

## HK 75: Heavy Ion Collisions and QCD Phases 12

Time: Friday 14:30–16:30

Location: T/SR25

**Group Report**

HK 75.1 Fri 14:30 T/SR25

**Experimental tests of the QCD symmetries with heavy-ion collisions** — ●JACOBUS ONDERWAATER for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgrabenstr. 9, 64289 Darmstadt

Not long after the discovery of parity violation in weak interactions it was realized that parity violation is not prohibited in strong interactions. Although experimental results put a very small upper limit on the amount of global parity violation, no such strong restrictions exist on spontaneous occurrence of local parity symmetry breaking interactions in the QCD vacuum. It was suggested that local parity violating interactions in combination with the strong magnetic field in a heavy-ion collision may result in novel phenomena like the Chiral Magnetic Effect and the Chiral Separation Effect that survive during the evolution of the hot and dense medium and can be observed via charge-dependent correlations. Charge-dependent effects are observed at RHIC and LHC but may contain contributions from different sources, such as local charge conservation.

In this report an overview of recent charge-dependent measurements with the ALICE detector is presented. Two particle correlations with respect to the event plane with one identified hadron, and two- and three-particles correlations with unidentified hadrons from Pb-Pb at  $\sqrt{s_{NN}} = 2.76$  TeV are discussed.

HK 75.2 Fri 15:00 T/SR25

**Transverse Momentum Spectra of Inclusive Charged Particles in pp, p-Pb and Pb-Pb Collisions with ALICE** — ●PHILIPP LÜTTIG for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

To study the properties of matter created in p-Pb and Pb-Pb collisions, a common observable is the nuclear modification factor ( $R_{AA}$ ) as function of the transverse momentum ( $p_T$ ). The ALICE detector at the CERN-LHC has accumulated a wealth of data in pp, p-Pb and Pb-Pb collisions in the past years. Using a combined tracking approach based on information in the Inner Tracking System (ITS) and the Time Projection Chamber (TPC) ALICE is capable to measure the transverse momentum in a broad range.

Transverse momentum spectra of charged particles in minimum-bias pp, p-Pb and Pb-Pb (LHC-Run-2010) collisions have been measured up to  $p_T = 50$  GeV/c.

For pp and p-Pb collisions, a feasibility study to extend the  $p_T$  range of the charged particle spectra using data triggered by the ALICE Electromagnetic Calorimeter or the ALICE Transition Radiation Detector is presented in this talk. For Pb-Pb collisions, the extension of these spectra for  $p_T > 50$  GeV/c by including LHC-Run-2011 data is discussed. Furthermore, we present a study of  $R_{AA}$  measured in Pb-Pb collisions as a function of  $p_T$  and angle with respect to the reaction plane. Supported by BMBF and the Helmholtz Association.

HK 75.3 Fri 15:15 T/SR25

**Correlation between mean transverse momentum and charged particle multiplicity based on geometrical superposition of p-Pb collisions** — ●JEROME JUNG for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The mean transverse momentum ( $\langle p_T \rangle$ ) as a function of the charged-particle multiplicity  $N_{ch}$  in pp, p-Pb and Pb-Pb collisions was recently published by ALICE. While in pp and in p-Pb collisions a strong increase of  $\langle p_T \rangle$  with  $N_{ch}$  is observed, Pb-Pb collisions show a saturation at a much lower  $\langle p_T \rangle$ .

Efforts of reproducing this behaviour in Pb-Pb with a superposition of nucleon-nucleon interactions do not succeed. A superposition of p-Pb collisions seems to be more promising, since the p-Pb data shows characteristics of both pp and Pb-Pb collisions.

The geometric distribution of the p-Pb impact parameters is based on the Woods-Saxon density distribution. Using the correlation of the impact parameter and the multiplicity  $N_{ch}$  in p-Pb collisions a multiplicity-spectrum was generated. Combining this spectrum with experimental p-Pb data we present  $\langle p_T \rangle$  as a function of  $N_{ch}$  in simulated Pb-Pb collisions and compare it to the correlation measured in

Pb-Pb by ALICE.

HK 75.4 Fri 15:30 T/SR25

**The relevance of multi-parton interactions for event-by-event mean  $p_T$  fluctuations in pp collisions** — ●STEFAN HECKEL for the ALICE-Collaboration — Goethe-Universität Frankfurt, Institut für Kernphysik, Max-von-Laue-Str. 1, 60438 Frankfurt am Main

Event-by-event mean transverse momentum fluctuations in pp collisions have recently been measured by ALICE at the LHC [1]. High collision energies as reached at the LHC enable the occurrence of multiple hard scatterings in a single pp collision, due to the large number of partons within the ultra-relativistically moving particles. High-multiplicity events in pp collisions at LHC energies are believed to be driven by such multi-parton interactions (MPIs).

We present an analysis of the influence of MPIs on event-by-event mean transverse momentum fluctuations in pp collisions at  $\sqrt{s} = 7$  TeV, which has been performed with Monte Carlo simulations using PYTHIA8. The results for those fluctuations are presented as a function of the charged-particle multiplicity density and dependent on the number of multi-parton interactions. In addition, the simulations have been performed with and without the color reconnection mechanism. The inclusive results taking into account all numbers of MPIs are very similar in both cases, but for discrete numbers of MPIs they show significant and interesting differences. Finally, the results are compared to the measurements by ALICE.

[1] ALICE Collaboration, B. Abelev et al., Eur. Phys. J. C **74** (2014) 3077. arXiv:1407.5530 [nucl-ex]

HK 75.5 Fri 15:45 T/SR25

**Identified charged hadron  $p_T$  spectra as a function of multiplicity in pp collisions at  $\sqrt{s} = 7$  TeV with ALICE** — ●BENJAMIN HESS for the ALICE-Collaboration — Universität Tübingen, Physikalisches Institut I, Auf der Morgenstelle 14, 72076 Tübingen

The intriguing observation of hadron correlations in high-multiplicity pp collisions at the LHC [1] suggests possible collective effects occurring in “central” pp collisions. The multiplicity dependence of particle ratios is very sensitive to various final-state effects like hadronisation, colour reconnection, and collective flow that are implemented in hadronic Monte Carlo models.

The ALICE detector provides excellent tracking and particle identification. Charged pions, kaons and (anti-)protons are identified using the TPC specific energy loss ( $dE/dx$ ) in the momentum range up to about 20 GeV/c. In this talk, the measurements of identified charged hadron spectra ( $\pi/K/p$ ) as a function of multiplicity in pp collisions at  $\sqrt{s} = 7$  TeV are presented. The multiplicity dependence of the yield ratios is compared to p-Pb and Pb-Pb collisions. In this context, different multiplicity estimators are discussed.

[1] CMS Collaboration, “Observation of Long-Range Near-Side Angular Correlations in Proton-Proton Collisions at the LHC”, *JHEP* **1009** (2010) 091, arXiv:1009.4122.

HK 75.6 Fri 16:00 T/SR25

**Constraining the Jet-Energy Loss using a Parton Cascade** — ●BARBARA BETZ — Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität, Frankfurt am Main

We have developed a generic jet-energy loss model that has been shown to describe the experimentally measured nuclear modification factor and the high-pT elliptic flow at RHIC and LHC energies when being coupled to state-of-the-art hydrodynamic prescriptions. Now we extend this study by using the parton cascade BAMPS to provide the bulk background. We discuss both pQCD-based and AdS/CFT-inspired jet-energy loss prescriptions, the impact of a temperature-dependent jet-medium coupling, transverse flow, viscosity, as well as the difference between reconstructed and pion jets.

HK 75.7 Fri 16:15 T/SR25

**Baryonic Matter Onset in Two-Color QCD with Heavy Quarks** — ●PHILIPP SCIOR<sup>1</sup> and LORENZ VON SMEKAL<sup>1,2</sup> — <sup>1</sup>TU Darmstadt — <sup>2</sup>Justus-Liebig-Universität Gießen

We study the heavy quark limit of two-color QCD by using a three-dimensional Polyakov theory [1]. This theory can be derived from

two-color QCD by a combined strong coupling expansion. In particular we investigate the cold and dense regime of the phase diagram where we expect to find the Silverblaze property realized as Bose-Einstein condensation of diquarks [2,3]. We find evidence for the Silverblaze property and a superfluid phase when the quark chemical potential  $\mu$  reaches half the diquark mass. For even higher  $\mu$  we find the decon-

finement transition indicated by an increase of the Polyakov loop as well as the quark number density.

[1] M. Fromm et al. , JHEP 2012, 24 (2012) [2] T. Boz et al. , EPJ A 49, 11 (2013) [3] N. Strodthoff and L. von Smekal Phys.Lett. B 731, 350 (2014)