HK 18 Physik mit schweren Ionen

Zeit: Montag 14:00–16:00

Gruppenbericht HK 18.1 Mo 14:00 TU MA041

Direct Photon Production Measured with the PHENIX Experiment — Christian Klein-Bösing and Baldo Sahlmuller for the PHENIX collaboration — Institut für Kernphysik, Wilhelm-Klemm-Str. 9, 48149 Münster

Direct photons with a large transverse momentum $p_T$ are in heavy ion collisions predominantly produced by parton scattering in the early phase of the reaction, similar to the direct photon production in $p+p$ collisions. An additional source in heavy ion collisions is the thermal production of the reaction, similar to the direct photon production in $p+p$ collisions. Anisotropic Flow of Charged Hadrons for Au+Au Collisions is suppressed due to final state interactions of the hard-scattered partons, direct photons should be unaffected by the surrounding medium. The comparison of the photon and neutral pion production at large $p_T$ in heavy ion collisions thus provides a direct verification of the jet quenching scenario, while the direct photon production in the intermediate $p_T$ region ($p_T = 1 - 3\, \text{GeV}/c$) is most sensitive to thermal sources, such as the QGP.

This work is supported by BMFB.

Gruppenbericht HK 18.2 Mo 14:30 TU MA041

Lambda Production at Forward Rapidity in $d+Au$ Collisions at $\sqrt{s_{NN}} = 200\, \text{GeV}$ — Frank Simon for the STAR collaboration — Max-Planck-Institut für Physik, München, Germany

We present results on the production of lambda and anti-lambda particles at forward rapidity in $d+Au$ collisions at $\sqrt{s_{NN}} = 200\, \text{GeV}$. Using the forward time projection chambers in the STAR experiment, measurements of net lambda yields and the lambda to pion ratio at forward and backward rapidity at $y = \pm 2.75$ were obtained.

The contributions of different processes to particle production and baryon transport are probed using the asymmetry of $d+Au$ collisions. Comparisons to a variety of model calculations show that the baryon transport on the deuteron side is due to multiple collisions of the deuteron nucleons with gold participants, while on the gold side the inclusion of target excitations or hadronic transport appears to be necessary.

Gruppenbericht HK 18.3 Mo 14:45 TU MA041

Anisotropic Flow of Charged Hadrons for $Au+Au$ Collisions at RHIC — Gerhard Bauer1, Johannes Bleibiel2, Christian Fuchs3, Amand Fassler4, Larissa Bravina5, and Eugene Zabrodin6 — Institute for Theoretical Physics, University of Tübingen, Auf der Morgenstelle 14, D-72076 Tübingen — 2Department of Physics, University of Oslo, N-0316 Oslo — 3Centre of Mathematics for Applications, University of Oslo, N-0316 Oslo

The pseudorapidity distributions of the azimuthal anisotropy parameters $v_1(\eta)$ and $v_2(\eta)$ of inclusive charged hadrons and their centrality dependence has been studied in $Au+Au$ at full RHIC energy of $\sqrt{s} = 200\, \text{GeV}$ within the microscopic quark-gluon string model. The QGSM simulation results for the directed flow show qualitatively and quantitatively a good agreement with the $v_1(\eta)$ data measured experimentally at high pseudorapidities, but cannot reproduce the flat behaviour of $v_1(\eta) \leq 1.3$. The $v_2$ behaviour of the elliptic flow $v_2$ extracted from our simulation agrees well in the whole pseudorapidity range for all centrality classes. Furthermore, the transverse momentum dependence of the elliptic flow $v_2(p_T)$ for identified and inclusive charged hadrons obtained with the QGSM is presented. The QGSM descriptions are rather good at low $p_T$, whereas they underestimate the measured elliptic flow for transverse momenta $p_T > 1\, \text{GeV}/c$. Nevertheless, they coincide quite well with the qualitative $p_T$ behaviour of the experimental data. In particular, the model is able to reproduce the experimental evidence of the crossing of the elliptic flow for mesons and baryons.

 Measurements of the nuclear modification factor $R_{dAu}$ (and $R_{p+p}$) and back-to-back correlations at high $p_T$ at mid-rapidity from $d+Au$ collisions at RHIC at $\sqrt{s_{NN}} = 200\, \text{GeV}$ demonstrated, that the strong suppression of high $p_T$ particle production previously observed in central $Au+Au$ collisions are due to final-state interactions with the dense medium generated in such collisions [1]. Recent results of the pseudorapidity and centrality dependence of $R_{dAu}$ (and $R_{p+p}$) from the BRAHMS collaboration [2] were interpreted as a possible onset of parton saturation in the Color Glass Condensate [3].

An alternative explanation of the strong suppression of $R_{dAu}$ (and $R_{p+p}$) at forward rapidities will be presented. In this Ansatz the suppression at higher rapidities is explained by the supression of particle yields in $d+Au$ relative to $p+p$ collisions caused by a shift of the center of mass in the asymmetric $d+Au$ collisions with respect to the nucleon-nucleon center of mass system.

In this new reference system the pseudorapidity and centrality dependence of $R_{dAu}$ (and $R_{p+p}$) can be explained and taking the asymmetry into account $R_{dAu}$ (and $R_{p+p}$) show a universal behaviour at RHIC energies.


Gruppenbericht HK 18.5 Mo 15:30 TU MA041

Ultraperipheral Collisions at RHIC and LHC — Kai Henciken1, Gerhard Bauer2, Ute Dreverich3, and Dirk Trautmann3 — 1 Uni Basel — 2FZ Jülich

Ultraperipheral Collisions (UPC) use the strong Coulomb fields surrounding the ions in relativistic energies to study photon-photon and photon-hadron processes in collisions with an impact parameter $b > 2R$. RHIC has published results on UPC and ALICE, CMS and ATLAS plan to study UPCs in the future as part of their HI program.

STAR/RHIC has recently measured electron-positron pairs at small impact parameter ($b \approx 20\, \text{fm}$). We compare their results with our QED calculation with good agreement.

Coherent vector meson production in photon-nucleus collisions has been measured for the $p$ at STAR/RHIC. Interference occurs in these processes as the role of the two ions can be exchanged. We study the transverse momentum distribution of this process especially for $b$. The results can be compared with the STAR measurements and are of importance for future experiments at the LHC.

Inelastic pair production offers the possibility to study quark pT inside nuclei, that is medium modifications, at moderate $Q^2$ and small $x$. We compare results of a full calculation with the equivalent photon and lepton approximation.

HK 18.4 Mo 14:00 TU MA041

Universal behaviour of the nuclear modification factor at RHIC — Jörg Putziche — Max-Planck-Institut für Physik, Föhringer Ring 6, 80805 München

Universal behaviour of the nuclear modification factor at RHIC $R_{p+p}$ and $R_{dAu}$ was found to strongly depend on the transverse momentum $p_T$ and the pseudorapidity $\eta$ of the particles. The $R_{p+p}$ factor reflects the impact parameter dependence of the produced $p_T$ particles. The $R_{dAu}$ factor is related to the nuclear modification factor $R_{AA}$ at RHIC. Recent results of the $R_{dAu}$ at RHIC at $\sqrt{s_{NN}} = 200\, \text{GeV}$ are compared with the STAR measurements and are of importance for future experiments at the LHC.