The 5th Asian Triangle Heavy Ion Conference (ATHIC2014)

Report of Contributions

https://indico.cern.ch/e/301039

Contribution ID: **0** Type: **plenary**

Energy momentum tensor and thermodynamics of gauge theory from gradient flow

Thursday 7 August 2014 10:00 (30 minutes)

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Author: KITAZAWA, Masakiyo (Osaka University)

Presenter: KITAZAWA, Masakiyo (Osaka University)

Session Classification: Plenary session 6

Contribution ID: **2** Type: **parallel**

Photons from hot dense matter

Wednesday 6 August 2014 14:40 (20 minutes)

High energy photons have been measured in heavy ion collisions, at both RHIC and LHC. The direct photons, not from decay, carries a special information of the expanding system. This is studied with (3+1)-dimensional ideal hydrodynamics, constrained with a large collection of data of various hadrons. Thus a comparison between a realistic calculation and the photon data from both LHC and RHIC will be presented. We will learn how the expanding hot dense matter shines.

[1] F.-M. Liu and S.-X. Liu,PHYSICAL REVIEW C 89, 034906 (2014).

[2] F.-M. Liu, T. Hirano, K. Werner, and Y. Zhu, Phys. Rev. C 79, 014905 (2009).

[3] T. Hirano, U. Heinz, D. Kharzeev, R. Lacey, and Y. Nara, Phys. Lett.B636,299(2006);J.Phys.G34,S879(2007);Phys.Rev. C 77, 044909 (2008).

[4] K. Werner, I. Karpenko, M. Bleicher, T. Pierog, and S.Porteboeuf-Houssais, Phys. Rev. C 85, 064907 (2012).

Author: Prof. LIU, Fu-Ming (CCNU)

Presenter: Prof. LIU, Fu-Ming (CCNU)

Session Classification: Electromagnetic probes

Contribution ID: **3** Type: **plenary**

Future Physics Program at STAR

Friday 8 August 2014 10:30 (30 minutes)

With the completion of the STAR Beam Energy Scan (BES) phase I program and the completion of the Heavy Flavor Tracker and Muon Telescope Detector upgrades, STAR has reached a new milestone in its scientific endeavor to study QCD phase diagram and properties of the Quark-Gluon Plasma with heavy ion collisions. I will give an overview of the STAR plan for the coming a few years to explore QCD nuclear parton structure functions and the heavy quark physics. I will discuss the STAR BES II program and the detector upgrade needed. The future of the RHIC depends on the US long range plan related to the Electron Ion Collider project. I will also briefly present our detector R&D projects towards an EIC detector in the future.

Author: Prof. HUANG, Huan Zhong (UCLA)

Presenter: Prof. HUANG, Huan Zhong (UCLA)

Session Classification: Plenary session 9

Contribution ID: **4** Type: **plenary**

Quarkonia in High Energy Nuclear Collisions

Wednesday 6 August 2014 12:00 (30 minutes)

Quarkonium production in high energy nuclear collisions is strongly affected by cold and hot nuclear matter effects, including Cronin effect, shadowing effect, nuclear absorption, color screening and regeneration. I will discuss the competition among these effects and focus on the quarkonium transverse momentum distribution at RHIC and LHC energies.

Author: Prof. ZHUANG, Pengfei (Tsinghua University)

Co-author: Prof. XU, Nu (Central China Normal University)

Presenter: Prof. ZHUANG, Pengfei (Tsinghua University)

Session Classification: Plenary session 5

Contribution ID: **5** Type: **plenary**

Recent Development in Relativistic Hydrodynamic Model

Tuesday 5 August 2014 16:30 (30 minutes)

Relativistic hydrodynamic models have played an important role in the physics of high-energy heavy ion collisions to describe the space-time evolution of the quark gluon plasma (QGP). Recent viscous hydrodynamic approaches enable us to extract bulk and transport properties of the QGP.

In this talk, I first show results from an integrated dynamical approach in which Monte-Carlo Glauber/KLN for the initial stage, relativistic hydrodynamics for the QGP stage and kinetic theory for the hadron gas stage are combined. In particular, I emphasize the importance of hadronic rescattering effects on transverse dynamics such as elliptic flow and HBT radii.

After that, some recent developments in the relativistic hydrodynamic model are highlighted. These topics include medium response to jet propagation, anomalous hydrodynamics, causal hydrodynamic fluctuation and its application to the QGP expansion.

Author: HIRANO, Tetsufumi (Sophia Univ)

Co-authors: HINOHARA, Hiromi (Sophia University); NAGAI, Kenichi (Sophia University); MURASE, Koichi (The University of Tokyo); HONGO, Masaru (The University of Tokyo); KURITA, Ryuichi (The University of Tokyo); TAKEUCHI, Shiori (Sophia University); TACHIBANA, Yasuki (The University of Tokyo); HIRONO, Yuji (The University of Tokyo)

Presenter: HIRANO, Tetsufumi (Sophia Univ)

Session Classification: Plenary session 3

Contribution ID: **6** Type: **plenary**

Jet tomography of fluctuating initial conditions and the opaqueness evolution from RHIC to LHC

Wednesday 6 August 2014 10:00 (30 minutes)

High energy jets, penetrating the hot QCD matter created in heavy ion collisions, provide unique probe of the medium property and the fluctuating initial conditions. Recently there has been a lot of interests in extracting the possibly nontrivial temperature dependence of the jet-medium coupling. Particularly sensitive to such T-dependence are two sets of observables: the anisotropy of jet energy loss via the azimuthal angle dependence of suppression $R_{aa}(\phi)$ (or equivalently the various harmonic coefficients v_n at high p_t), as well as the evolution of the overall suppression with beam energy, $R_{aa}(\sqrt{s})$. We report our systematic study of these observables using event-by-event simulations, and compare with available data from RHIC to LHC. The results strongly suggest a nontrivial temperature dependence of the jet-medium coupling and in particular its enhancement near the parton/hadron phase boundary. Recently emerging evidences for such a possibility from various other jet modelings, as well as efforts to understand such peculiar medium property from microscopic theories will also be discussed. Finally we also briefly discuss potentially final state jet attenuation effect in (possibly created) hot medium in the "mini-bang" (pPb and dAu collisions) and demonstrate that jet quenching anisotropy could provide a clean probe to tell whether there is substantial final state interaction in those collisions.

Author: LIAO, Jinfeng (Indiana University)

Presenter: LIAO, Jinfeng (Indiana University)

Session Classification: Plenary session 4

Contribution ID: **7** Type: **plenary**

The fluid nature and the viscosity of the quark gluon plasma

Tuesday 5 August 2014 15:30 (30 minutes)

In this talk, I will briefly review recent progress on the fluid nature and the viscosity of the quark gluon plasma. The related topics include: 1) extracting the QGP shear viscosity from the flow data at RHIC and the LHC 2) initial state fluctuations, final state correlations and event-by-event hydrodynamics, 3) flow and hydrodynamics in p+Pb collisions at \sqrt{s_{NN}}=5.02 TeV.

Author: Prof. SONG, Huichao (Peking University)

Presenter: Prof. SONG, Huichao (Peking University)

Session Classification: Plenary session 2

Contribution ID: **8** Type: **plenary**

Plan for nuclear physics experiments at RAON in Korea

Friday 8 August 2014 09:00 (30 minutes)

The new Rare Isotope Science Project (RISP) has been launched in Korea in 2011. The core of RISP is to design and construct the rare isotope accelerator, RAON, and the experimental facilities. For the nuclear physics experiments at RAON, the recoil spectrometer and the large-acceptance multipurpose spectrometer are being designed.
The KOrea Broad acceptance Recoil spectrometer and Apparatus (KOBRA) is dedicated to the nuclear structure and the nuclear astrophysics with low-energy beams up to 18.5 MeV/nucleon. It is a double achromatic focusing system with the two Wien filters and many magnets. The KOBRA will study the structure of exotic nuclei near the drip lines and various astrophysical processes such as r-, s-, and rp-processes, using cross sections, the transfer reactions, and the decay measurements.
The Large-Acceptance Multipurpose Spectrometer (LAMPS) is dedicated to study the properties of nuclear matter. One of the major goals for LAMPS is to investigate the nuclear equation of state and the symmetry energy in wide range of the beam energy. For this purpose the charged hadrons, nuclear fragments, and neutrons should be measured precisely in large phase space. The LAMPS intends to achieve this requirement by combining the solenoid and dipole magnet spectrometers.
This presentation will provide an overview of the objects for the nuclear physics program at RISP. The status of the KOBRA and LAMPS spectrometers with their future prospects will be also given.

Author: Prof. HONG, Byungsik (Korea University)

Presenter: Prof. HONG, Byungsik (Korea University)

Session Classification: Plenary session 8

Contribution ID: **9** Type: **plenary**

Heavy Quark diffusion and dilepton production in HIC

We study the dynamics of charm quarks in the partonic medium and its implication for the di-electron spectra in high-energy heavy ion collisions. The charm quarks traversing a thermal medium are simulated by the relativistic Langevin equation for elastic scattering of charm quarks by thermal partons in an expanding fireball. The di-electron invariant mass spectra are computed in the most central collisions and are compared to the STAR data

Author: Dr XU, Haojie

Presenter: Dr XU, Haojie

Contribution ID: **10** Type: **parallel**

The fluidity of hot interacting hadrons flowing out of chemical equilibrium

The ratio η/s of the shear viscosity, η, and the entropy density, s, of hot interacting hadrons is calculated using the Chapman-Enskog and virial expansion methods. Interactions are parametrized using the K-matrix which preserves the unitarity of the S-matrix. In the four component mixture $\pi-K-\eta-N$, 57 resonances up to 2 GeV are included. Increasing number of resonances is shown to reduce η and increase s resulting in a progressive decrease of η/s for temperatures close to the QCD
phase transition temperature. The addition of finite chemical potential reduce the value of η/s even more in the comparison with zero chemical potential.
Prospects of hot hadrons becoming a "perfect"fluid are discussed.

Author: Dr WIRANATA, Anton (CCNU)

Co-authors: Prof. PRAKASH, Madappa (Ohio University); KOCH, Volker (LBNL); WANG, Xin-Nian (Lawrence Berkeley National Lab. (US))

Presenter: Dr WIRANATA, Anton (CCNU)

Contribution ID: **11** Type: **plenary**

Strong field physics and early time dynamics in heavy ion collisions

Thursday 7 August 2014 11:00 (30 minutes)

I will give a brief review on the recent progress in strong field physics and its application to early time dynamics of heavy ion collisions. In high-energy heavy ion collisions, there appear two different strong fields: electromagnetic fields and color Yang-Mills fields called glasma. Glasma is responsible for the thermalization process, while the strong electric fields will play a role of probing the early time dynamics.

Author: ITAKURA, Kazunori (KEK)

Presenter: ITAKURA, Kazunori (KEK)

Session Classification: Plenary session 7

Contribution ID: **12** Type: **parallel**

Charged ρ condensation in magnetic fields

Thursday 7 August 2014 14:20 (20 minutes)

The charged vector ρ meson in the presence of external magnetic fields has been in- vestigated in the framework of the Nambu–Jona-Lasinio model. The self-energy of the ρ meson contains the quark-loop contribution, i.e. the leading order contribution in 1/Nc expansion. The charged ρ meson mass is investigated numerically as a function of the magnetic field at zero temperature. It is found that the charged ρ meson mass decreases as the magnetic field increases and drops to zero at a critical magnetic field, which is found to be much lower than the value predicted by a point-like vector meson. The charged vec- tor meson condensation, i.e. the electromagnetic superconductor is induced in the QCD vacuum above the critical magnetic field.

Author: LIU, hao (I)

Presenter: LIU, hao (I)

Session Classification: Theoretical developments 1

Contribution ID: **13** Type: **parallel**

Collectivity in p+p, p+A and A+A collisions from parton scatterings

Wednesday 6 August 2014 14:00 (20 minutes)

We show that the incoherent elastic scattering of partons, as present in a multi-phase transport model (AMPT), with a modest parton-parton cross-section of $\sigma = 1.5 - 3$ mb, naturally explains the long-range two-particle azimuthal correlation as observed in proton-proton, proton-nucleus and nucleus-nucleus collisions at the Large Hadron Collider. We calculate the elliptic, v_2, and triangular, v_3, Fourier coefficients of the two-particle azimuthal correlation function in proton-nucleus (p+Pb) and peripheral nucleus-nucleus (Pb+Pb) collisions. Our results for v_3 are in a good agreement with the CMS data. The v_2 coefficient is very well described in p+Pb collisions and is underestimated for higher transverse momenta in Pb+Pb collisions. The characteristic mass ordering of v_2 in p+A is reproduced whereas for v_3 such ordering is not observed. Our results indicates an emergence of collectivity in p+p, p+Pb and peripheral Pb+Pb collisions from parton scatterings.

References:
[1] Guo-Liang Ma and Adam Bzdak, arXiv:1404.4129.
[2] Adam Bzdak and Guo-Liang Ma, in preparation.

Author: MA, Guo-Liang (Shanghai INstitute of Applied Physics (SINAP), CAS)

Presenter: MA, Guo-Liang (Shanghai INstitute of Applied Physics (SINAP), CAS)

Session Classification: Collective dynamics

Contribution ID: **14** Type: **plenary**

High-Energy Nuclear Collisions and the QCD Phase Structure

Tuesday 5 August 2014 11:00 (30 minutes)

I will discuss the progress in the study of the QCD phase structure with high-energy nuclear collisions. The focus will be given on the recent results from the beam energy scan program at RHIC.

Author: XU, Nu (LBNL)

Presenter: XU, Nu (LBNL)

Session Classification: Plenary session 1

Contribution ID: **15** Type: **parallel**

QCD instability induced by a strong electromagnetic field in AdS/CFT

Thursday 7 August 2014 14:40 (20 minutes)

Recently, both theoretical and experimental physicists have been interested in the pair creations of strongly correlated particles in a magnetic field at the heavy ion collisions in RHIC and LHC. It is well-known that a strong magnetic field occurs when each charged particle collides. It may be plausible that a quark antiquark pair creation occurs by the strong magnetic field.

AdS/CFT correspondence has developed as one of the most powerful methods to study a strongly coupled gauge theory as QCD. By using the AdS/CFT, we evaluate the imaginary part of D-brane action including a constant electromagnetic field, and obtain the creation rate of the quark anti-quark pair in the strongly coupled gauge theory.

Author: SONODA, Akihiko (Osaka university)

Co-authors: HASHIMOTO, Koji (Osaka university); OKA, Takashi (University of Tokyo)

Presenter: SONODA, Akihiko (Osaka university)

Session Classification: Theoretical developments 1

Contribution ID: **16** Type: **parallel**

Quark-hadron phase transition in the PNJL model with mesonic and baryonic excitations

Thursday 7 August 2014 16:00 (20 minutes)

We study the QCD phase transition by a Nambu-Jona-Lasinio model extended with the Polyakov loop. This model was proposed by combining the Nambu-Jana-Lasinio model which describes the chiral transition and the Polyakov loop which works as an order parameter of de-confinement transition. The aim of this work is to describe the change of degrees of freedom from hadrons to quarks through the transition region. For this purpose, we calculated an equation of state by an approach beyond the mean field approximation to take thermal excitations of hadrons into account. We will present an equation of state concerning mesonic excitations at zero quark chemical potential in the PNJL model for interacting quarks. In addition, we have thought the way to introduce baryonic correlation as the three body system of quarks at finite chemical potential. We will also discuss about that.

Author: YAMAZAKI, Kanako (University of Tokyo)

Co-author: Prof. MATSUI, Tetsuo (the University of Tokyo)

Presenter: YAMAZAKI, Kanako (University of Tokyo)

Session Classification: QCD phase diagram

Contribution ID: **17** Type: **parallel**

Heavy-flavour correlations in pp, p-Pb and Pb-Pb collisions with ALICE

Wednesday 6 August 2014 15:40 (20 minutes)

ALICE (A Large Ion Collider Experiment) is specifically optimized for the study of heavy-ion collisions at the LHC. In these collisions a state of matter consisting of deconfined quarks and gluons (Quark-Gluon Plasma) is formed. Due to their large masses, heavy quarks (charm and beauty) are predominantly produced in hard scattering processes in the initial phase of the collision, before the formation of the QGP. Therefore they are excellent probes to study the properties of the Quark-Gluon Plasma. While interacting with the medium, they lose energy via both collisional and radiative processes as supported by several measurements, among which is the observation of the strong suppression of D meson production for p_T > 4 GeV/c in central Pb-Pb collisions with respect to pp collisions.

Further insight into the effects of the medium on charm and beauty quarks can be obtained by measuring the angular correlations between heavy–flavour hadrons (or their decay products) and charged particles.

The comparison of the azimuthal correlations in pp and Pb-Pb collisions can provide deeper information on the processes by which heavy quarks lose energy in the QGP and can spot possible modifications to the charm parton shower and hadronisation in the presence of the medium. Beside providing the reference necessary for the interpretation of p-Pb and Pb-Pb results, the study of the azimuthal correlations in pp collisions can provide deeper insight into the heavy quark production mechanism and their hadronization. In addition, the study of the angular correlations between heavy-flavour decay electrons and charged particles in pp collisions allows also for a statistical separation of the charm and beauty contributions to the yield of heavy-flavour decay electrons.

In p-Pb collisions, double-ridge long range correlations were observed for light particles (pions, kaons and protons), that could originate from a collective behaviour of the system, as well as from gluon saturation in the initial state (Color Glass Condensate). This effect can be studied for heavier quarks via the correlation between heavy-flavour hadrons (or their decay electrons) and charged particles.

Results from the analyses of angular correlations of D mesons and charged particles and of heavy-flavour decay electrons and charged particles, performed using the data collected with ALICE in pp collisions at $\sqrt{s}$ = 7 TeV, Pb-Pb at $\sqrt{s_{NN}}$ = 2.76 TeV, and in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV along with comparison to the models will be presented in this contribution.

Author: KUMAR, Jitendra (IIT- Indian Institute of Technology (IN))

Presenter: KUMAR, Jitendra (IIT- Indian Institute of Technology (IN))

Session Classification: Jets

Contribution ID: **18** Type: **parallel**

Open charm production measurements in pp, Pb-Pb and p-Pb collisions with the ALICE detector at the LHC

Heavy quarks (charm and beauty) are effective probes to investigate the properties of the hot and dense strongly-interacting medium created in heavy-ion collisions as they are produced in partonic scattering processes occurring in the early stages of the collision. Due to their long life time, they probe all the stages of the medium evolution and they interact with its constituents, losing energy via gluon radiation and elastic collisions. The measurement of the nuclear modification factor of the D-mesons provides a key test of parton energy-loss models. These models predict that beauty quarks lose less energy than charm quarks and the latter experience less in-medium energy loss than light quarks and gluons. Furthermore, the production of D-mesons in pp collisions at the LHC provides an important test of pQCD calculations and also serves as an essential reference for understanding the results from heavy-ion collisions. The study of D-meson production in p-Pb collisions is necessary to disentangle the hot and cold nuclear matter effects in Pb-Pb collisions. D-meson production has been measured with ALICE in pp, Pb-Pb and p-Pb collisions at different energies. After reviewing the ALICE results on D-meson production in pp collisions, the latest results from the analysis of the Pb-Pb data sample will be discussed. Finally, the recent results on D-meson production in p-Pb collisions will also be presented.

Author: Dr BALA, Renu (University of Jammu (IN))

Presenter: Dr BALA, Renu (University of Jammu (IN))

Contribution ID: **19** Type: **parallel**

Application of a event generator version of DHJ formula to forward hadron spectra

Thursday 7 August 2014 14:00 (20 minutes)

Models based on the Color Glass Condensate (CGC) framework have been successful in explaining many experimental data from RHIC and LHC.
However, applicability of these models are limited to a high transverse momentum region or one relies on the assumption of hadron-parton duality to compute multiplicity of the produced hadrons, because there are always non-perturbative effects in the process of hadronic interactions.
In this talk, we will present a newly developed Monte-Carlo event generator based on the CGC which is combined with Lund string fragmentation model.
We will show the comparison of our results to the forward hadron spectra at RHIC and LHCf, and discuss mechanism of the particle production.

Author: Prof. NARA, Yasushi (Akita International University)

Co-authors: FUJII, Hirotsugu (University of Tokyo); ITAKURA, Kazunori (KEK); Dr DENG, Wei--Tian (Huazhong University of Science and Technology (HUST))

Presenter: Prof. NARA, Yasushi (Akita International University)

Session Classification: Initial state physics

Contribution ID: **20** Type: **parallel**

Quarkonia in Magnetic Field Created in Heavy Ion Collisions

Thursday 7 August 2014 15:00 (20 minutes)

We study quarkonium motion in static magnetic field created in the early stage of heavy ion collisions. We investigated the Schroedinger equation for the quarkonium bound states in the magnetic field. The interaction between the heavy quarks includes the Cornell potential and spin-spin coupling. Due to the electromagnetic force on heavy quarks and in turn on the quarkonium states, the angular momentum is no longer conserved, and the singlets like η_c are mixed with the triplets like J/ψ. We numerically solved the equation by using the inverse power method and obtained the quarkonium masses, average radius, polarization, and the mixing of differernt spin and orbital angular momentum components as functions of the strength of the magnetic field. We found that the quarkonium elliptic flow is sizeable at high transverse momentum, which can be considered as a sensitive signature of the magnetic field formed in relativistic heavy ion collisions at RHIC and LHC energies.

Authors: ZHUANG, Pengfei (Tsinghua University); SHI, Shuzhe (Tsinghua University); GUO, Xingyu

Presenter: GUO, Xingyu

Session Classification: Theoretical developments 1

Contribution ID: **21** Type: **plenary**

A Heavy-ion Program at J-PARC

Friday 8 August 2014 09:30 (30 minutes)

In J-PARC, possibility of a future heavy-ion program has been discussed.
There are two physics subjects included in the program. One is a low energy heavy ion physics, to study unstable nuclei with the linac beam at 1-10 AMeV/c, and the other is a high energy heavy ion physics to explore nuclear physics at a high baryon density with the Main Ring beam at 1-10 AGeV/c. In this work, the latter is presented.
We discuss a heavy ion accelerator scheme, physics goals, and an experimental set-up. The accelerator scheme includes a new heavy ion linac, with or without a new heavy ion booster ring, and utilizes the existing 3 GeV Rapid Cycling Synchrotron, and 30 GeV Main Ring.
We focus on studies of dilepton measurements, exotic hadrons such as the H-dibaryon and exotic nuclei such as hypernuclei. The enhancement of dilepton in the low mass region (below rho mass) tens to having a maximum around the J-PARC energies where the highest baryon density coincodes. The yield of hypernuclei has also maximum in this energy region due to coalescence of high density baryons.
We designed a 4-pi acceptance heavy-ion spectrometer which consists of a solenod spectrometer detecting backward hadrons and a dipole spectrometer detecting middle and forward hadrons and leptons. Performance of the spectrometer is evaluated with simulations.

Author: SAKO, Hiroyuki (ASRC/J-PARC, Japan Atomic Research Agency)

Co-authors: Dr HARADA, Hiroyuki (J-PARC, Japan Atomic Energy Agency); Dr IMAI, KenIchi (ASRC/J-PARC, Japan Atomic Energy Agency); SHIGAKI, Kenta (Hiroshima University (JP)); Dr OZAWA, Kyoichiro (J-PARC, KEK); Dr KANETA, Masashi (Tohoku University); Dr SAHA, Pranab (J-PARC, Japan Atomic Energy Agency); Prof. NAGAMIYA, Shoji (RIKEN); SAKAGUCHI, Takao (BNL); Dr GUNJI, Taku (CNS, University of Tokyo); Dr LIU, Yong (J-PARC, KEK); SATO, susumu (jaea)

Presenter: SAKO, Hiroyuki (ASRC/J-PARC, Japan Atomic Research Agency)

Session Classification: Plenary session 8

Contribution ID: **22** Type: **parallel**

Momentum flow in dijet+QGP-fluid system

Wednesday 6 August 2014 15:00 (20 minutes)

Increase of highly-asymmetric dijet events compared with p+p collisions
is obsereved in ultra-relativistic heavy-ion collisions both at LHC and at RHIC.

At LHC, enhancement of low-p_T particles extending upto large angle from axes of jets
is observed by the CMS Collaboration [1].
The total-p_T of these low-p_T particles compensate
the imbalance of the dijet momenta.
On the other hand, according to recent results from the STAR collaboration at RHIC,
the di-jet imbalance is compensated by the low-p_T particles closer to the jet direction [2].

Motivated by these latest results,
we study the transport dynamics of momenta deposited from jets in QGP fluid.
Simulations of dijet asymmetric events in ultra-relativistic heavy-ion collisions at LHC and at RHIC are performed
by solving relativistic hydrodynamic equations with source terms in fully (3+1)-dimensional Milne coordinates.
We calculate the p_T distribution around jets to interpret di-jet asymmetric events both at LHC and at RHIC.

References
[1] Doga Gulhan [CMS Collaboration], talk at Quark Matter 2014.
[2] Jörn Putschke [STAR Collaboration], talk at Quark Matter 2014.

Author: TACHIBANA, Yasuki (The University of Tokyo)

Co-author: HIRANO, Tetsufumi (Sophia Univ)

Presenter: TACHIBANA, Yasuki (The University of Tokyo)

Session Classification: Jets

Contribution ID: **23** Type: **parallel**

Functional Renormalization for Deconfinement Phase Transition in Friedberg-Lee Model

Thursday 7 August 2014 15:20 (20 minutes)

We investigate the deconfinement phase transition at high temperature and density in the frame of Friedberg-Lee model. The method we employ is based on the exact renormalization group equation for the free energy. The truncated nonperturbative flow equations are derived and solved via both grid and potential expansion. We find that the deconfinement is a first order phase transition at high temperature and density.

Author: SHIJUN, mao (X)

Presenter: SHIJUN, mao (X)

Session Classification: Theoretical developments 1

Contribution ID: **24** Type: **plenary**

Experimental status of heavy-ion collisions at LHC

Tuesday 5 August 2014 12:00 (30 minutes)

After the first period of the heavy-ion run (Run-1, 2009 - 2013) at the Large Hadron Collider (LHC) at CERN, we obtained many new experimental results from ALICE, ATLAS and CMS collaborations. Now we are entering the new phase, i.e. a precise determination of properties of Quark Gluon Plasma (QGP) created in LHC/RHIC. In this talk, we review the experimental heavy ion results from LHC Run-1, as well as the results in p-p and p-Pb. We also present the future directions of the heavy ion physics program in LHC Run-2 and beyond.

Author: CHUJO, Tatsuya (University of Tsukuba (JP))

Presenter: CHUJO, Tatsuya (University of Tsukuba (JP))

Session Classification: Plenary session 1

Contribution ID: **25** Type: **parallel**

Diffusion phenomenon of electric charge and fluctuation observed at ALICE

Thursday 7 August 2014 16:40 (20 minutes)

We investigate the effects of the global charge conservation on the rapidity window dependences of fluctuations of conserved charges observed in heavy ion collisions by solving the diffusion master equation with boundaries. Our result suggests that the effects of the global charge conservation for the diffusion in the hadronic phase is negligible in the experimental results even with the largest rapidity window acceptance at ALICE. The rapidity window dependences of the fluctuations of conserved charges contain various information on the matter generated in heavy ion collisions such as diffusion constant in the hadronic phase.

Author: Ms SAKAIDA, Miki (Osaka University)

Co-authors: KITAZAWA, Masakiyo (Osaka University); ASAKAWA, Masayuki (Osaka University)

Presenter: Ms SAKAIDA, Miki (Osaka University)

Session Classification: QCD phase diagram

Contribution ID: **26** Type: **parallel**

Multi-strange hadrons as penetrating probes

Wednesday 6 August 2014 16:20 (20 minutes)

We study the hadronic rescattering effects, in particular for multi-strange hadrons, on the final observables within an integrated dynamical approach in which a (3+1)D ideal hydrodynamic model is combined with hadronic cascade model, JAM.

Since the measured observables contain all the information throughout the space-time evolution in relativistic heavy ion collisions,
dissipation caused by hadronic rescattering in the late stage
must be taken into account to investigate the properties of the quark gluon plasma.

By comparing final observables to those obtained just after the QGP stage in this approach, we quantify the hadronic rescattering effects on particle ratio, azimuthal anisotropic flow v_n and mean transverse momentum $\langle p_{\mathrm{T}} \rangle$.

Furthermore we show that multi-strange hadrons can be direct probes of the QGP at hadronization due to a fact that multi-strange hadrons less rescatter with non-strange hadrons.

Author: TAKEUCHI, Shiori (Sophia University)

Co-authors: MURASE, Koichi (The University of Tokyo); HUOVINEN, Pasi (Johann Wolfgang Goethe-Universität); HIRANO, Tetsufumi (Sophia Univ); Prof. NARA, Yasushi (Akita International University)

Presenter: TAKEUCHI, Shiori (Sophia University)

Session Classification: Hadron production

Contribution ID: **28** Type: **plenary**

Hydro plus Jets event generation

Wednesday 6 August 2014 09:30 (30 minutes)

We present a hybrid model of hydrodynamics, jets and Boltzmann transport for heavy ion collisions.
While our previous work to couple MUSIC hydro and UrQMD transport was aimed to describe the low-p_T regime,
the improved event generator with MARTINI jets is capable of describing the intermediate and high-p_T regimes as well.
We discuss MUSIC+MARTINI+UrQMD model, its implications on the properties of QGP matter and further improvements.
We also compare different initial conditions –MC-Glauber and IP-Glasma –and show how they affect the hadronic observables.

Author: RYU, Sangwook (McGill University)

Co-authors: Dr SCHENKE, Bjoern (Brookhaven National Lab); GALE, Charles (McGill University); YOUNG, Clint (University of Minnesota); DENICOL, Gabriel (McGill University); LUZUM, Matthew (McGill / LBNL); JEON, Sangyong (McGill University)

Presenter: RYU, Sangwook (McGill University)

Session Classification: Plenary session 4

Contribution ID: **29** Type: **parallel**

Evaluation of MPPC photon sensors for the PHOS upgrade in ALICE at CERN

Thursday 7 August 2014 14:00 (20 minutes)

The ALICE experiment aims to reveal a new phase of matter called Quark-Gluon Plasma produced by high-energy heavy-ion collisions at the LHC. PHOS is a high-granularity and high-energy resolution electromagnetic calorimeter composed of more than 10,000 lead-tungstate (PWO) crystals attached with avalanche photodiodes (Hamamatsu S8664-55) to achieve the best energy resolution of σ/E = 3.5% (at 1GeV). One of the important goals is to detect direct photons, especially thermal photons to measure temperature in the QGP phase, that is a unique feature of ALICE in the LHC experiments.

Since the yield of thermal photons is an order of 10-3 compared to others, all the other hits in PHOS have to be removed as precise as possible. A cluster produced by a charged particle can be identified with tracking information, however, clusters made by neutral hadrons cannot be removed. A serious background could be originated by anti-neutrons in low energies, since they create hits of a few GeV in annihilation in the PWO crystals. The TOF technique can be applied to remove these background hits. Unfortunately the present APD readout did not provide good timing resolutions, so we are investigating new photon sensors with a good timing resolution for the PHOS upgrade.

We evaluated basic properties of two types of Multi-Pixel-Photon-Counter (MPPC) with 14,400- and 90,000-pixels. We measured linearity, dynamic range and timing characteristics of these devises using 80ps wide light pulser at 403nm. We constructed a PWO element attached with the MPPC and APD devices to readout cosmic-ray hits. We found the MPPC timing resolution of σ = 500ps, which is much better than APD. In my talk, I present the test results and discuss about possibility of MPPC application to the PHOS upgrade.

Author: TARUNAGA, Kazuya (H)

Co-author: SATO, Daichi (Hiroshima University (JP))

Presenter: TARUNAGA, Kazuya (H)

Session Classification: Future experimental facilities

Contribution ID: **30** Type: **parallel**

Heavy quark in-medium evolution and sophisticated description of J/psi productions at RHIC and LHC

When extending higher energy regimes such as those reached by the LHC experiments, heavy quarks become ultra-relativistic as well and thus are expected to behave similarly as light partons. Transport models such as Langevin approach incorporated collisional and
radiative energy loss corrections has been used to simulated the in-medium evolution of heavy quarks. For J/psi productions, there is still lack of a realistic transport model simulation considering both charm quark in-medium energy loss and the regeneration contribution. Our goal is to fill the blank and improve the J/psi research to a more sophisticated level.

Author: DAI, Wei (Tsinghua University)

Co-authors: Dr KAI, Zhou (tsinghua University); Prof. PENGFEI, Zhuang (Tsinghua University)

Presenter: DAI, Wei (Tsinghua University)

Contribution ID: **31** Type: **parallel**

Thermalization of a gluon plasma and the possible Bose-Einstein condensation

Thursday 7 August 2014 14:20 (20 minutes)

Using the parton transport model BAMPS, the thermal equilibrium process for the dense gluon plasma produced in the early stages of ultra-relativistic heavy ion collisions is studyed, under the Color Glass Condensate inspired initial conditions. The bose enhancement effect's role in speeding up the growth of soft gluons is emphasized. Diffrent initial conditions is implemented into the model and the results are discussed. We found that the potential gluon condensate must be taken into account when the initial gluons are overpopulated. With this consideration, we calculate the the condensate growth and also the whole system's evolution.

Author: ZHOU, Kai (Tsinghua University)

Co-authors: ZHUANG, Pengfei (Tsinghua University); XU, Zhe

Presenter: ZHOU, Kai (Tsinghua University)

Session Classification: Initial state physics

Contribution ID: **33** Type: **parallel**

Search for intense magnetic field via electron-positron pair asymmetry measurements in Pb-Pb collisions at sqrt{s_NN} = 2.76 TeV with ALICE

Wednesday 6 August 2014 15:20 (20 minutes)

We aim to experimentally detect an intense magnetic field to be created in heavy ion collisions. The intensity of this magnetic field in non-central collisions should reach ~10^{14} T at the LHC energies. Interesting expectations in the very intense field, such as chiral magnetic effects, synchrotron radiation, photon decay and so on, have been theoretically discussed in the recent years. The field, however, has not yet been detected.

We have proposed two new approaches for the detection. First, we focus on polarization of direct virtual photons. Virtual photons perpendicular to the field strongly interact with the field and a polarization of the order of 10% may appear according to theoretical calculations [1]. Second, we focus on aligned deflection of electron-positron pairs from the decay of direct virtual photons. Electrons and positrons in the magnetic field deflect into opposite directions. The direction from the electron to the positron is hence aligned to the direction of the field. For this analysis, we first determine the direction of the field. The field appears perpendicularly to the reaction plane, and its direction depends on the orientation of the plane.
In this presentation, the status of the two analyses, polarization and deflection, in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV at ALICE will be presented.

[1] K. Ishikawa, D. Kimura, K. Shigaki, and A. Tsuji, J. Mod. Phys. A28 (2013) 1350100

Author: TANIZAKI, Remi (Hiroshima University (JP))

Presenter: TANIZAKI, Remi (Hiroshima University (JP))

Session Classification: Electromagnetic probes

Contribution ID: **34** Type: **parallel**

Study of performance for particle identification at sPHENIX

Thursday 7 August 2014 14:20 (20 minutes)

We will present our ongoing study of performance for particle identification at the sPHENIX project using a Geant4 simulation. The sPHENIX is the planned/anticipated upgrade of the PHENIX detector at RHIC. The physics programs of sPHENIX primarily aim at jets and heavy flavors. The program can be much enhanced with the preshower that provides separation of single photons from double photons from neutral pions up to 40 GeV/c and improved electron identification. A possible design of the preshower using a Geant4 simulation. The preshower detector is a very thin sampling calorimeter which is hence capable to observe electromagnetic showers at their initial development. First we calculate the lower limit of the opening angles of double photons from 40GeV/c neutral pions. Setting the cell size less than the lower limit allows us to identify the double photons, hence to separate high p_T single photons from high p_T neutral pions. Second, we try to improve the rejection power against charged pions to get a clean electron sample. The rejection power is found to reach the order of a thousand by properly choosing the cut parameters on the energy and shower shape in the preshower and the EM calorimeter in case of single particle. Further we have evaluated response in case of producing multiple particle using Hijing.

Author: NAGASHIMA, Kazuya (Hiroshima University)

Presenter: NAGASHIMA, Kazuya (Hiroshima University)

Session Classification: Future experimental facilities

Contribution ID: **35** Type: **plenary**

Next stages of PHENIX for enhanced physics with jets, quarkonia, and photons

Friday 8 August 2014 11:00 (30 minutes)

The PHENIX collaboration at BNL-RHIC has been developing detector upgrade plans for an enhanced physics program utilizing the improved luminosity of RHIC to explore the properties of the Quark-Gluon Plasma in the strong coupling regime in a way to complement the heavy ion programs at the LHC.

The next stage, referred to as sPHENIX, provides focused physics programs through a series of aggressive detector upgrades. The present PHENIX central arms are to be replaced with a former BaBar superconducting solenoid, and electromagnetic and hadronic calorimeters with a uniform coverage in the mid-rapidity, aiming at much enhanced jet measurements. Additional tracking layers and an electromagnetic preshower are under a discussion to enable the program to include quarkonia, and neutral mesons and direct photons across a wide range of transverse momentum up to 40 GeV/c.

The physics capabilities of the sPHENIX program will be presented, along with the detector designs and the time lines, as well as the planned staging toward an electron ion collider detector, called ePHENIX.

Author: SHIGAKI, Kenta (Hiroshima University (JP))

Presenter: SHIGAKI, Kenta (Hiroshima University (JP))

Session Classification: Plenary session 9

Contribution ID: **36** Type: **parallel**

Anomaly-induced transport in heavy-ion collisions

Thursday 7 August 2014 15:00 (20 minutes)

Anomaly-induced transport effects, like the chiral magnetic effect or the chiral separation effect, have recently attracted much attention. These effects represent the existence of dissipationless vector and axial currents along the magnetic field and are expected to occur in ultra-relativistic heavy-ion collisions. It has been pointed out that the coupling between the chiral magnetic effect and the chiral separation effect provokes a novel type of gapless collective excitation in the plasma, called chiral magnetic wave (CMW).

The experimental search for anomaly-induced transports in heavy-ion collisions is now ongoing. Since the CMW leads to an electric charge quadrupole deformation in the quark-gluon plasma (QGP) created in heavy-ion collisions, the elliptic flow parameter v_2 would be charge-dependent, which can be considered as a signal of anomalous transports [1]. The STAR Collaboration observed such a charge dependent elliptic flow for pions $\Delta v_2(\pi_\pm)$ [2]. This result seems to be consistent with the prediction from a simple model [1], in which propagation of non-interacting waves under spatially and temporally uniform temperature and homogeneous magnetic field is considered. However, since the QGP created in heavy-ion collisions is drastically expanding, it is necessary to describe the space-time evolution of the QGP together with that of electromagnetic fields in order to assess the contribution from anomalous transports.

In this study, we numerically solve anomalous hydrodynamic equations and apply it to the dynamics of heavy-ion collisions [3]. We develop a numerical code which is applicable to the description of the QGP under arbitrary external electromagnetic fields. We describe the propagation of the CMW in the expanding QGP under spatially and temporally inhomogeneous external electromagnetic fields. We analyze the charge-dependent elliptic flow $v_2^\pm$ and discuss possible implications for experimental observations of anomalous transport effects.

References:

[1] Y. Burnier, D. E. Kharzeev, J. Liao, and H. -U. Yee, Phys. Rev. Lett. 107, 052303 (2011)

[2] G. Wang [STAR Collaboration], Nucl. Phys. A904-905 2013, 248c (2013)

[3] M.Hongo, Y. Hirono, T. Hirano, [arXiv: 1309.2823]

Author: HONGO, Masaru (The University of Tokyo)

Co-authors: HIRANO, Tetsufumi (Sophia Univ); HIRONO, Yuji (Stony Brook University)

Presenter: HONGO, Masaru (The University of Tokyo)

Session Classification: Initial state physics

Contribution ID: **37** Type: **parallel**

Study of di-electron asymmetry in Au+Au collisions at RHIC-PHENIX

Wednesday 6 August 2014 15:00 (20 minutes)

Creation of a strong magnetic field in non-central heavy-ion collisions is predicted by several models. The field can reach as high as 10^{14} teslas at RHIC. Some interesting effects in a strong magnetic filed are discussed by theories but the field is yet to be directly detected experimentally. Direct (virtual) photons are good candidates for a probe of the field detection, because they are not affected by the strong interaction.
According to theoretical calculation using vacuum polarization tensor in external magnetic field, virtual photon decay probability depends on the field direction [1]. This phenomenon causes di-electron asymmetry with respect to the reaction plane and the strength of the asymmetry depends on collision centrality because the strength of the magnetic field changes over centrality. We look for the strong magnetic field effect via virtual photon decay by taking advantage of an excellent electron-identification capability in PHENIX. In this presentation, we will report the current status of di-electron asymmetry analysis.

[1] K. Ishikawa et. al., Int. J. Mod. Phys. A28 (2013) 1350100

Author: Mr HOSHINO, Tomoya (Hiroshima University)

Presenter: Mr HOSHINO, Tomoya (Hiroshima University)

Session Classification: Electromagnetic probes

Contribution ID: **38** Type: **parallel**

K* mesons in heavy ion collisions

We study the K*meson production in heavy ion collisions by focusing on the hadronic effects on the K* meson abundance. We evaluate the absorption cross sections of the K*meson and kaon by light mesons in the hadronic matter, and further investigate the variation in the meson abundances for both particles during the hadronic stage of heavy ion collisions. We show how the interplay between the effective width of the K* meson in the hadronic medium and the lifetime of the hadronic matter determines the final yield difference of the statistical hadronization model to the experimental measurements.

Authors: LEE, Su Houng (Yonsei University); CHO, Sungtae

Presenter: CHO, Sungtae

Contribution ID: **39** Type: **parallel**

Non-perturbative dilepton production rate in strongly interacting QGP

Wednesday 6 August 2014 15:40 (20 minutes)

We analyze the production rate of dileptons from the deconfined medium using a quark propagator obtained from a first principle lattice QCD numerical simulation. We calculate the dilepton production rate non-perturbatively at two temperatures in the deconfined phase with the quark propagator measured on the lattice. The photon-quark vertex is determined gauge-invariantly, so as to satisfy the Ward-Takahashi identity.
The obtained dilepton production rate shows an enhancement of order 10 or so compared with the rate from free quark systems at low invariant mass region and van Hove singularity. This rate could explain the discrepancy in the dilepton production yields in the low mass region between the PHENIX result and theoretical predictions.

Author: Mr KIM, Taekwang (Osaka University)

Co-authors: KITAZAWA, Masakiyo (Osaka University); ASAKAWA, Masayuki (Osaka University)

Presenter: Mr KIM, Taekwang (Osaka University)

Session Classification: Electromagnetic probes

Contribution ID: **40** Type: **parallel**

Lee-Yang zero from net baryon number multiplicity distributions

Thursday 7 August 2014 16:20 (20 minutes)

We discuss feasibility of detecting the QCD phase boundary using Lee-Yang zero from the net baryon number multiplicity distributions. Since only limited number of net proton can be measured in heavy ion collisions, the canonical partition function extracted from the multiplicity distribution loses information stored in the tail of the distribution.
By using a random matrix model, we investigate the behavior of distribution of Lee-Yang zero in complex chemical potential plane with respect to cutting the tail part of the distribution and compare them with the exact phase boundary. We found the zero closest to the real axis is insensitive to the tail. We also discuss the difference of those from the non-critical Skellam distribution and the characteristics to the case with the phase transition.

Author: MORITA, Kenji

Co-author: NAKAMURA, Atsushi (Hiroshima Univ)

Presenter: MORITA, Kenji

Session Classification: QCD phase diagram

Contribution ID: **41** Type: **parallel**

Two-particle correlations between neutral pions and charged hadrons in pp and Pb-Pb collisions with ALICE at the LHC

Wednesday 6 August 2014 15:20 (20 minutes)

The LHC heavy-ion physics program aims at investigating the properties of strongly-interacting matter in extreme conditions of temperature and energy density, where the formation of the Quark Gluon Plasma (QGP) is expected. Azimuthal angluar correlations between two particles provide a powerful tool to study medium-induced parton energy loss and jet modification in heavy-ion collisions. Neutral mesons production at high-pT is modified in Pb-Pb collisions due to the parton energy loss mechanism. Jet in trigger meson direction and opposite jet in azimuth are also quenched in the medium. Therefore, the charged particles yield associated with the high-pT neutral meson is modfied in Pb-Pb collisions compared to the pp reference at the same colliding energy.
ALICE, the only detector designed and optimized for heavy-ion physics at the LHC, measures the azimuthal angular correlations between neutral pions measured through the ElectroMagnetic Calorimeter (EMCAL) located at central rapidity(-0.7 < y < 0.7) and charged hadrons detected in the central tracking system. Azimuthal angular correlation distributions and jet yield modification measured by the ¼0-hadron correlations in pp and Pb-Pb collisions at sqrt(s_NN) = 2.76 TeV will be presented in the talk.

Author: ZHOU, Daicui (Institute of Particle Physics - Hua-Zhong Normal University)

Presenter: ZHOU, Daicui (Institute of Particle Physics - Hua-Zhong Normal University)

Session Classification: Jets

Contribution ID: **42** Type: **parallel**

Heavy flavor deconfinement, strangeness freeze-out and equation of state at nonzero density

We utilise our recent lattice QCD results on fluctuations and correlations of conserved charges to show that both strange and charm hadrons start to deconfine in the chiral crossover region of QCD. These lattice QCD calculations also provide evidence for the presence of additional, experimentally yet unobserved open charm and strange hadrons below the QCD crossover. We also show that when these additional strange hadrons are taken into account, they yield a lower value of the freeze-out temperature for strange hadrons. Finally, we present results for the lattice QCD equation of state at nonzero baryonic chemical potential. The lattice QCD equation of state is well controlled upto baryon chemical potential of about 300 MeV corresponding to RHIC BES runs down to $\sqrt{s_{NN}}$=12 GeV.

Author: HEGDE, Prasad

Presenter: HEGDE, Prasad

Contribution ID: **44** Type: **parallel**

Effects of near-zero Dirac eigenmodes on axial U(1) symmetry at finite temperature

Thursday 7 August 2014 17:00 (20 minutes)

We investigate the issue of possible restoration of the axial U(1) symmetry at finite temperature, using lattice simulations with the Mobius domain-wall fermion. In this talk, we focus on the effects of near-zero Dirac eigenmodes, which play a crucial role for both SU(2)xSU(2) chiral symmetry restoration and the restoration/breaking of axial U(1) symmetry.
Performing simulations at two different volumes, two different quark masses, and reweighting to other masses and to overlap Dirac operators, we study its volume, mass, residual mass dependences.

Author: TOMIYA, Akio (Osaka university)

Co-authors: Dr COSSU, Guido (KEK); FUKAYA, Hidenori (Unknown); Dr NOAKI, Junichi (KEK); HASHIMOTO, Shoji (KEK)

Presenter: TOMIYA, Akio (Osaka university)

Session Classification: QCD phase diagram

Contribution ID: **46** Type: **parallel**

Dielectron measurement in p-Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV with the ALICE detector

Wednesday 6 August 2014 14:00 (20 minutes)

The primary role of the ALICE experiment is to investigate the properties of the deconfined state of matter, the quark-gluon plasma (QGP), created in relativistic heavy-ion collisions.
Electron-positron pairs (dielectrons) are excellent probes for studying the properties of QGP. In the low mass region below 1 GeV/c^2, dielectrons from light vector meson decays and virtual photons are dominant. Information on direct photons and on the chiral symmetry restoration can be obtained by studying this invariant mass region.
In the intermediate and high mass region, above 1 GeV/c^2, dielectrons from semi-leptonic decays of open heavy flavors are the main contributions to the spectrum. They are sensitive to thermalization and energy loss in the medium.
Furthermore, the detailed study of heavy quark contributions is crucial to extract a signal of thermal radiation from the medium, which provides key information on the space-time evolution of QGP.
Initial state effects such as gluon shadowing, gluon saturation, and initial state energy loss are very important for heavy quark production because heavy quarks are produced by gluon fusion, gluon splitting, and flavor excitation at LHC energy. The initial state effects mentioned above can be investigated by studying proton-nucleus collisions, and the modifications of the transverse momentum and invariant mass spectra of dielectrons with respect to pp give important information on such cold nuclear matter effects in the intermediate and high mass regions.
To access to the intermediate and high mass regions, abundant high p_T electron samples are needed. In the ALICE experiment, the Transition Radiation Detector (TRD) is used for the electron identification above $p > 1$ GeV/c momentum. The TRD also provides an electron trigger to enrich the data samples for the study of charmonium and open heavy flavor production.
In 2012, ALICE has successfully collected p-Pb collisions with the TRD trigger($L_{\rm int} = 1.4$ nb^{-1}), allowing us to extend the invariant mass spectrum of dielectrons to higher pair $p_{\rm T}$ and mass.
We will present the status of the dielectron analysis in p-Pb collisions at $\sqrt{s_{\rm NN}}$=5.02 TeV and will also show the transverse momeuntum and invariant mass spectrum of the TRD-triggered dielectron sample in p-Pb collisions.

Author: HAYASHI, Shinichi (University of Tokyo (JP))

Presenter: HAYASHI, Shinichi (University of Tokyo (JP))

Session Classification: Electromagnetic probes

Contribution ID: **47** Type: **parallel**

Measurements of di-electron production in Au+Au collisions at RHIC-PHENIX

Wednesday 6 August 2014 14:20 (20 minutes)

The measurement of di-electrons is a powerful tool to study the properties of the strongly interacting matter formed in heavy-ion collisions. Since electrons are not subject to final state interactions, they carry the information at the time of their production. In an earlier di-electron measurement by PHENIX[1], a large enhancement of a factor of $\sim$5 with respect to expected hadronic sources was observed in the mass region 0.15-0.75 GeV/c^2 for minimum bias events. However, the measurement was limited by a huge combinatorial background dominated by the electrons from π^0 Dalitz decays and γ conversions. In order to remove such background electrons, a Hadron Blind Detector (HBD) was installed as an upgrade of the PHENIX detector. In 2009 and 2010, the HBD was successfully operated and a data sample of p+p collisions and Au+Au collisions were collected. In this presentation, we report the current status of the di-electron analysis at RHIC-PHENIX.
[1] A. Adare et al, Phys. Rev. C81, 034911(2010)

Author: Dr WATANABE, Yosuke (University of Tokyo)

Presenter: Dr WATANABE, Yosuke (University of Tokyo)

Session Classification: Electromagnetic probes

Contribution ID: **48** Type: **parallel**

CGC+HIJING, a new Monte-Carlo model for heavy ion collisions

In high energy hadronic collisions, non-linear effects in QCD becomes important due to high parton density at small-x which is formulated by the framework of Color Glass Glass Condensate (CGC).
We have developed a new Monte-Carlo event generator by implementing CGC framework into HIJING.
This is the first attempt to implement CGC into full event generator on market.
Therefore, our simulation includes particle productions by pQCD hard process, CGC, and soft interaction.
Partons produced from these processes are fragmented into hadrons within LUND string model. In this talk, some detail description of this newly developed model will be presented, and our results for heavy ion collisions will be discussed. We demonstrate this CGC+HIJING model in pp, pA, AA collisions at RHIC and LHC energies, and also apply for the pA collisions at cosmic ray energies. Our model provides a novel hadronic interaction model useful for air shower simulation code of Ultra High Energy Cosmic Rays.

Author: DENG, Wei-Tian (Huazhong University of Science and Technology)

Co-authors: FUJII, Hirotsugu (University of Tokyo); ITAKURA, Kazunori (KEK); Dr NARA, Yasushi (Akita International University)

Presenter: DENG, Wei-Tian (Huazhong University of Science and Technology)

Contribution ID: **49** Type: **plenary**

Gluon dynamics and kt factorization at small-x

Thursday 7 August 2014 11:30 (30 minutes)

In this talk, I would like to discuss the recent theoretical progress towards the exploration of the gluon saturation phenomenon in pA collisions at both RHIC and the LHC.
Two important pillars of this exploration are the single inclusive forward hadron productions and forward dihadron correlations, which have both been computed up to one-loop order within the small-x k_t factorization formalism. This has helped us to establish an effective k_t factorization at small-x. Furthermore, the one-loop calculation for dihadron productions in pA collisions shows that there is a new type of large logarithm, which is known as the Sudakov factor, arising in the back-to-back correlation limit. In addition, detailed numerical study for the single inclusive hadron production at next-to-leading order provides us good description of the RHIC data in dAu collisions.

Author: XIAO, Bowen (Central China Normal University)

Presenter: XIAO, Bowen (Central China Normal University)

Session Classification: Plenary session 7

Contribution ID: **50** Type: **parallel**

Polarization energy loss in hot viscous quark-gluon plasma

The gluon polarization tensor for the quark-gluon plasma with shear viscosity is derived with the viscous chromohydrodynamics. The longitudinal and transverse dielectric functions are evaluated from the gluon polarization tensor, through which the polarization energy loss suffered by a fast quark traveling through the viscous quark-gluon plasma is investigated. The numerical analysis indicates that shear viscosity significantly reduces the polarization energy loss.

Author: Prof. HOU, Defu (Central China Normal University)

Presenter: Prof. HOU, Defu (Central China Normal University)

Contribution ID: **51** Type: **parallel**

Production of Muons from Heavy-Flavour Hadron Decays in p–Pb Collisions at $\sqrt{s_{\rm NN}} = 5.02$ TeV with ALICE at the LHC

Wednesday 6 August 2014 16:20 (20 minutes)

Z.Zhang[1,2] ***for the ALICE Collaboration***

[1] *Key Laboratory of Quark and Lepton Physics(MoE) and Institute of Particle Physics, CCNU, Wuhan, China*

[2] *Laboratoire de Physique Corpusculaire, Clermont-Ferrand, France*

The LHC heavy-ion physics program aims at investigating the properties of
strongly-interacting matter in extreme conditions of temperature
and energy density,
where the formation of the Quark Gluon Plasma (QGP) is expected.
In high-energy heavy-ion collisions, heavy quarks(charm and beauty) are regarded as efficient probes of the properties of the QGP
as they are created on a short time compared to that of the QGP.
One of the observables for the study of the QGP properties is the nuclear modification $R_{\rm AA}$ defined as the ratio of the yield measured in Pb–Pb collisions to that observed in pp collisions scaled by the number of binary nucleon-nucleon collisions.

In order to disentangle hot and cold nuclear matter effects, the nuclear modification factor has been measured in p–Pb collisions.
In particular, $R_{\rm pPb}$ is expected to be around unity
if cold nuclear matter effects are small.
Moreover, measuring $R_{\rm pPb}$ also allows us to test models implementing
cold nuclear matter effects such as
modification of parton distribution
functions and parton saturation in the low-x region.

With ALICE, the detector designed and optimized for heavy-ion physics at
the LHC, open heavy-flavours are measured with the muon spectrometer in the pseudo-rapidity range $-4 < \eta < -2.5$ using semi-muonic decays.
The latest results on muons from heavy-flavour hadron decays
at forward and backward rapidity in p–Pb collisions at
$\sqrt{s_{\rm NN}} = 5.02$ TeV will be presented.
The nuclear modification factor of muons from heavy-flavour hadron decays
($R_{\rm pPb}$) and the forward-to-backward ratio ($R_{\rm FB}$) are presented as a function transverse momentum in minimum bias collisions.

Summary

The data are compared to perturbative QCD calculations including the EPS09 NLO parameterization
of shadowing.
The results confirm that the strong suppression measured at high $p_{\rm T}$ in central Pb–Pb collisions relative to binary scaled pp collisions, is due to the hot nuclear medium.

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Author: Mr ZHANG, Zuman (Central China Normal University CCNU(CN))

Presenter: Mr ZHANG, Zuman (Central China Normal University CCNU(CN))

Session Classification: Heavy Flavor

Contribution ID: **52** Type: **parallel**

Neutral pion analysis with high energy photon trigger in pp collisions at 8TeV

Wednesday 6 August 2014 14:20 (20 minutes)

ALICE is designed to study heavy-ion collisions at the LHC to investigate properties of deconfined strongly interacting matter, Quark Gluon Plasma (QGP). High p_{T} particle production is considered as a powerful tool to study the QGP. The hadron yields in nucleus-nucleus collisions can be quantified by the nuclear modification factor R_{AA}. The R_{AA} at high p_{T} is significantly smaller than 1, which can be interpreted by the parton energy loss. Measurements of hadron production in pp collisions is important as a reference for studying heavy-ion collisions.

The high-energy photon trigger was deployed by the Photon Spectrometer (PHOS) of the ALICE detector to enhance the higher pT photon and neutral pion detection capability. To evaluate the neutral pion production cross-section with this trigger, the trigger efficiency for neutral pion has to be studied. Minimum-bias data sample was used to measure the trigger efficiency for a single cluster as a function of reconstructed energy. The trigger efficiency for neutral pion is then estimated in simulations using the single-cluster efficiency. The status of analysis of neutral pion production in pp collisions at $\sqrt{s} = 8$ TeV measurement with the high-energy photon trigger will be presented.

Author: YANO, Satoshi (Hiroshima University (JP))

Presenter: YANO, Satoshi (Hiroshima University (JP))

Session Classification: Jets

Contribution ID: **53** Type: **parallel**

Low p_T non-photonic electron production in AuAu collisions at $\sqrt{s_{\rm NN}} = 200$ GeV

Wednesday 6 August 2014 16:40 (20 minutes)

Particles containing heavy quarks are very useful tool to investigate the properties of hot and dense matter produced in early stage of the relativistic heavy ion collision in terms of the mechanisms of their interaction with nuclear matter. This can be studied by non-photonic electrons (NPE) coming from semi-leptonic decays of heavy flavor hadrons. In year 2010, STAR has collected a large sample of minimum bias Au+Au events at $\sqrt{s_{\rm NN}} = 200$ GeV with newly implemented full barrel Time-Of-Flight detector. This enables us to analyze NPE production in the low p_T region ($0.2 < p_T < 2.0$ GeV/c) with high statistics.
In this presentation we report status of the low p_T NPE analysis in Au+Au collisions at $\sqrt{s_{\rm NN}} =$ 200 GeV at STAR.

Author: Mr OH, Kunsu (Pusan National University (KR))

Presenter: Mr OH, Kunsu (Pusan National University (KR))

Session Classification: Heavy Flavor

Contribution ID: **54** Type: **parallel**

Jet azimuthal distributions with high p_T neutral pion triggers in pp collisions at $\sqrt{s}$ = 7 TeV from LHC-ALICE

Wednesday 6 August 2014 14:00 (20 minutes)

Jet measurements play an essential role in probing the hot and dense matter in heavy ion collisions through parton energy loss and in observation of possible modification of this matter by the deposited energy.\\
In this talk, we report azimuthal distributions of charged jets with respect to neutral pion triggers with large transeverse momentum (p_T) in pp collisions at $\sqrt{s}$ = 7 TeV from ALICE. Neutral pions are identified using the electromagnetic calorimeter (EMCal). Jets are reconstructed from charged particle tracks that are measured by the Time-Projection Chamber (TPC) and Inner-Tracking System (ITS).\\
The sample of neutral pions is enhanced by using the EMCal gamma trigger in combination with a shower shape analysis to identify neutral pions. We report conditional yields and Gaussian widths of both near and away-side correlation peaks as a function of neutral pion trigger p_T and jet p_T. The results will also be compared with PYTHIA.

Author: WATANABE, Daisuke (University of Tsukuba (JP))

Presenter: WATANABE, Daisuke (University of Tsukuba (JP))

Session Classification: Jets

Contribution ID: **56** Type: **parallel**

pi^{0} production in p-Pb collisions at sqrt{s_{NN}}=5.02 TeV with ALICE PHOton Spectrometer at the LHC

Wednesday 6 August 2014 16:40 (20 minutes)

The measurement of the neutral pion production in p-Pb collisions provides the information about the nuclear modified parton distribution function and allows to disentangle initial-state effects and final-state effects for Pb-Pb collisions. Meanwhile, it is also important to understand the decay photon background in measuring the direct photon production.

The ALICE experiment at the LHC performs measurements of the neutral pion spectrum and the nuclear modification factor $\mathrm{R_{pPb}}$ in p-Pb collisions at $\sqrt{\mathrm{s_{NN}}} = 5.02$ TeV with different methods, using two electromagnetic calorimeters via two-photon decays, as well as the central tracking system to reconstruct photons via conversion in the materials of the inner ALICE detectors and to reconstruct the π^0 Dalitz decay. In this contribution, we will focus on the measurements by ALICE PHOton Spectrometer. Comparison of the π^0 spectra from all ALICE subsystems will also be shown.

Author: ZHU, Hongsheng (Central China Normal University CCNU (CN))

Presenter: ZHU, Hongsheng (Central China Normal University CCNU (CN))

Session Classification: Hadron production

Contribution ID: **57** Type: **parallel**

ALICE-ITS Pixel Chip Test-system at Pusan National University

Thursday 7 August 2014 14:40 (20 minutes)

The ALICE (A Large Ion Collider Experiment) is a general purpose experiment dedicated to the study of heavy ion collisions at the LHC. The main goal of the ALICE-ITS (Inner Tracking System) upgrade project is to improve the vertexing and the tracking capabilities at low pT according to projected luminosity at LHC. The new ITS is, therefore, based on the latest silicon pixel technology and designed to raise the data taking rate with new readout system and to reduce the pixel size and the material budget. We construct a pixel chip test system at Pusan National University to measure the characteristics of the pixel chips. We present some results of the prototype pixel chip.

Authors: Mr LIM, Bong-Hwi (Pusan National University(KR)); YOO, In-Kwon (Pusan National University (KR)); KIM, Jiyoung (Pusan National University (KR)); CHOI, Kyungeon (Pusan National University (KR))

Presenter: KIM, Jiyoung (Pusan National University (KR))

Session Classification: Future experimental facilities

Contribution ID: **58** Type: **parallel**

The holographic potential model of the quarkonium and its dissociation

Thursday 7 August 2014 16:00 (20 minutes)

We explore analytically the screening property of the heavy-quark potential within the framework of AdS/QCD. The results show that under a fairly general conditions of the metric underlying AdS/QCD, the screening remains kink-like, like that of the super Yang-Mills. In other words, AdS/QCD cannot provide a exponentially screening potential in the plasma phase. We shall also point out the kink-like screening potential may violate fundamental principles of quantum field theories.
Furthermore, we considered the relativistic effect on basis of the NR limit, and calculated the first order correction of the quarkonium dissociation temperature using the holographic potential model from AdS/CFT. Starting from the Hamiltonian of the two body Dirac equation, under the Foldy-Wouthuysen transformation. Respect to the perturbative calculation, in spite of the large constituent mass, the correction is significant in size, especially for J/Ψ. In addition, the first order relativistic correction will lower the dissociation temperature with a holographic potential.

Author: WU, Yan (Central China Normal University)

Co-author: Prof. HOU, Defu (Central China Normal University)

Presenter: WU, Yan (Central China Normal University)

Session Classification: Theoretical developments 2

Contribution ID: **59** Type: **parallel**

The Ginzburg-Landau Free Energy in Holographic Superconductor

Thursday 7 August 2014 16:20 (20 minutes)

The approach to study holographic superconductor with the *Gauge/ Gravity correspondence* is a novel method to explore the strong coupled system, for instance, the research to high temperature superconductor. It triggers an instructive thought to tackle strong coupled system. Holographic superconductor system is composed of gravitational field; gauge field and complex scalar field. A lot of researches are done since the mechanism of holographic superconductor was posed by Gubser et.al. in 2008, and many of numerical computations and simulations reveal the Ginzburg-Landau paradigm is obeyed near the critical temperature. However the analytic formulas of the order-parameter and Ginzburg-Landau free energy were not obtained.

Our motivation is to analytically derive the Ginzburg-Landau free energy from holographic superconductor action and seek the general expression of order-parameter. A conundrum of the coupled fields is there exist no analytic solution for their motion of equations. However all information about condensate and phase transition are concealed within those equations . To tackle this difficult problem, we change the differential equation of gauge field into an integral form and obtain its iterative solution, substituting the iterative solution of gauge field in a specified ensemble, we switch the holographic superconductor action into functional of scalar field. Performing a variation, we have a non-linear integro-differential equation of scalar field to describe its behavior deviating from the critical temperature, where the asymptotic coefficients correspond to the one-point function on AdS boundary theory. On the other hand, at the critical point, the gauge field has an exact analytic solution and the EoM of the scalar field becomes a standard Sturm-Liouville problem, this differential equation is a Fuchian equation with **Five** singularities, its leading eigenvalue is related to the critical temperature. We employ the complete functions from the Sturm-Liouville equation to expand the solution of the integro-differential equation and obtain the relation between the order-parameter and expansion coefficients. At last, the analytic formulas of order-parameter and Ginzburg-Landau coefficients are obtained in (grand) canonical ensemble with conformal dimension one and two, respectively.

We verify the consistency between our formulation and the fundamental thermodynamic relation. Utilizing our formulas, we calculate the scaling coefficients of order-parameter and Ginzburg-Landau coefficients in s-wave holographic superconductor. For the canonical ensemble part, the scaling coefficient has been computed via numerical simulation since 2008, our results is in close good agreement with the results from computation. The difference of the scaling coefficients between the two thermodynamic ensembles is revealed manifestly from our formulas. By comparing with the situation in classically weak coupled BCS theory, we interpret this difference results from the feature of strong coupled system. Further, the Ginzburg-Landau free energy in inhomogeneous space is studied.

Summary

- The **analytical formulas** of *Order-Parameter* in G.C.E and C.E.
- The **on-shell** and **off-shell** *Ginzburg-Landau Free Energy* are achieved.
- The **Ginzburg-Landau coefficients** are obtained.
- The **difference** of order-parameter between *G.C.E and C.E.* reveals the *Strong-coupling feature* of holographic superconductor.

- The **criterion** of *Thermodynamic Consistency* is deduced.
- The GL free energy in **inhomogeneous space** is considered.

Author: Dr YIN, Lei (Institute of Particel Physics)

Co-authors: Prof. HOU, Defu (Central China Normal University); Prof. REN, Hai-cang (Rockefeller University)

Presenter: Dr YIN, Lei (Institute of Particel Physics)

Session Classification: Theoretical developments 2

Contribution ID: **60** Type: **parallel**

Entropy fluctuation from hydrodynamic noise

Wednesday 6 August 2014 14:20 (20 minutes)

In the hot and dense QCD matter, quarks and gluons are deconfined to form Quark-Gluon Plasma (QGP). The QGP, which existed in the early universe, can be created experimentally by the relativistic heavy ion collisions at RHIC and LHC. The dynamics of the QGP in these experiments is well described by relativistic hydrodynamics.
Recently event-by-event initial fluctuations have been included in the hydrodynamic models. In addition to these fluctuations, fluctuations originated from thermal noises arise during hydrodynamic evolution. To investigate this hydrodynamic fluctuation, causal fluctuating hydrodynamics is formulated very recently [1]. Applying this framework to the (0+1)-dimensional Bjorken expansion, we investigate total entropy fluctuations. Final entropy is fluctuating around mean value. More interestingly, we found that, in one event, entropy can decrease with time although its probability is quite small. The probability of the events with decreasing entropy and that with increasing entropy are related through ''fluctuation theorem" [2]. Through this theorem, we also calculate the entropy fluctuation and claim that the thermal noise gets more important in the smaller systems such as p-A and peripheral A-A collisions.

[1] K. Murase and T. Hirano, arXiv:1304.3243.
[2] D. J. Evans and D. J. Searles, PRE52, 5839 (1995).

Author: Mr KURITA, Ryuichi (the Univ. of Tokyo, RIKEN, Sophia Univ.)

Co-authors: Mr NAGAI, Kenichi (Sophia Univ.); MURASE, Koichi (The University of Tokyo); HIRANO, Tetsufumi (Sophia Univ)

Presenter: Mr KURITA, Ryuichi (the Univ. of Tokyo, RIKEN, Sophia Univ.)

Session Classification: Collective dynamics

Contribution ID: **61** Type: **parallel**

Thermal interpretation of the proton number fluctuations in the beam-energy scan at RHIC/STAR

Wednesday 6 August 2014 17:00 (20 minutes)

We exposit an interpretation of the kurtosis and the skewness of the proton number fluctuation based on a thermal model.
We demonstrate that the kurtosis decreases to show a significant deviation from the unity due to quantum statistics when the baryon density grows up. Such a simple estimate of the fluctuations in a thermal gas picture fits in with the experimental data of the beam-energy scan at RHIC/STAR.

We also discuss effects from the nuclear matter region where the density dependent in-medium mass would further decrease the fluctuations.

Author: Dr SASAKI, Takahiro (Tokyo University)

Co-author: FUKUSHIMA, Kenji (Keio University)

Presenter: Dr SASAKI, Takahiro (Tokyo University)

Session Classification: Hadron production

Contribution ID: **62** Type: **parallel**

Measurement of direct photon collective flow in Au+Au $\sqrt{s_{NN}}$=200GeV collisions at RHIC-PHENIX experiment

Wednesday 6 August 2014 15:20 (20 minutes)

Due to small cross section in the QGP direct photons preserve information about different stages of the heavy ion collisions.
Therefore, detailed measurement of direct photons can be considered as a powerful probe to study QGP physics.

Photons have different angular emission patterns depending on their production mechanism.
The second order azimuthal anisotropy (v_2) of direct photons is measured at PHENIX, and none-zero positive v_2, comparable to that of hadrons, is observed at low p_T.
The production mechanism of the positive v_2 has not yet been well understood, and the third order azimuthal anisotropy (v_3) of direct photons has been expected to provide additional constrains for theoretical models.

We report the current results of direct photon v_2 and v_3 in Au+Au $\sqrt{s_{NN}}$=200GeV collisions at PHENIX.

Author: Mr MIZUNO, Sanshiro (University of Tsukuba, RIKEN (JP))

Presenter: Mr MIZUNO, Sanshiro (University of Tsukuba, RIKEN (JP))

Session Classification: Collective dynamics

Contribution ID: **63** Type: **parallel**

Parametric instabilities in the earliest stage of heavy ion collisions

Thursday 7 August 2014 15:20 (20 minutes)

Instabilities play important roles in thermalization of heavy ion collisions since they may affect the emergence of chaoticity and field-particle conversions. In classical Yang-Mills fields, there are several known instabilities
induced by color magnetic fields; Weibel and Nielsen-Olesen instabilities. We investigate instabilities of classical gluon fields under the homogeneous, but time dependent color magnetic fields in the linear regime.

Due to the time periodicity of the background magnetic field, we can analyze the stability of fluctuations based on the Floquet theory which consists the basis of the Bloch theory. As a result, we get the complete structure of instability bands appear from parametric resonance and growth rates of fluctuating fields. We find that the parametric instabilities considered here have the different nature from the above two types of instabilities.

In the presentation, we also discuss the relevance of these instabilities to the particle production in the earliest stage of heavy ion collisions.

Author: TSUTSUI, Shoichiro (Kyoto University)

Co-authors: OHNISHI, Akira (Kyoto University); IIDA, Hideaki (Kyoto University); KUNIHIRO, Teiji (Kyoto University)

Presenter: TSUTSUI, Shoichiro (Kyoto University)

Session Classification: Initial state physics

Contribution ID: **64** Type: **parallel**

Entropy production in the early stage of relativistic heavy-ion collisions from the Glasma

Thursday 7 August 2014 14:40 (20 minutes)

Entropy production in the early stage of relativistic heavy-ion collisions is studied based on the classical Yang-Mills (CYM) dynamics.
CYM field is regarded as a coherent state, and then the von-Neumann entropy is calculated from the density matrix given by the coherent state assuming that the matrix is diagonal due to decoherence.
We calculate the entropy in the non-expanding plasma from Glasma initial condition, and find that this increases rapidly when longitudinal fluctuations are added in the initial state.
With larger fluctuations, chaotic behavior of the CYM field and hence entropy production emerges in the earlier time, and then earlier thermalization is achieved.
We show that reasonable strengths of the initial fluctuations with respect to the amplitude of the background classical field could account for the early thermalization suggested by the phenomenological analysis based on the hydrodynamics.

Author: IIDA, Hideaki (Kyoto University)

Co-authors: OHNISHI, Akira (Kyoto University); KUNIHIRO, Teiji (Kyoto University); TAKAHASHI, Toru T. (Gunma National College of Technology)

Presenter: IIDA, Hideaki (Kyoto University)

Session Classification: Initial state physics

Contribution ID: **65** Type: **parallel**

A calculation of $\alpha_i$and $\beta_i$in the Israel-Stewart Equation for a hadronic gas

Thursday 7 August 2014 16:40 (20 minutes)

A second order relativistic hydrodynamical equation, Israel-Stewart Equation, contains additional transport coefficients α_i and β_i. We numerically evaluate the coefficients by using a hadro-molecular simulation and discuss the temperature dependences and the baryon number density dependences.

Author: Prof. MUROYA, Shin (Dept. of C.M., Matsumoto Univ.)

Presenter: Prof. MUROYA, Shin (Dept. of C.M., Matsumoto Univ.)

Session Classification: Theoretical developments 2

Contribution ID: **66** Type: **parallel**

Higher harmonics from causal hydrodynamic fluctuation

Wednesday 6 August 2014 14:40 (20 minutes)

The hydrodynamic fluctuations are thermal fluctuations arising in the event-by-event hydrodynamic evoluation of the system, and its power spectrum is determined through the fluctuation-dissipation relation. While, the higher harmonics v_n are systematically observed in RHIC and LHC and attract a lot of theoretical and experimental interests. Initial state fluctuations turned out to be important to explain these higher harmonics through event-by-event hydrodynamic simulations. The event-by-event hydrodynamic fluctuation, although its average is locally zero, also has effects on the higher harmonics and other observables in the same manner as the initial fluctuations which vanish in the averaged picture of the initial condition. We implement causal hydrodynamic fluctuation [1] in our (3+1)-dimensional dissipative hydrodynamics code, and investigate the effect of the hydrodynamic fluctuation,in addition to the initial state fluctuations, on higher harmonics.

Author: MURASE, Koichi (The University of Tokyo)

Co-author: HIRANO, Tetsufumi (Sophia Univ)

Presenter: MURASE, Koichi (The University of Tokyo)

Session Classification: Collective dynamics

Contribution ID: **67** Type: **parallel**

Charged hadron flow in Cu+Au collisions at RHIC-PHENIX

Wednesday 6 August 2014 15:00 (20 minutes)

Quark Gluon Plasma(QGP) is a phase of nuclear matter at high temperature and high energy density.
And this is experimentally formed by relativistic nucleus collisions at RHIC.
Flow measurements played an important role in understanding basic properties of QGP
, because it reflects the initial spatial anisotropy.
In 2012, Cu+Au collisions, the first asymmetric collisions of heavy nuclei, were operated at RHIC in order to provide more differential information of QGP property.
For this purpose, various observables were measured in Cu+Au collisions for different conditions from those in symmetric collisions: participant density profiles, pressure gradients, initial triangularity
at mid-central collisions and corona-less smaller nucleus in most-central collisions.
In this talk we present current analysis status of flow observables in Cu+Au 200 GeV collisions at PHENIX as a function of transverse momentum and (pseudo)rapidity

Author: Mr NAKAGOMI, Hiroshi (University of Tsukuba)

Presenter: Mr NAKAGOMI, Hiroshi (University of Tsukuba)

Session Classification: Collective dynamics

Contribution ID: **68** Type: **parallel**

Charmonium spectra and dispersion relation with improved Bayesian analysis in lattice QCD

Wednesday 6 August 2014 17:00 (20 minutes)

We study the charmonium property at finite temperature and finite momentum in quenched lattice QCD with improved maximum entropy method (MEM).
We extend the MEM analysis to the product space of the correlation functions at more than two different momenta to take advantage of more data and the strong correlation among Euclidean correlators with different momenta.
Then we find that this method drastically improves the error of the reconstructed images.
We apply this method to analyze the dispersion relation of charmonia at finite temperature with two different lattice spaces.

Author: IKEDA, Atsuro (Osaka University)

Co-authors: KITAZAWA, Masakiyo (Osaka University); ASAKAWA, Masayuki (Osaka University)

Presenter: IKEDA, Atsuro (Osaka University)

Session Classification: Heavy Flavor

Contribution ID: **69** Type: **plenary**

Phase diagram at strong coupling

Thursday 7 August 2014 09:30 (30 minutes)

We study the QCD phase diagram in the strong coupling region with finite coupling and fluctuation effects. Elucidating the phase diagram structure in QCD is a big challenge,
but the sign problem in finite density lattice QCD make it difficult to perform precision ab initio calculations. The strong coupling lattice QCD is a promising machinery, in which the effective action is obtained by integrating the link variables analytically at a given order of the strong coupling expansion, then the sign problem is expected to be weakened.

We have investigated the QCD phase diagram at strong coupling in the mean field approximation [1], and recently we have examined the fluctuation effects in the strong coupling limit by using the auxiliary field Monte-Carlo (AFMC) method [2]. Compared with the mean field results, hadron phase is found to be suppressed (extended) at low (high) chemical potential. These results are consistent with those obtained in the monomer-dimer-polymer (MDP) simulation [3].

It is staightforward to include finite coupling effects in AFMC. Next-to-leading order (NLO) effective action terms proportional to $1/g^2$ appear from one plaquette configurations and are found to contain four-Fermi and eight-Fermi interactions of quarks. We can transform the effective action including $1/g^2$ terms into that in the bilinear form of quarks by using the extended Hubbard-Stratonovich (EHS) transformation. As a first step, we have performed a Monte-Carlo calculation with temporal plaquette configurations at $\mu = 0$. The phase transition temperature is found to decrease at finite coupling [4] as found in the mean field approximation. Effective action terms from spatial plaquette configurations requires multi-step EHS transformations, and it seems that naive bosonization leads to a severer weight cancellation [4].

In the presentation, we first review the previous studies of strong coupling lattice QCD including those in the mean field treatment, MDP and AFMC methods. Next we discuss finite coupling and fluctuation effects. We also discuss the order of the phase transition based on the finite size scaling of the chiral susceptibility in the strong coupling limit. Several prescriptions to weaken the sign problem are also discussed.

[1] T. Z. Nakano, Kohtaroh Miura, Akira Ohnishi, Phys. Rev. D 83 (2011), 016014; T. Z. Nakano, K. Miura, A. Ohnishi, Prog. Theor. Phys. 123 (2010), 825; K. Miura, T. Z. Nakano, A. Ohnishi, Noboru Kawamoto, Phys. Rev. D 80 (2009), 074034.
[2] T. Ichihara, A. Ohnishi, T. Z. Nakano, arXiv:1401.4647 [hep-lat].
[3] W. Unger, P. de Forcrand, J. Phys. G38 (2011) 124190.
[4] T. Ichihara, A. Ohnishi, in preparation.

Author: Prof. OHNISHI, Akira (YITP, Kyoto University)

Presenter: Prof. OHNISHI, Akira (YITP, Kyoto University)

Session Classification: Plenary session 6

Contribution ID: **70** Type: **parallel**

QCD theta-vacua from the chiral limit to the quenched limit

Thursday 7 August 2014 17:00 (20 minutes)

We study the quark mass dependence of the QCD θ-vacua in the framework using the Veneziano — Di-Vecchia Lagrangian, which reproduces topological properties of QCD on the two boundaries related to the quark mass, i.e. the chiral limit and the quenched limit. Then we find that for any quark mass, there are the continuous structures of the vacua, including the first order phase transitions at $\theta = \pi$. We also investigate general mechanisms of the QCD θ-vacua dependent on the quark mass; how the vacuum is determined in QCD and what role then the quark mass plays for the determination. To do this we reveal the quark mass dependence of the chiral condensate. Additionaly we discuss what is the differece of the phase transition at $\theta = \pi$ in the chiral and quenched limit from the point of view of the θ-vacuum struture dependent on the quark mass.

Author: MAMEDA, Kazuya (The University of Tokyo)

Presenter: MAMEDA, Kazuya (The University of Tokyo)

Session Classification: Theoretical developments 2

Contribution ID: **71** Type: **plenary**

Experimental results from RHIC

Tuesday 5 August 2014 11:30 (30 minutes)

Ultra-relativistic heavy-ion collision experiments are being carried out at RHIC and LHC in order to investigate the properties of quark gluon plasma at extreme temperature and density. Recent results from RHIC experiments are reviewed especially on hard and penetrating probes as well as collective bulk signals in heavy ion collisions including asymmetric and small systems.

Author: Dr ESUMI, ShinIchi (Inst. of Physics, Univ. of Tsukuba)

Presenter: Dr ESUMI, ShinIchi (Inst. of Physics, Univ. of Tsukuba)

Session Classification: Plenary session 1

Contribution ID: **72** Type: **parallel**

Medium modification of jet shapes in heavy-ion collisions

Wednesday 6 August 2014 14:40 (20 minutes)

Jet shape gives the internal energy distribution of a jet and its alteration in heavy-ion collisions relative to hadron-hadron reactions has recently attracted a lot of attentions. In this talk we investigate the medium modification of differential jet shapes in heavy-ion collisions within the framework of QCD resummation at NLO for pp baseline and PYQUEN parton energy loss model in AA reactions. A centrality-dependent nuclear modification of differential jet shapes and their comparison of experimental data are present.

Summary

It is shown that the differential jet shapes are significantly modified after fast parton propagated the hot and dense nuclear matter created in this reaction. The angular distribution of medium induced gluon ratiation is close relative to the medium correction of jet shapes. In peripheral collisions, the jet shapes in heavy-ion collisions are similar to those in pp collisions.

Author: Mr CHEN, Shi-Yong (CCNU)

Co-authors: Prof. ZHANG, Ben-Wei (CCNU); Dr LI, Zhao (Institute of High Energy Physics)

Presenter: Mr CHEN, Shi-Yong (CCNU)

Session Classification: Jets

Contribution ID: **73** Type: **parallel**

Omega production in p+p, Au+Au and U+U collisions at STAR

Multi-strange hadrons are excellent probe to the hadronization of the hot and dense medium produced in heavy ion collisions, since they may decouple earlier from the hadronic system. The measurements of Ω enhancement factor in heavy ion collisions is good test of canonical models, and Ω nuclear modification factors at intermediate pT are also good examination of recombination/coalescence models. However, the limited statistics put large uncertainties in those measurements. The high-statistics p+p, Au+Au and U+U data collected by STAR during the years of 2011 and 2012 will enable a high-precision systematic survey of these observables. Comparing data from Au+Au and U+U collisions also allows us to identify possible different medium properties due to different system size.

In this talk, we present the measurements of Ω production in p+p, Au+Au and U+U collisions at top RHIC energies. The Ω nuclear modification factors will be presented for both Au+Au and U+U collisions. Strangeness enhancement factors for Ω in U+U, Au+Au with respect to p+p collisions will be presented as well. Implications on collision dynamics will be discussed.

Author: Dr ZHU, Xianglei (Tsinghua University)

Presenter: Dr ZHU, Xianglei (Tsinghua University)

Contribution ID: **74** Type: **plenary**

Future perspectives of the ALICE experiment and detector upgrade

Friday 8 August 2014 11:30 (30 minutes)

The goal of the ALICE experiment at CERN-LHC is to study the structure of QCD phase diagram at extremely high temperature and very small baryon chemical potential. In particular, ALICE focuses on the properties of the hot and dense matter possibly created in ultra-relativistic heavy ion collisions. The strength of the ALICE experiment is excellent tracking down to low $p_{\mathrm{T}}(\sim$ 150 MeV/c), as well as the a variety of particle identification techniques, compared to other LHC experiments. After the LS2 (2018 Long Shutdown), ALICE will focus on rare probes, such as heavy-flavors, quarkonium, photons and jets with improved performance, thanks to the detector upgrade which will further strengthen the physics potential of the experiment. The long term strategy of the ALICE upgrade is to fully utilize high luminosity provided by the LHC after the LS2, and to collect minimum 10 nb^{-1} with the collision rates 50 kHz (luminosities L = $6 \times 10^{27}\mathrm{cm}^{-2}\mathrm{s}^{-1}$) in order to carry out the precision measurements of rare probes.

In this talk, we present the current status of ALICE detector upgrades in both near and long terms, and discuss the proposed measurements with expected precisions in future.

Author: MASUI, Hiroshi (University of Tsukuba (JP))

Presenter: MASUI, Hiroshi (University of Tsukuba (JP))

Session Classification: Plenary session 9

Contribution ID: **75** Type: **not specified**

QCD phase structure: An experimental overview

Tuesday 5 August 2014 10:00 (30 minutes)

Presenter: MOHANTY, Bedangadas (Institute of Physics)

Session Classification: Plenary session 1

Contribution ID: **76** Type: **not specified**

QCD phase structure: A theoretical overview

Tuesday 5 August 2014 10:30 (30 minutes)

Presenter: FUKUSHIMA, Kenji (urn:Facebook)

Session Classification: Plenary session 1

Contribution ID: **77** Type: **not specified**

Welcome

Tuesday 5 August 2014 09:50 (10 minutes)

Presenter: ASAKAWA, Masayuki (Osaka University)

Session Classification: Plenary session 1

Contribution ID: **78** Type: **not specified**

Hard probes overview

Tuesday 5 August 2014 14:00 (30 minutes)

Presenter: QIN, Guang-You (Central China Normal University)

Session Classification: Plenary session 2

Contribution ID: **79** Type: **not specified**

Soft physics overview

Tuesday 5 August 2014 14:30 (30 minutes)

Presenter: YOO, In-Kwon (Pusan National University (KR))

Session Classification: Plenary session 2

Contribution ID: **80** Type: **not specified**

Higher harmonic flows as probes

Tuesday 5 August 2014 15:00 (30 minutes)

Presenter: Dr JIA, Jiangyong (State University of New York (US))

Session Classification: Plenary session 2

Contribution ID: **81** Type: **not specified**

Energy dependence of dielectron production in AuAu collisions at RHIC

Tuesday 5 August 2014 17:00 (30 minutes)

Presenter: ZHAO, jie (lbl&sinap)

Session Classification: Plenary session 3

Contribution ID: **82** Type: **not specified**

Exotics search in STAR at RHIC

Tuesday 5 August 2014 17:30 (30 minutes)

Presenter: XIN, Kefeng

Session Classification: Plenary session 3

Contribution ID: **83** Type: **not specified**

Energy dependence of net-Q, net-p distributions at RHIC

Wednesday 6 August 2014 10:30 (30 minutes)

Presenter: Prof. LUO, Xiaofeng (Central China Normal University)

Session Classification: Plenary session 4

Contribution ID: **84** Type: **not specified**

QCD phase structure: the latest results on the lattice

Thursday 7 August 2014 09:00 (30 minutes)

Presenter: Prof. GUPTA, Sourendu (TIFR, Mumbai)

Session Classification: Plenary session 6

Contribution ID: **85** Type: **not specified**

Energy dependence of dielectron production in AuAu collisions at RHIC

Presenter: ZHAO, jie (lbl&sinap)

Contribution ID: **86** Type: **not specified**

Bottomonia at finite temperature

Wednesday 6 August 2014 11:30 (30 minutes)

Presenter: KIM, Seyong (Unknown)

Session Classification: Plenary session 5

Contribution ID: **87** Type: **not specified**

Initial gluon fluctuations

Presenter: TRIBEDY, Prithwish (VECC)

Contribution ID: **88** Type: **not specified**

Closing

Friday 8 August 2014 12:00 (10 minutes)

Session Classification: Plenary session 9

Contribution ID: **89** Type: **not specified**

Jet Physics with ALICE at LHC

Wednesday 6 August 2014 09:00 (30 minutes)

does not need

Author: ZHANG, Xiaoming (Lawrence Berkeley National Lab. (US))

Presenter: ZHANG, Xiaoming (Lawrence Berkeley National Lab. (US))

Session Classification: Plenary session 4