HK 41: Heavy-Ion Collisions and QCD Phases VII

Time: Thursday 16:15–18:00 Location: PHIL A 602

Group Report HK 41.1 Thu 16:15 PHIL A 602

Dielectron production in pp and Pb−Pb collisions with ALICE in LHC Run 3 — •Emma Ege for the ALICE Germany-Collaboration — Goethe Universität, Frankfurt, Germany

Dielectrons are ideal probes to study the properties of strongly-interacting matter, produced in relativistic heavy-ion collisions, as they are created in all stages of the collision and do not interact strongly with the medium. However, at LHC energies, the thermal dielectrons emitted in the early stages from the quark-gluon plasma (QGP) are overshadowed by correlated e^+e^--pairs from semi-leptonic decays of heavy-flavor (HF) hadrons. Since the decay length of HF hadrons is much larger than that of prompt contributions, such as from the thermal radiation, dielectrons can be topologically separated based on their distance-of-closest approach (DCA) to the primary vertex of the collision. DCA measurements in pp collisions enable the search for prompt sources in small systems and can be used as a baseline for heavy-ion studies to identify the thermal radiation of the QGP. The improved pointing resolution of the upgraded ALICE detector for Run 3 leads to a better topological separation of prompt thermal radiation and non-prompt e^+e^--pairs from HF hadron decays.

In this talk, an overview of the latest results regarding the dielectron production in pp collisions at $\sqrt{s} = 13.6$ TeV and Pb−Pb collisions at $\sqrt{s_{\rm NN}} = 5.36$ TeV in Run 3, recorded with the ALICE detector, is given. A special focus is set on the topological separation with DCA, and the impact of the detector upgrades on the dielectron analysis.

HK 41.2 Thu 16:45 PHIL A 602

Performance of soft dielectron measurement in pp collisions at $\sqrt{s} = 13.6$ TeV with ALICE in Run 3 — •Belana Lubinski for the ALICE Germany-Collaboration — Goethe University Frankfurt

Low-mass dielectrons are an exceptional tool to deepen our understanding of strongly interacting matter produced in hadronic and nuclear collisions. As they are produced during all stages of the collision and are unaffected by the strong interaction, they keep the information of their original production mechanism. This allows dielectrons to probe even the soft regime of QCD which is often unaccessible otherwise.

At the Intersecting Storage Rings (ISR) at CERN, an enhancement of e^+e^- pairs over the expectation from know dielectron sources had been measured at low invariant mass and small pair momenta in pp collisions at $\sqrt{s} = 63$ GeV. A similar kinematic regime can be accessed with ALICE by reducing the magnetic field of the central barrel solenoid. First results from Run 2 indicate an excess also at LHC energies, albeit with a significance of 1.6σ. With the upgrade of the ALICE detector for Run 3 much higher data-acquisition rates can be achieved increasing the event statistics by a factor of 400 compared to Run 2.

In this talk, a first look at pp collisions at $\sqrt{s} = 13.6$ TeV recorded with a reduced ALICE magnetic solenoid field will be presented and their potential to address the excess observed in Run 2 will be discussed.

HK 41.3 Thu 17:00 PHIL A 602

Dielectron performance of the CBM experiment — •Adrian Meyer-Ahrens for the CBM-Collaboration — Institut für Kernphysik Münster, Münster, Deutschland

The Compressed Baryonic Matter (CBM) experiment is a fixed-target experiment currently under construction at FAIR in Darmstadt which will explore the QCD phase diagram at high net-baryon densities using heavy-ion beams in the kinetic energy range of 2-11 AGeV provided by the SIS100 accelerator complex. Dielectrons serve as versatile probes for properties of the hot and dense medium created in the collisions, since they do not interact strongly and escape the fireball undisturbed. Dielectron analysis depends on a reliable estimation of of the combinatorial background, dominated by π^0 decays, misidentified hadrons as well as electrons from photon conversions in the target or detector material. In this talk, simulation results concerning the dielectron performance of CBM in Au-Au collisions will be presented, with a discussion of background estimation techniques and the extraction of the thermal signal.

This project has received funding from NRW Netzwerke (NW21-024-E).

HK 41.4 Thu 17:15 PHIL A 602

Preliminary study for dilepton flow analysis with CBM — •Simon Neuhaus for the CBM-Collaboration — Bergische Universität Wuppertal, Wuppertal, Deutschland

Dileptons enable the study of the early phases of the quark-gluon-plasma formed in heavy-ion collisions, as they escape the medium without QCD interactions. Their particle flow characterized by flow coefficients v_n ($n = 1, 2, ...$) allows us to probe azimuthal anisotropies of these early phases. While dilepton flow has already been investigated in experiments including HADES, no corresponding studies exist yet for the upcoming CBM experiment.

This talk will present the preliminary study of the reconstruction of the dilepton flow at the upcoming CBM experiment. CBM is a fixed-target heavy-ion experiment currently under construction at FAIR/GSI. Additionally, we evaluate the impact of electron identification purity on the physics case of flow reconstruction. This study is based on simulations of Au-Au collisions generated with SMASH at 8 AGeV collision energy.

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HK 41.5 Thu 17:30 PHIL A 602

Combined description of thermal and vacuum contributions to the dilepton spectrum — •Jessica Vogel[1], Tetyana Galatyuk[1,2], Florian Seck[1], and Joachim Stroth[2,3] — [1]Technische Universität Darmstadt — [2]GSI, Darmstadt — [3]Goethe-Universität Frankfurt

Dileptons give access to the hot and dense matter created in heavy-ion collisions, as they escape the reaction zone largely unaffected by strong interactions. Measurements of such penetrating probes provide insight into the properties of the created fireball. High baryon densities are reached at beam energies of a few GeV which lead to significant in-medium modifications on the spectral functions of vector mesons.

Because the short-lived ρ meson mainly decays inside the fireball, it primarily produces thermal dileptons. However, the longer-lived ω meson decays partly outside the fireball and thus contributes with a mix of thermal and vacuum rates to the dilepton spectrum.

This work introduces a framework that models the dilepton spectrum by describing the vacuum decays via the shining method and determines the thermal contribution using a coarse-graining microscopic transport approach. This joined approach gives accurate predictions of the invariant mass spectrum in collisions within the few GeV regime. We examine how the relative contribution of thermal and vacuum rates varies with transverse momentum and how the collision centrality influences the results.

This work has been supported by the DFG through grant CRC-TR 211.

HK 41.6 Thu 17:45 PHIL A 602

Dielectron reconstruction in the HADES Au+Au Beam Energy Scan — •Henrik Flörsheimer for the HADES-Collaboration — Technische Universität Darmstadt

Heavy-ion collisions at relativistic energies create a hot and dense medium whose microscopic properties can be studied using electromagnetic probes. Dileptons are especially valuable for this purpose, as they do not interact strongly with the surrounding matter, allowing them to carry undisturbed information about the QCD matter produced throughout the reaction.

The beam energy scan features Au+Au collisions at four energies, 200, 400, 600, and 800 AMeV, which allows for the investigation of energy-dependent properties of created QCD matter.

In this contribution, the key steps of the dielectron analysis will be outlined and the first results will be presented.

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