HK 35: Heavy-Ion Collisions and QCD Phases VII

Zeit: Mittwoch 14:00–15:45 Raum: HS 12

Gruppenbericht HK 35.1 Mi 14:00 HS 12

Spectral Functions from the Functional Renormalization Group — •Christopher Jung[1], Ralf-Arno Tripolt[2], Lorenz von Smekal[1], and Jochen Wambach[3,4] — [1]JLU, Giessen — [2]GU, Frankfurt — [3]ECT*, Trento — [4]TU Darmstadt

We present the current status on spectral functions as obtained by applying the non-perturbative functional renormalization group approach (FRG) and a recently proposed analytic continuation method to an effective low-energy theory motivated by the gauged linear sigma model. Here we study the in-medium behavior of the spectral functions of the ρ and a1 meson in different regimes of the phase diagram where we focus on signatures in these data for a critical endpoint (CEP) and the restoration of chiral symmetry. We also present results for in-medium electromagnetic spectral functions and aim at computing temperature and chemical potential dependent dilepton rates within this setup.

HK 35.2 Mi 14:30 HS 12

Application of the fast vectorised Kalman filter based track fit to the STAR experiment — •Artemiy Belousov[1], Yuri Fisyak[3], Ivan Kisel[1,2], and Maksym Zyzak[2] for the CBM-Collaboration — [1]FIAS — [2]GSI — [3]Brookhaven National Laboratory

Modern experiments in high energy physics tend to increase the amount of data to be processed, thus, the execution speed of the algorithms becomes crucial. However, the efficiency and precision of the applied procedures cannot be compromised. Therefore, the Kalman filter method is usually used as a basis in particle tracks reconstruction, since it satisfies the above-mentioned requirements.

Current implementation of the Kalman filter method for reconstruction of charged particle trajectories is added to the TPC CA track finder of the STAR experiment within the FAIR Phase 0 program. The algorithm will be applied in the High Level Trigger of STAR during the Beam Energy Scan II (BES II) program, which requires high operational speed. At the same time, quality of the fitting procedure should stay high. The developed Kalman filter based track fit uses all specific technical data we can capture from a detector. Therefore we improve the quality of the fitting procedure.

As a part of the preparation for the BES II program the track fitting procedure is required to be extended to the outer ToF and MTD detectors, where the magnetic field and the TPC gas parameters are not homogeneous. The Kalman filter based track fit was modified to cope with these complicated conditions. It shows correct distributions of track parameter residuals and pulls, and χ^2.

HK 35.3 Mi 14:45 HS 12

Application and improvement of Cellular Automaton track finder in the TPC detector — •Grigory Kozlov[1,2] and Ivan Kisel[1,3] for the CBM-Collaboration — [1]FIAS, Frankfurt am Main, Germany — [2]JINR, Dubna, Russia — [3]GSI, Darmstadt, Germany

Track finding procedure is one of the most important part of event reconstruction in high energy physics experiments. Tracking algorithms combine hits into tracks and reconstruct trajectories of particles flying through the detector. Due to the high combinatorics, they are usually considered as the most time consuming tasks. Calculation speed is critical in heavy ion experiments, especially for online reconstruction. Thus, tracking procedure mast be extremely fast, keeping high efficiency at the same time. The Cellular Automaton (CA) algorithm provides a perfect solution for this task. Because of its properties, it provides required speed, efficiency and can be massively parallelised on the modern many core computing platforms. The CA track finder algorithm was investigated in application to the TPC CA track finder in the STAR experiment within the FAIR Phase 0 as a part of preparation to the Beam Energy Scan II (BES II) program. The initial implementation of the TPC CA algorithm is dominated by the data copying, that complicates an efficient utilisation of the advantages of the SIMD unit. In this work we consider several improvements of the CA algorithm, which allows us to get the maximum benefit from using vectorized calculations. New approaches are compatible and interchangeable with existing CA methods. This allows full use of the SIMD-registers and sufficiently high efficiency at the maximal calculation speed.

HK 35.4 Mi 15:00 HS 12

Application of the 3-Fluid Hydrodynamic Event Generator THESEUS to CBM — •Elena Volkova for the CBM-Collaboration — Tuebingen university, Germany

The Compressed Baryonic Matter experiment (CBM) at FAIR will measure nucleus-nucleus collisions at beam energies up to 11 AGeV for Au. The key objective of CBM is to investigate the QCD phase diagram in the region of the highest net-baryon-densities. The experiment is well suited to explore the Equation-of-State of nuclear matter at densities as they might occur in the interior of neutron stars or during neutron star mergers. Recently, a new event generator, THESEUS, has been developed. It is based on the three-fluid hydrodynamics approach for the early stage of the collision, followed by a particlization at the hydrodynamic decoupling surface to join to a microscopic transport model, i.e., UrQMD. This accounts for hadronic final state interactions. The three-fluid approximation is a minimal way to simulate the finite stopping power at the initial stage of the collision. The model incorporates the evolution of three baryon-rich fluids: a target and projectile fluid, and a fluid describing the hot fiereball of participant matter. The generator allows, e.g., to employ different Equations-of-State for the description of nuclear matter. We plan to investigate the physics performance of the CBM detector by testing the sensitivity of various observables (e.g. flow) to different EoS as THESEUS generator input. The first results of the CBM with THESEUS events will be present.

HK 35.5 Mi 15:15 HS 12

(Non-)equilibrium dynamic critical phenomena — •Dominik Schweitzer[1], Sören Schlichting[2], and Lorenz von Smekal[1] — [1]Justus-Liebig-Universität, Gießen, Germany — [2]Universität Bielefeld, Germany

Uncovering the phase diagram of QCD is one of the main goals of heavy-ion collision experiments. One expects to find a critical point at the end of the chiral transition line at finite temperature and baryon chemical potential. To confirm and locate it, one will have to find signatures of critical behaviour in collision experiments.

Collision experiments inherently are dynamic in nature; therefore, one has to study the dynamics of critical phenomena.

Close to a critical point, different theories show the same universal behaviour. This allows us to gain meaningful insight without looking at full QCD. We use one-component ϕ^4 theory on the lattice and calculate spectral functions from real-time simulations. From those we extract relaxation times and the dynamic critical exponent z.

By introducing a coupling to a heat bath and an explicit symmetry breaking, we can force the system along Trajectories through its phase diagram. This then allows us to numerically study the non-equilibrium critical dynamics of a field theory.

HK 35.6 Mi 15:30 HS 12

Particle Production via Strings and Baryon Stopping in a Hadronic Transport Approach — •Justin Mohs[1,2,3], Sangwook Ryu[1], and Hannah Elfner[1,2,3] — [1]Frankfurt Institute for Advanced Studies, Ruth-Moufang-Strasse 1, 60438 Frankfurt am Main, Germany — [2]Institute for Theoretical Physics, Goethe University, Max-von-Laue-Strasse 1, 60438 Frankfurt am Main, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt, Germany

The changing shape of the rapidity spectrum of net protons over the SPS energy range is still lacking theoretical understanding. A model for string excitation and string fragmentation is implemented in order to describe high energy interactions between hadrons within a hadronic transport approach. Free model parameters are tuned to match experimental data for proton-proton collisions. Using the fixed set of parameters we investigate baryon stopping in heavy ion collisions at SPS energies. The interaction of string fragments is of major importance for describing the stopping of baryons. Varying the influence of different parameters of the particle formation, such as formation time or cross section scaling factors, and comparing to experimental data might contribute to a better understanding of the formation process.