HK 4: Heavy-Ion Collisions and QCD Phases I

Zeit: Montag 14:00–16:00 Raum: HS 15

Gruppenbericht HK 4.1 Mo 14:00 HS 15

Energy and system size dependent charged-particle production measured with ALICE — •Patrick Huhn — IKF, Goethe Universität Frankfurt am Main, Deutschland

The ALICE experiment at the LHC is designed to investigate the properties of the so-called Quark-Gluon Plasma (QGP) by studying high-energy pp, p-Pb, Pb–Pb and recently for the first time Xe–Xe collisions. Such a hot and dense deconfined QCD medium (the QGP) is created in collisions of Pb- or Xe-ions at high center-of-mass energies. High energetic quarks and gluons created in the early phase of the collision traveling through the plasma loose energy (parton energy loss). Such medium effects can be examined by comparing the production of charged particles in heavy-ion collisions with the production in pp collisions where no medium is created. This comparison is usually expressed by means of the nuclear modification factor R_{AA}, the ratio of the yield in A–A collisions and the yield in pp collisions scaled by the number of binary collisions.
In this talk, we present the analysis of transverse-momentum distributions for primary charged particles as well as the nuclear modification factors in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 2.76$ TeV and 5.02 TeV and in Xe-Xe collisions at $\sqrt{s_{\mathrm{NN}}} = 5.44$ TeV measured with ALICE. In particular, we focus on a comparison of the nuclear modification factors in Pb-Pb and Xe-Xe collisions to investigate a possible system size and energy dependence of R_{AA}.

HK 4.2 Mo 14:30 HS 15

Study of the path length dependence of jet quenching in relativistic heavy-ion collisions with JEWEL — •Luisa Bergmann for the ALICE-Collaboration — Physikalisches Institut, Universität Heidelberg

In relativistic heavy-ion collisions, a deconfined medium with high energy density is created, the quark-gluon plasma. Amongst other observables, jets – originating from primordial hard scatterings – act as useful probes for the properties of this medium. As the initial partons traverse the quark-gluon plasma, they lose energy by interacting with the constituents of the medium. The study of this so called "jet quenching" yields insight into the interaction properties of the medium.

This talk focuses on the study of correlation functions. By analyzing the angular dependence of the distribution of charged hadrons in two particle and multi-hadron correlations, one obtains information about the path-length dependent energy loss of jets in the medium. To provide a well formed basis for future data analyses, the study of correlations is first performed with models, in particular by employing JEWEL. The usage of Monte-Carlo event generators offers the possibility to gain knowledge about the interaction processes in a controlled environment, which can then be used to understand structures in real data. This information ultimately helps to constrain the models on energy loss and on interactions of colored probes and media.

HK 4.3 Mo 14:45 HS 15

Influence of modified (non-)strange hadron spectra on statistical hadronization model calculations — Anton Andronic[1], Peter Braun-Munzinger[2], •Yannick Kirchhoff[3], Markus Köhler[3], and Johanna Stachel[3] — [1]Westfälische Wilhelms-Universität Münster, Institut für Kernphysik, Münster, Germany — [2]Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [3]Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany

A major interest in heavy-ion collisions is the investigation of the QCD phase transition from a Quark-Gluon Plasma to hadronic matter. One tool to study this phase transition is the statistical hadronization model. It describes the produced hadron densities in the fireball using a (thermal) fit to hadron yields with only a few parameters and has shown to be successful over a broad range of collision energies up to lead-lead collisions at the LHC. The results of the thermal fits depend on the included hadron spectrum. In this contribution, the impact is studied considering additional (non-)strange hadron states predicted by LQCD or the constituent quark model, particularly regarding deviations in the proton yields seen in earlier fits to LHC data. It will be shown that this problem cannot be solved by adding further hadron states but that, in fact, these states lead to a massive deterioration of the fit. This will be interpreted by applying a correction, making use of the description of statistical mechanics in terms of the S-matrix.

HK 4.4 Mo 15:00 HS 15

Multi-differential measurement of correlated pion-proton pairs in Au+Au collisions at $\sqrt{s_{NN}} = 2.42\ GeV$ with HADES.* — •Georgy Kornakov for the HADES-Collaboration — TU Darmstadt

The study of hadron formation and their properties in hot and dense QCD matter is one of the main topics in sub-nuclear physics. The short-lived states (∼1 fm/c), produced and decayed within the QCD matter contain fundamental information about the surrounding medium created in collisions of heavy-ions at relativistic energies. HADES measures rare and penetrating probes in the regime of 1-2 GeV kinetic energy per nucleon. Excitation of baryonic resonances is a key mechanism for meson, dilepton and strangeness production. The measured multi-differential spectra of mass, rapidity and transverse momentum of π^+p and π^-p correlated pairs from Au+Au collisions are going to be presented in this contribution as well as the developed methods for their reconstruction and comparison to previous measurements.

**This work has been supported by the VH-NG-823, Helmholtz Alliance HA216/EMMI and GSI*

HK 4.5 Mo 15:15 HS 15

Multiplicity dependent charged particle p_{T} spectra with ALICE at the LHC — •Mario Krüger — Institut für Kernphysik, Goethe-Universität Frankfurt

The study of the Quark-Gluon Plasma created in ultrarelativistic heavy-ion collisions at the CERN-LHC is complemented by reference measurements in proton-lead (p–Pb) and proton-proton (pp) collisions, where the effects of multiple-parton interactions and hadronization beyond independent string fragmentation can be investigated.

In this talk, we present an unfolding procedure based on the iterative D'Agostini method to reconstruct the correlation between transverse momentum (p_{T}) spectra of charged particles and the corresponding charged-particle multiplicities N_{ch}. The unfolded spectra are presented in single multiplicity ($\Delta N_{\mathrm{ch}} = 1$) bins and are used to derive moments of the p_{T} distributions for a variety of energies and system sizes.

Supported by BMBF and the Helmholtz Association.

HK 4.6 Mo 15:30 HS 15

R_{AA} studies in Xe-Xe and Pb-Pb collisions with ALICE — •Richard Kaiser for the ALICE-Collaboration — Physikalisches Institut, University of Heidelberg

Transverse momentum (p_T) spectra of charged particles at mid-pseudorapidity in Xe-Xe collisions at $\sqrt{s_{NN}} = 5.44$ TeV measured with the ALICE apparatus at the Large Hadron Collider (LHC) are reported. The kinematic range $0.15 < p_T < 50$ GeV/c and $|\eta| < 0.8$ is covered. Results are presented in nine classes of collision centrality in the 0-80% range. The charged-particle multiplicity $\frac{dN_{ch}}{d\eta}|_{|\eta|<0.8}$ in Pb-Pb collisions is matched to those in Xe-Xe collisions. The nuclear modification factor (R_{AA}) in central Xe-Xe collisions and Pb-Pb collisions shows a remarkable similarity at $p_T < 1$ GeV/c. These results from the two colliding systems with significantly different size provide insight on the path length dependence of medium-induced parton energy loss.

HK 4.7 Mo 15:45 HS 15

Understanding soft hadron production at RHIC and LHC energies — •Damir Devetak for the ALICE Collaboration — PI, Heidelberg

The Quark-Gluon Plasma (QGP), created in ultra-relativistic heavy-ion collisions, is a system of strongly interacting partons. Experimental evidence from RHIC and LHC points towards a fluid-like behaviour of the formed QGP during its expansion. Here we concentrate on transverse momentum spectra of identified particles for central collisions as a function of collision energy in the ranges of RHIC and LHC. We investigate in detail how well experimental data are described by a fluid model based on causal relativistic fluid dynamics, including a Cooper-Frye type kinetic freeze-out and subsequent strong resonance decays. Also the dependence on model parameters such as the initial energy density, freeze-out temperature and viscosities will be discussed.