HK 55: Heavy Ion Collisions and QCD phases

Time: Wednesday 16:30–19:00 Location: H-ZO 10

Group Report HK 55.1 We 16:30 H-ZO 10

Strangeness Production in Heavy Ion Collisions close to Threshold with HADES — •Alexander Schmah for the HADES-Collaboration — Technische Universität München

For the first time, at SIS energies, the combined and inclusive identification of sub-threshold produced K^+, K^- and ϕ-mesons was carried out. These data refer to the reaction Ar+KCl at kinetic beam energy of 1.756 AGeV, measured by the HADES collaboration. It will be demonstrated that the mesons are reconstructed with high purity. The same data also provide full phase space distributions for K^0_s-mesons and Λ-hyperons and an estimate of the not measured Σ-hyperons relying on strangeness balance. The result is compared to previous published data [1].

The transverse momentum distributions, rapidity distributions and multiplicities of the kaons (K^+, K^-) and ϕ-mesons are compared to previous measurement showing a nice agreement of the data with the available systematics [2]. The high statistics and quality of the K^0_s data allows studying of the low momentum region, which is supposed to be sensitive to the kaon-nucleon potential. The data are compared with theoretical models.

Supported by HGF and Excellence Cluster Universe.

[1] A. Foerster et al., arXiv:nucl-ex 0701014v1.
[2] M. Merschmeyer et al., Phys. Rev. C 6 (2007) 145.

Invited Group Report HK 55.2 We 17:00 H-ZO 10

Hadronic matter at finite baryon densities - what do we know about it? — •Yvonne Leifels for the FOPI-Collaboration — GSI Darmstadt

Hadronic matter is a subject of intensive investigations both experimentally and theoretically over the last two decades. In the energy range of the Heavy Ion Synchrotron at GSI nuclear matter densities of 2 - 3 times normal nuclear matter density at relative moderate temperatures are created in relativistic heavy ion collisions. A multitude of phenomenons have been observed, i.e. collective flow, stopping and particle production, which have been confronted to the predictions of theoretical models to investigate the constraints on the bulk characteristics of nuclear matter. Strange particle production, in particular charged kaons, at energies close to the production threshold in NN-collisions is sensitive not only to the nuclear equation of state but also to the modification of hadron properties in the hot and dense medium. In trying to describe in addition the strangeness degree of freedom evidence was produced that strange particle properties are influenced by the surrounding baryonic medium.

The current status of understanding the bulk properties of hadronic matter and the in-medium modifications of the constituents will be discussed.

HK 55.3 We 17:30 H-ZO 10

Resonance phenomena in heavy nuclei collisions and structurization of positron spectrum — •Alexander Glushkov — Odessa University, P.O.Box 24a, Odessa-9, Ukraine, 65009 — Russian Academy of Sciences, Troitsk, Russia, 142090

A consistent unified quantum mechanics and QED approach is used for studying the electron-positron pair production (EPPP) process in the heavy nuclei collisions and treating the compound nucleus in an extreme electromagnetic field. The positron spectrum narrow peaks as a spectrum of the resonance states of compound super heavy nucleus are treated. To calculate the EPPP cross-section we use the modified versions of the relativistic energy approach, based on the S-matrix Gell-Mann and Low formalism [1]. The nuclear system dynamics is treated within the Dirac equation with an effective potential [2]. We present the calculation results for cross-sections at different collision energies, corresponding to energies of the resonances of the compound 238U+238U, 232Th+250Cf and 238U+248Cm nuclei. Calculation with 2-pocket nuclear potential is carried out and led to principally the same physical picture as 1-pocket one [1], besides an appearance of some new peaks. References: 1. A.Glushkov, L.Ivanov, Phys.Lett.A170,36 (1992);Preprint ISAN,N5, Troitsk,1992; A.Glushkov etal,Nucl. Phys.A.734S, 21 (2004); Europ.Phys.Journ.ST 160, 195 (2008). 2. V.Zagrebaev, V.Samarin, W.Greiner, Phys.Rev.C. 75, 035809 (2007);J.Phys.G.34,1 (2007).

HK 55.4 We 17:45 H-ZO 10

Proton-Lambda correlations in central Pb+Pb collisions at 158A GeV — •Hans Beck[1], Julian Book[1], Christoph Blume[1], Volker Friese[2], Marek Gazdzicki[1], Claudia Höhne[2], Dmytro Kresan[2], Michael Mitrovski[1], Moritz Pohl[1], Rainer Renfordt[1], Tim Schuster[1], Reinhard Stock[1], Herbert Ströbele[1], and Milica Utvić[1] for the NA49-Collaboration — [1]Fachbereich Physik der Universität, Frankfurt — [2]Helmholtzzentrum für Schwerionenforschung (GSI), Darmstadt

Proton-Lambda correlations at small momentum differences allow to extract source sizes in nuclear collisions. In contrast to pp correlations, which are widely used in heavy ion physics, the correlation function in the pΛ case is not influenced by Coulomb interactions and quantum correlations. Thus the short-range pΛ correlations are solely affected by the final-state strong interactions and therefore it has been suggested that they provide a higher sensitivity for larger source radii [1].

In this contribution pΛ correlations are analyzed using $2.6 \cdot 10^6$ central (23%) Pb+Pb collisions at 158A GeV registered by NA49 at the CERN SPS. Preliminary results on the measured correlation function have already been shown by the NA49 collaboration [2]. Here, we will report on results of an improved analysis. Comparisons to the former analysis of NA49, model predictions and other measurements (e.g. [3]) will be presented.

[1] F. Wang and S. Pratt, Phys. Rev. Lett. **83**, 3138 (1999).
[2] C. Blume et al. (NA49), Nucl. Phys. **A715**, 55 (2003).
[3] J. Adams et al. (STAR), Phys. Rev. **C74**, 64906 (2006).

HK 55.5 We 18:00 H-ZO 10

Heavy quark observables from first principles — •Marcus Tassler — Institute of Theoretical Physics, University of Muenster, Germany

The heavy-quark diffusion constant as well as the recently introduced real-time static potential, generalizing the concept of a static potential to a thermal medium, are discussed. A derivation of these quantities for a strongly anisotropic medium, as present in the initial phase of heavy ion collisions, is presented. The corresponding analytic results from first principles are supplemented by results obtained using real-time lattice techniques.

HK 55.6 We 18:15 H-ZO 10

Bridging Low and High Energy Processes:From Hadron-Nuclei to Relativistic Ions Collisions — •Sergey Eliseev — Joint Institute for Nuclear Research, 141980 Dubna, Russian Federation

A new model (a la Glauber) for hadron–nuclei interaction at intermediate energy is proposed. The main theoretical assumptions such as in the approaches of others authors describing J/Psi suppression in nuclear collisions and color transparency of nuclei at high energy is used. Yet, a number of new ingredients in the model: noneikonal corrections, correlations of nucleons in the nuclei is introduced, etc. The nuclear Fermi motion effect was taken into account. The relevant momentum distributions of the nucleons was taken from different models. To examine the nuclear interior, the K^+-meson (at intermediate energy, IE) is regarded as a unique probe due to its long mean free-path in the nuclear matter. A detailed analysis of the cross sections of K^+ - nuclei interactions at IE is presented. Our model improve the agreement between theory of others authors and data for the K^+ - nuclei scattering, but remain the "window"for some "exotics". The nature of that "exotics"(mass reduction, or "swelling"(etc.) will be discussed. In the conclusion, it is important to note that: 1. Our results have been obtained without fitting any new parameters. 2. The discrepancy between calculations and data on K^+ - nuclei scattering my be regarded as one of more probable signal of new physics in nuclear collisions. (It is just the contrary what was obtained for J/Psi suppression and color transparency.)

HK 55.7 We 18:30 H-ZO 10

A transport calculation with an embedded (3+1)d hydrodynamic evolution: Elliptic flow results from $E_{\mathrm{lab}} = 2{-}160A$ GeV — •Hannah Petersen[1,2], Jan Steinheimer[2], Marlene Nahrgang[2], Gerhard Burau[2], and Marcus Bleicher[2] — [1]Frankfurt Institute

for Advanced Studies, Frankfurt, Germany — [2]Institut for Theoretical Physics, Frankfurt University, Frankfurt, Germany

The elliptic flow excitation function calculated in a full (3+1)d Boltzmann approach with an intermediate hydrodynamic stage for heavy ion reactions from GSI-SIS to the highest CERN-SPS energies is discussed in the context of the experimental data. Within this integrated dynamical approach different equations of state are explored without adjusting parameters. At higher SPS energies, where the pure transport calculation cannot account for the high elliptic flow values, the smaller mean free path in the hydrodynamic evolution leads to higher elliptic flow values. Event-by-event fluctuations are directly taken into account via event wise non-equilibrium initial conditions generated by the primary collisions and string fragmentations in the microscopic UrQMD model. Due to the more realistic initial conditions and the incorporated hadronic rescattering the results are in line with the experimental data almost over the whole energy range from $E_{\rm lab} = 2 - 160A$ GeV. This newly developed approach leads to a substantially different shape of the v_2/ϵ scaling curve as a function of $(1/SdN_{ch}/dy)$ which is now in line with the experimental data compared to previous ideal hydrodynamic calculations. We also present predictions for the differential flow measurements in the RHIC low energy run.

HK 55.8 We 18:45 H-ZO 10

reconstruction of $D^{*+} \rightarrow D^0 + \pi^+$ in $p + p$ collisions at $\sqrt{s}$ = 10 TeV in the central barrel of ALICE — •YIFEI WANG for the ALICE-TRD-Collaboration — Physikalisches Institut, Heidelberg, Germany

Heavy quarks(c, b), due to their large mass, are excellent tools to study the degree of thermalization of the initially created matter in high energy nuclear collisions at LHC. Their masses remain heavy, even if chiral symmetry is restored in a QGP. Furthermore, theoretical predictions of heavy-quark production have large uncertainties due to the poorly known parton distributions in the low Feynman-x region relevant for LHC energies. Thus, measurements on charm production in $p + p$ and Pb+Pb collisions at LHC energy are essential.

We present the latest results of our performance studies on open-charm resonance production measurements in $p + p$ collisions at $\sqrt{s}$ = 10 TeV with the ALICE central barrel based on the measurement of D^{*+} mesons. The decay channel $D^{*+} \rightarrow D^0 + \pi^+$ (BR: 68%), where the D^0 mesons are reconstructed in the $D^0 \rightarrow K^- + \pi^+$ decay channel (BR: 4%), is investigated using events generated by PYTHIA and a full Monte Carlo simulation of the ALICE setup with all sub-detectors in the central barrel. The influence of single-track selection and topological cuts on the signal to background ratio are presented.