HK 17: Heavy Ion Collisions and QCD Phases III

Zeit: Dienstag 14:00–15:45 Raum: HZO 60

Gruppenbericht HK 17.1 Di 14:00 HZO 60

Study of electromagnetic radiation from hot and dense medium formed in Au+Au collisions at $\sqrt{s_{NN}}$ = 2.42 GeV* — •Szymon Harabasz for the HADES-Collaboration — TU Darmstadt

In heavy-ion collisions at energies 1-2 GeV per nucleon the medium is formed with baryon density a few times higher than normal nuclear matter density. The unique tool to study properties of such medium is electromagnetic radiation.

HADES has investigated virtual photons produced in N+N, N+A, A+A and π+A reactions in this energy regime. The results from the largest system – Au+Au at $\sqrt{s_{NN}}$ = 2.42 GeV – reveal nearly exponential low invariant mass spectra after subtracting properly contributions of first-chance NN collisions, and hadron decays at freeze-out. These findings suggest strong modification of vector meson spectral function, due to coupling to abundant baryon resonances, in accordance with significant drop of chiral condensate at such high densities.

In this contribution, first results of differential data analysis will be presented and compared to the available theory model calculations.

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

HK 17.2 Di 14:30 HZO 60

Dilepton production and resonance properties within a new hadronic transport approach — •Jan Staudenmaier[1,2] and Hannah Petersen[1,2,3] — [1]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, 60438 Frankfurt am Main — [2]Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität, Max-von-Laue-Str. 1, 60438 Frankfurt am Main — [3]GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt

The dilepton emission in heavy-ion reactions at low beam energies is examined within a hadronic transport approach. In this talk the production of electron-positron pairs from a new approach named SMASH (Simulating Many Accelerated Strongly-interacting Hadrons) is introduced. The dilepton emission is consistently taken into account below the hadronic threshold. The calculations are systematically confronted with HADES data. The present approach employing a resonance treatment based on vacuum properties is validated by an excellent agreement with experimental data up to system sizes of carbon-carbon collisions. After establishing this well-understood baseline in elementary and small systems, the significance of medium effects is investigated with a coarse-graining approach based on the same hadronic evolution. The effect of explicit in-medium modifications to the vector meson spectral functions is important for dilepton invariant mass spectra in ArKCl and larger systems, even though the transport approach with vacuum properties reveals similar features due the coupling to baryonic resonance and the intrinsically included collisional broadening.

HK 17.3 Di 14:45 HZO 60

Electromagnetic Spectral Functions from the FRG — •Christopher Jung[1], Naoto Tanji[2], Ralf-Arno Tripolt[2], Lorenz von Smekal[1], and Jochen Wambach[2] — [1]JLU, Giessen — [2]ECT*, Trento

We present first results on electromagnetic spectral functions as obtained by applying the non-perturbative functional renormalization group approach to an effective low-energy theory motivated by the gauged linear sigma model. We study the in-medium behavior of these spectral functions in different regimes of the phase diagram and aim in calculating temperature and chemical potential dependent dilepton rates. In particular, we focus on possible signatures in these data for a critical endpoint (CEP) and the restoration of chiral symmetry.

HK 17.4 Di 15:00 HZO 60

Thermal dilepton emission at low and intermediate energies — •Florian Seck[1], Tetyana Galatyuk[1,2], Ralf Rapp[3], and Joachim Stroth[4,2] — [1]TU Darmstadt — [2]GSI, Darmstadt — [3]Texas A&M Univ., College Station, USA — [4]Goethe-Universiät Frankfurt

The systematic study of dilepton production in heavy-ion collisions across a large range of collision energies makes it possible to link experimental observables like yields and slopes of the spectra to features in the QCD phase diagram. As dileptons are emitted during the whole space-time evolution of the collision, the resulting spectra comprise several contributions from first-chance NN collisions, the hadronic freeze-out cocktail, but also thermal radiation which serves as messenger of the QCD matter properties inside the hot and dense medium.

We couple in-medium thermal dilepton rates with a coarse-graining method of hadronic transport simulations to compute dilepton spectra at energies $\sqrt{s_{NN}} \leq 10$ GeV, where hydrodynamic simulations may be less reliable. After checking the degree of thermalization of the system, local temperature, baryon and pion densities can be extracted in the nearly equilibrated parts of the fireball. This allows for the convolution of thermal rates with the space-time evolution of the medium.

The results will be discussed in the context of the excitation function of yields and slopes of the invariant-mass spectrum at different energies and compared to available experimental data.

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HK 17.5 Di 15:15 HZO 60

Dielectron production in pp collisions at $\sqrt{s}$= 7 TeV with ALICE — •Sebastian Scheid for the ALICE-Collaboration — Institut für Kernphysik, Goethe University, Frankfurt

Dileptons are a prime probe of the deconfined state of strongly-interacting matter, the Quark-Gluon Plasma (QGP), produced in high-energy heavy-ion collisions, as they are not affected by final-state interactions and produced at all stages of the collision. A measurement of the thermal radiation from the QGP in the dielectron intermediate-mass region gives information on the medium temperature. In this region the main component of the dielectron continuum is coming from correlated semi-leptonic decays of D- and B-mesons, which may be affected by the interaction of the heavy quarks with the QGP. Therefore, it is crucial to understand the primordial heavy-flavour production in vacuum and find a way to separate this contribution from the thermal signal of the QGP. This can be studied in proton-proton collisions.

In this talk, the measurement of correlated e^+e^- pairs in pp collisions at $\sqrt{s}$ = 7 TeV with ALICE will be presented. In particular, we will show how the measured distance of closest approach (DCA) of the electrons to the primary vertex of the collision gives the possibility to separate prompt and non-prompt dielectron pairs. The results will be compared with the expectations from known hadronic sources as a function of m_{ee}, $p_{T,ee}$ and DCA_{ee}. The extraction of the charm and beauty cross sections from a fit of the data with different Monte-Carlo generators will be discussed, as well as the measured fraction of direct photons to inclusive photons. Supported by BMBF.

HK 17.6 Di 15:30 HZO 60

Dielectron production in Pb–Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV with ALICE — •Carsten Klein for the ALICE-Collaboration — Institut für Kernphysik, Goethe Universität Frankfurt

Electron-positron pairs are an excellent probe to investigate the properties of the Quark-Gluon Plasma (QGP) created in ultra-relativistic heavy-ion collisions. Because they are produced at all stages of the collision and do not interact strongly with the medium, their spectra reflect the entire space-time evolution of the system. At low invariant mass, the dielectron production is sensitive to the properties of vector mesons in the dense medium which is related to the predicted restoration of the chiral symmetry. In the intermediate-mass region, the dielectron continuum gives further insight into the heavy-quark energy loss in the QGP via the measurement of correlated electron-positron pairs from charm- and beauty- hadron decays.

In this talk, the status of the dielectron measurements in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV with ALICE will be presented. In order to interpret the data, the findings will be compared to the expected yield of known hadronic sources, i.e. the hadronic cocktail, as a function of the invariant mass and pair transverse momentum. Finally, the status of the measurement of virtual direct photons and modifications of the dielectron yield in Pb-Pb collisions will be discussed.

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