HK 29: Heavy Ion Collisions and QCD Phases VI

Zeit: Mittwoch 16:45–19:00 Raum: F 1

Gruppenbericht HK 29.1 Mi 16:45 F 1

Recent results on two-particle correlation measurements in pp and Pb–Pb collisions from ALICE — •Alice Ohlson for the ALICE-Collaboration — Physikalisches Institut, Universität Heidelberg

Two-particle correlation measurements are commonly performed in high energy heavy-ion collision experiments to investigate diverse phenomena such as jet fragmentation and its modification in a heavy-ion environment, collectivity and the hydrodynamic-like behaviour of the quark–gluon plasma (QGP), and femtoscopic effects. Surprising results have also arisen from angular correlation studies in smaller collision systems, which normally serve as a baseline for heavy-ion measurements. In particular, the presence of correlations between particles separated by large pseudorapidity intervals (known as the 'ridge') in pp and p–Pb collisions has recently led to reevaluations of our understanding of collective effects in both small and large collision systems. In this talk we will present the latest two-particle correlation results from the ALICE Collaboration, including new results on the multiplicity evolution of correlation functions in pp collisions at $\sqrt{s} = 7$ and 13 TeV, the pathlength-dependence of jet quenching in Pb–Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV, and correlations of identified particles which inform our understanding of particle production throughout the collision evolution.

Supported by BMBF and SFB 1225 ISOQUANT.

HK 29.2 Mi 17:15 F 1

Magnetic field influence on microscopic dynamics in heavy-ion collisions — •Moritz Greif — Goethe Universität Frankfurt

In heavy-ion collisions, strong magnetic fields occur at very early times after the collision. We show, how the Lorentz force influences the dynamics of quarks in the quark-gluon plasma. For this study, we use the microscopic transport approach BAMPS (Boltzmann Approach To Multi-Parton Scatterings) including magnetic fields. BAMPS, solving the 3+1D Boltzmann equation, is ideally suited for explicit nonequilibrium phenomena. We prove, that thermalization is not affected by external fields, but show that the isotropisation of quark momenta is largely influenced. The asymmetric nature of the magnetic fields gives rise to several interesting phenomena, such as momentum asymmetries of quarks and electromagentic probes produced by quark scattering. We furthermore show first efforts to simulatneously solve the Maxwell- and Boltzmann equation in a common numerical framework to get a more precise picture of the evolution of magnetic fields in the quark-gluon plasma.

HK 29.3 Mi 17:30 F 1

Constraining the contribution of the chiral magnetic effect to charge dependent correlations in heavy ion collisions — •Jacobus Onderwaater and Ilya Selyuzhenkov for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

The moving charges in heavy-ion collisions give rise to a strong magnetic field in the overlap region, where the quark-gluon plasma (QGP) is formed. It is thought that sphaleron and instanton transitions, that change chirality, produce an imbalance between left- and right-handed quarks inside the QGP. This imbalance results in a separation of charges along the magnetic field direction, a phenomenon called the chiral magnetic effect (CME). The search for the CME consists of the analysis of charge-dependent correlations along the magnetic field. Observations of a charge separation by STAR and ALICE in Pb-Pb collisions, and recently by CMS in p-Pb collisions, indicate the importance of understanding background correlations not related to the CME.

We present recent results from ALICE which aim to separate the CME signal from background correlations, the latter arising mainly from local charge conservation. We use different techniques, such as higher order mixed harmonic correlations that probe the shape of the charge separation, event-shape-engineering to measure the dependence of the charge separation on the strength of the elliptic flow, and particle identification to study quark type and mass dependence of charge correlations.

HK 29.4 Mi 17:45 F 1

Analysis of charged-dependent azimuthal correlations with HADES — •Frederic Kornas[1], Tetyana Galatyuk[1,2], and Ilya Selyuzhenkov[2] for the HADES-Collaboration — [1]TU Darmstadt, Darmstadt, Germany — [2]GSI, Darmstadt, Germany

Charge-dependent azimuthal correlations relative to reaction plane have been proposed as a probe in the search for the chiral magnetic effect in heavy-ion collisions. These type of correlations have been measured at the RHIC BES by STAR and at the LHC by ALICE.

The contribution will report about the status of the two charged particle correlations measured with high statistic sample of Au+Au collisions at 1.23 AGeV collected by HADES. Efficiency and Acceptance corrected spectra will be shown and compared to previous measurements.

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

HK 29.5 Mi 18:00 F 1

Collective flow in heavy-ion collisions at $E_{\rm lab} = 1 - 2A$ GeV — •Markus Mayer[1,2], LongGang Pang[1], and Hannah Petersen[1,2,3] — [1]Frankfurt Institute for Advanced Studies — [2]Goethe Universität Frankfurt — [3]GSI Helmholtzzentrum für Schwerionenforschung

In this talk the elliptic flow v_2 and the triangular flow v_3 of nucleons and pions at beam energies of $1 - 2A$ GeV are investigated within the hadronic transport approach SMASH (Simulating Many Accelerated Strongly-interacting Hadrons). Collective flow is a good observable to gain information about the transport properties of the fireball matter. The anisotropic flow is characterized by the anisotropies in the pressure gradients and thus depends on the shape of the initial density profile. The largest contribution to this anisotropic flow comes from the elliptic flow v_2. Since the distribution of the fireball matter is inhomogeneous, there are also higher anisotropic coefficients, for example the triangular flow v_3. The elliptic flow v_2 is compared to HADES and FOPI data while predictions for v_3 are performed. Especially the effects of potentials and Fermi motion on these flow coefficients are investigated.

HK 29.6 Mi 18:15 F 1

Flow harmonics in Au-Au collisions at 1.23 AGeV measured with HADES — •Behruz Kardan for the HADES-Collaboration — Goethe-Universität, Frankfurt am Main

HADES provides a large acceptance combined with a high mass-resolution and therefore allows to study di-electron and hadron production in heavy-ion collisions with unprecedented precision. Due to the high statistics of seven billion Au+Au collisions at 1.23 AGeV collected in 2012, a multi-differential (p_t, rapidity and centrality) analysis of collective flow phenomena and as well as a systematic study of higher-order flow harmonics is possible.

Multi-particle azimuthal correlation techniques can be utilized to disentangle the contribution from collective and non-flow process involved in the dynamical evolution of heavy-ion reactions. At low energies directed and elliptic flow has been measured for pions, charged kaons, protons, neutrons and fragments at the BEVALAC and SIS18, but so far high-order harmonics have not been studied. They allow to characterize the properties of the dense hadronic medium produced in these collisions, such as its viscosity, and provide thus an important reference to measurements at higher energies.

Supported by BMBF (05P15RFFCA), HGS-HIRe and H-QM.

HK 29.7 Mi 18:30 F 1

CBM performance for anisotropic flow measurements of charged hadrons — •Vitalii Blinov[1,2] and Ilya Selyuzhenkov[2] for the CBM-Collaboration — [1]Goethe-Universitat, Frankfurt am Main — [2]GSI, Darmstadt

The Compressed Baryonic Matter experiment (CBM) at FAIR aims at the investigation of the QCD phase diagram in the region of high net baryon densities and moderate temperatures. Anisotropic transverse flow is one of the key observables to study the properties of matter created in heavy-ion collisions.

The performance of CBM for anisotropic flow measurements of charged pions, kaons and protons and their anti-particles as a function of rapidity and transverse momentum in different centrality classes is reported. Gold ion collisions at SIS-100 energies were simulated with Monte-Carlo event generators including spectator fragments. The CBM tracking system as well as the projectile spectator detector were used for the investigation. The extracted signal was corrected for effects of detector azimuthal non-uniformity. The possible systematic bias due to non-flow correlations was also studied.

Supported by Helmholtz Graduate School for Hadron and Ion Research (HGS-HIRe) and GSI Helmholtzzentrum für Schwerionenforschung.

HK 29.8 Mi 18:45 F 1

Data-driven particle composition correction of tracking efficiency for charged particles with ALICE — •Patrick Huhn for the ALICE-Collaboration — IKF, Goethe-Universität Frankfurt

The ALICE experiment at the LHC is designed to investigate the properties of the Quark-Gluon Plasma by studying high energy pp, p-Pb and Pb-Pb collisions. The parton energy loss in the medium can be examined by measuring the production of charged particles and their nuclear modification factor at high transverse momentum. In ALICE, charged particles are measured with the Time Projection Chamber. An accurate estimate of the tracking efficiency is a key ingredient for such measurements.

In this talk, we show how tracking efficiencies are obtained based on Monte Carlo simulations with PYTHIA and HIJING event generators for particle production and GEANT to simulate the detector response. In particular, we focus on the data-driven procedure being performed to re-weight the tracking efficiencies of identified particle that account for the different abundances of the various particle species in Monte-Carlo and data.

We present results on the tracking efficiency obtained from this data-driven procedure for the measurement of charged particles, especially in pp and Pb– Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV.

Supported by BMBF and the Helmholtz Association.