HK 40: Schwerionenkollisionen und QCD Phasen

Zeit: Dienstag 16:45–19:00 Raum: HSZ-204

Gruppenbericht HK 40.1 Di 16:45 HSZ-204

Dileptons and photons produced in relativistic heavy ion collisions at SPS, RHIC and LHC — •Olena Linnyk[1], Elena Bratkovskaya[2,3], and Wolfgang Cassing[1] — [1]Justus Liebig Universität Gießen, Gießen, Deutchland — [2]Johann Wolfgang Goethe Universität, Frankfurt am Main, Deutchland — [3]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Deutchland

We address the dilepton and photon production by the (in-medium) mesons, correlated decays of charm and bottom quarks and the quark and gluon interactions in the early stage of relativistic heavy-ion collisions within the parton-hadron-string dynamics (PHSD) off-shell transport approach. The approach treats the full evolution of a relativistic heavy-ion collision from the initial hard scatterings and string formation through the dynamical deconfinement phase transition to the strongly interacting quark-gluon plasma (QGP) as well as hadronization and to the subsequent interactions in the hadronic phase. We study the dilepton yield from the collisions at energies from SPS to RHIC to LHC. By comparing to the data of the NA60, PHENIX and STAR Collaborations, we determine the relative importance of the different dilepton production mechanisms and point out the regions in phase space where partonic channels are dominant. Explicit predictions are presented for dileptons from the Pb+Pb collisions at sqrt(s)=2.76 TeV. Additionally, the photon production under the influence of the strong magnetic fields in the initial stage of the collision is discussed.

HK 40.2 Di 17:15 HSZ-204

Production of Low Mass Dielectrons in Pb-Pb collisions with ALICE — •Christoph Baumann for the ALICE-Collaboration — Goethe-Universität Frankfurt

The measurement of low mass dielectrons allows probing all stages of ultra-relativistic collisions as electrons do not suffer from final state interactions. This enables the search for thermal radiation of the hot and dense medium created in heavy-ion collisions at LHC. We will present the status of the dielectron measurements in Pb-Pb collisions at $\sqrt{s_{\rm NN}} = 2.76$ TeV with ALICE, focussing on the search for thermal radiation, via the study of a possible dielectron enhancement at low masses. The status and perspectives of dielectron analyses in pp and p-Pb will also be discussed.

HK 40.3 Di 17:30 HSZ-204

ω and ϕ Meson Analysis via the Dielectron Channel in pp at $\sqrt{s}$= 7 TeV with ALICE — •Mahmut Özdemir for the ALICE-Collaboration — Institut für Kernphysik, Goethe Universität, Frankfurt

Low-mass dielectrons are an important experimental tool to probe the properties of the hot and dense medium created in ultrarelativistic heavy-ion collisions. Electrons do not interact strongly, therefore they provide information from all stages of the collision. In particular, dielectron decays of $\omega(782)$ and $\phi(1020)$ mesons carry important information on their in-medium properties, where pp collisions are used as medium-free reference for the possible modifications of the medium. Furthermore, pp collisions are interesting by themselves to investigate particle production at LHC energy. In this contribution we will present the status of a measurement of $\omega(782)$ and $\phi(1020)$ meson production in the e^+e^--decay channel in pp collisions at $\sqrt{s} = 7$ TeV with ALICE.

HK 40.4 Di 17:45 HSZ-204

Prospects of Low-Mass Dielectron Measurements in ALICE with an upgraded Central Barrel Detector — •Patrick Reichelt for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The measurement of electron-positron pairs in the low invariant mass region allows to study the vacuum and in-medium properties of light vector mesons. Dielectrons also probe the production of thermal photons in heavy-ion collisions. ALICE is well-suited to perform this measurement due to its excellent tracking and particle identification capabilities at very low momenta. However, Dalitz decays and photon conversions lead to a high combinatorial background. Additionally, coincident semi-leptonic decays of charm and anti-charm hadrons produce a continuum signal, which dominates over a thermal dielectron signal. Both contributions can be reduced by an improved Inner Tracking System, to be installed during LHC's long shutdown 2 (2018). It will further improve the tracking efficiency at low $p_{\rm T}$ and provide excellent detection capabilities for electrons from secondary vertices like conversions and heavy-quark decays. Additionally, an upgrade of the TPC readout will substantially increase the data taking rate. The expected impact on the low-mass dielectron measurement in Pb-Pb collisions at full LHC energy will be presented.

HK 40.5 Di 18:00 HSZ-204

Measurement of direct photons in pp and Pb-Pb collisions with ALICE — •Martin Wilde for the ALICE-Collaboration — WWU Münster

Direct photons are an important probe in diagnosing the highly excited state of nuclear matter created in heavy-ion collisions: They provide access to various stages of the collision including the initial state.

The ALICE detector is equipped with two high resolution electromagnetic calorimeters and a central tracking system that make it well suited to study direct photon production over a brought rang of p_T. In addition to classical calorimeter measurements, the low p_T regime can be targeted via the measurement of photon conversion products by the ALICE TPC with high tracking efficiency.

In this talk the analysis of direct photon production in pp (at $\sqrt{s} = 7\,\text{TeV}$ and $\sqrt{s} = 2.76\,\text{TeV}$) and Pb-Pb (at $\sqrt{s_{NN}} = 2.76\,\text{TeV}$) collisions is presented. The inclusive photon and neutral pion spectrum is measured via photon conversions in the ALICE setup. From the neutral pion yield a decay photon cocktail is deduced. The signal is obtained by calculating the double ratio $(\gamma/\pi^0)/(\gamma_{\rm decay}/\pi^0)$. Implications on the search for a direct photon excess at low p_T will be discussed.

HK 40.6 Di 18:15 HSZ-204

Measurement of Direct Photon Elliptic Flow in Pb-Pb Collisions at $\sqrt{s} = 2.76$ TeV with ALICE — •Daniel Lohner for the ALICE-Collaboration — Physikalisches Institut, Ruprecht-Karls Universität Heidelberg

A unique tool for the study of the system evolution in nucleus-nucleus collisions is the measurement of photons. Since photons do not interact with the medium they carry undistorted information of the system at their production time. Besides photons from hadron decays also direct photons are emitted at every stage of the system evolution.
Recently, the ALICE collaboration presented a first measurement of the direct-photon spectrum and elliptic flow $v_2^{\gamma,dir}$ in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76 TeV$ at the LHC. The observed direct photon spectrum can be described by NLO (pQCD) predictions at momenta above 4 GeV/c while the spectrum at low p_T shows a clear excess above the NLO pQCD prediction. In order to describe the low p_T direct-photon spectrum, recent hydrodynamical calculations include a substantial portion of thermal photons from the hot plasma phase. As a consequence of the early production time, $v_2^{\gamma,dir}$ is expected to be small compared to hadrons. However, the measurement of the direct photon azimuthal anisotropy provides evidence for a non-zero $v_2^{\gamma,dir}$ for $1 < p_T < 3 GeV/c$ with a magnitude similar to the observed charged pion $v_2^{\pi^\pm}$. A large $v_2^{\gamma,dir}$ might lend support for a significant direct-photon emission from late stages of the system evolution where hadron flow has developed.

HK 40.7 Di 18:30 HSZ-204

Thermal Photons at RHIC — •Hendrik van Hees[1], Ralf Rapp[2], and Charles Gale[3] — [1]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany — [2]Cyclotron Institute, Texas A&M University, College Station, Texas 77843-3366, USA — [3]Department of Physics, McGill University, 3600 University Street, Montreal, Canada H3A 2T8

Recent measurements of direct photons in 200 AGeV Au-Au collisions at RHIC by the PHENIX collaboration find an unexpectedly large anisotropic flow, v_2 of these photons. Here we present a model for thermal-photon emission from the matter created in the heavy-ion collision, taking into account both the partonic (QGP) and hadronic phases of the fireball evolution. For the corresponding thermal-photon rates we use an HTL resummed pQCD matrix element for the emission from the QGP and a hadronic model in the confined phase. Convoluting these rates over the history of the fireball evolution within a simple elliptic blastwave model we find the photon yield to be dominated by

radiation from the hadronic phase for $q_T \lesssim$ 2-3 GeV, leading to a direct-photon v_2 comparable with the lower edge of the error bars of the measurement. Also an analysis of the photon-q_T slopes shows consistency of our model with the data due to the blue shift of the hadronic photon spectrum from the radial flow of the thermal source, which compensates the lower temperatures of the hadronic phase.
Supported by the Helmholtz Association through the ExtreMe Matter Institute (EMMI) and BMBF.
[1] H. van Hees, C. Gale, R. Rapp, Phys. Rev. C **84**, 054906 (2011)

HK 40.8 Di 18:45 HSZ-204

Studying Hot and Dense Nuclear Matter at RHIC: High p_T Results from the PHENIX Experiment — •Baldo Sahlmueller — Goethe-Universität Frankfurt — for the PHENIX collaboration

High p_T particles such as π^0 and direct photons were found to be crucial probes to study the hot and dense matter created in ultra-relativistic heavy-ion collisions. The π^0 as the leading particle from jet fragmentation can be used to probe the QGP directly, its modification is connected to the energy loss of partons in the medium. Direct photons on the other hand are produced at various stages of the collision and can leave the medium unaffected, once produced. They give access to the earliest stages of the collision as well as to the thermalized medium that evolves later.

We present recent PHENIX results on direct photon and π^0 production in Au+Au collisions at centre-of-mass energies between 39 and 200 GeV. The results will be discussed in the light of theoretical models and compared to results of similar observables at the LHC.