HK 23: Heavy Ion Collisions and QCD Phases IV

Zeit: Dienstag 16:30–18:30 Raum: HZO 60

Gruppenbericht HK 23.1 Di 16:30 HZO 60

Measurement of light (hyper)nuclei and their antiparticles with ALICE at the LHC — •Alberto Caliva for the ALICE-Collaboration — GSI, Planckstraße 1, 64291 Darmstadt

The production of light nuclei, hypernuclei (nuclei with strangeness) and their antiparticles in high-energy hadronic and heavy-ion collisions can be described by the statistical hadronization model and by the coalescence approach. The measurement of the production yield, p_{T}-spectra and flow of light (hyper)nuclei are important to constrain these two models. Hypernuclei, in addition, offer the possibility to study the hyperon-hyperon and hyperon-nucleon interactions, contributing to the QCD theory development. The study of antimatter and hypermatter has also some important implications for astrophysical measurements and direct searches for dark matter.

In this talk, I will present an overview of the ALICE results on the measurements of light nuclei, hypernuclei, and their antiparticles. The measurement of the lifetime of hypertriton will be presented and its comparison to the lifetime of free Λ baryon will be discussed. The perspectives for the measurements of light nuclei and hypernuclei after the ALICE upgrade will be discussed and the searches for exotic bound states will also be presented.

HK 23.2 Di 17:00 HZO 60

Reconstruction of Weak Decays in Au+Au Collisions at 1.23A GeV with HADES — •Simon Spies for the HADES-Collaboration — Goethe-Universität Frankfurt

We use a high statistic data sample of 7.3×10^9 recorded Au(1.23A GeV)+Au events to investigate Λ^0 baryon and K_S^0 meson production below their free nucleon nucleon threshold. For the first time these hadrons have been investigated using a neural network to identify their weak decay topologys inside HADES. We highlight details of the analysis procedure such as event selection, particle identification and topological cuts on the decay kinematic before presenting and discussing the transverse energy spectra as well as production yields and their rapidity dependence. The results are confronted with phenomenological models.

This work has been supported by BMBF (05P15RFFCA), GSI and HIC for FAIR.

HK 23.3 Di 17:15 HZO 60

Λ production in Ar+Sc collisions at 40A GeV/c in NA61/SHINE experiment at CERN/SPS — •Hamda Cherif — for the NA61/SHINE Collaboration — Goethe-Universität Frankfurt am Main

NA61/SHINE is a fixed target experiment operating at the CERN Super-Proton-Synchrotron (SPS). The NA61/SHINE Collaboration studies properties of hadron production in nucleus-nucleus collisions. The primary aim is to uncover features of the phase transition between confined matter and quark gluon plasma. Within the current program data on p+p, Be+Be, Ar+Sc, Xe+La and Pb+Pb collisions at beam momenta in the range 13A-150A GeV/c has been recorded. Strangeness enhancement is one of the earliest signatures of the formation of a deconfined QGP. Strange particles are of particular interest in hadronic collisions since they carry a new quantum number not present in the colliding nuclei. The study of Λ hyperons allows to study simultaneously strangeness production and the effect of net baryon density. In this contribution, the status of Λ production in Ar+Sc collisions is presented and discussed as obtained from the recent data taken by NA61/SHINE collaboration at 40A GeV/c.

HK 23.4 Di 17:30 HZO 60

Lambda Polarization in Au+Au collisions at 1.23 AGeV measured 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

Through its self-analyzing nature the Λ hyperon allows to extract the spin orientation by measuring the outgoing proton momentum. A possible spin polarization with respect to the reaction plane could probe a global polarization of the fireball. This would be a hint for vortical effects at the very early stages of the collision.

Measurements of the Λ polarization by the STAR collaboration indicate a strong enhancement towards lower beam energies. In Au+Au collisions at $\sqrt{s}_{NN} = 7.7\,\mathrm{GeV}$ they estimated the vorticity to be of the order $10^{21}\,s^{-1}$ which would be by far the most highest vorticity ever observed in the laboratory.

The contribution will report the status of the Λ polarization in Au+Au collisions at 1.23 AGeV measured with HADES.

HK 23.5 Di 17:45 HZO 60

Measurement of the p_{T}-differential yield of (Anti-)^{3}He in p–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.023$ TeV with ALICE — •Sebastian Hornung for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — Heidelberg University, Germany

The production mechanism of light (anti-)nuclei in ultra-relativistic hadron collisions is one of the open puzzles in high-energy physics.

On the one hand, the statistical hadronization model can describe the particle yields, including the yields of light nuclei, over a wide range of energies in AA collisions. The particle abundances are fixed at the chemical freeze-out, but since the binding energy of light nuclei is very small, at most a few MeV, it is not probable that they remain bound during the hadronic phase with temperatures between 100 MeV and 170 MeV.

On the other hand, the nuclei yields can be explained by the coalescence of protons and neutrons which are close by in phase space.

To address this topic, the ALICE collaboration has measured (anti-)nuclei up to A = 4 in Pb–Pb collisions as well as deuterons in pp and p–Pb collisions and ^{3}He in pp collisions. This study is now extended by measuring the yield of (anti-)^{3}He as a function of the transverse momentum in p–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.023$ TeV. In addition, the anti-^{3}He-over-^{3}He ratio is calculated as a function of p_{T}. With this ratio the CPT invariance can be tested by comparing it to unity because the baryo-chemical potential is zero at the LHC.

HK 23.6 Di 18:00 HZO 60

Production of (anti-)t, (anti-)^{3}He and (anti-)^{4}He at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV with ALICE at the LHC — •Esther Bartsch for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The high collision energies reached at the LHC lead to significant production yields of light (anti-)nuclei in proton-proton and, in particular, Pb–Pb collisions. The excellent particle identification capabilities of the Time Projection Chamber, using the specific energy loss (dE/dx), and the time-of-flight measurement, allow for the detection of these rarely produced particles. Furthermore the Inner Tracking System gives the possibility to separate primary nuclei from those coming from the decay of heavier systems.

New results on (anti-)tritons, (anti-)^{3}He and (anti-)^{4}He production in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV will be presented. The goal is to study production mechanisms such as coalescence and thermal models, and to compare them to those in heavy-ion collisions at lower energies.

Supported by BMBF and the Helmholtz Association.

HK 23.7 Di 18:15 HZO 60

Multi-differential analysis of Σ hyperons in the CBM experiment — Ivan Kisel[1,2,3], •Pavel Kisel[1,3,4], Peter Senger[3], Iouri Vassiliev[3], and Maksym Zyzak[3] for the CBM-Collaboration — [1]Goethe-Universität Frankfurt — [2]Frankfurt Institute for Advanced Studies — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [4]Joint Institute for Nuclear Research

Strange particles are important probes of the properties of hot and dense nuclear matter produced in high-energy heavy-ion collisions. A large fraction of the produced strange quarks is carried by Σ^+ and Σ^- hyperons, which have decay modes with at least one neutral daughter particle.

In order to identify these hyperons, a missing mass method has been developed and implemented in the CBM KF Particle Finder package, which allows to reconstruct 18 decays with neutral daughter particles with high efficiency and large signal-to-background ratios. The results of a multi-differential analysis of Σ hyperon yields as function of momentum, rapidity, and transverse mass will be presented. The reconstructed distributions are in a good agreement with the Monte Carlo spectra.