HK 12: Heavy-Ion Collisions and QCD Phases II

Time: Tuesday 16:30–18:30 Location: H1

Group Report HK 12.1 Tue 16:30 H1

Charm production and hadronisation at the LHC with ALICE — •Jianhui Zhu for the ALICE-Collaboration — GSI Helmholtz Centre for Heavy Ion Research

Recent measurements of charm-baryon production at midrapidity by the ALICE collaboration show baryon-to-meson yield ratios significantly higher than those in e^+e^- collisions for different charm-hadron species, suggesting that the charm fragmentation is not universal across different collisions systems. Thus, measurements of charm-baryon production are crucial to study the charm quark hadronisation in proton–proton collisions, relevant also for the description of heavy-flavour mesons. In large systems such as Pb-Pb collisions, the charm baryon-to-meson yield ratio is expected to be further enhanced if charm quarks hadronise via recombination with the surrounding light quarks in the QGP.

In this talk, the measurements of Λ_c^+, $\Xi_c^{0,+}$ and the first measurement of Ω_c^0 baryons performed with the ALICE detector at midrapidity in pp collisions at $\sqrt{s} = 5.02$ and 13 TeV, as well as the total charm cross section and charm fragmentation fractions will be presented. In Pb-Pb collisions, the measurement of Λ_c^+ production, the nuclear modification factor and the Λ_c^+/D^0 ratio will be discussed. These results will be compared to predictions from Monte Carlo event generators and theoretical calculations based on the statistical hadronisation model and on the hadronisation via coalescence.

HK 12.2 Tue 17:00 H1

Λ_c^+ cross section in p–Pb collisions down to $p_\mathrm{T} = 0$ at $\sqrt{s_\mathrm{NN}} = 5.02$ TeV measured with ALICE — •Annalena Sophie Kalteyer for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany

In this contribution, the latest ALICE measurement of Λ_c^+ production performed down to $p_\mathrm{T} = 0$ in p–Pb collisions at $\sqrt{s_\mathrm{NN}} = 5.02$ TeV is presented. This allows to show the first measurement of Λ_c^+/D^0 and Λ_c^+ nuclear modification factor (R_pPb) down to $p_\mathrm{T} = 0$ in this system. The baryon-to-meson ratio is significantly enhanced with respect to the one in e^+e^- collisions, suggesting that the charm fragmentation is not a universal process across different collision systems. Furthermore, the ratio as a function of the transverse momentum is shifted to higher p_T in p–Pb collisions with respect to pp collisions. The reason for this momentum shift could be a modification of the charm hadronisation mechanism and/or the presence of radial flow in p–Pb collisions. Typically this is observed in heavy-ion collisions where a hot deconfined medium is created. In addition, the R_pPb is useful to investigate possible initial state effects such as shadowing in the collisions of a proton with a heavy nucleus. R_pPb can help disentangling initial from final state effects, which would involve the presence of a medium. The results are compared with theoretical calculations including initial and final state effects.

HK 12.3 Tue 17:15 H1

Blast-wave description of Upsilon elliptic flow at LHC energies — Klaus Reygers[1], Alexander Schmah[1], •Anastasia Berdnikova[1], Nadine Gruenwald[1], and Xu Sun[2] — [1]Physikalisches Institut, Ruprecht-Karls-Universitat Heidelberg, Heidelberg, Germany — [2]Georgia State University, Atlanta, Georgia 30303, USA

A simultaneous blast-wave fit to particle yields and elliptic flow (v_2) measured as a function of transverse momentum in Pb–Pb collisions at LHC energies is presented. A compact formula for the calculation of $v_2(p_T)$ for an elliptic freeze-out surface is used which follows from the Cooper-Frye ansatz without further assumptions. Over the full available p_T range, the Υ elliptic flow data is described by the prediction based on the fit to lighter particles. This prediction shows that, due to the large Υ mass, a sizable elliptic flow is only expected at transverse momenta above 10 GeV/c.

HK 12.4 Tue 17:30 H1

Heavy-quark diffusion current in the Quark-Gluon Plasma — •Federica Capellino[1,2], Andrea Dubla[2], Stefan Floerchinger[3], Eduardo Grossi[4], Silvia Masciocchi[1,2], Jan M. Pawlowski[3], Ilya Selyuzhenkov[2], and Johanna Stachel[1] — [1]Physikalisches Institut Heidelberg, Universität Heidelberg, 69120 Heidelberg, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, 64291 Darmstadt, Germany — [3]Institut für Theoretische Physik, Universität Heidelberg, 69120 Heidelberg, Germany — [4]Center for Nuclear Theory, Department of Physics and Astronomy, Stony Brook University, Stony Brook, New York 11794-3800, USA

A hydrodynamic approach to the transport of heavy quarks in the Quark-Gluon Plasma is presented. We exploit the conservation of the number of heavy quark - antiquark pairs within the evolution of the plasma to construct causal second-order hydrodynamic equations of motion. The hydrodynamic transport coefficients associated to the heavy-quark diffusion current are then compared with the momentum-diffusion coefficients obtained in the standard Fokker-Planck formalism. The purpose of the present work is to provide further insights on the level of thermalization of charm and bottom quarks inside the expanding Quark-Gluon Plasma by investigating the relation between the two approaches and determining if their merging is able to capture the complexity of the heavy-quark in-medium dynamics. This work is funded via the DFG ISOQUANT Collaborative Research Center (SFB 1225).

HK 12.5 Tue 17:45 H1

Measurements of J/ψ production in p–Pb collisions at $\sqrt{s_\mathrm{NN}} = 8.16$ TeV with ALICE — •Minjung Kim for the ALICE-Collaboration — Physikalische Institut, Unversität Heidelberg, Heidelberg, Germany

Measurements of J/ψ production in p–Pb collisions are a valuable probe to study cold–nuclear–matter effects as well as possible final state mechanisms, which can modifiy its production with respect to the one in pp collisions.
In ALICE (A Large Ion Collider Experiment), J/ψ production is measured at midrapidity via the dielectron decay channel relying on the electron identification capability provided by the Time Projection Chamber (TPC). Excellent track pointing resolution provided by the Inner Tracking System (ITS) allows the contribution of J/ψ from a weak decays of beauty hadrons (non-prompt J/ψ) statistically separated based on the long life time of beauty hadrons.
In this presentation, we will show measurements of inclusive and non-prompt J/ψ production in p–Pb collisions at $\sqrt{s_\mathrm{NN}} = 8.16$ TeV from a high–p_T electron enriched data sample collected using the trigger capabilities of the Transition Radiation Detector (TRD).

HK 12.6 Tue 18:00 H1

Recent measurements of charged-particle production in ALICE — •Youssef El Mard Bouziani for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The ALICE experiment at the LHC is designed to investigate the properties of the Quark-Gluon Plasma by studying high-energy A–A collisions. Medium effects like parton energy loss can be examined by comparing the production of charged particles at high transverse momentum (p_T) in heavy-ion collisions with the one in pp collisions where no hot QCD medium is expected. This comparison is usually expressed by means of the nuclear modification factor R_AA. In addition, the correlation between p_T spectra and event multiplicity of charged particles can give insight in the different production mechanisms.
In this talk, we report on a study of charged-particle production in pp, p-Pb, Xe–Xe and Pb–Pb collisions at all available LHC beam energies. By comparing to QCD-inspired models, this measurement can help to understand the energy and system size dependence of charged-particle production at LHC.

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HK 12.7 Tue 18:15 H1

Charged Kaon and ϕ Reconstruction in Ag+Ag Collisions at $\sqrt{s_{NN}} = 2.5$ GeV with HADES — •Marvin Kohls for the HADES-Collaboration — Goethe-Universität Frankfurt am Main

Heavy ion collisions in the few GeV energy regime probe similar temperatures and densities as created in neutron stars, which gives us a tool to probe the matter created in those macroscopic collisions in earthly laboratories [1].

In March 2019, the HADES collaboration recorded $13 \cdot 10^9$ Ag(1.58A GeV)+Ag events as part of the FAIR Phase-0 program. Within this talk we present the status of the reconstruction of K^+, K^- and ϕ and further discuss preliminary results.
Due to the fact, that these strange hadrons are produced at or below the free nucleon-nucleon production threshold, they are a good probe for in-medium effects with respect to their steep excitation function. Furthermore, comparing the production yields in pheripheral collisions to those in central collisions will provide additional information about the system size dependence of strangeness production.
The work has been supported by BMBF (05P19RFFCA), GSI and HIC for FAIR.

[1] Adamczewski-Musch, J., Arnold, O., Behnke, C. et al. *Probing dense baryon-rich matter with virtual photons.* Nat. Phys. 15, 1040*1045 (2019) doi:10.1038/s41567-019-0583-8