Workshop for young scientists with research interests focused on physics at FAIR

Report of Contributions

https://indico.gsi.de/e/fairness2013

Contribution ID: **4** Type: **not specified**

Microscopic-macroscopic method for studying single-particle level density of superheavy nuclei

Tuesday, 17 September 2013 11:00 (30 minutes)

The shell structure of heavy nuclei with Z > 104, which can be produced in the actinide-based complete fusion reactions, is studied with modied two-center shell model. Using microscopic-macroscopic approach, the mass excesses and Q_alpha - values are calculated and compared with available experimental data. The predicted properties of superheavy nuclei show that the next doubly magic nucleus beyond 208 Pb is at Z >= 120. It is shown that the production cross sections of new superheavy nuclei decisively depend on the position of proton shell closure.

Primary authors: Mrs BEZBAKH, Anna (Joint Institute for Nuclear Research); Mr ADAMIAN, Gurgen (Joint Institute for Nuclear Research); Mr ANTONENKO, Nikolay (Joint Institute for Nuclear Research)

Presenter: Mrs BEZBAKH, Anna (Joint Institute for Nuclear Research)

Session Classification: Talks and Discussions

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

Triplet Based Online Track Finding in the PANDA-STT

Friday, 20 September 2013 15:00 (30 minutes)

The PANDA-Experiment at the future FAIR facility in Darmstadt will implement a Micro-Vertex-Detector (MVD) and a large-volume Straw Tube Tracker (STT) around the target interaction region together with a set of GEM disks for the charged particle tracking within a 2 T solenoidal magnetic field. The STT is a gas based detector which is comprised of 4636 cylindrical drift chambers (straw tubes) of 1 cm diameter and 150 cm length, filling an almost cylindrical volume from 16 cm up to a radius of 42 cm around the MVD.

At PANDA a continuous readout mode of the detectors is required due to the broad range of different event topologies and the very high interaction rate of 2*10^7 annihilations per second. Due to the similar topology of the interesting physics events and the hadronic background, PANDA will use an online event filter which uses high level information (PID, momentum, invariant mass, etc.) to distinguish signal events from background. Such high level information must be reconstructed in a continuous manner and tracking is a key input to do so.

I will present an online tracking scheme for PANDA which is designed to continuously reconstruct all particle tracks to provide the required input for the online event filter. A variety of algorithms is foreseen to allow an optimized, staged processing of the incoming data.

I will also present a fast and efficient track finding algorithm. It works without knowledge of the event time and is based on the detection of hit triplets in the STT. It is based on the identification of hit triplets within a certain time window. It is then particularly simple to analytically calculate the circle parameters of the track helix' projection into the xy-plane. Due to its simplicity it is suitable as an early algorithm in the aforementioned online tracking scheme and can provide seed information for subsequent algorithms.

This work was supported by BMBF, HIC4FAIR and Forschungszentrum Jülich GmbH.

Primary author: Dr MERTENS, Marius C. (Justus-Liebig-Universität Gießen)

Presenter: Dr MERTENS, Marius C. (Justus-Liebig-Universität Gießen)

Session Classification: Talks and Discussions

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

Effective field theory for the weak ΛN–>NN interaction

Friday, 20 September 2013 11:30 (30 minutes)

An effective field theory for the weak ΛN–>NN interaction has
been developed up to next-to-next-to leading order.
The relation between the low energy constants appearing in the
leading order effective field theory description and the parameters
of the one-meson-exchange model previously developed are obtained.
We extract the relative importance of the different exchange mechanisms
included in the meson picture by means of a comparison to the
corresponding operational structures appearing in the effective approach.
The ability of this procedure to obtain the weak baryon-baryon-meson
couplings for a possible scalar exchange is also discussed.
The calculation of the two-pion exchange diagrams and the contact
operational structures contributing to next-to-leading and next-to-next-to-leading
orders will also be presented.

Primary author: Mr PÉREZ-OBIOL, Axel (Universitat de Barcelona)

Co-authors: Dr PARREÑO, Assumpta (Universitat de Barcelona); Dr JULIÁ-DÍAZ, Bruno (Universitat de Barcelona); Dr R. ENTEM, David (Universidad de Salamanca)

Presenter: Mr PÉREZ-OBIOL, Axel (Universitat de Barcelona)

Session Classification: Talks and Discussions

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

Finite density equation of state of QCD by means of resummed perturbation theory

Monday, 16 September 2013 12:00 (30 minutes)

I will report on recent perturbative studies of the hot and dense QCD equation of state, via two different resummed perturbation theories.
Using Hard-Thermal-Loop perturbation theory (HTLpt), the full one-loop pressure as well as various diagonal quark number susceptibilities are derived.
In addition, the same quantities are computed by resummation of the well known four-loop finite density equation of state, obtained via dimensional reduction.
A detailed comparison of these results, for various numbers of flavors, with lattice data is performed, with emphasis on the good agreement down to the phase transition region.
Finally, the convergence of the high-temperature truncation, approximation which is needed at higher-loop order in HTLpt, is analysed.

Primary author: Mr MOGLIACCI, Sylvain (Bielefeld University)

Presenter: Mr MOGLIACCI, Sylvain (Bielefeld University)

Session Classification: Talks and Discussions

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

Wilson coefficients of Four-Quark Condensates for the Description of Medium Modifications of qQ Mesons

Monday, 16 September 2013 14:30 (30 minutes)

Medium dependent spectral properties of qQ mesons are evaluated by means of QCD sum rules at non-zero nucleon densities and/or temperatures. The well-known operator product expansion (OPE) of qQ mesons in medium up to mass dimension 5 is extended to four-quark condensate contributions of mass dimension 6. A complete catalogue of four-quark condensates in the qQ sector is presented. The calculation of associated Wilson coefficients from tree-level diagrams is performed for pseudo-scalar interpolating currents. Condensates containing field operators of heavy quarks are expanded in powers of the inverse heavy quark mass. Adding four-quark condensate contributions of heavy quarks to the medium OPE goes beyond latest D meson sum rule evaluations. First numerical results showing the impact of four-quark condensate contributions are presented. Since the medium dependence of four-quark condensates is expected to influence the in-medium properties of mesons, accessible at the envisaged experiments at FAIR, the determination of the four-quark condensate contributions is crucial.

Supported by BMBF.

Primary author: Mr BUCHHEIM, Thomas (Helmholtz-Zentrum Dresden-Rossendorf, Technische Universität Dresden)

Co-authors: Prof. KÄMPFER, Burkhard (Helmholtz-Zentrum Dresden-Rossendorf, Technische Universität Dresden); Dr HILGER, Thomas (Helmholtz-Zentrum Dresden-Rossendorf, Technische Universität Dresden)

Presenter: Mr BUCHHEIM, Thomas (Helmholtz-Zentrum Dresden-Rossendorf, Technische Universität Dresden)

Session Classification: Talks and Discussions

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

Strange and heavy mesons in hadronic matter

Wednesday, 18 September 2013 09:00 (45 minutes)

We discuss recent results on the properties of strange and heavy flavored mesons in hot hadronic matter.
The strange meson sector is studied within a chiral unitary approach in coupled channels for kaon/antikaon nucleon interactions. As an application, we focus on the in-medium cross sections in several channels (such as Kbar N -> pi Sigma), which are of particular interest for microscopic transport simulations of strangeness production in heavy-ion collisions.
Regarding heavy flavored mesons, triggered by a sizable dispersion of results in the literature, we present a study of charm and bottom transport coefficients in a hot meson gas such as is formed in the hadronic phase of heavy ion collisions. We emphasize on the relevance of using realistic models for the interaction of heavy mesons with the constituents of the medium (mostly pions). Implications for heavy meson spectrum observables in Heavy Ion Collisions are discussed.

Primary author: CABRERA, Daniel (Frankfurt University)

Presenter: CABRERA, Daniel (Frankfurt University)

Session Classification: Talks and Discussions

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

The relation between cross section, decay width and imaginary potential of heavy quarkonium in a quark-gluon plasma

Thursday, 19 September 2013 12:00 (30 minutes)

Computations with weakly-coupled plasmas and some lattice results suggest that the heavy quarkonium potential has an imaginary part that is important in order to study dissociation. This imaginary part is due to the inelastic scattering with partons in the medium. At temperatures much below dissociation another process that is known to be important is the so-called gluo-dissociation. The aim of this work is to clarify in a perturbative framework the relation of the different expressions for the quarkonium cross sections that
can be found in the literature with the quarkonium thermal width. Finally, with the use of effective field theories we evaluate the quasi-free and gluo-dissociation cross sections in a wide range of temperatures ranging from the binding energy to the dissociation temperature.

Primary author: Dr ESCOBEDO ESPINOSA, Miguel Angel (Technische Universität München)

Presenter: Dr ESCOBEDO ESPINOSA, Miguel Angel (Technische Universität München)

Session Classification: Talks and Discussions

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

D-meson diffusion in hadronic matter

Wednesday, 18 September 2013 11:30 (30 minutes)

We calculate the transport coefficients for D mesons in a finite-temperature bath, populated by light mesons and baryons.
Using the Fokker-Planck formalism, the drag force and diffusion coefficients are obtained as a function of temperature, baryonic chemical potential and particle content.
The interaction with light mesons and baryons is described with the help of effective field theories up to temperatures around T=140 MeV. Scattering amplitudes are unitarized to preserve the unitarity of the scattering matrix.
We present recent results at vanishing baryochemical potential, and for hadronic trajectories at typical FAIR energies, at finite net nuclear density.

Primary author: Dr TORRES-RINCON, Juan M. (Institut de Ciencies de l'Espai, Barcelona (Spain))

Co-authors: Dr CABRERA, Daniel (Frankfurt Institute for Advanced Studies (Frankfurt a.M.)); Dr LLANES-ESTRADA, Felipe J. (Universidad Complutense de Madrid (Spain)); Dr TOLOS, Laura (Institut de Ciencies de l'Espai, Barcelona (Spain)); Dr ABREU, Luciano M. (Universidade Federal da Bahia (Brazil))

Presenter: Dr TORRES-RINCON, Juan M. (Institut de Ciencies de l'Espai, Barcelona (Spain))

Session Classification: Talks and Discussions

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

Zero temperature properties of mesons and baryons from an extended linear sigma-model

Friday, 20 September 2013 14:30 (30 minutes)

We study scalar, pseudoscalar, vector, and axial-vector mesons as well as octet and decouplet baryons with non-strange and strange quantum numbers in the framework of a linear sigma model with global chiral U_L(3)xU_R(3) symmetry for the mesons and SU_L(3)xSU_R(3) for the baryons. We perform a global fit of meson masses, decay widths, as well as decay amplitudes. The quality of the fit is, for a hadronic model that does not consider isospin-breaking effects, surprisingly good. After the fit in the mesonic sector we also do fit in the baryon sector. We also investigate the question whether the scalar \bar{q}q states lie below or above 1 GeV and find the scalar states above 1 GeV to be preferred as \bar{q}q states. Additionally, we also describe the axial-vector resonances as \bar{q}q states.

Primary author: Dr KOVACS, Peter (Wigner Research Centre for Physics, Hungary)

Co-authors: Dr PARGANLIJA, Denis (Vienna University, Vienna); Prof. RISCHKE, Dirk (Goethe University, Frankfurt); Dr GIACOSA, Francesco (Goethe University, Frankfurt); Prof. WOLF, Gyuri (Wigner Research Centre for Physics, Hungary)

Presenter: Dr KOVACS, Peter (Wigner Research Centre for Physics, Hungary)

Session Classification: Talks and Discussions

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

Monte-Carlo simulation of lepton pair production in ”p pbar −> e+e− + X” events at PANDA

Tuesday, 17 September 2013 15:30 (30 minutes)

The lepton pair production process in collisions of antiproton beam (E_beam = 15 GeV) with proton target in PANDA experiment is
studied on the basis of event samples simulated with PYTHIA6 generator and PandaRoot package. The considered quark level subprocesses goes through the production of virtual photon which converts into the lepton pair (q qbar −> gamma* −> e+e-). Such
quark-antiquark annihilation process of hadron-hadron collision may provide an interesting information about the quark dynamics
inside the hadron.
The distributions of different kinematical variables of final leptons, as well as their correlations and comparison at fast and full simulation level, will be presented. The problems of the background separation will be discussed. The set of cuts which could help to supress the background will be proposed.

Primary author: Dr SKACHKOVA, Anna (JINR)

Presenter: Dr SKACHKOVA, Anna (JINR)

Session Classification: Talks and Discussions

Contribution ID: **14** Type: **not specified**

Evolution of elliptic and triangular flow as a function of beam energy in a hybrid model

Thursday, 19 September 2013 11:30 (30 minutes)

Elliptic flow has been one of the key observables for establishing the finding of the quark-gluon plasma (QGP) at the highest energies of Relativistic Heavy Ion Collider (RHIC) and the Large Hadron Collider (LHC). As a sign of collectively behaving matter, one would expect the elliptic flow to decrease at lower beam energies, where the QGP is not produced. However, in the recent RHIC beam energy scan, it has been found that the inclusive charged hadron elliptic flow remains nearly constant in magnitude in the energies between 7.7 and 39 GeV per nucleon-nucleon collision.

We study the collision energy dependence of the elliptic and triangular flow utilizing a Boltzmann+hydrodynamics hybrid model described in [1,2]. Such a hybrid model provides a natural framework for the transition from high collision energies, where the hydrodynamical description is essential, to smaller energies, where the hadron transport dominates. This approach is thus suitable to investigate the relative importance of these two mechanisms for the production of the collective flow at different values of beam energy. Extending the examined range down to 5 GeV per nucleon-nucleon collision allows also making predictions for the CBM experiment at FAIR.

References:
[1] H. Petersen, J. Steinheimer, G. Burau, M. Bleicher and H. Stocker, Phys. Rev. C78, 044901 (2008).
[2] J. Auvinen and H. Petersen, arXiv:1306.0106.

Primary author: AUVINEN, Jussi (Frankfurt Institute for Advanced Studies)

Co-author: PETERSEN, Hannah (Frankfurt Institute for Advanced Studies)

Presenter: AUVINEN, Jussi (Frankfurt Institute for Advanced Studies)

Session Classification: Talks and Discussions

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

Mesons, PANDA and the Importance of Scalar Glueball

Tuesday, 17 September 2013 10:00 (30 minutes)

I review outstanding issues in the sector of scalar mesons with particular emphasis on reasons why a scalar glueball has not yet been unambiguously identified and how PANDA possesses the potential to resolve this important question of low-energy QCD. Such an effort will require input from theory that will also be discussed.

Primary author: Dr PARGANLIJA, Denis (Vienna TU)

Presenter: Dr PARGANLIJA, Denis (Vienna TU)

Session Classification: Talks and Discussions

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

Experimental overview of PANDA

Friday, 20 September 2013 09:15 (45 minutes)

The physics program of the PANDA (anti-Proton ANhiliation ar DArmstadt) experiment will address various questions related to the strong interactions by employing a multi-purpose detector system at the High Enery Storage Ring for anti-protons of the upcoming Facility for Anti-proton and Ion Research (FAIR).

The excellent antiproton beam resolution of $\Delta p/p \approx 10\text{-}5$ and the high luminosity L=2x1032cm-2s-1 will allow the precise measurement of the charmonium spectrum both below and above the open charm threshold as well as investigations in the region of D and Ds resonances. There is a large discovery potential for exotic hadrons like multiquarks, glueballs and hybrids, since there is significant less mixing with the much narrower conventional states in the charmonium energy region. The study of in-medium modifications of hadrons and the nucleon structure is also part of the physics program.

An overview of the different experimental aspects and of the physics topics of the PANDA experiment will be presented.

Primary author: FIORAVANTI, Elisa (INFN Ferrara)

Presenter: FIORAVANTI, Elisa (Istituto Nazionale di Fisica Nucleare (INFN-Ferrara))

Session Classification: Talks and Discussions

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

Production of heavy meson-pairs at proton-antiproton collisions within a double handbag approach

Tuesday, 17 September 2013 11:30 (30 minutes)

We study the pair-production of heavy mesons in proton-antiproton annihilations within a perturbative QCD motivated framework [A.T. Goritschnig, B. Pire and W. Schweiger, Phys.Rev. D87 (2013) 014017]. In particular we investigate p \bar{p} to \bar{D^0} D^0 within a double handbag approach, where the hard process ud ubar dbar to cbar c factorizes from soft matrix elements of c q q operators. The soft matrix elements can be parameterized by transition distribution amplitudes, which are off-diagonal in flavor space. The transition distribution amplitudes are modelled by representing them as overlaps of light-cone wave-functions (where we have treated the proton within a quark-diquark picture). We obtain rather robust model results for p \bar{p} -> \bar{D^0} D^0 cross sections, which are also expected to be measured at the future PANDA detector at GSI-FAIR.

Primary author: Dr GORITSCHNIG, Alexander Thomas (Ecole Polytechnique)

Co-authors: Prof. PIRE, Bernard (Ecole Polytechnique); Prof. SCHWEIGER, Wolfgang (University of Graz)

Presenter: Dr GORITSCHNIG, Alexander Thomas (Ecole Polytechnique)

Session Classification: Talks and Discussions

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

Polyakov Loop Susceptibilities in Pure Gauge System

Friday, 20 September 2013 12:00 (30 minutes)

We shall present the new lattice data on Polyakov loop susceptibilities in SU(3) pure gauge system. Like the Polyakov loops, the susceptibilities can serve as the order parameter for the spontaneous Z(3) center symmetry breaking. In the context of Polyakov loop effective models, these susceptibilities are related to the curvatures of the potential. We shall discuss how the new data can be employed to constrain various Polyakov loop models. We shall also discuss the determination of critical end point for deconfinement phase transition in the heavy quark regime.

Primary author: Dr LO, Pok Man (GSI)

Presenter: Dr LO, Pok Man (GSI)

Session Classification: Talks and Discussions

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

Electron identification in Au+Au at 1.23 GeV/u using multi-variate analysis

Tuesday, 17 September 2013 14:30 (30 minutes)

The High Acceptance Di-Electron Spectrometer experiment, installed at GSI, Darmstadt, has measured rare penetrating probes and strange particles production in elementary nucleon-nucleon as well as in heavy ion collisions. In recent years, an upgrade of the data acquisition system was carried out and a major improvement of the spectrometer in terms of granularity and particle identification capability has been made by replacing the TOFino detector with the new Resistive Plate Chamber (RPC) time-of-flight wall. Thanks to this, the heaviest system, Au+Au at a beam kinetic energy of 1.23 GeV/u has been measured by HADES in April - May 2012.
In such collisions, extracting a pure sample of very rare di-electrons radiated from a dense fireball plays a crucial role. Therefore, a careful electron identification is necessary. This can be achieved by exploring not only information from the Ring Imaging Cherenkov detector but also from the time-of-flight measurement in combination with an evidence of an electromagnetic shower formation. Since a sequence of one- or two-dimensional cuts has been proven to be insufficient, lepton identification has to be done using a multi-dimensional condition calculated by an artificial neural network.
In this contribution I will present results on efficiency and purity of electron identification obtained using multi-variate analysis method.

Primary author: Mr HARABASZ, Szymon (Technische Universität Darmstadt (TUDA))

Presenter: Mr HARABASZ, Szymon (Technische Universität Darmstadt (TUDA))

Session Classification: Talks and Discussions

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

Simulation and optimization of the PANDA detector to measure the form factor of the Ds semileptonic decay

Thursday, 19 September 2013 11:00 (30 minutes)

Semileptonic decays Ds-> e + ν + π,η,η' are an excellent environment for precision measurements of the CKM matrix element |Vcd| and |Vcs|. These decays are governed by both the weak and strong forces; extraction of the weak CKM parameters requires knowledge of strong interaction effects. These can be parameterized by form factors, which encapsulate the QCD bound-state effects. Techniques such as lattice quantum chromodynamics (LQCD) offer increasingly precise calculations of these form factors, but as the uncertainties in the predictions shrink, experimental validation of the results becomes increasingly important. Furthermore, in these decays, the gluonic contributions enter that couple to the singlet component of the η and η', and that the mass corrections are more important due to the larger strange quark mass. The important observables are the branching fractions and the q2 variation of the transition form factor. Therefore, the investigation of this system opens a new approach to improve the mixing angle as well.

In the reconstruction procedure, we focus on developing the software and evaluating the expected precision of these measurements with the Monte Carlo simulation studies of the physics performance of the PANDA detector. The related decay models in this chain are checked via Dalitz plot analyses; the present version of EvtGen in PANDAROOT has been enhanced by a new model describing the Ds- ->K+K-pi- decay. With the help of theoretical predictions of the cross section, the production rate is estimated. The next steps include detailed investigations of the reconstruction efficiency and resolution, incorporating kinematic fit procedures to extract information on the unmeasured neutrino in the final state.

Primary author: Ms CAO, Lu (IKP1, Forschungszentum Juelich)

Co-author: Prof. RITMAN, James (IKP1, Forschungszentrum Juelich)

Presenter: Ms CAO, Lu (IKP1, Forschungszentum Juelich)

Session Classification: Talks and Discussions

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

Reconstruction of pi0 and eta mesons via external conversion in Au+Au at 1.23 AGeV with HADES

Tuesday, 17 September 2013 15:00 (30 minutes)

Lepton pairs emerging from decays of virtual photons are considered to be the most promising probes of dense hadronic matter. The HADES experiment at GSI studies dielectron radiation as well as strangeness production in various proton, deuteron and heavy-ion induced reactions. The understanding of the corresponding experimental results calls for supporting studies from transport
calculations. For a more model independent understanding of the dilepton pair cocktail the production cross sections of particles created during the freeze out is crucial.
In this contribution we will present results from a 4-lepton
analysis of Au+Au in 1.23 AGeV collisions providing information on
pi0 and eta mesons. Therefore the ability of HADES to detect dilepton pairs from external conversion of real photons has been studied in details. To gain further insight we will compare a clean sample of simulated mesons created with the PLUTO event generator to UrQMD cocktail simulations as well as real measured lepton double pair distributions.

Primary author: Mrs BEHNKE, Claudia (Institut fuer Kernphysik, Goethe-Universitaet, Frankfurt, Germany)

Co-authors: Prof. STROTH, Joachim (Institut fuer Kernphysik, Goethe-Universitaet, Frankfurt, Germany); Prof. GALATYUK, Tetyana (Technische Universität Darmstadt)

Presenter: Mrs BEHNKE, Claudia (Institut fuer Kernphysik, Goethe-Universitaet, Frankfurt, Germany)

Session Classification: Talks and Discussions

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

Search for mesic nuclei in the photoproduction of η and η' mesons off light nuclei

Thursday, 19 September 2013 10:00 (30 minutes)

For the understanding of the strong nuclear force,
the interaction of mesons with nuclei is important.
In case of long lived charged mesons, like π and K,
secondary beams can be used for experiments.
But the situation is different for the short lived neutral mesons,
like η and η'.
The only access is indirect, making use of final-state interaction.
The mesons are produced with some initial reaction in the nucleus
and then their interaction with the same nucleus is studied.
It is much discussed whether it is possible to form,
via the strong interaction, quasi-bound states of mesons and nuclei,
which would be the ideal tool for such studies.
Experimentally, signatures for such states have been sought
in the threshold behavior of meson production reactions,
using different probes.
We will present results from the Crystal Ball/TAPS
experiment at the Mainz MAMI accelerator for coherent photoproduction
of neutral mesons, showing strong threshold
enhancement in particular for the ^3He case and discuss their relevance
for the formation of an η-mesic state.
Furthermore a fist attempt has been made to measure the threshold behavior
of the photoproduction of η' mesons from the ^3He and ^2H.
Preliminary results will be discussed.

Primary author: Dr KESHELASHVILI, Irakli (University of Basel)

Presenter: Dr KESHELASHVILI, Irakli (University of Basel)

Session Classification: Talks and Discussions

Contribution ID: **26** Type: **not specified**

Dileptons from Transport Calculations and Coarse-grained Dynamics

Saturday, 21 September 2013 10:15 (30 minutes)

Microscopic transport models are frequently used to investigate dilepton production in nuclear collisions, but usually they have difficulties to deal with in-medium effects in heavy-ion collisions. We present an alternative approach that uses coarse-grained output from transport calculations with the UrQMD model to determine thermal dilepton emission rates. For this purpose, a four-dimensional space-time grid is set up to extract local baryon and energy densities, respectively temperature and baryon chemical potential. The lepton pair emission is then calculated for each cell of the grid using thermal equilibrium rates. A big advantage of this approach is that it enables to cover the whole space-time evolution and all collision energies (from SIS and FAIR to RHIC) in a unified description. We compare the resulting spectra with HADES and NA60 data, present predictions for future FAIR energies and investigate the influence of different spectral functions and equations of state. Moreover, the results are contrasted to pure transport respectively transport-hydro hybrid calculations.

Primary author: Mr ENDRES, Stephan (Frankfurt Institute for Advanced Studies / University of Frankfurt)

Co-authors: Dr VAN HEES, Hendrik (Frankfurt Institute for Advanced Studies); Prof. BLEICHER, Marcus (Frankfurt Institute for Advanced Studies / University of Frankfurt)

Presenter: Mr ENDRES, Stephan (Frankfurt Institute for Advanced Studies / University of Frankfurt)

Session Classification: Talks and Discussions

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

How spinodal decomposition influences observables at FAIR energies

Monday, 16 September 2013 11:30 (30 minutes)

The FAIR facility will make the region of high net-baryon densities experimentally accessible, where a first-order phase transition is conjectured. We investigate the dynamics of chiral symmetry breaking and the onset of confinement during a heavy-ion collision at large baryochemical potentials within a nonequilibrium chiral fluid dynamics model including effects of dissipation and noise. The order parameters are explicitly propagated and coupled to a fluid dynamically expanding medium of quarks. We demonstrate that the coupled system is strongly influenced by spinodal instabilities creating domains in the order parameters and large spatial fluctuations in the baryon density within single events. As a consequence we find a clear enhancement of higher flow harmonics at the first-order phase transition in comparison with transitions through the crossover or critical point.

Primary author: Mr HEROLD, Christoph (Frankfurt Institute for Advanced Studies)

Co-author: Prof. BLEICHER, Marcus (Frankfurt Institute for Advanced Studies)

Presenter: Mr HEROLD, Christoph (Frankfurt Institute for Advanced Studies)

Session Classification: Talks and Discussions

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

The Compressed Baryonic Matter experiment

Thursday, 19 September 2013 14:30 (30 minutes)

The Compressed Baryonic Matter (CBM) experiment will be one of the major scientific pillars of the future Facility for Antiproton and Ion Research (FAIR) in Darmstadt. The goal of the CBM research program is to explore the QCD phase diagram in the region of high net baryon densities using high-energy nucleus-nucleus collisions. This includes the study of the equation-of-state of nuclear matter at high densities, and the search for the deconfinement and chiral phase transitions. The CBM detector is designed to measure both bulk observables with large acceptance and rare diagnostic probes such as charmed particles, multi-strange hyperons and low mass vector mesons. The physics program of CBM will be summarized, followed by an overview of the detector concept. Finally, the expected physics performance of CBM will be presented and discussed.

Primary author: Dr SEDDIKI, Selim (GSI/Darmstadt)

Presenter: Dr SEDDIKI, Selim (GSI/Darmstadt)

Session Classification: Talks and Discussions

Contribution ID: **29** Type: **not specified**

Investigation of surface homogeneity of mirrors for the CBM-RICH detector and low-mass di-electron feasibility studies in CBM

Monday, 16 September 2013 10:00 (30 minutes)

The Compressed Baryonic Matter (CBM) experiment at the future FAIR facility will investigate high baryon density matter at moderate temperatures in A+A collisions from 3-35 AGeV. One of the key observables of the CBM physics program is electromagnetic radiation from the early fireball carrying undistorted information on its conditions to the detector. This includes detailed investigations of low-mass vector mesons in their di-electron channel. A clean and efficient identification of electrons is required for such measurements. In CBM the electron identification will be performed by a Ring Imaging Cherenkov detector and several layers of Transition Radiation Detectors. The RICH detector will be operated with CO2 radiator gas, MAPMTs as photodetector and spherical glass mirrors as focusing elements. A high quality of the mirrors in terms of reflectivity and surface homogeneity is required. In the first part of the contribution results on measurements of the mirror surface homogeneity are presented. Results on the feasibility studies of low-mass di-electron measurements with realistic detector response are discussed in the second part of the contribution.

Primary author: Mrs LEBEDEVA, Elena (Justus-Liebig-Universität Gießen)

Co-author: Prof. HOEHNE, Claudia (Justus-Liebig-Universität Gießen)

Presenter: Mrs LEBEDEVA, Elena (Justus-Liebig-Universität Gießen)

Session Classification: Talks and Discussions

Contribution ID: **30** Type: **not specified**

Overview of the Compressed Baryonic Matter Experiment at FAIR

Wednesday, 18 September 2013 11:00 (30 minutes)

The Compressed Baryonic Matter (CBM) Experiment will explore the phase diagram of strongly interacting matter in the region of high net baryon densities. The experiment is laid out for nuclear collisions at rates up to 10 MHz, the highest in the field. A unique wide spectrum of observables will be accessible, including rarest probes like hadrons containing charm quarks, or multi-strange hyperons.
The realization of the full CBM physics programme requires heavy-ion beams of energies up to 45 GeV/nucleon. Those will be delivered by the SIS-300 synchrotron at the completed FAIR accelerator complex. Parts of the research programme can already be addressed with the SIS-100 synchrotron installed in the same machine tunnel for the start phase of FAIR. The initial energy range of up to 11 GeV/nucleon for heavy nuclei, 14 GeV/nucleon for light nuclei, and 29 GeV for protons, allows addressing the equation of state of compressed nuclear matter, the properties of hadrons in a dense medium, the production and propagation of charm near the production threshold, and exploring the third, strange dimension of the nuclide chart.
In the presentation I will give an overview of the CBM physics programmes and the detector configurations, and end with a short summary of the status of prototype developments.

Primary author: Mr BALOG, Tomas (GSI)

Presenter: Mr BALOG, Tomas (GSI)

Session Classification: Talks and Discussions

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

Track measurements in the high multiplicity environment at the CBM experiment

Thursday, 19 September 2013 15:00 (30 minutes)

In the Compressed Baryonic Matter (CBM) experiment at FAIR, the Silicon Tracking System (STS) will perform track reconstruction and momentum determination of the charged particles created in interactions of heavy-ion beams with nuclear targets. The STS will consist out of 8 tracking layers located at distances between 30 cm and 100 cm downstream of the target inside the 1 T magnetic dipole field. An ultra-low material budget is required to achieve momentum resolution of the order of $\Delta p/p = 1\%$. Thus come the restrictions on the location of power-dissipating front-end electronics to be placed outside the physics aperture. The active volume of the STS is built from 300 μm thick double-sided silicon microstrip sensors mounted onto lightweight carbon fiber support ladders. The sensors will be read out through ultra-thin micro-cables with fast self-triggering electronics at the periphery of the stations where also other infrastructure such as cooling can be placed.

I will present the development status of the detector system, highlighting the overview of the STS layout, tracking algorithms, performance simulations and test results with prototypes.

Primary author: Mr GHOSH, Pradeep (GSI Darmstadt - Goethe Univeritaet Frankfurt)

Presenter: Mr GHOSH, Pradeep (GSI Darmstadt - Goethe Univeritaet Frankfurt)

Session Classification: Talks and Discussions

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

The psi(4040) at the future PANDA experiment

Monday, 16 September 2013 15:00 (30 minutes)

The PANDA experiment will be carried out at the future FAIR facility, it
will be a fixed target experiment, where antiproton beams, of unprecedented quality and intensity, will be used to study interaction on protons and on nuclei.
PANDA will be an excellent tool to investigate final states which include short-lived particles. Since different charmonium states can be accessed in direct formation with all the available quantum numbers in
antip-p annihilations, the charmonium spectroscopy is one of the main goal of the experiment. The PANDA experiment represents a unique possibility to improve both statistics
and precision of existing data and to further explore the physics in the charm quark
sector. Indeed, an energy scan with high precision over the full charm spectrum is still
missing and will not be delivered by future experiments currently planned as upgrade of the existing facilities.
A detailed description of the possibility to reconstruct the psi(4040)-> D+ *D*- at PANDA, together with the study of
the huge hadronic background suppression will be presented. The importance of the Micro-Vertex Detector for the reconstruction of D mesons decay will be showed.

Primary author: Ms ZOTTI, laura (University of Torino and INFN Torino)

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Presenter: Ms ZOTTI, laura (University of Torino and INFN Torino)

Session Classification: Talks and Discussions

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

Double handbag description of proton-antiproton annihilation into a light meson pair

Friday, 20 September 2013 11:00 (30 minutes)

We propose to describe the process $p\bar{p} \to \pi^- pi^+$ in a perturbative QCD motivated framework where a double-handbag hard process $ud\bar{u}\bar{d} \to d\bar{d}$ factorizes from transition distribution amplitudes (TDAs). A TDA describes the non-perturbative transition of the proton to the meson by emission of 2 quarks and absorption of an antiquark (analogously for the $\bar{p} \to \pi^-$). We advocate that the scale allowing this factorization is the large transverse momentum transfer. We calculate this process in a simplified framework in which the proton is considered as a quark-(scalar) diqark. We model the TDAs as overlaps of ight-cone wave functions and present the expected cross sections for the PANDA experiment at GSI-FAIR.

Primary author: Mr KOFLER, Stefan (University of Graz)

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Presenter: Mr KOFLER, Stefan (University of Graz)

Session Classification: Talks and Discussions

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

Status and future plan of deeply bound pionic atoms spectroscopy

Friday, 20 September 2013 15:30 (30 minutes)

The masses of hadrons like protons and neutrons are considered to be partially due to the result of the spontaneous chiral symmetry breaking. The chiral symmetry is known to be restored in hot or dense medium and the order parameter of the chiral symmetry breaking <qbar q > diminishes. We need to study this effect quantitatively in order to improve our understanding of the origin of mass.
Spectroscopy of deeply bound pionic atoms provides us with the evidence of the restoration of chiral symmetry breaking in nuclear medium experimentally. From the past experiment using the (d, He3) nuclear reaction, which were performed at GSI [1], it was deduced that the order parameter of chiral condensate <q qbar > is reduced by 30 percent at the nuclear saturation density compared with the vacuum value of <q qbar >.

Currently we are performing a series of experiments to study systematically several deeply bound pionic atoms with stable nuclei at RIBF in order to reduce the error of <qbar q >. Thanks to high intensity deuteron beam at RIBF, we can achieve higher count rate than previous experiment and the high rate is indispensable for the systematic study. We conducted a pilot experiment employing Sn122 target in 2010 and observed the deeply bound pionic Sn121 states. The angular dependence of the cross section of pionic atom formation was measured for the first time [2].
In parallel with the experiment at RIBF, we are planning the spectroscopy of pionic atoms with unstable nuclei using inverse kinematics reaction d(HI, He3) where HI denotes unstable nuclei. The measurement with unstable nuclei such as neutron rich nuclei is highly motivated because it enable us to study the <qbar q > at different nuclear density due to the neutron skin effect and the density dependence of <qbar q >. Our recent simulation study shows that the experiment is feasible by employing active target deuterium gaseous TPC and an array of silicon detectors placed inside it to measure the full energy of He3 [3].
In this contribution, we will present the the experimental setup and the recent analysis of the pilot experiment at RIBF. The detailed results of the feasibility study of the inverse kinematics will be presented in respect to the resolution and the yield of the pionic atom.

[1] K.Suzuki et al. , Phys. Rev. Lett. , 92, 072302(2004).
[2] T. Nishi et al. , Accel. Prog. Rep. 45, iv (2012).
[3] K. Okochi et al., to be submitted to Nucl. Instr. Meth.

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Presenter: Mr WATANABE, Yuni (Department of Physics, The University of Tokyo)

Session Classification: Talks and Discussions

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

Nonequilibrium dynamics and transport near the chiral phase transition of a quark-meson model

Monday, 16 September 2013 11:00 (30 minutes)

Based on the 2PI quantum effective action of the linear sigma model with constituent quarks, we develop a transport approach to study systems out of equilibrium. In particular, we focus on the chiral phase transition as well as the critical point in QCD, where nonequilibrium effects near the phase transition give rise to critical behavior of the ordering parameter. Predictions for long-range correlations and fluctuations of observables in our model could be used to indicate a phase transition.

Primary author: Mr MEISTRENKO, Alex (University of Frankfurt)

Co-authors: Prof. GREINER, Carsten (University of Frankfurt); Mr WESP, Christian (University of Frankfurt); Dr VAN HEES, Hendrik (University of Frankfurt)

Presenter: Mr MEISTRENKO, Alex (University of Frankfurt)

Session Classification: Talks and Discussions

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

Nature of f0(1370), f0(1500) and f0(1710) within the extended Linear Sigma Model

Thursday, 19 September 2013 15:30 (30 minutes)

Using the U(3)R x U(3)L extended Linear Sigma Model (eLSM) with ordinary mesonic degrees of freedom and glueballs we calculate decay widths in order to study their vacuum interactions at low energy and in particular the nature of the resonances f0(1370),
f0(1500) and f0(1710). In this context the understanding of the mixing behaviour in the scalar-isoscalar sector is essential.

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Session Classification: Talks and Discussions

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

Theory of the CBM experiment: QCD phase transitions, critical phenomena and rare diagnostic probes

Monday, 16 September 2013 09:15 (45 minutes)

In the Compressed Baryonic Matter (CBM) experiment at FAIR strongly interacting matter at highest baryonic densities will be produced, which offers unprecedented opportunities for the investigation of this yet unexplored region of the QCD phase diagram.
It will fill the gap in understanding bulk properties like the equation of state between the quark-gluon plasma at vanishing baryonic density and high temperatures as it existed in the early universe and is produced at top-RHIC and LHC energies and the cold but ultradense matter in the core of neutron stars.
At high baryochemical potential various effective models predict a first-order phase transition between chirally-restored, deconfined and chirally-broken, confined matter. As a consequence there must be a critical point in the plane of temperature and baryochemical potential. In order to relate observables in heavy-ion collisions to thermodynamical features at the phase transition and the critical point dynamical modeling of the fluctuations is necessary.
The symmetries of QCD, which are relevant at the phase transition, also determine properties of in-medium excitations and can be studied by electromagnetic probes, which penetrate the matter without interaction.
Open charm is an ideal probe of transport properties of the medium as it is expected not to fully thermalize within. The properties of the interaction between heavy quarks and their dissociation and regeneration dynamics are investigated by the charmonia spectra and their suppression. It will give useful insight into the nature of the produced medium and the onset of deconfinement.
This talk will discuss the theoretical challenges that come along with the physics program at CBM.

Primary author: Dr NAHRGANG, Marlene (Duke University)

Presenter: Dr NAHRGANG, Marlene (Duke University)

Session Classification: Talks and Discussions

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

Radiation fields from HZE particles studied with Geant4-based simulations

Wednesday, 18 September 2013 14:30 (30 minutes)

The exposure to high charge and energy (HZE) particles is one of major concerns for humans during their missions in space. As radiation effects essentially depend on charge, mass and energy of cosmic-ray particles, the radiation quality has to be investigated, e.g. by means of microdosimetry measurements on the board of a spacecraft. In microdosimetry a Tissue Equivalent Proportional Counter (TEPC) is applied for measurement of energy deposition events in micrometer volumes. This technique is also used for characterization of radiation fields of protons and carbon ions in radiotherapy. The description of energy deposition on micrometer scale is fundamental for understanding of physical and biological effects due to high LET radiation. Several experiments at HIMAC in Japan and AGS in the USA used TEPC detectors for microdosimetry measurements of HZE particles in the energy range of 200A to 1000A MeV [1–3]. Similar measurements, but with heavy nuclei at higher energies are expected to be performed at the BIOMAT facility at FAIR [4]. These experiments will contribute to a better understanding of radiation effects induced by HZE particles. In our previous study [5] we benchmarked the electromagnetic models of Geant4 toolkit with microdosimetry data obtained with TEPCs for HZE particles. A proper description of nuclear reactions is also required for correct estimation of radiation effects in space missions and ion beam cancer therapy. Different hadronic models for cross sections and nuclear interactions are available in the Geant4 toolkit. Microdosimetry data for H, He, Li, C and Si ion beams in the energy range of 150A to 490A MeV were measured inside [6] and behind [7] an extended medium providing an indirect way to validate hadronic models. In this study we benchmark the hadronic models of Geant4 and evaluate the influence of nuclear fragmentation on microdosimetry spectra. The uncertainty in the estimation of radiation effects due to the choice of different models is investigated.

[1] B. B. Gersey et al., Radiat. Res. 157 (2002) 350–60
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[3] P. J. Taddei et al., Radiat. Meas. 41 (2006) 1227–34
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[5] L. Burigo et al., J. Phys.: Conf. Ser. 426 (2013) 012006 .
[6] G. Martino et al., Phys. Med. Biol. 55 (2010) 3441
[7] S. Tsuda et al., J. Radiat. Res. 53 (2012) 264

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Session Classification: Talks and Discussions

Contribution ID: **40** Type: **not specified**

Recent results on dilepton and strangeness production with HADES and perspectives at FAIR

Wednesday, 18 September 2013 09:45 (45 minutes)

HADES is a versatile detector located at GSI Helmholtzzentrum für Schwerionenforschung and currently operating at the SIS18 accelerator in the range of beam kinetic energies of 1-2 GeV/u (for nucleus-nucleus collisions), up to 3.5 GeV in proton-induced reactions. The ultimate goal of the HADES experimental program is to reveal signals of hadron modification expected to occur at non-zero baryonic densities. In this respect, primary objects of interest are light unflavoured vector mesons (rho, omega, phi), accessible via di-electron measurements, and (anti)kaons. The strategy is to perform systematical measurements ranging from elementary reactions to collisions of heavy nuclei.

Study of elementary nucleon-nucleon reactions delivers a basis for the interpretation of proton-nucleus and nucleus-nucleus collisions. Of particular interest here is the role of baryonic resonances in the production of electron-positron pairs and strange particles. Besides, already the vacuum properties of certain particles such as the molecular-like state Lambda(1405) are of interest by themselves. Proton-nucleus reactions (pNb at 3.5 GeV) present a next level of complexity. Here, the behaviour of various mesons created inside a nucleus, including omega's and neutral kaons, was examined by HADES. A truly heavy colliding system (Au+Au collisions at 1.23 GeV/u) was measured by HADES in 2012 and a number of analyses is on-going with first promising results both in the dilepton and in the strange sector.

In the near future, HADES has a unique opportunity to perform measurements with pion-induced reactions characterized by favourable conditions for an observation of in-medium effects. After completion of the experimental program at SIS18, HADES will move to FAIR and will continue measurements at SIS100 at beam energies of up to 8 GeV/u.

Primary author: Dr LAPIDUS, Kirill (Excellence Cluster 'Universe' TUM)

Presenter: Dr LAPIDUS, Kirill (Excellence Cluster 'Universe' TUM)

Session Classification: Talks and Discussions

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

Hyperon production in proton-antiproton annihilations with PANDA

Tuesday, 17 September 2013 12:00 (30 minutes)

Whereas the strong interaction is successfully described by perturbative QCD for processes with large scales, QCD in the confinement domain remains one of the most challenging problems in contemporary physics. Generally the scale of a specific process needs to be larger than the QCD cut-off (~200 MeV) in order to be treated perturbatively. The mass of the strange quark (~150 MeV), is very close to the QCD cut-off and the creation of a strange-antistrange pair is therefore a suitable process to study in order to understand confinement QCD.
Hyperons contain one or more strange quarks and the creation of a hyperon-antihyperon pair in antiproton-proton interactions involves the annihilation of a light (u or d) quark-antiquark pair and a subsequent creation of a strange-antistrange pair. Hyperon production can be discussed in terms of the OZI rule, which states that processes with disconnected quark lines are suppressed. By comparing several reactions involving different quark flavours the OZI rule can be tested for different levels of disconnected quark-line diagrams separately.
Furthermore, the parity violating weak decay of most ground state hyperons introduces an asymmetry in the distribution of the decay particles. This is quantified by the decay asymmetry parameter and gives access to spin degrees of freedom for these processes, e.g. antihyperon/hyperon polarisation and spin correlations. One open question is how these observables relate to the underlying degrees of freedom.
All strange hyperons, as well as single charmed hyperons are energetically accessible for the PANDA experiment at HESR, FAIR. A systematic investigation of these reactions will bring new information on single and multiple strangeness production and its dependence on spin observables. In particular, above 2 GeV/c, practically nothing is known about the hyperon angular distributions and spin observables. Simulation studies performed by the Uppsala group show that the differential cross sections as well as the spin observables can be well reconstructed with PANDA, for strangeness channels as well for the the single charmed. Results from the simulations will be shown.

Primary author: Dr SCHÖNNING, Karin (Dept. of Physics and Astronomy, Uppsala University)

Co-author: Dr THOMÉ, Erik (Uppsala University)

Presenter: Dr SCHÖNNING, Karin (Dept. of Physics and Astronomy, Uppsala University)

Session Classification: Talks and Discussions

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

A new method for electron momentum reconstruction in the PANDA experiment

Monday, 16 September 2013 15:30 (30 minutes)

The aim of the PANDA (AntiProton ANnihilation at DArmstadt) experiment at FAIR is to improve our knowledge of the strong interaction and of the structure of hadrons. In particular, the study of electromagnetic processes (pbarp->e+e-, pbarp-> e+e-π0, etc..) gives access to the proton structure (electric and magnetic time like form factors, Transition Distribution Amplitudes, Generalized Distribution Amplitudes, etc..). In such channels, the electron and positron signal needs to be separated from the hadronic background which is six orders of magnitude larger than the signal. Excellent particle identification and momentum reconstruction are therefore crucial for such studies.

The PandaRoot software, based on ROOT and Virtual MonteCarlo, is used as the simulation and analysis framework for the future PANDA experiment. A Kalman Filter provides the particle momenta deduced from the central tracker, with GEANE as track follower. This method is not optimally suited for electrons, for which the highly non-Gaussian Bremsstrahlung process yields a tail in the momentum resolution distribution.

A new method was therefore developed to improve the electron momentum reconstruction with an event by event procedure. Indeed, a considerable fraction of the Bremsstrahlung photons can be detected in the Electromagnetic Calorimeter and their energy is deduced from a dedicated analysis of the distribution of energy deposited in the crystals. This new analysis takes advantage of two facts: the photons are emitted along the electron direction and the Bremsstrahlung process takes place in the Micro Vertex Detector area which is located close to the target. This allows isolating the area where the photons can be detected.

We will show that the inclusion of the Bremsstrahlung photons considerably improves the resolution of the electron momentum, which results in a gain in the signal selection efficiency for the measurement of electromagnetic processes. The effect of the method on the radiative correction calculation will also be presented.

Primary author: Mr MA, Binsong (institut de physique nucleaire d'orsay)

Presenter: Mr MA, Binsong (institut de physique nucleaire d'orsay)

Session Classification: Talks and Discussions

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

Theoretical nuclear structure and astrophysics at FAIR

Saturday, 21 September 2013 09:30 (45 minutes)

Next generation of radioactive ion beam facilities like FAIR and detectors like AGATA will open a bright future for nuclear structure and nuclear astrophysics research.
In particular, very exotic nuclei (mainly neutron rich) isotopes will be produced and a lot of new exciting experimental data will help to test and improve the current nuclear models. In addition, these data (masses, reaction cross sections, beta decay half-lives, etc.) combined with the development of better theoretical approaches will be used as the nuclear physics input for astrophysical simulations.
In this presentation I will review some of the state-of-the-art nuclear structure methods, their comparison with recent experimental data and their application in nucleosynthesis calculations.

Primary author: Dr RODRÍGUEZ, Tomás (GSI)

Presenter: Dr RODRÍGUEZ, Tomás (GSI)

Session Classification: Talks and Discussions

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

MPD Detector at NICA, JINR, Dubna, Russia

Saturday, 21 September 2013 11:45 (30 minutes)

The main purpose of the report is to present NICA/MPD Project, particularly the Multi-purpose detector's structure and physical goals and also the current stage of its performance.

NICA is a new accelerator complex being constructed at JINR, Dubna, Russia. The global scientific goal of the NICA/MPD project is to explore the phase diagram of strongly interacting matter in the region of highly compressed baryonic matter.The study of hot and dense baryonic matter would provide relevant information on:in-medium properties of hadrons and nuclear matter equation of state, de-confinement and/or chiral symmetry restoration,
phase transition, mixed phase and critical end-point and possible strong P- and CP violation.
In the first stage of the project are considered - multiplicity and spectral characteristics of the identified hadrons including strange particles, multi-strange baryons and antibaryons; event-by-event fluctuations in multiplicity, charges and transverse momenta; collective flows (directed, elliptic and higher ones) for observed hadrons. In the second stage the electromagnetic probes (photons and dileptons) will be measured. It is proposed that along with heavy ions NICA will provide proton and light ion beams including the possibility to use polarized beams.

The design concept of a detector which would be used to operate at NICA is a challenging task. The detector for exploring phase diagram of strongly interacting matter in a high track multiplicity environment has to cover a large phase space, be functional at high interaction rates and comprise high efficiency and excellent particle identification capabilities. It must also be based on the recent detector developments.The MPD detector matches all these requirements. It comprises the central detector and two forward spectrometers FS-A and FS-B (optional) situated along the beam line symmetrically with respect to the centre of MPD. The central detector consists of a barrel part and two endcaps located inside the magnetic field. The barrel part is a set of various detector systems surrounding the interaction point and aimed to reconstruct and identify both charged and neutral particles. The barrel part consists of tracker and particle identification system. The principal tracker is the time projection chamber (TPC) supplemented by the inner tracker (IT) surrounding the interaction region. Both subdetectors (IT and TPC) have to provide precise track finding, momentum determination, vertex reconstruction and pattern recognition. The high performance time-of-flight (TOF) system must be able to identify charged hadrons and nuclear clusters in the broad rapidity range and up to total momentum of 2 GeV/c. Another part of the MPD detector is the electromagnetic calorimeter. The main goal of the electromagnetic calorimeter (EMC) is to identify electrons, photons and measure their energy with high precision.

Primary author: Ms YORDANOVA, Lyubka (Member of MPD Collaboration, JINR, Russia)

Presenter: Ms YORDANOVA, Lyubka (Member of MPD Collaboration, JINR, Russia)

Session Classification: Talks and Discussions

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

QCD phase diagram: overview of recent lattice results

Tuesday, 17 September 2013 09:15 (45 minutes)

Two parameters that have a strong influence on the finite temperature QCD transition, and play an important role in various physical scenarios are the quark density and the external magnetic field. The effect of these parameters on the thermal properties of QCD will be discussed, and an overview of the latest lattice results will be given.

Primary author: Dr ENDRODI, Gergely (University of Regensburg)

Presenter: Dr ENDRODI, Gergely (University of Regensburg)

Session Classification: Talks and Discussions

Contribution ID: **48** Type: **not specified**

Investigation of light and heavy tetraquark candidates using lattice QCD

Friday, 20 September 2013 10:00 (30 minutes)

I review the status of an ongoing long-term lattice investigation of the spectrum and structure of tetraquark candidates. I will focus on light scalar mesons, e.g. a_0(980). First steps and future plans regarding heavier tetraquark candidates, in particular those containing charm quarks, will also be outlined.

Primary author: Prof. WAGNER, Marc (Johann Wolfgang Goethe-Universität Frankfurt am Main)

Presenter: Prof. WAGNER, Marc (Johann Wolfgang Goethe-Universität Frankfurt am Main)

Session Classification: Talks and Discussions

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

Understanding the structure of exotic nuclei - experimental techniques and developments

Thursday, 19 September 2013 09:15 (45 minutes)

Experimental and theoretical investigations of nuclei far away from stability became a vital and active research field in nuclear physics in the past decades.
With the advent of radioactive beam facilities, isotopes close to the driplines can be produced and their structure is studied via scattering experiments at intermediate and high energies.

Neutron-proton asymmetric nuclei, i.e. nuclei having a large excess of protons over neutrons and vice versa, exhibit new phenomena, like e.g. the disappearance of conventional magic numbers, nuclear halo states and low-lying collective modes.
The structure of radioactive isotopes also plays a key role in nucleosynthesis occurring during stellar explosions and accreting neutron stars.
Still, open questions remain and new facilities are needed in order to
produce even more exotic nuclei with sufficient intensity to carry out reaction studies.

In this talk, I will review some recent experimental investigations of the single-particle structure and the collective response of short-lived nuclei, carried out at GSI in Darmstadt and at the National Superconducting Cyclotron Laboratory at Michigan State University (MSU).
The presented experiments also involve reaction studies specifically
designated to address open questions related to nuclear astrophysics.
The main focus of the talk will be on the experimental techniques and developments needed to successfully accomplish high-resolution studies of exotic nuclei.

Finally, an outlook will be given about anticipated nuclear reaction studies at FAIR and at complementary facilities like the Facility for Rare Isotope Beams (FRIB) at MSU.

Primary author: Dr LANGER, Christoph (NSCL)

Presenter: Dr LANGER, Christoph (NSCL)

Session Classification: Talks and Discussions

Contribution ID: **50** Type: **not specified**

Beam energy scan using a hydro+cascade model

Saturday, 21 September 2013 11:15 (30 minutes)

We employ the up-to-date version of viscous Hydro-Kinetic Model (vHKM) based on 3+1D viscous hydrodynamic code coupled to UrQMD hadron cascade.
Following the experimental program at BNL RHIC, we perform a similar "energy scan" in the model, and study the collision energy dependence of charged and identified hadron spectra, flow coefficients and femtoscopic radii. For this aim the equation of state for finite baryon density from Chiral model coupled to Polyakov loop is employed for hydrodynamic stage. 3D initial conditions from UrQMD model are used to study gradual deviation from boost-invariant picture for midrapidity interval justified for top RHIC energies and above.
In particular, we address the question, how far down in the collision energy the well-established at RHIC and LHC energies picture of (viscous) hydro+cascade can be applied at BES. Based on the constraints from the NA49/CERES data the model may also be used to provide the predictions for the measurements in RHIC BES program.

Primary author: Dr KARPENKO, Iurii (FIAS, Frankfurt)

Co-authors: Dr PETERSEN, Hannah (FIAS, Frankfurt); Prof. BLEICHER, Marcus (FIAS, Frankfurt); Dr HUOVINEN, Pasi (FIAS, Frankfurt)

Presenter: Dr KARPENKO, Iurii (FIAS, Frankfurt)

Session Classification: Talks and Discussions