Excited QCD 2012

Report of Contributions

https://indico.cern.ch/e/eQCD2012

Contribution ID: **0** Type: **not specified**

Transition From Ideal To Viscous Mach Cones In A Kinetic Transport Approach

Thursday, 10 May 2012 18:30 (30 minutes)

Using a microscopic transport model we investigate the evolution of conical structures originating from the supersonic projectile moving through the hot matter of ultrarelativistic particles. Using different scenarios for the interaction between projectile and matter, and different transport properties of the matter, we study the formation and structure of Mach cones. Especially, a dependence of the Mach cone angle on the details and rate of the energy deposition from projectile to the matter is investigated. Furthermore, the two-particle correlations extracted from the numerical calculations are compared to an analytical approximation. We find that the propagation of a high energetic particle through the matter does not lead to the appearance of a double peak structure as observed in the ultrarelativistic heavy-ion collision experiments. The reason is the strongly forward-peaked energy and momentum deposition in the head shock region. In addition, by adjusting the cross section we investigate the influence of the viscosity to the structure of Mach cones. A clear and unavoidable smearing of the profile depending on a finite ratio of shear viscosity to entropy density is clearly visible.

Primary author: BOURAS, Ioannis (University of Frankfurt a.M.)

Co-authors: EL, Andrej (University of Frankfurt); GREINER, Carsten (University of Frankfurt); NIEMI, Harri (Frankfurt Institute for Advanced Studies); FOCHLER, Oliver (Goethe-Universität Frankfurt); XU, Zhe

Presenter: BOURAS, Ioannis (University of Frankfurt a.M.)

Contribution ID: **2** Type: **not specified**

Model Investigation of QCD thermodynamics and phase diagram

Tuesday, 8 May 2012 09:30 (30 minutes)

We consider the $(2+1)$ flavor Polyakov Quark Meson Model (PQM) and study the effect of including fermion vacuum fluctuations on the thermodynamics and phase diagram. The variation of the thermodynamic quantities across the phase transition region becomes smoother.
This results in better agreement with the lattice QCD (LQCD) data. The critical end point is pushed into higher values of the chemical potential. We then go on to study the fluctuations (correlations) of conserved charges in PQM upto sixth (fourth) order. Comparison is made with LQCD wherever available and overall good qualitative agreement is found, more so for the case of the normalised susceptibilities. Our study provides a solid basis for the use of PQM as an effective model to understand the topology of the QCD phase diagram.

Primary author: Mr CHATTERJEE, Sandeep (PhD student)

Co-author: Mr MOHAN, Kirtimaan A. (PhD student)

Presenter: Mr CHATTERJEE, Sandeep (PhD student)

Contribution ID: **3** Type: **not specified**

Effects of the low lying Dirac modes on excited hadrons in lattice QCD

Monday, 7 May 2012 11:30 (30 minutes)

Chiral symmetry breaking in Quantum Chromodynamics is associated with the low lying spectral modes of the Dirac operator according to the Banks-Casher relation. Here we study how removal of a variable number of low lying modes from the valence quark sector affects the masses of the first excited states of baryons and mesons in two flavor lattice QCD.

Primary authors: Prof. LANG, Christian B. (Universitaet Graz); Dr GLOZMAN, Leonid (Universitaet Graz); Mr SCHROECK, Mario (Universitaet Graz)

Presenter: Mr SCHROECK, Mario (Universitaet Graz)

Contribution ID: **5** Type: **not specified**

Study of nucleon spin structure by the Drell-Yan process in the COMPASS experiment

Friday, 11 May 2012 10:00 (30 minutes)

The Parton Distribution Functions (PDFs) and the spin structure of the nucleon are important topics studied by COMPASS in Semi-Inclusive Deep Inelastic Scattering. The Drell-Yan process is a complementary way to access the Transverse Momentum Dependent PDFs (TMD PDFs), using a transversely polarized target.

Studying the angular distributions of dimuons from the Drell-Yan reactions in the scattering of a negative pion beam with 190 GeV/c negative pions beam momentum off a transversely polarized proton target we are able to extract the azimuthal spin asymmetries and to access to the various TMD PDFs, like Sivers and Boer-Mulders functions. The start of the COMPASS DY experiment is scheduled for 2014. An important beam test has been already performed in 2009, using a hadron absorber prototype downstream of the target and a high intensity beam, to understand the absorber background reduction factors and the spectrometer response, and also to verify our results from Monte-Carlo simulations.

COMPASS aims at performing the first DY experiment with a transversely polarized target.

Primary author: Ms QUARESMA, Márcia (LIP-Lisbon)

Co-authors: Dr QUINTANS, Catarina (LIP-Lisbon); Mr TERÇA, Gonçalo (LIP-Lisbon); Prof. BORDALO, Paula (LIP/IST); Prof. RAMOS, Sérgio (LIP/IST)

Presenter: Ms QUARESMA, Márcia (LIP-Lisbon)

Contribution ID: **6** Type: **not specified**

Latest QCD results from the PHENIX Experiment

Thursday, 10 May 2012 09:00 (30 minutes)

The PHENIX experiment has produced an extensive array of measurements in heavy ion collisions in order to study the created strongly interacting medium. This medium is seen to modify the properties of many global and high-momentum observables; a strong suppression relative to that expected from p+p collisions is observed. The medium forms after the initial hard-scattering of partons, which they then traverse prior to fragmentation. A comparison of the final measured jet (a stream of particles with large transverse momenta in a localized region of phase space) in heavy ion and p+p collisions represents the energy loss of the partons within the medium. In order to systematically study this effect, PHENIX uses a suite of methods: full jet reconstruction, single-particle spectra, and correlations, all measured in different collision systems. In this talk, I will present our latest QCD results, focusing on inclusive jet production and two-particle correlations in heavy ion collisions.

Primary author: Dr IORDANOVA, Aneta (University of California, Riverside)

Presenter: Dr IORDANOVA, Aneta (University of California, Riverside)

Contribution ID: **7** Type: **not specified**

The lattice Landau gauge gluon propagator at zero and finite temperature

Tuesday, 8 May 2012 10:00 (30 minutes)

We study the Landau gauge gluon propagator at zero and finite temperature using lattice simulations. Particular attention is given to the finite size effects and to the infrared behaviour. Furthermore, the modeling of the lattice data is discussed.

Primary authors: Dr OLIVEIRA, Orlando (Centro de Física Computacional, Univ. Coimbra); SILVA, Paulo (U)

Presenter: SILVA, Paulo (U)

Contribution ID: **8** Type: **not specified**

The QCD Critical End Point in the Context of the Polyakov–Nambu–Jona-Lasinio Model

Wednesday, 9 May 2012 09:00 (30 minutes)

We investigate the phase diagram of the so-called Polyakov–Nambu–Jona-Lasinio model at finite temperature and nonzero chemical potential. The calculations are performed in the framework of the PNJL Lagrangian in the light and strange quark sector (u,d,s) which includes the ʻt Hooft instanton induced interaction term that breaks the axial symmetry, and the quarks are coupled to the (spatially constant) temporal background gauge field. Analysing the relevant order-like parameters, possible interrelations between chiral symmetry restoration and deconfinement are discussed.
A special attention is given to the critical end point (CEP): the influence of the strangeness on the location of the CEP is studied; also the strength of the flavor-mixing interaction alters the CEP location, once when it becomes weaker the CEP moves to low temperatures and can even disappear.
On the other hand we also explore the connection between QCD, a nonlocal Nambu–Jona-Lasinio type model and the Landau gauge gluon propagator. Possible links between the quenched gluon propagator and low energy hadronic phenomenology are investigated.

References:
P. Costa, C. A. de Sousa, M. C. Ruivo, H. Hansen, Europhys. Lett.86 (2009) 31001;
P. Costa, M. C. Ruivo, C. A. de Sousa, H. Hansen, Symmetry 2 (2010) 1338.
P. Costa, O. Oliveira, P.J. Silva, Physics Letters B 695 (2011).

Primary author: COSTA, Pedro (Physics Department of the University of Coimbra)

Presenter: COSTA, Pedro (Physics Department of the University of Coimbra)

Contribution ID: **9** Type: **not specified**

Hadron formation in the deconfined matter at RHIC and LHC

Thursday, 10 May 2012 17:00 (30 minutes)

Recent work on in-medium hadronization in the non-equilibrated fragmentation process has been followed up by studies on bound state formation in the equilibrated deconfined matter as described by lattice QCD. Through the comparison to PNJL model calculations we find evidence for an extended phase of mixed degrees of freedom. The extracted hadron formation probability exhibits flavor and baryon number dependencies which are experimentally verifiable. We confront the calculations with measurements from RHIC and LHC.

Primary author: BELLWIED, Rene (University of Houston (US))

Presenter: BELLWIED, Rene (University of Houston (US))

Contribution ID: **10** Type: **not specified**

The phase diagram of effective theories for the QCD center degrees of freedom

Tuesday, 8 May 2012 09:00 (30 minutes)

We study effective theories for QCD at non-zero temperature and finite chemical potential, using local Polyakov loops as the degrees of freedom. The sign problem is solved by exactly mapping the partition sum to a sum over flux variables with only real and positive weights, and the theory is then accessible to Monte Carlo Techniques. We determine the phase diagram as a function of the temperature and the chemical potential.

Primary author: DELGADO MERCADO, Ydalia (Karl-Franzens University)

Presenter: DELGADO MERCADO, Ydalia (Karl-Franzens University)

Contribution ID: **11** Type: **not specified**

Review of STAR Heavy Ion results

Thursday, 10 May 2012 09:30 (30 minutes)

We present some highlights of recent results from STAR experiment at RHIC. Selected topics from results on heavy quarkonia production, collectivity and their energy and system dependence are presented from the experiments heavy ion program.

Primary author: KABANA, Sonia

Co-author: AND THE STAR COLLABORATION, . (STAR)

Presenter: KABANA, Sonia

Contribution ID: **12** Type: **not specified**

The PANDA experiment at FAIR

Friday, 11 May 2012 19:00 (30 minutes)

The PANDA experiment is one of the major projects at the upcoming Facility for Antiproton and Ion Research (FAIR) facility in Darmstadt, Germany. It will study interactions between antiprotons and protons or nuclei in the momentum range of 1.5 GeV/c to 15 GeV/c with a 4pi state-of-the-art detector. The purpose of the experiment is to learn about fundamental aspects of the strong interaction in the transition region between perturbative QCD and nuclear phenomena. PANDA will cover a broad physics program ranging from hadron spectroscopy and structure, hadron properties in nuclei to hypernuclei.

An overview of the physics topics of PANDA will be given together with a presentation of the detector and the FAIR antiproton facility.

Primary author: JOHANSSON, Tord (Uppsala University)

Presenter: JOHANSSON, Tord (Uppsala University)

Contribution ID: **13** Type: **not specified**

Meson spectroscopy: too much excitement and too few excitations

Monday, 7 May 2012 17:00 (30 minutes)

Contrary to widespread belief, there are not too many observed mesonic resonances to be accounted for by normal quark-antiquark states, which is the usually invoked argument to justify the introduction of (crypto)exotic configurations. The reasons why newly detected mesonic enhancements often seem to be incompatible with $q\bar{q}$ states can be manifold:

(i) the underlying confining potential may be different from what is generally taken for granted;
(ii) mass shifts due to unitarisation (or "unquenching") are mostly neglected;
(iii) unitarisation sometimes even yields extra, dynamically generated resonances, which nevertheless have a $q\bar{q}$ source;
(iv) the opening of strong decay thresholds generally distorts the line shapes of nearby resonances, or can even by themselves give rise to enhancements that look like resonances;
(v) large inelasticity effects between observed OZI-forbidden decays and non-observed OZI-allowed ones can lead to signal depletion at true resonances and/or thresholds, resulting in non-resonant apparent enhancements in between.

In this talk, an assessment will be made of the status of meson spectroscopy in the light of the above mechanisms, with several concrete examples of light and heavy-light mesons as well as charmonium and bottomonium states. Some candidates for exotic mesons will be critically discussed.

Primary author: RUPP, George (IST)

Co-authors: Prof. VAN BEVEREN, Eef (Physics Department, University of Coimbra, Portugal); COITO, Susana (IST-Lisbon)

Presenter: RUPP, George (IST)

Contribution ID: **15** Type: **not specified**

Is the X(3872) a molecule?

Monday, 7 May 2012 17:30 (30 minutes)

Recently, we have successfully described [1] the controversial X(3872) charmonium resonance as a normal axial-vector ($J^{PC} = 1^{++}$) $c\bar{c}$ state, but non-perturbatively unitarised and mass-shifted owing to several OZI-allowed and OZI-suppressed decay channels. Nevertheless, many authors still consider the X(3872) a meson-meson molecule, due to its very close proximity to the $D^0 D^{*0}$ threshold. It is argued [2] that, because of this closeness, the X(3872) will have a molecular-type wave function, with a strongly dominant $D^0 D^{*0}$ component, irrespective of the mechanism creating the state.

In this talk, I shall present results from a simplified study of this issue, employing a two-channel model, i.e., one channel for the confined axial-vector $c\bar{c}$ state and another for the dominant S-wave $D^0 D^{*0}$ decay component. Harmonic-oscillator wave functions will be used for the confinement part and a delta-shell potential for transitions between the $c\bar{c}$ and $D^0 D^{*0}$ channels, thus mimicking string breaking that gives rise to $^3P_0$ quark-pair creation. Probabilities of the two wave-function components will be computed as in Ref. [3], for different bound-state pole positions approaching the $D^0 D^{*0}$ threshold from below.

[1] Susana Coito, George Rupp, and Eef van Beveren, Eur. Phys. J. C 71 (2011) 1762 [arXiv:1008.5100 [hep-ph]].

[2] Eric Braaten and Meng Lu, Phys. Rev. D 76 (2007) 094028 [arXiv:0709.2697 [hep-ph]].

[3] E. van Beveren, C. Dullemond, and T.A. Rijken, Z. Phys. C 19 (1983) 275.

Primary author: COITO, Susana (IST-Lisbon)

Co-authors: Prof. VAN BEVEREN, Eef (CFC-Universidade de Coimbra); RUPP, George (IST)

Presenter: COITO, Susana (IST-Lisbon)

Contribution ID: **16** Type: **not specified**

Thermodynamics of the O(N) model in 1+1 dimensions: Analytical study versus lattice simulations

Tuesday, 8 May 2012 11:00 (30 minutes)

The thermodynamics of the O(N) model in 1+1 dimensions is studied applying the auxiliary field method. In order to compute the thermodynamical quantities we apply the CJT formalism within the Hartree-Fock approximation extended by sunset diagrams. The numerical results for the renormalized mass of the scalar particles, the pressure, the trace anomaly and the energy density are presented and compared with fully nonperturbative results coming from finite-temperature lattice simulation of the model. We find that when including the sunset type diagrams into the computation of the effective potential there is a very good correspondence between the numerical results of the CJT formalism and the lattice study. At asymptotically high temperatures the pressure approaches the Stefan Boltzmann limit of a gas of N-1 free massless particles, which is a direct consequence of the nonlinear constraint.

Primary author: Mrs SEEL, Elina (ITP Frankfurt University)

Co-authors: Dr GIACOSA, Francesco (ITP University Frankfurt); Dr LOTTINI, Stefano (ITP Frankfurt University)

Presenter: Mrs SEEL, Elina (ITP Frankfurt University)

Contribution ID: **17** Type: **not specified**

Phenomenology of Dilaton in a Chiral Linear Sigma Model with Vector Mesons

Tuesday, 8 May 2012 18:30 (30 minutes)

We present a two-flavour linear sigma model with global chiral symmetry and (axial-)vector mesons as well as an additional glueball degree of freedom. We study the structure of the well-established scalar resonances f0(1370) and f0(1500): by a fit to experimentally known decay widths we find that f0(1370) is predominantly a quark-antiquark state and f0(1500) is predominantly a glueball state. The overall phenomenology of these two resonances can be well described. Other assignments for our mixed quarkonium-glueball states are also tested, but turn out to be in worse agreement with the phenomenology. As a by-product of our analysis, the gluon condensate is determined.

Primary author: Mr JANOWSKI, Stanislaus (Institute for Theoretical Physics, J. W. Goethe University)

Co-authors: Prof. RISCHKE, Dirk H. (Institute for Theoretical Physics, J. W. Goethe University); Dr GIACOSA, Francesco (Institute for Theoretical Physics, J. W. Goethe University)

Presenter: Mr JANOWSKI, Stanislaus (Institute for Theoretical Physics, J. W. Goethe University)

Contribution ID: **18** Type: **not specified**

Scalar and Axial-Vector Mesons in a Three-Flavour Sigma Model

Wednesday, 9 May 2012 11:30 (30 minutes)

Scalar mesons have been one of the most hotly debated issues of
low-energy QCD for decades. Experimental data show the existence of six scalar isosinglet states in the region below 1 GeV – next to the famous sigma meson, there are five states with the same quantum numbers but higher energies than the energy of the sigma. If we consider u and d quarks as degenerate and work in a theoretical framework that also includes strange states, then we can construct two isoscalar \bar q - q states. Thus constructed isoscalars can, of course, describe at most two out of the mentioned six experimentally known states - but the question is: Which two? We present an Nf=3 linear sigma model with (pseudo)scalar and (axial-)vector mesons that allows us to pursue an answer to this question. We find the isoscalar states above 1 GeV – f0(1370) and f0(1710) – to be strongly favoured as quarkonia rather than f0(600) and f0(980).

Primary author: Mr PARGANLIJA, Denis (TU Vienna, ITP)

Co-authors: Prof. RISCHKE, Dirk H. (Frankfurt University, ITP); Dr GIACOSA, Francesco (Frankfurt University, ITP); Dr WOLF, Gyorgy (Research Institute for Particle and Nuclear Physics, Budapest); Dr KOVACS, Peter (Research Institute for Particle and Nuclear Physics, Budapest)

Presenter: Mr PARGANLIJA, Denis (TU Vienna, ITP)

Contribution ID: **19** Type: **not specified**

Detailed study of the quark-antiquark flux tubes

Thursday, 10 May 2012 19:00 (30 minutes)

In this work we compute the color fields in the mediator plane between a static quark and a static antiquark using quenched lattice QCD.
In special, we see the effect of the quark-antiquark distance on this fields. To obtain this results an improved multihit technique is developed
and an extend smearing technique is used. The results for the fields are fitted with different models and in particular the roughening of the
flux tube is observed. By using a variational method in the smearing, the color fields for the excited flux tubes are also calculated and presented.

Primary author: CARDOSO, Marco (Instituto Superior Técnico)

Co-authors: CARDOSO, Nuno (IST); BICUDO, Pedro (IST Lisboa)

Presenter: CARDOSO, Marco (Instituto Superior Técnico)

Contribution ID: **20** Type: **not specified**

The phase diagram in T-mu-Nc space

Wednesday, 9 May 2012 09:30 (30 minutes)

We examine the phase diagram of hadronic matter when the number of colours Nc, as well as temperature and density, are varied. We show that in this regime a new percolation phase transition is possible, and examine the implications of this transition for extrapolations to physical QCD of the large-Nc limit.

Primary author: LOTTINI, Stefano (Goethe Universitaet, Frankfurt am Main)

Co-author: TORRIERI, Giorgio (JW Goethe Universitat, Frankfurt)

Presenter: LOTTINI, Stefano (Goethe Universitaet, Frankfurt am Main)

Contribution ID: **21** Type: **not specified**

Phase diagram of the SU(3) flavor NJL with eight quark interactions

Friday, 11 May 2012 11:00 (30 minutes)

The topic I would like to present is the effect of chiral multiquark interactions (with emphasis on the new eight quark terms) on the temperature versus baryonic chemical potential phase diagram of this extended Nambu Jona Lasinio model of QCD. The talk is mainly based on the works:

The Phase diagram for the Nambu-Jona-Lasinio model with ‘t Hooft and eight-quark interactions.
B. Hiller, J. Moreira, A.A. Osipov, A.H.
Phys.Rev. D81 (2010) 116005

and

Polyakov-NJL model with eight quark interactions.
A.H. Blin, J. Moreira, A.A. Osipov, B. Hiller (Coimbra U.). arXiv:1110.3663. Oct 2011. 3 pp.
e-Print: arXiv:1110.3663 [hep-ph], to appear in the proceedings ISMD 2011.

Primary author: Prof. HILLER, Brigitte (Departamento de Física, Faculdade de Ciências e Tecnologia, Universidade de Coimbra, P-3004-516 Coimbra, Portugal)

Co-authors: Prof. BLIN, Alex H. (Departamento de Física, Faculdade de Ciência e Tecnologia, Universiade de Coimbra, P-3004-516 Coimbra, Portugal); Dr OSIPOV, Alexander A. (Departamento de Física, Faculdade de Ciências e Tecnologia, Universidade de Coimbra, P-3004-516 Coimbra, Portugal); Dr MOREIRA, João (Departamento de Física, Faculdade de Ciências e Tecnologia, Universidade de Coimbra, P-3004-516 Coimbra, Portugal)

Presenter: Prof. HILLER, Brigitte (Departamento de Física, Faculdade de Ciências e Tecnologia, Universidade de Coimbra, P-3004-516 Coimbra, Portugal)

Contribution ID: **22** Type: **not specified**

Correlations and fluctuations from lattice QCD: Wuppertal-Budapest results

Thursday, 10 May 2012 10:00 (30 minutes)

We present the new results of the Wuppertal-Budapest lattice QCD collaboration on flavor diagonal and non-diagonal quark number susceptibilities with 2+1 staggered quark flavors, in a temperature regime between 120 and 400 MeV. A Symanzik improved gauge and a stout-link improved staggered fermion action is utilized; the light and strange quark masses are set to their physical values. Lattices with N_t=6,8,10,12,16 are used. We perform a continuum extrapolation of all observables under study. Preliminary results for charm quark susceptibilities are also presented, with the charm quark treated at the partially quenched level.

Primary author: RATTI, Claudia

Co-authors: Dr SZABO, Kalman (Wuppertal University); KATZ, Sandor; Dr KRIEG, Stefan (Wuppertal University); Dr BORSANYI, Szabolcs (Wuppertal University); FODOR, Zoltan (BUW)

Presenter: RATTI, Claudia

Contribution ID: **24** Type: **not specified**

Gluon mass through massless bound states excitations.

Wednesday, 9 May 2012 10:00 (30 minutes)

Recent large-volume lattice simulations have established that, in the Landau gauge, the gluon propagator is infrared-finite.
The most natural way to explain this observed finiteness is the generation of a nonperturbative, momentum-dependent gluon mass.
Such a mass may be generated without compromising the gauge-invariance of the fundamental QCD Lagrangian
by employing the famous Schwinger mechanism in d=4. The main assumption underlying this mechanism
is that the interaction vertices of the theory contain masslesss poles, originating from the dynamical formation of
massless bound-state excitations. In this work we demonstrate that this key assumption is indeed realized
by the QCD dynamics. Specifically, the corresponding Bethe-Salpeter equation describing the aforementioned massless excitations is solved under certain approximations,
and non-trivial solutions are obtained.

Primary author: IBÁÑEZ GIL DE RAMALES, David (University of Valencia)

Presenter: IBÁÑEZ GIL DE RAMALES, David (University of Valencia)

Contribution ID: **27** Type: **not specified**

NLO corrections for large multiplicity processes

Monday, 7 May 2012 18:30 (30 minutes)

Recent progress in the calculation of Next-To-Leading order observables in perturbative QCD are presented, with a focus on results from so-called unitarity techniques for high multiplicity processes.

Primary author: MAITRE, Daniel (CERN)

Presenter: MAITRE, Daniel (CERN)

Contribution ID: **28** Type: **not specified**

Quark confinement in the heavy mass limit

Friday, 11 May 2012 11:30 (30 minutes)

In this talk we consider the heavy quark limit of nonperturbative Coulomb gauge QCD. In this framework, we demonstrate, under truncation, a direct connection between the Yang-Mills sector of the theory (the temporal component of the gluon propagator) and the quark confining potential. We further show that only color singlet quark-antiquark (meson) and three-quark (baryon) bound states are physically allowed, and discuss the implications for phenomenological studies of hadrons.

Primary author: POPOVICI, Carina

Presenter: POPOVICI, Carina

Contribution ID: **31** Type: **not specified**

Transport Coefficients of the Quark-Gluon Plasma: From Weak to Strong Coupling

Friday, 11 May 2012 17:00 (30 minutes)

The knowledge of transport coefficients of the Quark-Gluon Plasma (QGP) gives fundamental insights into the nature of strongly interacting matter under extreme conditions. By means of relativistic heavy-ion collisions, these properties are intended to be experimentally revealed, providing also information about the structure of the produced hot matter. One of the remarkable findings is that the QGP created in experiments at RHIC and LHC is an almost ideal fluid obeying, apart from ultra-cold fermionic systems near unitarity, the smallest shear viscosity to entropy density ratio observed in nature.

By means of a quasi-particle model for QCD thermodynamics, which is related to QCD via the two-loop phi-functional formalism, featuring dynamically generated self-energies of the excitation modes and being extended to non-equilibrium systems self-consistently within an effective kinetic theory approach, the temperature dependence of shear and bulk viscosity coefficients of the QGP is investigated [1]. Showing the parametric dependencies on coupling and temperature known from perturbative QCD at large temperatures, their extrapolation into the non-perturbative regime near the deconfinement transition temperature exhibits fairly nice agreement with available lattice QCD results for the pure gluon plasma. Moreover, the ratio of bulk to shear viscosity depicts at large temperatures the quadratic dependence on the conformality measure known from perturbative QCD, while in the vicinity of the deconfinement transition a linear behaviour as known from specific strongly coupled theories based on the gauge/string duality is found [2]. Via weak coupling arguments, an interrelation between the specific shear viscosity and the energy loss parameter can be derived [3]. The transport coefficient determined in this way exhibits a pronounced temperature dependence, which serves as a possible explanation for the observed centrality dependence of the azimuthal anisotropic flow.

[1] M. Bluhm, B. Kampfer, K. Redlich, Phys. Rev. C 84 (2011) 025201
[2] M. Bluhm, B. Kampfer, K. Redlich, Phys. Lett. B 709 (2012) 77
[3] A. Majumder, B. Muller, X.-N. Wang, Phys. Rev. Lett. 99 (2007) 192301

Primary author: Dr BLUHM, Marcus (Laboratoire SUBATECH)

Co-authors: Prof. KAMPFER, Burkhard (Helmholtzzentrum Dresden-Rossendorf); Prof. REDLICH, Krzysztof (University of Wroclaw); Dr NAHRGANG, Marlene (Laboratoire SUBATECH)

Presenter: Dr BLUHM, Marcus (Laboratoire SUBATECH)

Contribution ID: **32** Type: **not specified**

The QCD phase transition in nonequilibrium chiral fluid dynamics

Friday, 11 May 2012 17:30 (30 minutes)

In thermodynamics system the correlation length of fluctuations of the order parameter diverges at a critical point. This is the basis of expecting large event-by-event fluctuations for heavy-ion collisions that reach in the critical region. Heavy-ion collisions are however very small and dynamic systems, which at most reach local thermal equilibrium. The effect of critical slowing down is further expected to limit the size of the fluctuations.
We present a fully dynamic nonequilibrium model of the evolution of the fluctuations of the order parameter of chiral symmetry, the sigma field. It is propagated by a Langevin equation and couples to an expanding fluid of quarks and antiquarks. The entire system evolves under energy- and momentum conservation.
Nonequilibrium effects, like supercooling and reheating, are observed.
At a critical point the dynamic correlation length grows. As a consequence we find an enhancement of event-by-event fluctuations for a scenario with a critical point compared to a first order phase transition.

Primary author: Dr NAHRGANG, Marlene (SUBATECH, Nantes & FIAS, Frankfurt)

Presenter: Dr NAHRGANG, Marlene (SUBATECH, Nantes & FIAS, Frankfurt)

Contribution ID: **33** Type: **not specified**

CuBA

Monday, 7 May 2012 19:00 (30 minutes)

The interaction of particles is one of the fundamental questions in Physics. We decided to study the interaction between a gluon gas produced at the onset of 'Heavy Ion Collisions', and forming pions and other hadrons. To do so, we develop a code for Graphics Processing Units, using CUDA as program language, based on the CPU code 'Boltzmann Approach for Many Parton Scattering (BAMPS)'developed in Frankfurt. Therefore we denominated our code as CuBA. To get a good compromise between computational runtime and physical accuracy, we used the application of microscopic theories together with strong assumptions like neglecting quantum mechanical effects. Furthermore, we benchmark our code with the Riemann Problem, studying the propagation of shock waves in the gluon plasma. The resulting data can be used to confirm the CPU code and improve the study of shocking particles.

Primary authors: BOURAS, Ioannis (University of Frankfurt a.M.); CARDOSO, Nuno (IST); BICUDO, Pedro (IST Lisboa); EILHAUER, Ulrike (I)

Presenter: EILHAUER, Ulrike (I)

Contribution ID: **34** Type: **not specified**

FAIR: exploring the nature of matter and its evolution

Friday, 11 May 2012 18:30 (30 minutes)

The new international accelerator facility FAIR under construction in Darmstadt aims at studying matter at atomic, nuclear, and hadronic levels.
I will present different aspects of the current status of the Facility for Antiproton and Ion Research. I will discuss the focus of the experiments at FAIR and the associated theory in hadron physics, nuclear structure and compressed nuclear matter physics, plasma and atomic physics, physics with antiprotons, as well as related applications.

In the second part of my talk I will very briefly present results for the nucleon and Delta-baryon masses and electromagnetic form factors, as well as the N-Delta electromagnetic transition form factors, calculated within the Dyson-Schwinger/Bethe-Salpeter equations approach. Recently the method has been accommodated to study scattering processes of photons and mesons with hadrons, and thus can be applied to exclusive proton-antiproton annihilation into two photons that will be studied with the PANDA experiment at FAIR.

Primary author: NICMORUS, diana (Facility for Antiproton and Ion Research in Europe GmbH)

Presenter: NICMORUS, diana (Facility for Antiproton and Ion Research in Europe GmbH)

Contribution ID: **35** Type: **not specified**

Study of compact U(1) flux tubes in lattice gauge theory using GPU's

Thursday, 10 May 2012 11:00 (30 minutes)

We utilize Polyakov loop correlations to study 4D compact U(1) flux tubes and the static electron-positron potential in lattice gauge theory. By using field operators it is possible in U(1) lattice gauge theory to probe directly the electric and magnetic fields.
In order to improve the signal-to-noise ratio in the confinement phase, we apply the Lüscher-Weiss multilevel algorithm.
Our code is written in CUDA, and we run it in NVIDIA FERMI generation GPU's, in order to achieve the necessary performance for our computations.

Primary authors: AMADO, Andre (CFTP - IST); CARDOSO, Marco (Instituto Superior Técnico); CARDOSO, Nuno (IST); BICUDO, Pedro (IST Lisboa)

Presenter: AMADO, Andre (CFTP - IST)

Contribution ID: **36** Type: **not specified**

Landau Gauge Fixing on GPUs

Thursday, 10 May 2012 17:30 (30 minutes)

We explore the performance of CUDA in performing Landau gauge fixing in Lattice SU(3), using the steepest descent method with Fourier acceleration.
The code performance was tested in a Tesla C2070, Fermi architecture.
We also present a study of the string tension at finite temperature in the confined phase.
The string tension is extracted from the colour averaged free energy and the color singlet with and without applying Landau gauge fixing.

Primary author: CARDOSO, Nuno (IST)

Co-authors: Prof. OLIVEIRA, Orlando (Universidade de Coimbra); SILVA, Paulo (Universidade de Coimbra); BICUDO, Pedro (IST Lisboa)

Presenter: CARDOSO, Nuno (IST)

Contribution ID: **37** Type: **not specified**

Latest QCD results from the ALICE experiment

Monday, 7 May 2012 09:00 (30 minutes)

ALICE is the LHC experiment dedicated to the study of heavy-ion collisions. Its features also make it an ideal detector for QCD studies in pp collisions. Thanks to its excellent particle identification capabilities and low material budget, ALICE can measure hadron and lepton production over a wide momentum range both in pp and in Pb-Pb collisions.
In this talk we review recent QCD results, focusing in particular on charged-particle multiplicity density, strange particle production, particle ratios, identified particle spectra and heavy flavours in pp collisions at √s = 0.9, 2.76 and 7 TeV. Results on these observables and on elliptic flow will also be presented for Pb-Pb collisions at √sNN = 2.76 TeV.

Presenter: GUERZONI, Barbara

Contribution ID: **38** Type: **not specified**

Latest QCD results from CMS pp and PbPb collisions

Monday, 7 May 2012 09:30 (30 minutes)

Results from a variety of QCD and Heavy Ion physics analyses are presented using pp and PbPb collision data collected by the CMS experiment. The data distributions are compared with the predictions of Monte Carlo event generators and with perturbative QCD calculations.

Presenter: ISILDAK, Bora

Contribution ID: **39** Type: **not specified**

Latest QCD results from ATLAS pp and PbPb collisions

Monday, 7 May 2012 10:00 (30 minutes)

Presenter: WOZNIAK, Krzysztof

Contribution ID: **41** Type: **not specified**

Langevin diffusion in holographic plasmas

Tuesday, 8 May 2012 11:30 (30 minutes)

Presenter: NITTI, Francesco

Contribution ID: **42** Type: **not specified**

Jet quenching

Tuesday, 8 May 2012 17:00 (30 minutes)

Presenter: IANCU, Edmond

Contribution ID: **43** Type: **not specified**

Tau decay, weak interaction and hadrons

Tuesday, 8 May 2012 19:00 (30 minutes)

Presenter: HABERSETZER, Anja

Contribution ID: **44** Type: **not specified**

Decays of the pseudoscalar glueball

Wednesday, 9 May 2012 11:00 (30 minutes)

We present the extension of
the globally chirally invariant N_f=3 linear sigma model with
vector and axial-vector degrees of freedom to N_f=4. We
calculate the masses of axial- vector mesons from the extended
model and present it.

Presenter: ESHRAIM, Walaa

Contribution ID: **45** Type: **not specified**

Overview of the Color Glass Condensate

Friday, 11 May 2012 09:00 (30 minutes)

At high energy and/or for large atomic numbers the wave-function of a generic hadron is dominated by gluon modes and saturates. This is the Color Glass Condensate (CGC) and it can manifest itself in Deep Inelastic Scattering and in Proton-Proton and Heavy Ion Collisions. The evolution of the CGC with energy satisfies a Renormalization Group Equation, the JIMWLK equation. We review the theory and the phenomenology of the CGC and we emphasize on recent progress on determining higher-point correlations in the CGC, an essential element for the calculation of particle production.

Presenter: TRIANTAFYLLOPOULOS, Dionysis

Contribution ID: **46** Type: **not specified**

Multiple particle production in the presence of saturation

Friday, 11 May 2012 09:30 (30 minutes)

In the context of high density QCD systems, the high occupancy numbers make it convenient to consider the strong classical fields as the appropriate degrees of freedom. High energy collision experiments are particularly sensitive to the correlators of these multiple sources by means of the multiple scattering undergone by the produced particles. By carefully studying the color structure of several multi-particle production processes in the presence of strong color fields, we show that higher point correlations are suppressed by powers of the number of colors Nc and, in particular, can be neglected in the large-Nc limit. The leading contribution to any process under this particular setup can be written in terms of only the two-point (dipole) and four-point functions (quadrupole).

Presenter: DOMINGUEZ, Fabio

Contribution ID: **47** Type: **not specified**

Advances in the Hybrid Monte Carlo method for lattice QCD

Thursday, 10 May 2012 11:30 (30 minutes)

Lattice QCD is a first-principle computational tool to describe the properties of hadron spectrum and decay modes, which allows for precision tests of the Standard Model. The algorithm of choice for lattice QCD simulations is known as the Hybrid Monte Carlo (HMC) algorithm. I am going to discuss recent algorithmic and implementation improvements which lead to a better scaling of the new highly optimized HMC packages, and some of the challenges ahead.

Primary author: MARINKOVIC, Marina (Humboldt University Berlin)

Presenter: MARINKOVIC, Marina (Humboldt University Berlin)

Contribution ID: **49** Type: **not specified**

Radiative Energy Loss in the absorptive QGP

Tuesday, 8 May 2012 17:30 (30 minutes)

Presenter: GOSSIAUX, Pol

Contribution ID: **52** Type: **not specified**

Intriguing solutions of Bethe-Salpeter equation for radially excited pseudoscalar charmonia

Friday, 11 May 2012 12:00 (30 minutes)

When generalizing recent various quantum mechanical models of $c - \bar{c}$ states to Quantum Filed theoretical approach based on BSE one is faced to the solutions that do not exist in non-relativistic limit. Mainly, there is unexpected doubling of the spectrum when comparing to the spectrum expected or known from the experiments as well as the ones known from the solution of the Schroedinger equation. These additional states do not belong to the known ghost and non-physical solutions as they have the same symmetry as the usual ones, however we argue they appear due to the sensitivity of BSE to the details of the analytical form of the constituents quark propagators, more specifically they are consequence of using non-confining form of the propagators. To show this explicitly we develop and describe the efficient method of the numerical solution of Q-Q BSE and numerically solve it for the case of pseudo-scalar $c - \bar{c}$ mesons. For the bare propagators of constituents we are able to find BSE solution for arbitrarily high excited state without any 3-dimensional reduction. Unlike to the Schroedinger equation the excited states are not orthogonal. Using free charm quark propagators we observe that the spin $0, 1$ ground states are the only mesons left bellow naive quark threshold $2m_c$, while the all excited states are situated above this threshold. In the second part of the paper we consider the model of BSE with complex conjugated poles and show the influence on the spectrum directly in the 3+1 dimensional space.

Primary author: Mr SAULI, Vladimir (DTP, NPI Rez near Prague)

Presenter: Mr SAULI, Vladimir (DTP, NPI Rez near Prague)

Contribution ID: **54** Type: **not specified**

Recent results in the infrared sector of QCD

Monday, 7 May 2012 11:00 (30 minutes)

I will report on recent results which provides novel qualitative as well as quantitative information on the infrared sector of QCD. In particular i will concentrate on i) the unquenching of the gluon propagator through the SDEs as well as ii) the comparison of these results with new lattice data obtained from configurations containing 2 light and two heavy quarks, iii) the all order equation that describes the dynamically generated gluon mass, and finally iv) a new method that allows for lattice simulations in background field gauges.

Primary author: BINOSI, Daniele (E)

Presenter: BINOSI, Daniele (E)

Contribution ID: **55** Type: **not specified**

Hydrodynamics for Relativistic Heavy Ion Collisions

Tuesday, 8 May 2012 12:00 (30 minutes)

We apply hydrodynamic model calculations to predict soft particle observables in relativistic heavy-ion collisions. Results of simulations of a 3+1D viscous hydrodynamic model are presented. A satisfactory description of transverse momentum spectra, HBT radii, and elliptic and triangular flows in heavy-ion collisions at RHIC and the LHC is obtained. Most advanced simulations of the model are
performed event-by-event and include non-flow correlations from charge conservation. The possibility of observing collective flow in p-p and p-Pb collisions at the LHC is addressed.

Primary author: BOZEK, Piotr

Co-authors: WYSKIEL-PIEKARSKA, Iwona (Institute of Nuclear Physics PAN); BRONIOWSKI, Wojciech (IFJ PAN)

Presenter: BOZEK, Piotr

Contribution ID: **56** Type: **not specified**

Nucleon spectroscopy on the lattice

Monday, 7 May 2012 12:00 (30 minutes)

We study positive and negative parity states of the nucleon, with particular interest in the parity reversal pattern of the Roper resonance. We investigate the isospin 1/2 channel of the pion-nucleon scattering on the lattice, including meson-nucleon interpolators. The distillation method makes the computation of disconnected diagrams affordable, while the variational method is used to extract the masses. Similar techniques can be exploited for other states of the QCD spectrum.

Primary author: VERDUCI, Valentina (University of Graz)

Co-author: Prof. LANG, Christian B. (Universitaet Graz)

Presenter: VERDUCI, Valentina (University of Graz)