time evolution equations for an expanding plasma, discuss the hadronization cross section and how they act in such a scenario. We present in detail how one can transform the time evolution equation to a simulation program and apply this program to study the expansion of a plasma created in experiments at RHIC and LHC. We present first results on the centrality dependence of v2 and of the transverse momentum spectra of pions and kaons and discuss in detail the hadronisation mechanism.
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