HK 10: Heavy Ion Collision and QCD Phases III

Zeit: Montag 16:30–18:30 Raum: S1/01 A01

Gruppenbericht HK 10.1 Mo 16:30 S1/01 A01

Low-Mass Dielectron Measurements in pp, p-Pb and Pb-Pb Collisions with ALICE — •Carsten Klein for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

Electron-positron (dielectron) pairs are an excellent experimental probe to investigate the properties of the quark-gluon plasma which is formed during ultrarelativistic heavy-ion collions. Because they do not interact strongly their spectra reflect the entire space-time-evolution of the collision. The created medium can lead to a modification of the dielectron production with respect to the vacuum rate. Therefore measurements in pp collisions serve as a medium-free baseline while the measurements in p-Pb collisions help to separate cold nuclear matter effects from those of the hot and dense medium.
In this contribution, recent dielectron measurements in the central barrel of ALICE are presented. The dielectron invariant mass and pair transverse momentum distributions will be compared to those from expected hadronic sources in pp collisions at $\sqrt{s} = 7$ TeV and in p-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV. From those distributions we discuss also constraints on the heavy-flavour production. The status of the analysis of Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 2.76$ TeV and an outlook to measurements at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV will also be presented. Supported by BMBF and the Helmholtz Association.

HK 10.2 Mo 17:00 S1/01 A01

Measurement of low-mass dielectrons in pp collisions at $\sqrt{s} = 13$ TeV with ALICE — •Ivan Vorobyev for the ALICE-Collaboration — Technische Universität München, Excellence Cluster Universe

Low-mass dielectrons are a unique experimental tool to investigate the hot and dense medium created in ultrarelativistic heavy-ion collisions. Electron-positron pairs are created during all stages of collision and do not interact strongly. Thus they carry important information unperturbed by strong final-state effects allowing us to probe the space-time evolution of the system including effects of chiral symmetry restoration.

Measurement of dielectron production in pp collisions serves as important vacuum reference to quantify modifications observed in heavy-ion collisions. In this talk we present the current status of dielectron measurements with ALICE central barrel spectrometer in pp collisions at centre-of-mass energies of 13 TeV collected during the LHC operation in 2015. Electrons are identified based on specific energy loss measurements in the Inner Tracking System (ITS) and the Time Projection Chamber (TPC) as well as time-of-flight information. Aspects of dielectron production in high-multiplicity pp collisions will also be discussed.

HK 10.3 Mo 17:15 S1/01 A01

Treatment of the ω resonance in transport approaches observed through dilepton production — •Jan Staudenmaier[1,2], Janus Weil[1], Stephan Endres[1,2], and Hannah Petersen[1,2,3] — [1]Frankfurt Institute for Advanced Studies — [2]Goethe University Frankfurt — [3]GSI Helmholtzzentrum für Schwerionenforschung

In this talk we discuss the treatment of ω Dalitz decay as well as the effect of the electromagnetic Dalitz decay of N^* resonances on the ω spectral function. Both are observed through the dilepton spectrum.

We begin with a presentation of the employed hadronic transport approach called SMASH that is designed to describe the non-equilibrium evolution of hadronic matter in heavy-ion collisions. After explaining the basic principles and foundations of the model, we present the description of dilepton production within SMASH. The main contribution of the dilepton spectra in the energy range of a few AGeV originates from resonance decays. First results of the dilepton production with SMASH including dilepton invariant mass spectra are shown and compared to other transport approaches.

Furthermore we investigate two different treatments of the ω Dalitz decay. The decay is either described as a direct Dalitz decay or via an intermediate ρ meson. Finally we discuss the electromagnetic Dalitz decay of N^* resonances via the ω and its effect on the ω spectral function, which is accessible through the dilepton spectrum.

HK 10.4 Mo 17:30 S1/01 A01

Polarization of exclusive dilepton production in pion-nucleon collisions — •Enrico Speranza[1,2], Miklós Zétényi[3], and Bengt Friman[1] — [1]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [2]Technische Universität Darmstadt — [3]Wigner Research Centre for Physics, Budapest, Hungary

A study of the polarization of the virtual photon in the process $\pi N \to N e^+ e^-$ is presented [1]. Effective interactions describing only the physical degrees of freedom for baryon resonances up to spin-5/2 are employed to compute the spin-anisotropy coefficient for isolated intermediate baryon resonances. It is shown that a given spin state of the intermediate resonance exhibits a characteristic angular dependence of the spin-anisotropy coefficient. Furthermore, the anisotropy coefficient resulting from the interference between resonances with different spin is presented. Our results show that the polarization of the photon provides information that is useful for disentangling the resonance contributions to elementary dilepton production processes [2]. Moreover, it is argued that the study of polarization observables can provide information on the production process and equilibration mechanism in heavy-ion collisions.

[1] E. Speranza, M. Zétényi, and B. Friman (to be published)
[2] W. Przygoda (HADES Collaboration), talk presented at The 10th International Workshop on the Physics of Excited Nucleons, NSTAR2015, 25-28 May 2015, Osaka

HK 10.5 Mo 17:45 S1/01 A01

Background rejection in dilepton analysis with the CBM-MVD — •Erik Krebs for the CBM-MVD-Collaboration — Goethe-Universität Frankfurt

The structure of the QCD phase diagram for moderate temperatures and high baryon chemical potentials is still practically unexplored. Dilepton measurements could provide information on the onset of deconfinement and on the subject of chiral symmetry restoration. The light vector mesons ρ, ω and ϕ are known to be excellent probes of the strongly interacting matter under extreme conditions. The leptonic decay channels of these mesons are of special interest as the leptons leave the hot and dense fireball without strong interaction and may reveal information on the characteristics of the matter created in the collisions. However, electrons from photon-conversions and Dalitz decays of pions are the main contributors to a large combinatorial background obscuring the information carried by the rare dileptons.

Studies have been made about whether the Micro-Vertex Detector (MVD) of the Compressed Baryonic Matter (CBM) experiment can contribute to reduce this background by reconstructing the low momentum partner of background pair in the MVD. CBM has no detectors for electron identification in front of the magnetic field posing an additional challenge to dielectron analysis. Methods for background rejection will be presented in this contribution. The capabilities of CBM detector to reconstruct a thermal radiation will be addressed.

*This work has been supported by BMBF (05P12RFFC7), GSI and HIC for FAIR.

HK 10.6 Mo 18:00 S1/01 A01

Reconstruction of the $\Delta(1232)$ resonance in AuAu collisions at 1.23 AGeV with HADES — •Georgy Kornakov — Technische Universität Darmstadt

Direct reconstruction of the $\Delta(1232)$ resonance via its decay into charged hadrons, together with higher Δ excited states and N* may provide insights into the mechanisms of sub-threshold particle production and fix better sources contributing to the di-leptons at freeze-out. Here we present the analysis of the inclusive spectra of $\pi^{\pm}p$ measured in Au+Au collisions at 1.23 AGeV by HADES. The yield, mass and width of resonance structures as a function of transverse momentum, rapidity and its dependence with centrality will be discussed.

This work has been supported by VH-NG-823, Helmholtz Alliance HA216/EMMI and GSI

HK 10.7 Mo 18:15 S1/01 A01

Goldstone-Bosonen in inhomogenen Phasen stark-wechselwirkender Materie — •Marco Schramm und Michael Buballa — Institut für Kernphysik, Technische Universität Darmstadt, Deutschland

Das Phasendiagramm stark wechselwirkender Materie weist eine reiche Struktur auf. In verschiedenen Modellen wurde gezeigt, dass kristalline Phasen mit einem räumlich modulierten chiralen Kondensat in Bereichen niedriger Temperatur und mittlerer Dichten auftreten können, die den sonst gefundenen Phasenübergang erster Ordnung ersetzen. In dieser Phase sind neben der chiralen Symmetrie, auch die Translations- und Rotationsinvarianz gebrochen. Wir leiten die damit verbundenen Goldstone-Bosonen in einem Nambu–Jona-Lasinio Modell explizit her und diskutieren ihre Eigenschaften. Diese sind relevant, um Transporteigenschaften zu bestimmen oder Auswirkungen auf die Stabilität der inhomogenen Phase in einer Erweiterung über die sonst übliche Mean-Field Näherung hinaus zu untersuchen.