HK 5: Heavy Ion Collisions and QCD Phases 1

Time: Monday 14:30–16:30 Location: T/HS1

Group Report HK 5.1 Mon 14:30 T/HS1

Measurement of the J/ψ production in pp, p–Pb and Pb–Pb collisions with ALICE at LHC — •Julian Book for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt am Main

The investigation of the properties of strongly interacting matter under extreme conditions is the aim of the ALICE experiment. Quarkonia, i.e. bound states of heavy (charm or bottom) quarks such as the J/ψ, are expected to be produced in initial hard scattering processes in hadronic collisions. Thus they will provide insights into the earliest and hottest stages of nucleus-nucleus collisions where the formation of a Quark-Gluon Plasma is expected.
We present final results of J/ψ production in pp, p–Pb and Pb–Pb collisions performed by ALICE at the LHC in the first 4 years of data taking. Measurements in p–Pb and pp collisions help to decouple cold nuclear matter effects from hot nuclear effects in Pb-Pb collisions and serve as reference for the interpretation and evaluation of medium induced effects, such as color screening and recombination. Measurements differential in $p_{\rm T}$ and centrality of J/ψ decaying into e^+e^- obtained at mid-rapidity ($|y| < 0.9$) for the different collisions systems will be shown. Clearly less suppression with respect to SPS and RHIC results can be seen in Pb–Pb collisons at $\sqrt{s_{\rm NN}} = 2.76$ TeV. Results for J/ψ decaying into $\mu^+\mu^-$ measured at forward rapidities ($2.5 < y < 4.0$) will be presented. Furthermore, comparisons to theoretical calculations will be shown and their impact will be discussed.

HK 5.2 Mon 15:00 T/HS1

Status and perspectives of J/ψ analysis in proton-proton collisions with ALICE at the LHC — •Steffen Weber 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

ALICE is an experiment at the Large Hadron Collider especially designed to study the hot and dense matter created in heavy ion collisions. Charmonium mesons, bound states of charm-anticharm quarks, are prominent probes of the hot deconfined created matter.

Measurements in proton-proton collisions provide a necessary baseline for the interpretation of the data in lead-lead and in proton-lead collisions and are as well an important testing ground for perturbative and non-perturbative QCD theory.

The current status of J/ψ analysis in the dielectron decay channel in proton-proton collisions in ALICE will be presented and future opportunities for measurements in the Run2 of LHC data taking will be discussed.

HK 5.3 Mon 15:15 T/HS1

J/ψ Production in Proton-Lead Collisions with the Central Barrel of ALICE at the LHC — •Michael Winn for the ALICE-Collaboration — Physikalisches Institut, Universitaet Heidelberg

The investigation of J/ψ in p-A collisions represents an important reference for heavy-ion collisions, where charmonium production is seen as a key observable for deconfinement. Furthermore, the description of J/ψ production in proton-proton and its nuclear modification in proton-nucleus collisions remains challenging for theory based on perturbative QCD and factorization. The central-barrel detectors of ALICE ($|\eta| < 0.9$) are well suited to detect J/ψ in its dielectron decay channel and the associated charged tracks in the same event with full azimuthal coverage.

Final results of the nuclear modification factor of inclusive J/ψ in proton-lead collisions with the central barrel of ALICE, both integral as well as differential in transverse momentum, will be presented. Model comparisons will be discussed. First results on the multiplicity dependence will be also shown.

HK 5.4 Mon 15:30 T/HS1

D-meson production at ultra-low transverse momentum in pp collisions with ALICE at the LHC — •Christian Möhler for the ALICE-Collaboration — Physikalisches Institut, University of Heidelberg

The measurement of charm production provides valuable insights into the properties of the Quark-Gluon Plasma, which is expected to be formed in ultra-relativistic heavy-ion collisions at the LHC at CERN. Current ALICE results of D-meson production using an analysis strategy based on the reconstruction of secondary decay vertices are limited to $p_{\rm T} > 1$ GeV/c, due to the small Lorentz boost at low momentum of the D meson.
We present a new measurement of the $p_{\rm T}$-differential cross section of prompt D^0 production at mid-rapidity in pp collisions at $\sqrt{s} = 7$ TeV. By giving up the topological selection, the presented analysis extends the measurable $p_{\rm T}$-range down to zero. The $p_{\rm T}$-integrated charm production cross section at mid-rapidity in pp collisions, which serves as an essential baseline for Pb–Pb collisions, can thus be given without extrapolation for the first time at the LHC, resulting in a significantly increased precision.

HK 5.5 Mon 15:45 T/HS1

Event-by-event extraction of kinetic and chemical freeze-out properties in the CBM experiment — •Volodymyr Vovchenko[1,2,3,4], Ivan Kisel[1,2,3], and Dmitry Anchishkin[4,5] for the CBM-Collaboration — [1]Goethe University, Frankfurt am Main, Germany — [2]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [4]Taras Shevchenko University, Kyiv, Ukraine — [5]Bogolyubov Institute for Theoretical Physics, Kyiv, Ukraine

The future CBM experiment at FAIR is designed to study properties of strongly interacting matter produced in heavy-ion collisions at high baryon densities. It will employ high intensity beams and large acceptance detectors. One important task is to extract the thermal parameters of matter at stages of kinetic and chemical freeze-out from the observed data.

The extraction of thermal parameters is implemented as a package within the CBMROOT framework. The kinetic freeze-out temperature and the inverse slope of charged pions are extracted from their measured momentum spectra with appropriate correction on acceptance and reconstruction efficiency. The parameters of the chemical freeze-out are extracted by fitting the measured particle ratios in the framework of Hadron Resonance Gas model. The procedures can be used to perform analysis on event-by-event as well as on the inclusive spectra level.

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HK 5.6 Mon 16:00 T/HS1

Transport Coefficients in Yang–Mills Theory and QCD — •Nils Strodthoff[1], Nicolai Christiansen[1], Michael Haas[1], and Jan M. Pawlowski[1,2] — [1]Institut fuer Theoretische Physik, Heidelberg, Germany — [2]ExtreMe Matter Institute EMMI, Darmstadt, Germany

We calculate the shear viscosity over entropy density ratio η/s in Yang–Mills theory from the Kubo formula using an exact diagrammatic representation in terms of full propagators and vertices using gluon spectral functions as external input. We provide an analytic fit formula for the temperature dependence of η/s over the whole temperature range from a glueball resonance gas at low temperatures, to a high-temperature regime consistent with perturbative results. Subsequently we provide a first estimate for η/s in QCD.

HK 5.7 Mon 16:15 T/HS1

Shear viscosity from a large-Nc NJL model — •Robert Lang[1], Norbert Kaiser[1], and Wolfram Weise[2,1] — [1]TUM Physik Department, Garching, Germany — [2]ECT* Villa Tambosi, Villazzano (TN), Italy

We calculate the ratio of shear viscosity to entropy density within a large-Nc Nambu–Jona-Lasinio model. A consistent treatment of the Kubo formalism incorporating the full Dirac structure of the quark self-energy from mesonic fluctuations is presented. We compare our results to common approximation schemes applied to the Kubo formalism and to the quark self-energy. This work has been supported by BMBF.