HK 15: Schwerionenkollisionen und QCD Phasen III

Time: Tuesday 14:00–16:00 Location: HS AP

Group Report HK 15.1 Tue 14:00 HS AP

Hard probes within a pQCD-based partonic transport model — Oliver Fochler[1], •Jan Uphoff[1], Zhe Xu[2,1], and Carsten Greiner[1] — [1]Goethe-Universität Frankfurt — [2]Frankfurt Institute for Advanced Studies

High-energy partons and heavy quarks are studied in fully dynamic simulations of heavy-ion collisions at RHIC and LHC energies within the perturbative QCD-based partonic transport model BAMPS. In this framework we investigate simultaneously jet-quenching and elliptic flow of gluons, light quarks and heavy quarks. For gluons and light quarks the model consistently features elastic and inelastic $2 \leftrightarrow 3$ processes, the latter being based on the Gunion-Bertsch matrix element. Currently, heavy quarks only scatter elastically with light partons, but this process is treated accurately with improved Debye screening and running coupling. The nuclear modification factor stemming from the fragmentation of gluons and light quarks is investigated for different impact parameters at RHIC energies and for central LHC collisions. The experimentally measured nuclear modification factor and elliptic flow of heavy quarks can be explained simultaneously within BAMPS, but only if the cross section is enhanced by a factor of 4. Furthermore, we present results on open charm and J/psi production in the medium.

HK 15.2 Tue 14:30 HS AP

Heavy quarks in the Quark Gluon Plasma — •Hendrik van Hees — Institut für Theoretische Physik, Universität Giessen, Germany

Heavy quarks are valuable probes for the Quark-Gluon Plasma (QGP), formed in relativistic heavy-ion collisions since they are produced in the very early hard collisions and then interact with the equilibrated light quarks and gluons during the entire lifetime of the fireball.

In this talk I will discuss a model, where the large heavy-quark (HQ) diffusion within the QGP is described by a Langevin simulation [1]. The pertinent drag and diffusion coefficients are derived from a self-consistent many-body Brückner scheme, using input from lattice QCD for the in-medium HQ potential [2]. Hadronization to open-charm/bottom mesons is described as a combined coalescence-fragmentation process. The subsequent semileptonic decay of the D and B mesons allow a comparison of single-electron p_T-spectra with data on the nuclear-suppression factor, R_{AA}, and elliptic flow, v_2, of "non-photonic electrons" in semi-central Au-Au collisions with $\sqrt{s} = 200A$ GeV at the Relativistic Heavy-Ion Collider (RHIC). Some conclusions on transport properties (η/s) of the QGP are drawn.

Gefördert durch BMBF.

[1] H. van Hees, M. Mannarelli, V. Greco, R. Rapp, Phys. Rev. Lett. **100**, 192301 (2008).
[2] F. Riek, R. Rapp, Phys. Rev. C **82**, 035201 (2010).

HK 15.3 Tue 14:45 HS AP

Korrelationen von schweren Quarkteilchen in hochenergetischen Kern-Kern-Reaktionen — •Andre Mischke — ERC-Starting Independent Research Group QGP-ALICE, Universität Utrecht, Niederlande

Schwere Quarkteilchen (Charm und Bottom) sind durchdringende, sensitive Proben für die Bestimmung der Eigenschaften heißer Quarkmaterie, die sich im Labor mit Hilfe von hochenergetischen Kern-Kern-Reaktionen kreieren und untersuchen lässt. Theoretische Modellrechnungen sagen vorher, dass schwere Quarks einen kleineren Energieverlust im Medium haben sollten als leichte Quarks aufgrund der Unterdrückung der Gluonenabstrahlung (Dead-cone Effekt genannt). Für das detaillierte Verständnis der partonischen Wechselwirkungsprozesse im Medium ist es deshalb von besonderem Interesse, die Abhängigkeit des Energieverlustes von der Quarksorte und Quarkmasse sowie die Änderung der Fragmentationsfunktion zu untersuchen, da sie wesentliche Informationen über den Charakter der produzierten Materie liefern. Korrelationen von schweren Quarkteilchen erlauben es, Ereignisse mit Charm- oder Bottom-Quarkpaaren zu identifizieren und separat zu studieren. In diesem Beitrag wird die Korrelationsmethode [1] im Detail vorgestellt und neuste Ergebnisse von der RHIC-Beschleunigeranlage präsentiert. Des Weiteren werden die Perspektiven am Large Hadron Collider des CERNs diskutiert.

[1] A. Mischke, Phys. Lett. B671, 361 (2009).

HK 15.4 Tue 15:00 HS AP

Performance Studies for the Measurement of ψ' via the Decay Channel $\psi' \to J/\psi\ \pi^+\pi^- \to e^+e^-\pi^+\pi^-$ with the ALICE Detector — •Moritz Pohl[1], Christoph Blume[2], and Frederick Kramer[1] for the ALICE-Collaboration — [1]University of Frankfurt — [2]University of Heidelberg

The measurement of quarkiona production in heavy-ion collisions is crucial for the investigation of the Quark-Gluon Plasma, as studied by the ALICE experiment at the LHC. An important baseline for such studies are corresponding measurements in pp collisions.

The decay channel $\psi' \to J/\psi\ \pi^+\pi^- \to e^+e^-\pi^+\pi^-$ is of particular interest because it allows to estimate the contribution of secondary J/ψ to the total measured yield which results from the decay of excited charmonium states. Results of a Monte Carlo based study at $\sqrt{s} = 7$ TeV pp collisions will be presented. Acceptance and reconstruction efficiencies using the central barrel detectors of ALICE - the Inner Trackings System (ITS), the Time Projection Chamber (TPC) and the Transition Radiation Detector (TRD) - be discussed. Investigations on the signal to background ratio and possible strategies for improvements will be presented.

HK 15.5 Tue 15:15 HS AP

Dielectron production in Au+Au collisions at $\sqrt{s_{\mathrm{NN}}} = 39$ GeV at STAR — •Patrick Huck — Lawrence Berkeley National Laboratory, Berkeley, California 94720 — Physik Dept. E12, Technische Universität München, 85748 Garching, Deutschland

During a beam energy scan in 2010 a wide range of beam energies has been explored for Au+Au collisions using the STAR detector at RHIC. With minimum material budget in the tracking part of the detector this run is particularly suited for the investigation of virtual photons originating from the hot and dense medium created in heavy ion collisions. The completed installation of the STAR time-of-flight detector is a further distinctive feature which allows the particles' velocity to be used for particle identification in addition to their energy loss in the time projection chamber.

As electromagnetic probes, dielectron pairs do not interact strongly with the medium and hence carry direct information of its properties at the time of production. Thus, measurements of dielectron emissivity in heavy ion collisions provide an additional tool for the study of the quark gluon plasma.

For a center-of-mass energy of $\sqrt{s_{\mathrm{NN}}} = 39$ GeV, 170 M events have been taken. The talk presents the status of an ongoing dielectron analysis of this high statistics sample. It concentrates on particle identification, background rejection and subtraction, and the reconstruction of dielectron pairs up to $M^{ee}_{\mathrm{inv}} = 3.5\,\mathrm{GeV/c^2}$.

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HK 15.6 Tue 15:30 HS AP

Messung von Dielektronen niedriger Masse mit dem ALICE Detektor in Proton-Proton und Blei-Blei Kollisionen — •Markus Konrad Köhler für die ALICE-Kollaboration — Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — Technische Universität Darmstadt, Hochschulstr. 12, 64289 Darmstadt

Dielektronen sind eine einzigartige Sonde für das Medium, das in hochenergetischen Schwerionenkollisionen produziert werden kann. Da sie nicht der starken Wechselwirkung unterliegen, tragen sie Informationen aus allen Stadien der Kollision nahezu ungestört zu den Detektoren. Eventuelle Modifikationen des Mediums, wie Phasenübergänge, hätten somit messbare Auswirkungen auf die Eigenschaften von Dielektronen, wobei Proton-Proton Kollisionen als Referenz dienen.

Im ALICE Experiment am CERN LHC können Elektronen im zentralen Akzeptanzbereich mit Hilfe des inneren Spurrekonstruktionssystems (ITS), der Zeitprojektionskammer (TPC), dem Übergangsstrahlungsdetektor (TRD) und dem Flugzeitdetektor (TOF) identifiziert werden.

In diesem Beitrag wird der Status der Dielektronenanalyse in Proton-Proton ($\sqrt{s} = 7$ TeV) Kollisionen vorgestellt und eine Perspektive für Blei-Blei ($\sqrt{s_{NN}} = 2.76$ TeV) Kollisionen gegeben.

HK 15.7 Tue 15:45 HS AP

Dimuon radiation from a hybrid evolution model — •Elvira Santini[1] and Marcus Bleicher[1,2] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt — [2]Frankfurt Institute for Advanced Studies (FIAS)

We analyze dilepton emission from hot and dense matter created in heavy-ion collisions using a hybrid approach based on the UrQMD transport model with an intermediate hydrodynamic stage for the modeling of heavy-ion dynamics. During the hydrodynamic stage dilepton emission from hadronic and quark-gluon matter is described by radiation rates for a strongly interacting medium in thermal equilibrium. Focusing on the enhancement with respect to the contribution from long-lived hadron decays after freeze-out observed at the SPS in the dilepton spectra the relative importance of the various sources is discussed. A comparison to NA60 data is performed.