HK 79: Heavy Ion Collisions and QCD phases

Time: Friday 11:00–12:45 Location: H-ZO 10

Group Report HK 79.1 Fr 11:00 H-ZO 10

Dynamic parton rearrangement within the UrQMD transport approach — •Gunnar Gräf, Hannah Petersen, Gerhard Burau, and Marcus Bleicher — Institut für Theoretische Physik, Goethe-Universität, Max-von-Laue-Str. 1, 60438 Frankfurt am Main

We have implemented a mechanism for locally density-dependent dynamic parton rearrangement and fusion into the Ultra-relativistic Quantum Molecular Dynamics (UrQMD) approach. The same mechanism has been previously built in the Quark Gluon String Model (QGSM) [1, 2]. This rearrangement and fusion approach based on parton coalescence ideas enables the description of multi-particle interactions, namely $3 \rightarrow 3$ and $3 \rightarrow 2$, between (pre-)hadronic states in addition to standard binary interactions. The UrQMD model (v2.3) [3, 4] extended by these additional processes allows now to investigate the implications of multi-particle interactions on the reaction dynamics of ultra-relativistic heavy-ion collisions. We will present first results of this investigation, e.g. implications on the kinetic equilibration time due to the change of the mean free path and on measurable observables like spectra of final hadrons. (This work is supported by GSI and the Helmholtz International Center for FAIR within the framework of the LOEWE program launched by the State of Hesse.)

[1] J. Bleibel *et al.*, Phys. Rev. C 76 (2007) 024912.
[2] J. Bleibel *et al.*, Phys. Lett. B 659 (2008) 520.
[3] S. A. Bass *et al.*, Prog. Part. Nucl. Phys. 41 (1998) 255.
[4] M. Bleicher *et al.*, J. Phys. G 25 (1999) 1859.

Group Report HK 79.2 Fr 11:30 H-ZO 10

Recent Results from WA98 — •Christoph Baumann for the WA98-Collaboration — Westfälische Wilhelms-Universität Münster, Institut für Kernphysik, Wilhelm-Klemm-Str. 9, 48149 Münster

WA98 has published results on the production of neutral pions and direct photons in Pb+Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 17.4$ GeV. We have shown, that the available p+C and p+Pb data measured at $\sqrt{s_{\mathrm{NN}}} = 17.3$ GeV can be employed as a replacement for a p+p reference. With the p+A data, the nuclear modification factor of the neutral pion production was computed and a suppression in the most central collisions was observed. We will report on these results and compare them to most recent results from PHENIX in Cu+Cu collisions at $\sqrt{s_{\mathrm{NN}}} = 22.4$ GeV. From the direct photon results for Pb+Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 17.4$ GeV published by WA98, the initial temperature of the created state could be constrained to temperatures between 200 and 400 MeV. The spread of these temperatures arises from the uncertainty in the relative amount by which photons from hard scattering processes and thermally produced photons contribute to the photon excess. In this talk, results on the direct photon production in p+Pb and p+C data also measured by WA98 at $\sqrt{s_{\mathrm{NN}}} = 17.4$ GeV are presented and implications for the different production mechanisms in Pb+Pb collisions are discussed.

HK 79.3 Fr 12:00 H-ZO 10

Relativistic shocks in viscous gluon matter — •Ioannis Bouras, Zhe Xu, Etele Molnar, Carsten Greiner, Dirk Rischke, Oliver Fochler, and Andrej El — Institut für theoretische Physik, Universität Frankfurt

Considering the relativistic Riemann problem with a discontinuity of pressure in viscous gluon matter, we investigate the existence of relativistic shock waves at RHIC. Calculations employing the parton cascade BAMPS demonstrate for the first time the transition from viscous to ideal shocks by varying the shear viscosity to the entropy density ratio η/s from infinity towards zero. We show that if the η/s ratio of the medium is larger than 0.2, relativistic shocks will be hardly observed. Comparisons with viscous hydrodynamic calculations using vSHASTA confirm our findings. Moreover, on the contrary to the parton cascade, the recent version of vSHASTA fails to create shocks in a strong dissipative medium. The Knudsen number in the shock front is a proper quantity to understand the break down of hydrodynamics in an out of equilibrium state.

HK 79.4 Fr 12:15 H-ZO 10

Static quark-antiquark pairs at finite temperature — Nora Brambilla[1], •Jacopo Ghiglieri[1], Peter Petreczky[2], and Antonio Vairo[1] — [1]Technische Universität München, Physics Department T30f, James-Frank-Str. 1, 85747 Garching, Germany — [2]RIKEN-BNL Research Center & Physics Department Brookhaven National Laboratory, Upton, NY 11973, USA

In a framework that makes close contact with modern effective field theories for non-relativistic bound states at zero temperature, we study the real-time evolution of a static quark-antiquark pair in a medium of gluons and light quarks at finite temperature, obtaining the potential and decay widths in different temperature regions, with new results in the $1/r >> T$ regime.

HK 79.5 Fr 12:30 H-ZO 10

Flavour off diagonal susceptibilties in the PNJL model — •Simon Rössner, Thomas Hell, Nino Bratovic, and Wolfram Weise — Physik Department, TU München, 85748 Garching, Germany

We present an investigation of flavour sensitive quark number susceptibilities based on the 2-flavour Polyakov loop extended Nambu and Jona-Lasinio (PNJL) model [1]. This calculation features the two most important non-perturbative effects of QCD at temperatures below the 1 GeV-scale, spontaneous chiral symmetry breaking and confinement. The astonishingly good agreement of the equation of state with full lattice QCD calculations [2] persists for finite isovector chemical potentials. As a central result, finite up-down quark number susceptibilities are found even in the absence of explicit colour and flavour mixing terms in the model Lagrangian.

The PNJL model study suggests that the up-down quark number susceptibilities are intertwined with the Polyakov loop degrees of freedom. This observation can be understood with a simple model which features a coupling of both up and down quark densities to a flavour-blind degree of freedom. It remains an open issue, however, to what extend the modelled mechanism is at work in full QCD.

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[1] S. Rößner, T. Hell, C. Ratti, and W. Weise, Nucl. Phys. A**814**, 118 (2008).
[2] S. Rößner, C. Ratti, and W. Weise, Phys. Rev. D**75**, 034007 (2007).