HCBM 2010 - Hot and Cold Baryonic Matter 2010

Sunday 15 August 2010 - Thursday 19 August 2010

Hotel Normafa

Book of Abstracts

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Nonadditive Entropy and Nonextensive Statistical Mechanics - Concepts and Applications

Author: Constantino Tsallis[1]

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The realm of Boltzmann-Gibbs statistical mechanics, based on the standard additive entropy, essentially concerns ergodic systems, Markovian-like processes, linear Fokker-Planck equations, exponential behaviors of relevant physical, geometrical and dynamical quantities, the central limit theorem. What can be done when such simplifying hypothesis are not satisfied? The nonadditive entropy Sq, and its associated nonextensive statistical mechanics, precisely address a wide class of such anomalous situations, namely whenever power-law behaviors replace the
traditional exponential behaviors. A brief review will be given of the central concepts, and various applications will be exhibited, in particular those concerning high energy physics. BIBLIOGRAPHY:
(i) C. Tsallis, Introduction to Nonextensive Statistical Mechanics - Approaching a
Complex World (Springer, New York, 2009); (ii) C. Tsallis, Entropy, in Encyclopedia of Complexity and Systems Science (Springer, Berlin, 2009); (iii) S. Umarov, C. Tsallis, M. Gell-Mann and S. Steinberg, J. Math. Phys. 51, 033502 (2010); (iv) http://tsallis.cat.cbpf.br/biblio.htmhttp://tsallis.cat.cbpf.br/biblio.htm

1

The nuclear liquid-gas phase transition at large N_c

Author: Giorgio Torrieri[1]

Co-author: Jorge Noronha [2]

[1] *JW Goethe Universitat, Frankfurt*

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We examine the nuclear liquid-gas phase transition at large number of colors (N_c) within the framework of the Van Der Waals (VdW) model. We argue that the VdW equation is appropriate at describing inter-nucleon forces , and discuss how each parameter scales with N_c. We demonstrate that N_c=3 is not large with respect to the other dimensionless scale relevant to baryonic matter, the number of neighbours in a dense system. Consequently, we show that the
liquid-gas phase transition looks dramatically different at N_c
-> infinity with respect of our world: The critical point
temperature becomes of the order of L_qcd rather than below it. The critical point density becomes of the order of the baryonic density, rather than an order of magnitude below it. These are precisely the characteristics usually associated with the “Quarkyonic phase”. We therefore argue that at large N_c the nuclear liquid phase coincides with the conjectured quarkyonic phase, although the two are thought to occur at very different scales in our world.

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The Bjorken scaling and nucleon mass modifications in dense Nuclear Matter.

Author: Jacek Rozynek[1]

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Our model calculations performed in the frame of relativistic mean field (RMF) approach shows how important are the modifications of nucleon mass (particularly for those models with stiff Equation o State (EoS)). They allow to explain the EMC effect in saturation and restore the momentum sum rule badly violated by the nuclear parton structure in nuclear medium for finite pressure. The finite pressure corrections emerges from Hugenholtz-van Hove theorem of nuclear matter. The presented analysis of the nuclear distribution function in the Bjorken limit ask to modify the nucleon mass (consistent with deeply inelastic scattering) above the saturation point and to solve modified RMF equations. In the presented work we argue that nucleon structure function above saturation point has the same form as in the saturated nuclear matter. Consequently the decrease on nucleon mass was obtained making the EoS softer. This changes the compressibility K; for example from K=540MeV to 300MeV in Walecka model. Also the modified EoS in this model is close to extensive DBHF calculations with Bonn potential. However our model - an extension of nuclear RMF, has no additional parameters.

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Nonextensive critical effects in relativistic nuclear mean field models

Authors: Grzegorz Wilk[1]; Jacek Rozynek[1]

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The critical phenomena in strongly interaction matter are generally investigated using the mean-field model and are characterized by well defined critical exponents. However, such models provide only average properties of the corresponding order parameters and neglect altogether their possible fluctuations. Also the possible long range effect are neglected in the mean field approach. Here we investigate the critical behavior in the nonextensive version of the Nambu–Jona-Lasinio model (NJL). It allows to account for such effects in a phenomenological way by means of a single parameter q, the nonextensivity parameter. In particular, we show how the nonextensive statistics influence the region of the critical temperature and chemical potential in the NJL mean field approach.

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Meson fluctuations and thermodynamics of the Polyakov loop extended quark-meson model.

Author: Vladimir Skokov[1]

[1] *GSI, Darmstadt, Germany*

Corresponding Author: v.skokov@gsi.de

Thermodynamics and the phase structure of the Polyakov loop-extended two flavor chiral quark-meson model (PQM) are explored. The analysis of the PQM model is based on the functional renormalization group (FRG) method. An appropriate truncation of the effective action with quarks coupled to background gluonic fields is introduced. Within this scheme, we derive the renormalization group flow equation for the scale-dependent thermodynamic potential at finite temperature and density in the presence of a symmetry breaking external field. The influence of fluctuations and of the

background gluon field on the properties of net-quark number density fluctuations and their higher moments is explored. We study the dependence of the kurtosis of quark number fluctuations on the pion mass and show that, in the presence of a symmetry breaking term, the fluctuations lead to a smoothing of observables near the crossover transition.

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Collective flow and mach cones at RHIC

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tba

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Flow-Driven Conical Emission in Ultrarelativistic Heavy-Ion Collisions

Author: Barbara Betz[1]

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We use (3+1)-dimensional hydrodynamic simulations to describe the propagation of a jet through an opaque medium and to investigate the underlying jet-medium interactions. The impact of different energy and momentum loss scenarios, of different jet velocities, and system sizes are analyzed. We will discuss if the particle correlations measured at the Relativistic Heavy Ion Collider (RHIC) which show a conical shape are a clear signal for the creation of a Mach cone. It is demonstrated that radial expansion as well as the use of full hydrodynamics introduces important corrections to the structures seen in the linearized description.

Cold Baryonic Matter - Board: None / **7**

Holography vs. Tomography of the Hot sQGP at RHIC and LHC

Cold Baryonic Matter - Board: None / **8**

Microsecond Universe to Neutron Star - LHC, RHIC onto FAIR

Corresponding Author: bikash@veccal.ernet.in

Cold Baryonic Matter - Board: None / **9**

Towards Quantum Transport for Central Nuclear Reactions

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QCD Green's Functions and Phases of Strongly Interacting Matter

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Critical Point and Orders of Phase Transition - Board: None / **12**

Influence of the Polyakov loop on the chiral phase transition in the two flavor chiral quark model

Facilities and Experiments - Board: None / **13**

The Compressed Baryonic Matter experiment at FAIR

Lattice Models - Board: None / **14**

Cold quark stars from hot lattice QCD

Author: Robert Schulze[1]

Co-author: Burkhard Kämpfer [1]

[1] *Forschungszentrum Dresden-Rossendorf*

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Meson fluctuations and thermodynamics of the Polyakov loop extended quark-meson model.

Board: None / **17**

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Charmonium production from FAIR to LHC energy

Facilities and Experiments - Board: None / **19**

High-pT particle production at RHIC and LHC energies

Facilities and Experiments - Board: None / **20**

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Experiments and Theories - Board: None / **23**

Critical opalescence - an optical signature of the QCD critical point

Experiments and Theories - Board: None / **24**

Study of particle production coming from quark and gluon jets in proton-proton collisions

Experiments and Theories - Board: None / **25**

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Charmonium production and elliptic flow in heavy ion collisions

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Energy and system-size dependence of the chiral magnetic effect

Non-extensive Phenomena - Board: None / **31**

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Non-extensive Phenomena - Board: None / **33**

Hadron production in a parton cascade modell with non-additive energy composition

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Tsallis Distribution in High-energy Heavy Ion Collisions

Non-extensive Phenomena - Board: None / **35**

Nonadditive Entropy and Nonextensive Statistical Mechanics - Concepts and Applications

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Flavoring the Quark-Gluon Plasma with Charm.

Hydro and Transport Models I. - Board: None / **38**

Quark Number Scaling in Fluid Dynamics and Hadronization via Quarkyonic Matter

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Collective flow and mach cones at RHIC

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Hybrid approaches to heavy ion collisions and future perspectives

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Multi-particle interactions within UrQMD

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The temperature of moving bodies - thermodynamics, hydrodynamics and kinetic theory

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Second order dissipative fluid dynamics from kinetic theory

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Lattice gauge theory with fluctuating temperature

Critical Point and Orders of Phase Transition - Board: None / **45**

Transport with unstable particles

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Critical opalescence - an optical signature of the QCD critical point

Author: Tamás Csörgő[1]

[1] *MTA KFKI RMKI and Harvard University*

Corresponding Author: csorgo@physics.harvard.edu

Four possible scenarios are considered for a transition from a quark-gluon matter to hadronic matter, and their corresponding correlation signatures are discussed. Four criteria are highlighted for

a definitive experimental search for a QCD critical point. An old-new experimental measure, the optical opacity (or its inverse the nuclear attenuation length) is determined, in terms of a combination of nuclear suppression factors and a measurement of the relevant fireball length scales. Length scale estimates using either the Hanbury Brown – Twiss radii or that of the initial nuclear geometry for measurements of optical opacity with respect to the reaction plane yield, somewhat surprizingly, nearly the same nuclear attenuation lenght in 0-5 % most central 200 GeV Au+Au collisions, corresponding to 2.9 $\pm$ 0.3 fm. The necessity and the possibility of measuring critical exponents is also discussed in the context of determination of the universality class of the QCD critical point. Critical opalescence is proposed to locate such a critical point on the QCD phase diagram, corresponding to a maximum of optical opacity in heavy ion experiments.
These ideas will be discussed in the context of the current low energy scan program at RHIC and new possibilities at the upcoming FAIR facility.

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Hybrid approaches to heavy ion collisions and future perspectives

Author: Marcus Bleicher[1]

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We discuss recent developments in the area of
hybrid approaches to the simulation of heavy ion reactions
at relativistic energies. Focus will be on the exploration
of different equations of state and potential signature of the
QGP. The talk will also address some open questions for
future developments, like multi-particle interactions and
hadronisation.

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The Compressed Baryonic Matter experiment at FAIR

Author: Johann M. Heuser[1]

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Corresponding Author: j.heuser@gsi.de

The Compressed Baryonic Matter (CBM) experiment [1] is being planned at the international research center FAIR [2], under realization next to the GSI laboratory in Darmstadt, Germany. Its physics programme addresses the QCD phase diagram in the region of highest net baryon densities. Of particular interest are the expected first order phase transition from partonic to hadronic matter, ending in a critical point, and modifications of hadron properties in the dense medium as a signal of chiral symmetry restoration.
Laid out as a fixed-target experiment at the double-ring synchrotrons SIS-100/300, providing magnetic bending power of 100 and 300 T/m, the CBM detector will record both proton-nucleus and nucleus-nucleus collisions at beam energies up to 45A GeV. Hadronic, leptonic and photonic observables have to be measured with large acceptance. The nuclear interaction rates will reach up to 10 MHz to measure extremely rare probes like charm near threshold. Two versions of the experiment are being studied, optimized for either electron-hadron or muon identification, combined with silicon detector based charged-particle tracking and micro-vertex detection. The research programme will start at SIS-100 with ion beams between 2 and 11A GeV, and protons up to energies of 29 GeV

using the HADES detector and an initial configuration of the CBM experiment.
The CBM physics requires the development of novel detector systems, trigger and data acquisition concepts as well as innovative real-time reconstruction techniques. Progress with feasibility studies of the CBM experiment and the development of its detector systems will be discussed.

[1] www-cbm.gsi.de
[2] www.gsi.de/fair/

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Multi-particle interactions within UrQMD

Author: Gerhard Burau[1]

[1] *FIAS*

Corresponding Author: burau@fias.uni-frankfurt.de

A mechanism for locally density-dependent dynamic parton rearrangement and fusion has been implemented into the Ultra-relativistic Quantum Molecular Dynamics (UrQMD) approach. The same mechanism has been previously built in the Quark Gluon String Model (QGSM). This rearrangement and fusion approach based on parton coalescence ideas enables the description of multi-particle interactions, namely 3 -> 3 and 3 -> 2, between (pre-)hadronic states in addition to standard binary interactions. The UrQMD model (v2.3) extended by these additional processes allows to investigate implications of multi-particle interactions on the reaction dynamics of ultra-relativistic heavy-ion collisions. The mechanism, its implementation and first results of this investigation, e.g. implications on the kinetic equilibration and on measurable observables like spectra of final hadrons, will be presented and discussed.

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Absorption of phi mesons in proton-nucleus collisions

Author: Henry Schade[1]

Co-author: Burkhard Kämpfer [1]

[1] *FZD*

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Recent experiments of the ANKE collaboration concerning the phi meson production in pA-reactions p (2.83 GeV) + C, Cu, Ag and Au are appropriate for the absorptive phi-N interaction within the trancparency ratio. With the aim of analyzing the amount of phi absorption we applied our well confirmed transport model of Boltzmann-Ühling-Uhlenbeck (BUU) type on this scenario. The results seem to point to an absorption cross section of 18 \pm 3 mb only when accounting for secundary phi production processes as well as isospin asymmetry and ANKE acceptance conditions.

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Cold quark stars from hot lattice QCD

Author: Robert Schulze[1]

Co-author: Burkhard Kämpfer [1]

[1] *Forschungszentrum Dresden-Rossendorf*

Corresponding Author: r.schulze@fzd.de

Based on a quasiparticle model for \beta stable and electrically neutral deconfined matter we address the possibility of pure quark stars. The model is adjusted to recent hot lattice QCD results for 2+1 flavors with almost physical quark masses. Using stability and binding arguments general statements can be made concerning the existence of such compact stellar objects.

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Influence of the Polyakov loop on the chiral phase transition in the two flavor chiral quark model

Author: Zsolt Szep[1]

Co-author: Gergely Markó [2]

[1] *Statistical and Biological Physics Research Group of the Hungarian Academy of Sciences*

[2] *Department of Atomic Physics, Eötvös University*

Corresponding Author: szepzs@achilles.elte.hu

The chiral quark model consisting of the sigma and pion mesons and the constituent quarks propagating on the constant background of a temporal gauge field is solved at finite temperature and baryon chemical potential. Using an expansion in the number of flavors, both the chiral limit and the case with physical pion mass are studied. The location of the critical end point in the mu-T plane is determined using a tree-level fermion propagator and several approximations to the pion propagator.

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Study of particle production coming from quark and gluon jets in proton-proton collisions

Author: Sona Pochybova[1]

[1] *MTA KFKI RMKI*

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The study of particle production inside jets makes it possible to address the fragmentation properties of the leading parton depending on its flavour. We investigate whether different fragmentation properties of quarks and gluons affect identified particle spectra.\\
We present a systematic study of K, p and π production at RHIC, Tevatron and LHC energies. Through the study of various event shapes we can directly access the fragmentation properties of quark and gluon jets. We present MC estimate for the contribution of quark and gluon jets to individual particle species spectra, that can be compared to experimental results and test our current knowledge of the physics behind particle production inside jets. Where possible, we cross-check our results with existing data and further extend the study to higher energies.

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Second order dissipative fluid dynamics from kinetic theory

Author: Etele Molnar[1]

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We present the derivation of the (second order) equations of relativistic dissipative fluid dynamics from kinetic theory using Grad's moment expansion and discuss its applicability in heavy-ion collisions.

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HBT radii from the UrQMD transport approach at different energies

Author: Gunnar Gräf[1]

Co-author: Marcus Bleicher [2]

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[2] *FIAS, University of Frankfurt*

Corresponding Author: graef@th.physik.uni-frankfurt.de

We use the non-equilibrium transport approach Ultra-relativistic Quantum Molecular Dynamics (UrQMD) [1] to compute the dynamics of heavy ion collisions up to LHC energies. From this model we obtain directly the full phasespace distribution of all particles at the kinetic freeze out. By applying the Correlation After Burner (CRAB) [2] of Scott Pratt we extract the two-particle correlation function in three-dimensions. Using a gaussian parametrization we get the Hanbury-Brown Twiss (HBT) radii from these correlation functions which can be interpreted in terms of the space-time extension [3] of the particle-emitting source. A comparison between the spatial distribution at freeze out and the results from the HBT analysis will be presented. Correlation functions and HBT radii for a broad energy range will be shown.

[1] S. A. Bass et al., Prog. Part. Nucl. Phys. 41 (1998) 225.
[2] S. Pratt, CRAB version 3, http://www.pa.msu.edu/\~{}pratts/
[3] S. Chapman et al., Phys. Rev. Lett. 74 (1995) 4400

Board: None / **56**

The temperature of moving bodies

Hydro and Transport Models II. - Board: None / **57**

HBT radii from the UrQMD transport approach at different energies

Critical Point and Orders of Phase Transition - Board: None / **58**

Absorption of phi mesons in proton-nucleus collisions

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Measurements of hadron production at CMS

Author: Ferenc Siklér[1]

[1] *KFKI Research Institute for Particle and Nuclear Physics*

Corresponding Author: sikler@rmki.kfki.hu

Measurements of hadron production in proton-proton collisions at sqrt(s) = 0.9, 2.36 and 7 TeV, recorded with the CMS detector. To be extended.

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Quark Number Scaling in Fluid Dynamics and Hadronization via Quarkyonic Matter

Author: Laszlo P. Csernai[1]

[1] *University of Bergen*

Corresponding Author: csernai@mail.kfki.hu

The observed Constituent Quark Number Scaling of the flow parameter, v_2, for different mesons and baryons is instinctively a proof for collective flow development in quark gluon plasma. Fluid dynamical models assuming phase and chemical equilibrium during all stages cannot account for the observed scaling, while hybrid models with recombination into hadrons can in a limited p_t-range. However, the scaling with E_t is not obvious to explain in this scenario either. We follow the rapid and simultaneous hadronization of QGP via Quarkyonic matter dynamically, where partons gain weight and the perturbative vacuum field disappear simultaneously. We show that this dynamical process influences influences the flow observables, and scaling studies may provide an insight into the features and dynamics of this intermediate phase between ideal QGP and Hadronic Matter.

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Energy and system-size dependence of the chiral magnetic effect

Author: Viacheslav Toneev[1]

[1] *Dubna, Joint Institute for Nuclear Research*

Corresponding Author: toneev@theor.jinr.ru

The energy dependence of the local CP violation in Au+Au and
Cu+Cu collisions is estimated within a simple phenomenological

model. Predictions for LHC and SPS energies are given. Evolution of the magnetic field in heavy-ion collisions is discussed also.

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Interplay between chiral and deconfinement phase transition

Author: Mei Huang[1]

[1] *IHEP,CAS*

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The interplay between chiral restoration and deconfinement phase transition is discussed. In the Polyakov-loop NJL model, the relation between the two phase transitions is much parameter dependent, the chiral restoration can happen earlier or latter than the deconfinement phase transition, also the two phase transitions can coincide with each other. We use the dressed Polyakov loop as an equivalent order parameter of deconfinement phase transition, and investigate the chiral and deconfinement phase transitions in the NJL model as well as in the framework of DSE, and we find that in the case of first order and second order phase transitions, the chiral phase transition always coincide with deconfinement phase transition, and in the case of crossover, the chiral transition temperature is always smaller than that of the deconfinement. Our result agrees with the lattice result from Wuppetal-Budapest group.

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Hadron production in a parton cascade modell with non-additive energy composition

Author: Karoly Urmossy[1]

[1] *RMKI KFKI, ELTE*

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Identified particle spectra stemming from pp->hX and AA->hX reactions fit well to a cut-power law formula for various collision energies and wide transverse momentum range. This formula can be obtained as the equilibrium distribution of quasi particles having non-additive energy composition. Real nucleus collisions are however non-equilibrium processes. In this talk I discuss hadron production in a parton cascade modell with non-additive energy composition.

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Towards Quantum Transport for Central Nuclear Reactions

Authors: Arnau Rios[1]; Pawel Danielewicz[2]

Co-author: Brent Barker [2]

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[2] *NSCL/Cyclotron Laboratory, Michigan State University*

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Striving to develop a practical approach for nuclear collisions, based on nonequilibrium Green's functions, we start out by considering collisions of slabs in one dimension, within the mean-field approximation of the Green's-function method. In the latter case, the dynamics is self-consistently described in terms of a single-particle density-matrix for the colliding system. We concentrate on two issues of importance for the practical reaction simulations: on limiting the amount of information followed when simulating a reaction and on preparing the initial state for a reaction within the same methodology as for simulations. Regarding the second issue, we demonstrate that the mean-field ground-state may be arrived at by adiabatically switching on the mean-field interactions. We hope to be able to do the same for correlated states. Regarding the first issue above, we show that far off-diagonal elements of the density matrix, in the spatial representation, may be suppressed without affecting the evolution close to diagonal of the matrix. Those far-away elements represent entangled wavefunctions of nucleons emerging from a reaction. The growth in redundancy of information, with the progress of a reaction, appears to be closely tied to the expansion of the system. The only aspect of the system, for which the far-away elements appear to be crucial, is the time-reversal symmetry. Within the Wigner representation, the discarding of far-away elements of the matrix is equivalent to momentum smoothing of the Wigner function for the reaction. The findings bode well for the possibility of carrying out full three-dimensional calculations of collisions within the Green's function approach.

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Holography vs Tomography of the Hot and Cold Baryonic Matter

Author: Miklós Gyulassy[1]

[1] *Columbia University*

Corresponding Author: gyulassy@phys.columbia.edu

The two major competing paradigms for jet-medium interactions at RHIC and LHC
are perturbative pQCD and higher dimensional holographic hQCD.
I discuss why current RHIC data favor hQCD holography to pQCD tomography by a score of 2-to-1 as of today. hQCD does a remarkable robust job correlating bulk flow and heavy quark quenching observables while pQCD does a better job describing light quark tomography. Possible implications for the LHC jet-medium studies expected to start this November at CERN are discussed. Speculations about possible heavy baryon tomography are considered that could have relevance to future FAIR experiments.

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Propagation of vector-meson spectral-functions and dilepton production at SIS18 energies

Author: György Wolf[1]

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The time evolution of vector-meson spectral-functions is studied
within a kinetic theory approach.
We implement this formalism in a BUU type transport model.
Applications focus on ρ and ω mesons being

important pieces for the interpretation of
the di-electron invariant mass spectrum measured by the HADES collaboration for
the reaction C+C at 2 AGeV bombarding energy.
Since the evolution of the spectral functions is driven by the local
density, the in-medium modifications are tiny for small collision systems
within this approach, as the life time of the compressed stage is too short.

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Charmonium production and elliptic flow in heavy ion collisions

Author: Che-Ming Ko[1]

Co-author: Taesoo Song [1]

[1] *Texas A&M University*

Corresponding Author: ko@comp.tamu.edu

Using a two-component model for J/Ψ production, which includes both from initial hard nucleon-nucleon scattering and from regeneration in the produced quark-gluon plasma, we have studied the nuclear modification factor RAA and elliptic flow v2 of J/Ψ in Au+Au collision at sNN1/2=200 GeV. For the expansion dynamics of produced hot dense matter, we have introduced a schematic fireball model with its transverse acceleration determined from the pressure gradient inside the fireball and azimuthally anisotropic expansion parameterized to reproduce measured v2 of light hadrons. We assume that light hadrons freeze out at the temperature of 120 MeV while J/Ψ at 160 MeV, similar to, respectively, the kinetic and chemical freeze-out temperatures in the statistical model. For the properties of J/Ψ in the quark-gluon plasma, we use the perturbative QCD (pQCD) to calculate the screening mass between their charm quarks in the leading order and their dissociation cross sections up to the next-to-leading order. For the relaxation time of charm quarks in the quark-gluon plasma, it is also calculated in the leading order of pQCD. Modeling the effect of higher-order corrections in pQCD by introducing multiplicative constants to the dissociation cross section of J/Ψ and the elastic cross section of charm quarks, we find that their effects are small on the RAA of J/Ψ as they suppress the number of initially produced J/Ψ but enhance the number of regenerated ones. The higher-order corrections increase, however, the v2 of J/Ψ. Our results suggest that studying the v2 of J/Ψ provides the possibility to discriminate between the two J/Ψ production mechanisms from initial hard scatterings and from regeneration in the quark-gluon plasma.

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Lattice gauge theory with fluctuating temperature

Author: Zsolt Schram[1]

Co-author: Tamás Biró [2]

[1] *University of Debrecen*

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We study the possibility to implement the canonical Tsallis distribution for lattice field theory simulations. Formally, the application of the Tsallis distribution can be interpreted as introducing a fluctuating temperature. We give arguments for the approach and present our simulation method as well as our first numerical results in determining the equation of state for pure SU(2) lattice gauge fields.

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QCD Green's Functions and Phases of Strongly Interacting Matter

Author: Reinhard Alkofer[1]

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The knowledge of Landau gauge QCD Green's functions at zero temperature and density as well as their relation to confinement, dynamical chiral symmetry breaking, and the axial anomaly are briefly reviewed. The application of functional methods to the QCD phase transitions is discussed, and resulting properties of some phases are presented.

Critical Point and Orders of Phase Transition - Board: None / **70**

Zero temperature properties of mesons in a vector meson extended linear sigma model

Board: None / **71**

Closing Remarks

Board: None / **72**

Opening

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Zero temperature properties of mesons in a vector meson extended linear sigma model

Author: Péter Kovács[1]

Co-author: Gyuri Wolf [1]

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TBA

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Facets of the QCD Phase Diagram

Author: Volker Koch[1]

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I will discuss various aspects of the QCD phase diagram and how they can be explored in actual experiments.

Critical Point and Orders of Phase Transition - Board: None / **75**

Significant in-medium η' mass reduction in sqrt{s_NN}=200 GeV Au+Au collisions

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Recent theoretical developments in the QCD phase diagram

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Microsecond Universe to Neutron Star - LHC, RHIC onto FAIR

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The universe, microseconds after the Big Bang consisted of Quarks, Gluons, leptons and photons. Possible remnants from that epoch can be MACHO type of dark objects about the size of the Jupiter. One partial source of dark energy could be the orphan quarks left over from that epoch. In a typical phase diagram early universe corresponds to low baryon density but very high temperature.

Neutron Stars on the other hand correspond to very high baryon density but low temperature. Recent work indicates a rich variety of layers of exotic matter with the serious possibility of quark matter in the core. LHC, RHIC & FAIR - What can we learn?

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Significant in-medium η' mass reduction in sqrt{s_NN}=200 GeV Au+Au collisions

Authors: Janos Sziklai[1]; Robert Vertesi[1]; Tamas Csorgo[2]

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PHENIX and STAR data on the intercept parameter of the two-pion Bose-Einstein correlation functions in $\sqrt{s_{NN}} = 200$ GeV Au+Au collisions
are analyzed in terms of six different models of hadronic multiplicities.
To describe this combined PHENIX and STAR dataset, an in-medium η' mass reduction of at least 200 MeV is needed, at the 99.9 \% confidence level, in the considered model class.
The best description is achieved with an η' mass that is reduced from the 958 MeV vacuum value to an in-medium value of
$m^*_{etap} = 340^{+50}_{-60}$(statistics) $^{+280}_{-140}$ (model) ± 42 (systematics) MeV. The system size, energy and centrality dependence of this η' mass reduction is also investigated and estimate is given on its extent.

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Dynamical equilibration of the strongly interacting parton-hadron matter

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Tsallis Distribution in High-energy Heavy Ion Collisions

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Non-extensive thermodynamics is a novel approach to fields in high energy physics. The low and intermediate transverse momentum spectra are extremely well reproduced by the Tsallis-Pareto distribution however, the physical origin of the Tsallis parameter is still an unsettled question. Understanding hadronization processes in heavy-ion collisions requires more detailed tests, especially at high transverse momenta, where we are far from the thermal equilibrium state. In my talk I focus on parton fragmentation processes at the final state, I analyze whether the power-law-tailed fragmentation functions do overlap with Tsallis-Pareto energy distribution, reproducing experimental data.

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Search for the Critical Point at RHIC

Author: Roy Lacey[None]

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Transport with unstable particles

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The small value of the shear viscosity to entropy density ratio suggests a strongly interacting quark matter where the elementary excitations are far from being small-width quasiparticles. In this talk I suggest an approach how the transport coefficients can be calculated in systems with broad spectral functions. It will be shown that the transport coefficients are naturally small, and, in particular, the lower bound for eta/s is recalculated in this approach.

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Spectra of weakly decaying identified particles at 0.9 and 7 TeV with the CMS detector

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Underlying events in p+p collisions at LHC energies

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The temperature of moving bodies - thermodynamics, hydrodynamics and kinetic theory

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In the presentation the concept of temperature in relativistic thermodynamics is shortly surveyed and argued that the historical paradoxes are connected to the stability and causality issues of relativistic hydrodynamic theories. It is shown that a choice of "flow frames" (e.g. Eckart or Landau-Lifshitz), that is the definition of the velocity field, can partially hide the problematic aspects but eventually may lead to numerical instabilities.

Poster Section - Board: None / **88**

VHMPID: a new detector for the ALICE experiment at LHC

Poster Section - Board: None / **89**

Inverstigation of shear stress and shear flow within a partonic transport model