# HK 9: Heavy-Ion Collisions and QCD Phases II

Time: Monday 16:45–18:15 Location: HBR 62: EG 05

**Group Report** HK 9.1 Mon 16:45 HBR 62: EG 05

**Characterising the hot and dense fireball with virtual photons at HADES** — •Niklas Schild for the HADES-Collaboration — TU Darmstadt, Darmstadt, Germany

The High-Acceptance-Di-Electron-Spectrometer (HADES) at GSI, Darmstadt, measures heavy-ion and elementary collisions at a few GeV beam energies, enabling the investigation of nuclear matter at high densities and moderate temperatures. One pillar of HADES is the study of these collisions not only through hadrons, which are heavily affected by freeze-out stages, but also via rare electromagnetic probes, as they allow unique insights into the evolution of the collision throughout. In particular, virtual photons, decaying into $e^+e^-$ pairs, encode numerous characteristics of the fireball and deliver additional information in their invariant mass.

In this contribution, we present measurements of such dileptons collected in heavy-ion Ag+Ag and Au+Au as well as elementary p+p collisions at $\sqrt{s_{NN}} = 2.55$ GeV and $\sqrt{s_{NN}} = 2.42$ GeV. Combination of these HADES data sets brings a unique opportunity to gain new insights into the dilepton excess and its dependence on system size and centrality. Hence, we provide an overview of recent works and progress in the dilepton analysis at HADES. This includes advances in the particle identification, multidifferential dilepton spectra as well as studies on collectivity via the investigation of anisotropic flow and polarisation.

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HK 9.2 Mon 17:15 HBR 62: EG 05

**Simulating final-state electromagnetic interaction in heavy-ion collisions at energy of few GeV** — •Szymon Harabasz[1], Wojciech Florkowski[3], Tetyana Galatyuk[1,4], Malgorzata Gumberidze[4], Radoslaw Ryblewski[2], Piotr Salabura[3], and Joachim Stroth[4,5] — [1]TU Darmstadt — [2]Institute of Nuclear Physics PAS — [3]Jagiellonian University in Krakow — [4]GSI, Darmstadt — [5]Institut für Kernphysik, GU Frankfurt

It has been shown that transverse-mass and rapidity spectra of $p$ and $\pi^{\pm}$ produced in Au-Au collisions at $\sqrt{s_{\rm NN}} = 2.4$ GeV are well reproduced by thermal emission from a spheroid single freeze-out hypersurface [1]. To better understand the particle spectra, it is necessary to account for the effect of electromagnetic interactions. In central collisions at relatively low energies, i.e., of few GeV, incoming nucleons are largely stopped in the interaction region, and high positive electric charge density is generated. The electromagnetic field accelerates positively charged particles, and decelerates negatively charged ones.

In order to simulate this effect in THERMINATOR 2, a direct solution to relativistic Newton equation has been implemented, including electromagnetic forces between particles.

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[1] S. Harabasz *et al.*, Phys.Rev.C **107** (2023) no.3, 034917

HK 9.3 Mon 17:30 HBR 62: EG 05

**Soft $\omega$ meson production in pp collisions at $\sqrt{s}$ = 5.02 TeV with ALICE** — •Merle Luisa Wälde for the ALICE Germany-Collaboration — Institut für Kernphysik, Goethe Universität Frankfurt

Measurements of hadron production cross sections in proton-proton (pp) collisions at high energies are important to test our understanding of QCD and as a reference for heavy-ion studies. While the production of particles in hard scatterings can be calculated in a perturbative approach, the production via soft processes relies on phenomenological model approaches that require experimental input and suffer from sizeable uncertainties in their predictions. Therefore, the production cross section of the $\omega$ meson needs to be measured down to the lowest transverse momentum ($p_{\rm T}$) where the reach to low momenta is scarce at LHC energies and midrapidity.

In this talk, the first measurement of the $\omega$ meson down to $p_{\rm T} = 0$ in pp collisions at $\sqrt{s} = 5.02$ TeV at midrapidity will be presented. This measurement is performed in the decay channel $\omega \rightarrow {\rm e^+e^-}$ with ALICE. We will discuss the estimation of the different background sources as well as uncertainties related to the signal extraction, and track and PID requirements. The final results will be compared to model calculations focusing on particle production in the soft-$p_{\rm T}$ regime.

HK 9.4 Mon 17:45 HBR 62: EG 05

**Macroscopic description of HADES Au+Au and Ag+Ag particle yields using the HRG model** — •Marvin Kohls for the HADES-Collaboration — Goethe-Universität Frankfurt

A comparison of strange hadron production yields in Au(1.23 $A$GeV)+Au and Ag(1.58 $A$ GeV)+Ag collisions, measured with HADES, reveals a universal scaling behavior as a function of the system size. Together with the apparent observation of a melting $\rho$-meson, these findings hint towards the possibility of describing matter properties with thermal/statistical parameters extracted from a hadron resonance gas (HRG).

In this contribution, we will systematically compare measured particle yields to HRG fits. Particular emphasis will be placed on elucidating the characteristics of light nuclei and their excited states. Furthermore, the canonical description of strangeness, in particular the production rates of $K^-$, $\phi(1020)$, and $\Xi^-$, will be discussed.

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HK 9.5 Mon 18:00 HBR 62: EG 05

**towards the extraction of the baryon chemical potential for the fixed-target program at STAR** — •Yannick Söhngen for the CBM-Collaboration — Physikalisches Institut Heidelberg

The fixed-target program at STAR aims to extend the range in which the phase diagram of strongly interacting matter can be investigated towards lower collision energies or higher values of the baryon chemical potential. The ratio of proton and antiproton yields has been shown to provide a good estimator for the value of the baryon chemical potential. The status of current efforts to extract the baryon chemical potential at energies close to proton pair-production in gold-gold collisions will be presented and discussed.