HK 45: Heavy Ion Collisions and QCD phases

Time: Wednesday 14:00–16:00 Location: H-ZO 10

Group Report HK 45.1 We 14:00 H-ZO 10

Saturation and geometric scaling at RHIC and LHC with polarized and unpolarized final states — •Andre Utermann[1], Daniel Boer[2] und Erik Wessels[2] — [1]Institut für Theoretische Physik, Universität Regensburg — [2]Department of Physics and Astronomy, Vrije Universiteit Amsterdam

A strong rise of the gluon distribution, as predicted by linear QCD evolution, is clearly observed at small x. At some saturation scale $Q_s(x)$, the gluons in the proton may interact with each other and non-linear corrections to the evolution equations become significant, taming the growth of the gluon distribution. Geometric scaling, i.e. the observed property that the small-x DIS cross section depends only on the combination $Q^2/Q_s^2(x)$, is seen as an indication for gluon saturation, since this property is expected asymptotically $x \to 0$ from QCD evolution. We show that the whole range of RHIC data for hadron production in d-Au collisions is compatible with geometric scaling as well. To establish the scaling violations, expected from the non-linear evolution equation at small but finite x, a larger kinematic range in transverse momentum and rapidity would be needed. We point out that the fall-off of the p_t distribution of produced hadrons at large p_t is a sensitive probe of small-x evolution especially at the LHC. Furthermore, we show that the transverse polarization of forward Λ hyperons produced in high-energy p-A collisions is expected to display an extremum at a transverse momentum around the saturation scale. Moreover, the measurement of Λ polarization over a range of x_F values actually provides a direct probe of the x dependence of the saturation scale.

HK 45.2 We 14:30 H-ZO 10

How sensitive are di-leptons from rho mesons to the high baryon density region? — •Sascha Vogel[1], Hannah Petersen[1], Katharina Schmidt[1], Elvira Santini[1], Christian Sturm[2], Jörg Aichelin[3], and Marcus Bleicher[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Str. 1, 60438 Frankfurt am Main, Germany — [2]Institut für Kernphysik, Goethe-Universität Frankfurt, Max-von-Laue-Str. 1, 60438 Frankfurt am Main, Germany — [3]Subatech, Ecole des Mines de Nantes, 4 rue Alfred Kastler, F-44072 Nantes Cedex 03, France

We show that the measurement of di-leptons might provide only a restricted view into the most dense stages of heavy ion reactions. Thus, possible studies of meson and baryon properties at high baryon densities, as e.g. done at GSI-HADES and envisioned for FAIR-CBM and the low energy RHIC program, might observe weaker effects than currently expected in certain approaches. We argue that the strong absorption of resonances in the high baryon density region of the heavy ion collision masks information from the early hot and dense phase due to a strong increase of the total decay width because of collisional broadening. To obtain additional information, we also compare the currently used approaches to extract di-leptons from transport simulations - i.e. shining, only vector mesons from final baryon resonance decays and instant emission of di-leptons and find a strong sensitivity on the method employed in particular at FAIR and SPS energies.

HK 45.3 We 14:45 H-ZO 10

Thermodynamics of light front quantized QED$_{1+1}$ — •Stefan Strauss and Michael Beyer — Institute für Physik, Universität Rostock, 18051 Rostock, Germany

The thermodynamical properties of Quantum Electro Dynamics in 1+1 dimension are determined for various couplings using discrete light cone quantisation (DLCQ). For the computation of the partition function a large harmonic resolution is necessary and more accurate mass spectra and the bound state wave functions are obtained. The continuum and thermodynamical limits of the partition function and derived quantities are carefully considered. Error bounds and comparisons to the idealized gases are given.

HK 45.4 We 15:00 H-ZO 10

Strangeness fluctuations and MEMO production at FAIR — •Jan Steinheimer-Froschauer[1], Michael Mitrovski[1,2], Tim Schuster[1,2], Hannah Petersen[1,2], Marcus Bleicher[1], and Horst Stoecker[1,2,3] — [1]Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität, Max-von-Laue-Str. 1, 60438 Frankfurt am Main, Germany — [2]Frankfurt Institute for Advanced Studies (FIAS), Johann Wolfgang Goethe-Universität, Ruth-Moufang-Str. 1, 60438 Frankfurt am Main, Germany — [3]GSI - Helmholtzzentrum für Schwerionenforschung mbH, Planckstr. 1, Darmstadt

We apply a coupled transport-hydrodynamics model to discuss the production of multi-strange meta-stable objects in Pb+Pb reactions at the FAIR facility. In addition to making predictions for yields of these particles we are able to calculate particle dependent rapidity and momentum distributions. We argue that the FAIR energy regime is the optimal place to search for multi-strange baryonic object (due to the high baryon density, favoring a distillation of strangeness). Additionally, we show results for strangeness and baryon density fluctuations. Using the UrQMD model we calculate the strangeness separation in phase space which might lead to an enhanced production of MEMOs compared to models that assume global thermalization.

HK 45.5 We 15:15 H-ZO 10

Kaons and Antikaons in Nuclear Matter: AA vs. pA Collisions — •Henry Schade[1,2] and Burkhard Kämpfer[1,2] — [1]Institut für Theoretische Physik, TU Dresden, 01062 Dresden, Germany — [2]Forschungszentrum Dresden-Rossendorf, PF 510119, 01314 Dresden, Germany

Kaon- and antikaon production near the threshold is studied within a transport approach of Boltzmann-Uehling-Uhlenbeck type with the aim of a concise understanding of medium modifications. The role of (i) the strangeness-exchange reaction $\pi Y \to K^- N$, (ii) the feeding of $\phi \to K^+K^-$ and (iii) different models of $K^\pm N$ potentials with momentum dependence is elaborated. We compare our transport model calculations to experimental phase space distributions of $K^\pm$ in the reactions p+C, p+Au, C+C and Ar+KCl (KaoS and HADES data).

HK 45.6 We 15:30 H-ZO 10

Centrality dependence of K_s^0 production in 40A and 158A GeV Pb+Pb collisions at the CERN SPS — •Julian Book[1], Hans Beck[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

The NA49 experiment has measured strange hadron production in Pb+Pb collisions for different centralities and energies. Preliminary results on Λ, Ξ, $K^\pm$ have already been shown. In order to cross-check and complete these, K_s^0 production has been studied.
This analysis was based on data measured with the NA49 large acceptance hadron spectrometer. K_s^0 are identified via their decay topology and invariant mass determination.
Preliminary results on the centrality dependence of transverse mass and rapidity spectra as well as the total yields will be presented for 40A and 158A GeV. A comparison to the corresponding results for charged kaons measured via time of flight, energy loss and to various theoretical models will be shown.

HK 45.7 We 15:45 H-ZO 10

Charged kaon flow measurements in Ni+Ni collisions at 1.91A GeV with the FOPI detector — •tae im kang for the FOPI-Collaboration — GSI, Darmstadt, Germany — Korea University, Seoul, Korea

The FOPI collaboration studies bulk properties of nuclear matter as well as in-medium effects on hadrons in a hot and dense environment. The latter are assessed by the measurements of particle yields, momentum distributions, and the azimuthal emission pattern with respect to the reaction plane. Kaons have obtained particular interest. At SIS/GSI, kaons are produced in nucleus-nucleus collisions at subthreshold energies [1]. Theory suggest that in the medium the kaon effective masses change. These changes can be understood as a consequence of a density dependent kaon-nucleon potential. The measurement of charged kaon flow can provide important information on this in-medium potential [2].

To improve the charged kaon measurement, FOPI has successfully upgraded its apparatus with a novel Multi-strip Multi-gap RPC (MM-RPC) Time-of-Flight detector system in 2007 [3]. In this presentation we show first results obtained with this new detector for charged kaon

production in Ni+Ni collisions at 1.91A GeV.

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