

## HK 2: Heavy Ion Collisions and QCD Phases I

Zeit: Montag 14:00–16:00

Raum: HZO 60

**Gruppenbericht**

HK 2.1 Mo 14:00 HZO 60

**Measurement of direct photons in Pb-Pb collisions at centre-of-mass energy per nucleon of 2.76 TeV with the Photon Conversion Method in the ALICE experiment at LHC** — ●LUCIA LEARDINI for the ALICE-Collaboration — Physikalisches Institut — Heidelberg university

Photons are produced throughout the evolution of the Quark-Gluon Plasma (QGP), the hot and dense medium that is formed in heavy-ion collisions. The direct photons, originating from the early stages of the system evolution, are of particular interest to study the QGP characteristics and temperature at the photon emission time. The measurement presented here is extracted from the 2011 Pb-Pb run and relies on the Photon Conversion Method (PCM), based on the reconstruction of photon conversions by the Inner Tracking System (ITS) and the Time Projection Chamber (TPC).

HK 2.2 Mo 14:30 HZO 60

**Benchmark of microscopic hadronic direct photon emission in thermal equilibrium** — ●ANNA SCHÄFER<sup>1,2</sup>, JONAS ROTHERMEL<sup>1,2</sup>, JUAN M. TORRES-RINCON<sup>3</sup>, NIKLAS EHLERT<sup>2</sup>, CHARLES GALE<sup>4</sup>, and HANNAH PETERSEN<sup>1,2,5</sup> — <sup>1</sup>Frankfurt Institute for Advanced Studies, D-60438 Frankfurt am Main, Germany — <sup>2</sup>Institut für Theoretische Physik, Goethe-Universität, D-60438 Frankfurt am Main, Germany — <sup>3</sup>Department of Physics and Astronomy, Stony Brook University, US-11794 Stony Brook, USA — <sup>4</sup>Department of Physics, McGill University, CA-H3A 2T8 Montreal, Canada — <sup>5</sup>GSI Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt, Germany

Cross sections for direct photon production in hadronic scattering processes have been calculated according to an effective chiral field theory following Turbide et al. For  $\pi + \rho \rightarrow \pi + \gamma$  and  $\pi + \pi \rightarrow \rho + \gamma$  processes, these cross sections have been implemented into a novel hadronic transport approach (SMASH), which is suitable for collisions at low and intermediate energies. Comparisons of the obtained thermal rates in infinite matter calculations to theoretical predictions and to the ones used in hydrodynamic calculations are shown. This constitutes a benchmark for future non-equilibrium calculations. Employing SMASH for the final state rescattering in a hybrid approach will allow to assess the importance of the hadronic stage in the generation of direct photon flow.

HK 2.3 Mo 14:45 HZO 60

**Measurement of Neutral Mesons and Direct Photons in pp Collisions with ALICE at the LHC** — ●DANIEL MÜHLHEIM for the ALICE-Collaboration — Institut für Kernphysik, WWU Münster  
ALICE has published the invariant cross sections for the production of  $\pi^0$  and  $\eta$  mesons in proton-proton collisions at  $\sqrt{s} = 0.9$  TeV, 2.76 TeV, 7 TeV and most recently 8 TeV. Neutral mesons are reconstructed by means of three different detection systems; using the central barrel tracking detectors of ALICE in order to reconstruct photon conversions (PCM) and the two available calorimeters in the experiment, namely the PHOS and the EMCal. The reported measurements are carried out as well using a 'hybrid' system which reconstructs meson candidates by combining one EMCal photon with one PCM photon. Thus, this 'hybrid' system serves as an important cross-check and additionally measures an almost independent set of meson candidates. By using EMCal and PHOS triggers in addition, transverse momenta up to 40 GeV/c can be covered with the available statistics in the given datasets. In addition, the corresponding  $\eta/\pi^0$ -ratios will be shown to test scaling laws for particle production. All obtained results will be compared with different Monte Carlo generators as well as recent NLO pQCD predictions.

Based on the obtained results, inclusive direct photon measurements are being carried out, for which the most recent status will be presented. A novel method using the 'hybrid' PCM-EMCal system is followed in addition to tag  $\pi^0$  candidates and extract the direct photon signal, which will be shortly illustrated.

HK 2.4 Mo 15:00 HZO 60

**Reconstruction of neutral pions and direct photons at CBM-RICH detector via conversion\*** — ●IEVGENII KRES, KARL-HEINZ KAMPERT, and CHRISTIAN PAULY for the CBM-Collaboration — University of Wuppertal

The Compressed Baryonic Matter (CBM) experiment at the future FAIR complex will investigate the phase diagram of strongly interacting matter at high baryon density and moderate temperatures in A+A collisions from 2-11 AGeV (SIS100). A central component of the proposed detector setup is a Ring Imaging Cherenkov Detector (RICH) using  $CO_2$  as radiator gas, a focussing optics with a large spherical mirror, and, as a result of recent CBM RICH geometry optimizations, a cylindrically shaped photon detection surface. During the nucleus-nucleus collisions the created fireball passes several stages of evolution, where only specific types of particles can be produced. As leptons and photons are not affected by hadronic final state interactions, they offer the possibility to look into the fireball at different stages of evolution. The yields and transverse-momentum ( $p_T$ ) spectra of identified particles are widely used to determine the conditions of the fireball at chemical and kinetic freeze-out. The presented analysis aims at reconstructing  $\pi^0$  mesons via double conversion ( $\pi^0 \rightarrow \gamma(e^+e^-) + \gamma(e^+e^-)$ ) and direct photons via single conversion ( $\gamma \rightarrow (e^+e^-)$ ) inside the target or first detector layers in order to use their transverse-momentum ( $p_T$ ) spectra to study fireball properties. Results of this conversion analysis are presented.

\*gefördert durch BMBF 05P15PXFCA und GSI

HK 2.5 Mo 15:15 HZO 60

**Measurement of neutral pions in pp collisions at  $\sqrt{s} = 13$  TeV with the ALICE EMCal** — ●JOSHUA KOENIG for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

ALICE, as the dedicated heavy-ion experiment at the LHC, investigates the properties of the quark-gluon plasma (QGP), that is believed to be produced in Pb-Pb collisions at high center-of-mass energies. Reference measurements in pp collisions are essential to understand the characteristics of the QGP. The energy loss of partons traversing the QGP can be determined in hadron spectra at high transverse momentum. In ALICE the measurements of neutral meson ( $\pi^0$ ,  $\eta$ ) production with the calorimeters (EMCal, Dcal, Phos) complement the measurements of charged particles in the central barrel in these studies.

In this talk the reconstruction of  $\pi^0$  via their two-photon decay channel is realized with the EMCal, which measures the energy and position of photons. The status of the measurement of  $\pi^0$  in pp collisions at  $\sqrt{s} = 13$  TeV with the EMCal will be presented.

Supported by BMBF and the Helmholtz Association.

HK 2.6 Mo 15:30 HZO 60

**Measurement of neutral mesons in p-Pb collisions at  $\sqrt{s} = 5.02$  TeV with the ALICE-PHOS** — ●ANDREA HORNING for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

ALICE, the dedicated heavy-ion experiment at the LHC, investigates the properties of the quark-gluon plasma (QGP). In collisions of high energy nuclei, energy loss effects on the production of hadrons at high transverse momenta have been observed. To disentangle effects on particle production caused by the QGP and concurrent initial state effects, in addition to collisions of heavy nuclei, collisions of protons and nuclei are studied. In the experiment, measurements of neutral mesons ( $\eta$ ,  $\pi^0$ ) in the calorimeters complement measurements of charged particles in the central barrel.

The PHOS detector, one of the electromagnetic calorimeters of the experiment, measures the position and energy of photons and by such allows for the reconstruction of the  $\pi^0$  and the  $\eta$  meson via their two-photon decay channels. In this talk, the status of the measurement of  $\pi^0$  and  $\eta$  mesons in p-Pb collisions at  $\sqrt{s} = 5.02$  TeV will be presented.

Supported by BMBF and the Helmholtz Association.

HK 2.7 Mo 15:45 HZO 60

**Measurement of neutral mesons in Pb-Pb collisions at  $\sqrt{s_{NN}} = 5.02$  TeV with the photon conversion method in the ALICE experiment** — ●MEIKE DANISCH for the ALICE-Collaboration — Physikalisches Institut Heidelberg

Neutral mesons can provide important information on the energy loss of partons traversing the hot and dense matter, which is created in high energy heavy-ion collisions. Furthermore, they constitute the largest background contribution for direct photons, which are among the most

important tools to study the properties of the Quark Gluon Plasma. In the ALICE experiment, neutral mesons can be measured via their decay to two photons. Apart from the two calorimeters EMCal and PHOS, photons can be reconstructed also via the Photon Conversion Method (PCM). The latter exploits the fact that a photon can convert to an electron-positron pair. These charged particles can be detected via their tracks in the Time Projection Chamber (TPC) and

the Inner Tracking System (ITS). The PCM allows the measurement of both photons and neutral mesons, carrying low transverse momenta ( $p_T \gtrsim 1 \text{ GeV}$ ), with very good energy resolution. Apart from presenting the performance of the photon conversion method, results from the  $\pi^0$  and  $\eta$  meson production measurement in Pb-Pb collisions with a center-of-mass collision energy per nucleon of  $\sqrt{s_{NN}} = 5.02 \text{ TeV}$  will be shown.