HK 64: Heavy Ion Collisions and QCD Phases 8

Time: Thursday 17:00–18:45 Location: T/HS1

Group Report HK 64.1 Thu 17:00 T/HS1

Understanding photon production in hadron collisions and the equilibrating QGP in the early stage of the heavy-ion collisions — •Olena Linnyk[1], Elena Bratkovskaya[2], and Wolfgang Cassing[1] — [1]Justus Liebig University of Giessen, Germany — [2]Goethe University Frankfurt am Main, Germany

We show that the differential spectra, elliptic flow v2, triangular flow v3 and the polarization of emitted real and virtual photons reflect the properties of the QCD matter under extreme conditions as created in relativistic heavy-ion collisions: its temperature, sheer viscosity, conductivity and degree of equilibration. The first several fm/c of the collision evolution are particularly interesting, because the properties of the system before it equilibrates to QGP or hadron matter are not yet established. On the other hand, photons are emitted by every moving charge, a multitude of sources has to be disentangled in order to access the signal of interest. The direct photons at low transverse momentum are dominated by the thermal radiation from the QGP and the secondary meson+meson and meson+baryon interactions, such as the two-to-two processes (pi+pi->rho+gamma, rho+n->n+gamma, etc) and the bremsstrahlung mechanism (h+h->h+h+gamma). The implementation of photon bremsstrahlung in transport approaches was based until now on the soft photon approximation (SPA); it is valid only at very low energy (and pT) of the produced photon. Presently, we go beyond the SPA and use a one-boson-exchange model. Understanding the conventional sources lets us access the novel mechanisms of photon radiation in the non-equilibrium QCD matter and Glasma

Group Report HK 64.2 Thu 17:30 T/HS1

Direct photon production in Pb-Pb collisions at the LHC with the ALICE experiment — •Friederike Bock — Physikalisches Institut, Heidelberg University — Lawrence Berkeley National Laboratory, Berkeley

Unlike hadrons, direct photons are produced in all stages of a nucleus-nucleus collision and therefore test our understanding of the space-time evolution of the produced medium. Of particular interest are so-called thermal photons expected to be produced in a quark-gluon plasma and the subsequent hadron gas. The transverse momentum spectrum of thermal photons carries information about the temperature of the emitting medium. In this presentation, direct-photon spectra from Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV and p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV will be shown. The results were obtained by measuring e^+e^- pairs from external conversions of photons in the detector material. The measured direct-photon spectra will be compared with predictions from state-of-the-art hydrodynamic models. In the standard hydrodynamical modeling of nucleus-nucleus collisions, thermal photons mostly come from the early hot stage of the collision. As collective hydrodynamic flow needs time to build up, the azimuthal anisotropy of thermal photons quantified with the Fourier coefficient v_2 is expected to be smaller than the one for hadrons. However, the PHENIX experiment and ALICE experiment observed v_2 values of direct-photons similar in magnitude to the pion v_2. We will present the inclusive photon v_2 and v_3 in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV and discuss implications for the v_2 and v_3 of direct-photons.

Group Report HK 64.3 Thu 18:00 T/HS1

First results on electromagnetic radiation from Au+Au collisions at $E_{\mathbf{beam}}$ = 1.23 GeV/u in HADES. — •Szymon Harabasz for the HADES-Collaboration — TU Darmstadt

Investigations of heavy-ion collisions at low beam energies do not only reveal properties of vector mesons and baryonic resonances in hot/dense hadronic matter, but they also give access to the thermodynamics of QCD in the low T and high μ_B region of the phase diagram. Electromagnetic radiation emitted from such collisions provides a unique chance to study these issues in the laboratory. As photons and leptons are not subject to the strong force, they are able to deliver nearly undisturbed information on the processes in which they were produced. The High Acceptance Di-Electron Spectrometer installed at GSI has been used since many years to take these opportunities and study a wide range of colliding systems from NN and πN through NA to AA, including the Au+Au at E_{beam} = 1.23 GeV/u run from April-May 2012. Here, according to the non-linear scaling $\propto A_{\mathrm{part}}^{1.4}$ extracted from the former C+C and Ar+KCl results, much stronger in-medium radiation is expected.

In the current contribution, very non-trivial questions of e^+e^- identification, rejection of the strong contribution of γ-conversion and a proper treatment of combinatorics in such a background-dominated system will be addressed. A discussion of the obtained results on dilepton spectra will then follow.

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HK 64.4 Thu 18:30 T/HS1

Isolated photon measurement with the ALICE EMCAL detector — •Marco Marquard for the ALICE-Collaboration — Institut für Kernphysik, Goethe Universität Frankfurt am Main, Germany

Isolated photons at high transverse momenta are produced in initial hard scattering processes in high energy p-p and heavy ion collisions. Such processes are thought to scale by the number of binary nucleon-nucleon collisions in heavy ion collisions, hence isolated photons can be used to test scaling properties of particle production in such collisions, furthermore they may give insight to possible modifications of nuclear PDFs. In order to interpret isolated photon spectra in heavy-ion and p-Pb collisions at the LHC, they have to be measured in fundamental p-p collisions.

This talk will focus on the current status of the isolated photon analysis with the ALICE EMCAL. We will discuss technical aspects of the analysis and present methods to define and identify isolated photons. We will show first results of the analysis in p-p collisions.

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