HK 58: Heavy-Ion Collisions and QCD Phases X

Zeit: Freitag 14:00–16:00 Raum: HS 15

Gruppenbericht HK 58.1 Fr 14:00 HS 15

SMASH: A New Hadronic Transport Approach — •Anna Schäfer[1,2] and Hannah Elfner[3,1,2] — [1]Frankfurt Institute for Advanced Studies, D-60438 Frankfurt am Main, Germany — [2]Institut für Theoretische Physik, Goethe-Universität, D-60438 Frankfurt am Main, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt, Germany

Transport approaches are very successfully applied for the microscopic description of matter in and out of equilibrium. Hadronic transport approaches are particularly useful to describe low-energy heavy ion collisions as well as the late, dilute stages of high-energy collisions. In this talk, an overview of SMASH (Simulating Many Accelerated Strongly-interacting Hadrons), a novel and open-source hadronic transport approach is presented. First, the underlying concepts and assumptions are introduced before their functionality is verified in a number of test setups. Among those are comparisons to an analytic solution of the Boltzmann equation and to experimentally known cross section data. Finally, SMASH results for transport coefficients, electromagnetic probes, particle spectra and elliptic flow are presented and, where applicable, confronted with experimental data. It is further demonstrated that while the results agree well with those of existing transport codes, SMASH also provides new opportunities to investigate the properties of strongly interacting matter.

HK 58.2 Fr 14:30 HS 15

Recent net-baryon fluctuation results from ALICE in view of the effect of detection efficiency losses — •Mesut Arslandok for the ALICE-Collaboration — Physikalisches Institut Heidelberg

In a thermal system, fluctuations of particle yields are directly encoded in the equation of state of the system under the study. By measuring event-by-event fluctuations over an ensemble of events via cumulants or moments of particle multiplicity distributions, one can study the freeze-out conditions in heavy-ion collisions and clarify their relation to the QCD phase transition. Higher order cumulants of fluctuations of conserved quantities like electric charge and baryon number are related to thermodynamic susceptibilities, which can be calculated in the Grand Canonical Ensemble formulation of thermodynamics such as Lattice QCD or statistical models. Cumulants beyond the second order are more sensitive to the underlying physics however experimentally more challenging. In particular the effect of finite detection efficiency losses drastically influences the measurements. In this contribution, recent experimental results on event-by-event analysis of net- baryon number fluctuation measurements in Pb-Pb collisions recorded by the ALICE Collaboration at the CERN LHC will be presented. The cumulants of net-proton, used as a proxy to net-baryon, results up to third order will be discussed in view of the effect of detection efficiency losses.

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HK 58.3 Fr 14:45 HS 15

Higher order Symmetric Cumulants — •Cindy Mordasini — Technical University of Munich, James-Franck-Str. 1, 85748 Garching, Germany

The measurements of correlations between the fluctuations of amplitudes of different flow harmonics in heavy-ion collisions have been shown to have a better sensitivity to the properties of the Quark-Gluon Plasma than the flow harmonics computed individually. These results were obtained using a new method based on the computation of the multiparticle cumulants for two different harmonics: the Symmetric Cumulants.

This talk presents the generalization of the Symmetric Cumulants for the case of three or more different harmonics. It will be shown explicitly how this new observable is sensitive only to the genuine three-harmonic correlations, and therefore how it provides a new and independent constraint on the properties of the Quark-Gluon Plasma. Predictions of these new observables made with the iEBE-VISHNU model will be shown.

HK 58.4 Fr 15:00 HS 15

Net-Λ fluctuations in Pb-Pb collisions at ALICE at the LHC — •Alice Ohlson for the ALICE-Collaboration — Physikalisches Institut, Universität Heidelberg

The fluctuations of conserved charges – such as electric charge, strangeness, and baryon number – in ultrarelativistic heavy-ion collisions provide insight into the properties of the quark-gluon plasma and the QCD phase diagram. They can be related to the higher moments of the multiplicity distributions of identified particles such as pions, kaons, and protons. The Λ baryon carries both strangeness and baryon number and is thus of particular interest. We present the first measurement of net-Λ fluctuations in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV with the ALICE detector. The results are obtained with the Identity Method, which is applied in a novel way to account for the combinatoric background in the invariant mass distribution. The second moments of the net-Λ multiplicity distribution as a function of centrality and pseudorapidity acceptance are compared with the net-proton and net-kaon results measured by ALICE, as well as with model calculations.

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HK 58.5 Fr 15:15 HS 15

Influence of the neutron skin effect on the isospin density in heavy ion collisions — •Jan Hammelmann[1,2], Alba Soto Ontoso[4], Hannah Elfner[1,2,3], and Damjan Mitrovic[1,2] — [1]Institut für Theoretische Physik, Goethe Universität Frankfurt — [2]FIAS Frankfurt Institute for Advanced Studies — [3]GSI Helmholtzzentrum für Schwerionenvorschung — [4]Brookhaven National Laboratory

A key ingredient in any theoretical description of heavy ion collisions is the spatial distribution of the nucleons inside the nuclei. Traditionally, both protons and neutrons have been distributed in an identical way via the Woods-Saxon distribution in the nucleus. However it has been experimentally measured that this assumption is not correct: there are more neutrons distributed on the outer layers of the nucleus than protons, the so-called neutron skin effect. By initializing heavy nuclei like Au or Pb with a neutron skin within the transport model SMASH, we study the influence of this novel feature on the zeroth component of the baryonic isospin current j^μ for different impact parameters and $\sqrt{s}$. The aim of this study is to make predictions for the isobar systems Zr and Ru run at RHIC in 2018.

HK 58.6 Fr 15:30 HS 15

Non-Bessel-Gaussianity of Flow Distribution — •Seyed Farid Taghavi — Technical University of Munich, James-Franck-Str. 1, 85748 Garching, Germany

There is a strong evidence that the produced matter in the heavy ion collision exhibits non-trivial collective behavior. Moreover, we know that the initial energy density produced after the collision depends on both the collision geometry and the quantum fluctuations of the nucleons inside the nucleus. According to this picture, the footprint of the collision geometry and quantum fluctuations can be observed in the final particle momentum distribution after the collective evolution of the initial state. This picture is mostly examined by studying the cumulants of momentum distributions in the experiment. In the present talk, we connect observed cumulants to the momentum distribution systematically. The final particle momentum distribution is approximately considered as Bessel-Gaussian distribution while the cumulants of the distribution show non-Bessel-Gaussianity. Here, we introduce an expansion (Gram-Charlier A series) around Bessel-Gaussian distribution and connect the non-Bessel-Gaussianity to the observed cumulant fine-splitting. Also we disentangle the effect of the collision geometry from quantum fluctuations in the cumulants. Using this approach, we introduce new estimators for average ellipticity. Also we show how one can restrict the phase space of the observed cumulants into specific allowed regions.

HK 58.7 Fr 15:45 HS 15

Λ^0 and K^0_S Production in Au+Au Collisions at 1.23A GeV in HADES — •Simon Spies for the HADES-Collaboration — Goethe-Universität Frankfurt

We use a high statistic data sample of 7.3×10^9 recorded Au(1.23A GeV)+Au events to investigate Λ^0 baryon and K^0_S meson production below their free nucleon nucleon threshold. These hadrons are being reconstructed using their weak decay topologies that are being recognized with the help of an artificial neural network. We calculate kinematic distributions in transverse and logitudinal direction of these hadrons and put them in context with phenomenological models.

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