Strangeness in Quark Matter 2019

Report of Contributions

https://indico.cern.ch/e/755366

Contribution ID: **12** Type: **Contributed talk**

Sequential Coalescence with Charm Conservation in High Energy Nuclear Collisions

Tuesday, June 11, 2019 2:00 PM (20 minutes)

Heavy quarks are initially produced in nuclear collisions and the number is conserved during the evolution of the system. We establish a sequential coalescence model with charm conservation and apply it to charmed hadron production at RHIC and LHC energies. The charm conservation enhances the earlier formed hadrons and reduces the later formed ones, which leads to a Ds/D0 enhancement and a Lambda_c/D0 suppression. The mass dependence of the sequential hadron formation provides us a new tool for studying the quark-gluon plasma hadronization in high energy nuclear collisions.

Collaboration name

Track

Heavy Flavour

Authors: Mr ZHAO, Jiaxing (Tsinghua University); Dr SHI, Shuzhe (Indiana University); Prof. XU, Nu (Institute of Modern Physics, China); ZHUANG, Pengfei (Tsinghua University)

Presenter: ZHUANG, Pengfei (Tsinghua University)

Session Classification: Hadronization and Coalescence

Contribution ID: **19** Type: **Contributed talk**

Strangeness flow in Au+Au collisions at 1.23 AGeV measured with HADES

Thursday, June 13, 2019 4:30 PM (20 minutes)

We present the preliminary results on an anisotropic transverse flow of particles with strange content (K^0_s and K^+) in Au+Au collisions at $\sqrt{s}_{\mathrm{NN}} = 2.42\,\mathrm{GeV}$ measured with HADES. The strange particle flow in a heavy-ion collision is a good probe for nuclear equation-of-state. Kaon flow was seldom measured at such low centre-of-mass energy region due to sub-threshold production of strangeness. Thanks to the quantity of 2.6 billion events of the $40\,\%$ most central collisions this study is now possible. The obtained flow parameters (differential measurement of directed and elliptic flow) are compared with previously published world data as well as with flow of non-strange particles. The agreement of measurement with simulations using transport codes is also checked.

Collaboration name

HADES

Track

Strangeness and Light Flavour

Author: CHLAD, Lukáš (Nuclear Physics Institute of the CAS)

Presenter: CHLAD, Lukáš (Nuclear Physics Institute of the CAS)

Session Classification: Strangeness and Light Flavour

Contribution ID: **20** Type: **Contributed talk**

Hawking- Unruh Radiation from the relics of the cosmic quark hadron phase transition

Tuesday, June 11, 2019 2:40 PM (20 minutes)

It is entirely plausible that during the primordial quark –hadron transition, microseconds after the Big Bang, supercooling takes place accompanied by mini inflation leading to a first –order phase transition from quarks to hadrons. The relics, in the form of quark nuggets consisting of Strange Quark Matter under certain circumstances survive.

It is conjectured that color confinement turns the physical vacuum to an event horizon for quarks and gluons. The horizon can be crossed only by quantum tunnelling. The process just mentioned is the QCD counterpart of Hawking radiation from gravitational black holes. Thus, when the Hawking temperature of the quark nuggets gets turned off, tunnelling will stop and the nuggets will survive forever. The baryon number and the mass of these nuggets are derived using this theoretical format. The results agree well with the prediction using other phenomenological models. Further, the variation of Hawking temperature as a function of baryon number and mass of the nugget mimicks chiral phase transition, from zero mass to the full baryonic mass. Finally the strange quark nuggets may well be the candidates of baryonic dark matter.

Collaboration name

Track

Strangeness in astrophysics

Author: SINHA, Bikash (Variable Energy Cyclotron Centre)

Presenter: SINHA, Bikash (Variable Energy Cyclotron Centre)

Session Classification: Strangeness in Astrophysics

Contribution ID: **23** Type: **Poster**

Collective flow and correlation measurements with HADES in Au+Au collisions at 1.23 AGeV

Tuesday, June 11, 2019 6:45 PM (2 hours)

HADES provides a large acceptance combined with a high mass-resolution and therefore allows to study dielectron and hadron production in heavy-ion collisions with unprecedented precision. The high statistics measurements of flow coefficients for protons, deuterons and tritons in Au+Au collisions at 1.23 AGeV (performed with the HADES experiment at SIS18/GSI) are presented here. In addition to the directed (v1) and elliptic (v2) flow components also the higher coefficients v3 and v4 are investigated for the first time in this energy regime. All flow coefficients are studied multi-differential, i.e. as a function of transverse momentum pt and rapidity over a large region of phase space and for several intervals of reaction centrality. This provides the possibility to characterize the particle production in heavy-ion collisions as a full 3D-picture in momentum space and puts strong constraints on the determination of the properties of dense matter, such as its viscosity and equation-of-state (EOS).
Information on radial flow can be obtained from the analysis of pion HBT-correlations and transverse momentum spectra of identified particles. We will present new results on these observables extracted from the HADES data and discuss their correlations. From these a consistent picture emerges which provides strong evidence for a substantial radial expansion already at these low beam energies.

Supported by BMBF (05P15RFFCA), HGS-HIRe and H-QM.

Collaboration name

HADES

Track

Hadronisation and coalescence

Author: KARDAN, Behruz (IKF, Uni-Frankfurt)

Presenter: KARDAN, Behruz (IKF, Uni-Frankfurt)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **24** Type: **Poster**

Measurement of D^0 meson R_{AA} and v_2 in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV with ALICE

Tuesday, June 11, 2019 6:45 PM (2 hours)

In the ultra-relativistic heavy-ion collisions at the CERN Large Hadron Collider (LHC), a state of matter, called Quark-Gluon Plasma (QGP), is created.
Heavy quarks, like charm and beauty, are a powerful tool to investigate the medium formed in these collisions. They are produced in hard partonic scattering processes, which occur on a timescale shorter than the QGP formation time. They propagate through the medium and interact with its constituents, thus probing the entire evolution of the system.

The measurement of the nuclear modification factor R_{AA} of D^0 mesons provides information on the interactions of charm quarks with the medium, in particular on their energy loss.
In addition, the study of the D^0 elliptic flow (v_2) can give further insight into the coupling of the charm quarks to the system.
The analysis of the v_2 is done with the Event-Shape Engineering (ESE) technique, which allows the classification of events belonging to the same centrality, according to the azimuthal anisotropy of soft particles produced in the collision. Thus it is possible to investigate the dependence of the charm-quark flow on the initial conditions and eccentricity of the system.

In this poster we present the latest measurement of the D^0-meson R_{AA} obtained by analyzing the new data sample Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV collected at the end of 2018 with the ALICE detector. In addition, we will show the most recent results on the D^0 v_2 measured with the Event-Shape Engineering technique.

Collaboration name

ALICE Collaboration

Track

Heavy Flavour

Author: TROGOLO, Stefano (Universita e INFN, Padova (IT))

Presenter: TROGOLO, Stefano (Universita e INFN, Padova (IT))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **25** Type: **Poster**

Strange matter in SU(3) PNJL model: kaon-to-pion ratio along the phase transition line

Tuesday, June 11, 2019 6:45 PM (2 hours)

The behavior of strange matter in the frame of the SU(3) Polyakov-loop extended Nambu-Jona-Lasinio model is considered. We discuss the appearance of a peak in the ratio of the number of strange mesons to non-strange mesons known as the “horn”. We showed that the rise in the ratio K^+/π^+ appears in PNJL model when we build the K^+/π^+ ratio along the phase transition diagram. We considered how the matter propeties can affect to the behavior of the kaon-to-pion ratio.

Collaboration name

Track

QCD phase diagram and critical point

Author: FRIESEN, Alexandra (Joint Institute for Nuclear Research)

Co-author: Dr KALINOVSKY, Yuriy (Joint Institute for Nuclear Research)

Presenter: FRIESEN, Alexandra (Joint Institute for Nuclear Research)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **27** Type: **Contributed talk**

Production of hypernuclei and properties of hyper-nuclear matter

Tuesday, June 11, 2019 2:00 PM (20 minutes)

The research for hypernuclei and their production mechanisms open new opportunities for nuclear/particle physics and astrophysics. The hyperons influence many nuclear properties in finite nuclei and in neutron stars (infinite nuclear matter). In particular, hypernuclei allow to explore the many-body aspects of the strong three-flavor interaction at low energies. We review the main processes leading to the production of hypernuclei in nuclear reactions: In violent high-energy interactions leading to fragmentation and multifragmentation of nuclear matter they can be abundantly produced [1,2]. The binding energies of hyperons influence the hypernuclei formation [3] and this gives a chance to evaluate experimentally the hyperon effects in nuclear matter. The most promising process for such a research is a disintegration of large excited hyper-nuclear residues produced in peripheral relativistic nucleus-nucleus collisions. Besides, there is a coalescence of hyperons with other baryons into light clusters. We use the transport, coalescence and statistical models to describe the whole process, and demonstrate the important regularities of the hypernuclei formation and the advantages of such reactions over the traditional hypernuclear methods: A broad distribution of predicted hypernuclei in masses and isospin allows for investigating properties of exotic hypernuclei, as well as the hypermatter both at high and low temperatures. We point at the abundant production of multi-strange nuclei that can give an access to multi-hyperon systems and strange nuclear matter. The realistic estimates of hypernuclei yields in various collisions are presented. There is a saturation of the hypernuclei production at high energies [1], therefore, the optimal way to pursue this experimental study is to use the accelerator facilities of intermediate energies, like FAIR (Darmstadt) and NICA (Dubna).

[1] A.S. Botvina, et al., Phys. Rev. C95, 014902 (2017).

[2] A.S. Botvina, et al., Phys. Rev. C94, 054615 (2016).

[3] N. Buyukcizmeci, et al., Phys. Rev. C98, 064603 (2018).

Collaboration name

Track

Others

Authors: BOTVINA, Alexander (ITP and FIAS, University of Frankfurt am Main); Prof. BLEICHER, Marcus (ITP and FIAS, University of Frankfurt am Main)

Presenter: BOTVINA, Alexander (ITP and FIAS, University of Frankfurt am Main)

Session Classification: Strangeness in Astrophysics

Contribution ID: **29** Type: **Poster**

Azimuthal correlations of D mesons with charged particles in pp collisions at $\sqrt{s}$ = 13 TeV with the ALICE experiment at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

The ALICE experiment at the Large Hadron Collider (LHC) is dedicated to study the prop- erties of the Quark-Gluon Plasma (QGP), a de-confined partonic state of strongly-interacting matter formed in relativistic heavy-ion collisions. Heavy quarks (charm and beauty), produced by parton-parton hard scatterings in the early stages of such collisions, are considered to be effective probes to study the QGP, as they are expected to experience the full evolution of the system formed in the collision.

The azimuthal correlations between heavy-flavour particles and charged particles give insight on the modification of charm-jet properties in nucleus-nucleus collisions and the mechanisms through which heavy quarks in-medium energy-loss takes place. Studies in pp collisions, besides constituting the necessary baseline for nucleus-nucleus measurements, are important for testing expectations from pQCD-inspired Monte Carlo generators. This contribution will include the study, with the ALICE apparatus, of azimuthal correlations of D mesons with charged particles in pp collisions at $\sqrt{s}$ = 13 TeV, the highest available energy at the LHC. A comparison with pp collisions results at $\sqrt{s}$ = 7 TeV will allow studying the energy dependence of the correlation function.

Collaboration name

ALICE

Track

Heavy Flavour

Author: SADHU, Samrangy (Department of Atomic Energy (IN))

Presenter: SADHU, Samrangy (Department of Atomic Energy (IN))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **30** Type: **Poster**

Measurement of $\mathrm{D_s}$-meson production in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV with ALICE at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

Open-charmed mesons are unique tools to study the properties of the Quark-Gluon Plasma (QGP) formed in ultra-relativistic nucleus-nucleus collisions. Charm quarks, due to their large mass, are produced in hard partonic scattering processes in the initial stages of the collision. Therefore, they experience all the phases of the QGP evolution propagating through the medium and losing energy interacting with its constituents.

Measurements of open-charmed meson production in presence of the QGP and their comparison with results obtained in pp collisions give important insights into this deconfined state of hadronic matter. In particular, the measurement of the nuclear modification factor R_{AA} of $\mathrm{D_s}$ mesons compared with that of non-strange D mesons can provide information about the charm-quark hadronization mechanism. If a fraction of charm quarks hadronizes via recombination with lighter quarks of the hot medium, the relative abundance of $\mathrm{D_s}$ mesons with respect to non-strange D mesons is expected to be larger in Pb-Pb than in pp collisions, at low and intermediate transverse momentum (p_{T}), due to the enhanced production of strange quarks in the QGP. Furthermore, the study of the $\mathrm{D_s}$-meson elliptic flow v_2 in semi-central collisions, together with that of non-strange D mesons, allows us to assess the participation of charm quarks in the collective expansion of the system and the transport properties of the charm quark in the hadronic medium.

In this poster the most recent results on the production of $\mathrm{D_s}$ mesons measured at mid-rapidity in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV obtained by the ALICE Collaboration will be presented. In particular, the p_{T}-differential R_{AA} and v_2 of $\mathrm{D_s}$ mesons measured for different centrality classes will be shown, exploiting also the large data sample collected with ALICE at the end of 2018 and improved analysis techniques.

Collaboration name

ALICE

Track

Hadronisation and coalescence

Author: CATALANO, Fabio (Politecnico e INFN Torino (IT))

Presenter: CATALANO, Fabio (Politecnico e INFN Torino (IT))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **31** Type: **Poster**

Heavy-flavour correlations with charged particles and collective effects in p-Pb collisions at $\sqrt{s_{\rm NN}}$= 5.02 TeV with ALICE at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

In ultra-relativistic heavy-ion collisions, where the formation of a high-density colour-deconfined medium, the Quark-Gluon Plasma (QGP), is expected, heavy quarks are considered as an effective probe for investigating the properties of such a medium. Indeed, they are produced in scattering processes with large momentum transfer in the early stage of the collision and traverse the medium while interacting with its constituents, thus experiencing its full evolution. Measurements in proton-nucleus (p–Pb) collisions and their comparison to pp results provide a tool to constrain the presence of other effects not related to the presence of the QGP, the so-called Cold Nuclear Matter (CNM) effects.

Angular correlations of heavy-flavour particles with charged particles in pp collisions allow us to characterize the heavy-quark fragmentation and production mechanisms. Differences between the measurements in pp and p-Pb collisions can shed light on how cold nuclear matter effects affect the heavy-quark production and the fragmentation into heavy-flavour jets.
Furthermore, measurements of angular correlations of heavy-flavour particles with charged particles as a function of the multiplicity in p-Pb collisions allow us to investigate the collective behavior of the system or initial-state effects. In addition, they can give insights into the possible modification of the heavy-quark fragmentation and hadronisation in different centrality classes.

In this contribution, we will present ALICE results on heavy-flavour azimuthal correlations with charged particles in p–Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV. In particular, we will show the results obtained from D-meson azimuthal correlations with charged particles compared with Monte Carlo simulation expectations and the v_2 of heavy-flavour hadron decay electrons in high-multiplicity p-Pb collisions.

Collaboration name

ALICE Collaboration

Track

Heavy Flavour

Author: MAZZILLI, Marianna (Universita e INFN, Bari (IT))

Presenter: MAZZILLI, Marianna (Universita e INFN, Bari (IT))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **32** Type: **Contributed talk**

$K^*(892)^0$ production in p+p interactions from NA61/SHINE

Thursday, June 13, 2019 4:10 PM (20 minutes)

The NA61/SHINE experimental physics program is focused on searching for the critical point and on the study of the properties of the onset of deconfinement in strongly interacting matter. A scan of the phase diagram of strongly interacting matter is done by changing the energy of colliding ions (from 13A to 150/158A GeV) and by changing the system size (from p+p to Pb+Pb).

The main topic of this talk are preliminary results on $K^*(892)^0$ meson production in p+p interactions at beam momentum 158 GeV/c and the pilot results at beam momenta 31-80 GeV/c obtained by the NA61/SHINE experiment. The analysis of $K^*(892)^0$ was done for the first time with the template method in the $K^+\pi^-$ decay channel. The results include the double differential spectra $d^2n/(dydp_T)$, $d^2n/(m_T dm_T dy)$ as well as p_T integrated and extrapolated dn/dy spectra. The measured mass of the $K^*(892)^0$ as a function of transverse momentum is also presented and compared to other published results. Finally, the multiplicity of $K^*(892)^0$ and the ratio of $<K^*(892)^0>/<K^{+/-}>$ as a function of system size and energy are planned to be presented together with the results from other experiments.

Collaboration name

NA61/SHINE

Track

Hadron Resonances

Author: TEFELSKA, Angelika Magdalena (Warsaw University of Technology (PL))

Presenter: TEFELSKA, Angelika Magdalena (Warsaw University of Technology (PL))

Session Classification: Hadron Resonances

Contribution ID: **33** Type: **Poster**

Kaonic atoms at DAFNE to access the strong interaction with strangeness at threshold

Tuesday, June 11, 2019 6:45 PM (2 hours)

The X-ray measurements of kaonic atoms play an important role for understanding the low-energy QCD in the strangeness sector. The energy shift and broadening of the lowest-lying states of

such atoms, induced by the kaon-nucleus strong interaction, can be determined with high precision from atomic X-ray spectroscopy.

Significant achievements have been obtained by the SIDDHARTA experiment at the DAFNE electron-positron collider of LNF-INFN, among which: the most precise kaonic hydrogen measurement of the 1s level shift and width to date, fundamental information for the low-energy Kp interaction in theoretical studies; an upper limit of the X-ray yield of kaonic deuterium, important information for future Kd experiments.

Using the experience gained with SIDDHARTA experiment, new X-ray studies focused on kaonic deuterium are in preparation in the framework of the SIDDHARTA-2 experiment, with the goal to determine the isospin dependent scattering lengths, which is only possible by combining the Kp and the upcoming Kd results. This experimental method provides unique information to understand the low energy kaon-nucleus interaction at threshold.

Collaboration name

SIDDHARTA-2 Collaboration

Track

Upgrades and new experiments

Author: SIRGHI, Diana Laura (INFN-LNF)

Presenter: SIRGHI, Diana Laura (INFN-LNF)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **34** Type: **Poster**

Electrons from heavy-flavour hadron decays in proton-proton collisions with ALICE at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

Heavy quarks are produced in the early stages of relativistic heavy-ion collisions via initial hard scatterings. Therefore, they are considered as effective probes of the hot and dense Quark-Gluon Plasma (QGP) formed in such collisions since they witness its full evolution. In pp collisions, the measurement of charm and beauty hadron production cross sections can be used to test our understanding of the Quantum ChromoDynamics (QCD) in perturbative regime. In addition, pp collisions provide the required reference for the corresponding measurements in nuclear collisions like the measurement of the nuclear modification factor ($R_{\rm AA}$) of electrons from heavy-flavour and beauty-hadron decays.

In this contribution, the $p_{\rm T}$-differential production cross section of electrons from heavy-flavour hadron decays in pp collisions at $\sqrt{s}$ = 2.76, 5.02, 7 and 13 TeV and beauty-hadron decays in pp collisions at $\sqrt{s}$ = 7 TeV measured by ALICE at mid rapidity are reported. The analysis procedures employed for measuring the spectra of electrons from the heavy-flavour and beauty-hadron decays will be discussed. Comparisons of these results with the FONLL (Fixed-Order and Next-to-Leading Logarithms) model calculations will be shown.

Collaboration name

ALICE collaboration

Track

Heavy Flavour

Author: RODE, Sudhir Pandurang (Indian Institute of Technology Indore (IN))

Presenter: RODE, Sudhir Pandurang (Indian Institute of Technology Indore (IN))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **35** Type: **Contributed talk**

Probing QCD matter via K^{*0} and ϕ resonance production at RHIC

Thursday, June 13, 2019 4:50 PM (20 minutes)

Relativistic heavy-ion collisions offer a unique opportunity to study the properties of nuclear matter at very high temperature and/or high density. It is believed that resonances (like K^{*0}, ϕ) are excellent probes for the medium created in heavy-ion collisions. Particularly, K^{*0} (lifetime $\sim$ 4 fm/c) and ϕ (lifetime $\sim$ 42 fm/c) can be used to study the bulk properties of QCD matter produced in heavy-ion collisions. Because of a short lifetime, K^{*0} decays inside fireball and its decay daughters interact with the medium. Therefore, properties of K^{*0} can be modified by in-medium interactions. On the other hand, because of a long lifetime, the ϕ meson will mostly decay outside of the fireball and therefore its daughters will not have much time to rescatter in the hadronic phase. Hence, a comparison of the properties (e.g. yields, spectra, and elliptic flow) of K^{*0} and ϕ is interesting. In addition, ϕ-meson is considered to be a clean probe of pre-hadronic collectivity, since hadronic interaction cross section of ϕ meson is expected to be very small.
In this talk, we will present invariant yields of K^{*0} and ϕ as a function of beam energy ($\sqrt{s_{NN}}$=7.7-200 GeV) measured by the STAR experiment. Resonance to non-resonance particle ratios (ϕ/K and K^{*0}/K) will be shown as a function of centrality for various beam energies. Elliptic flow (v_2) of K^{*0} and ϕ and directed flow (v_1) of ϕ meson will be presented for different beam energies.

Collaboration name

STAR Collaboration

Track

Hadron Resonances

Author: NASIM, Md (IISER Berhampur)

Presenter: NASIM, Md (IISER Berhampur)

Session Classification: Hadron Resonances

Contribution ID: **36** Type: **Contributed talk**

Studies of low-energy K$^-$ hadronic interactions with light nuclei by AMADEUS

Tuesday, June 11, 2019 2:20 PM (20 minutes)

The experimental investigation of the low-energy negatively charged kaons interaction with the nuclear matter is very important to understand the strength of the K-nuclei interaction and to provide essential input for understanding of the non-perturbative QCD in the strangeness sector. It has strong consequences in various sectors of physics, like nuclear and particle physics as well as astrophysics.

The AMADEUS collaboration aims to provide new experimental contraints to the K^-N strong interaction in the regime of non-perturbative QCD, exploiting low-energy K^- hadronic interactions with light nuclei (e.g. H, ^{4}He, ^{9}Be and ^{12}C). The investigations are mainly focused on Λ(1405) properties studies and clarification of an existence of deeply bound kaonic states. The studies are performed with low-momentum kaons ($p_K \sim 127$ MeV/c) produced at the DAΦNE collider ideal to explore both stopped and in-flight K^- nuclear captures. The KLOE detector is used as active target, allowing to achieve excellent acceptance and resolutions for the data.

In the talk the results obtained from the recent AMADEUS studies will be presented, together with future plans.

Collaboration name

AMADEUS

Track

Strangeness and Light Flavour

Author: SKURZOK, Magdalena (INFN-LNF)

Presenter: SKURZOK, Magdalena (INFN-LNF)

Session Classification: Strangeness in Astrophysics

Contribution ID: **37** Type: **Poster**

Measurement of electrons from heavy-flavour hadron decays in Pb-Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV and in Xe-Xe collisions at $\sqrt{s_{\rm NN}}$ = 5.44 TeV

Tuesday, June 11, 2019 6:45 PM (2 hours)

The Quark-Gluon Plasma (QGP) is a deconfined state of strongly-interacting matter that is produced at the Large Hadron Collider (LHC) via ultra-relativistic heavy-ion collisions. The QGP properties can be investigated by studying the kinematic features of final-state hadrons containing charm or beauty quarks. Heavy quarks are mainly produced in hard scattering processes among partons, that occur immediately after the nuclei crossing with a time-scale shorter than the QGP formation time. Therefore, they are an effective probe to study the full evolution of the deconfined medium.

In this contribution, the measurements of the production of electrons from heavy-flavour hadron decays in central (0-10%), semi-central (30-50%) and peripheral (60-80%) Pb-Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV, and in central (0-20%) and semi-central (20-40%) Xe-Xe collisions at $\sqrt{s_{\rm NN}}$ = 5.44 TeV are shown. Electrons are reconstructed in the central rapidity region using different identification strategies, depending on the transverse momentum interval. The photonic tagging method is adopted for the subtraction of the main background component, which consists of electrons from photon conversions $\gamma \rightarrow {\rm e}^+{\rm e}^-$ and Dalitz decays of light neutral mesons π^0,$\eta \rightarrow \gamma{\rm e}^+{\rm e}^-$. Finally, the invariant yield of electrons from heavy-flavour hadron decays and the nuclear modification factor ($R_{\rm AA}$) are measured. The deviation of the $R_{\rm AA}$ from unity quantifies the energy lost by heavy quarks while traversing the plasma due to collisional and radiative processes. In addition, the comparison of the measured $R_{\rm AA}$ in different colliding systems and centrality classes provides insight on the path-length dependence of medium-induced parton energy loss.

Collaboration name

ALICE

Track

Heavy Flavour

Author: FAGGIN, Mattia (Universita e INFN, Padova (IT))

Presenter: FAGGIN, Mattia (Universita e INFN, Padova (IT))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **38** Type: **Contributed talk**

Proton and Light Nuclei Production in Au+Au collisions at $\sqrt{s_{NN}}$ = 2.4 GeV measured with HADES

Tuesday, June 11, 2019 4:10 PM (20 minutes)

We present high statistics data on proton and light nuclei emission from Au+Au collisions at $\sqrt{s_{NN}}$ = 2.4 GeV measured with HADES.
The data are analysed as function of reduced transverse mass $m_t - m_0$ and rapidity y in 4 centrality classes corresponding to the 40% most central events.
In contrast to higher energies light nuclei are not rare but make up about 30% of all particles participating in the collision at this energy.
The production of nuclei is discussed within two different scenarios: the thermal-statistical model and the coalescence model with a special emphasis on similarities and difference to the highest energies at the LHC measured with ALICE.

Collaboration name

HADES Collaboration

Track

Hadronisation and coalescence

Author: SZALA, Melanie (Goethe University)

Presenter: SZALA, Melanie (Goethe University)

Session Classification: Hadronization and Coalescence

Contribution ID: **39** Type: **Contributed talk**

Relativistic Dissipative Hydrodynamics: Quasiparticle Description

Tuesday, June 11, 2019 5:30 PM (20 minutes)

Relativistic Hydrodynamics has been very successful in describing the space-time evolution of hot and dense QCD matter created in high energy heavy ion collisions. We employ quasiparticle kinetic models to derive a causal theory of relativistic hydrodynamics which can incorporate any equation of state in a thermodynamically consistent framework. To this end, the phase space distribution function is modified either by introducing a temperature dependent mass or an effective fugacity. The effective mass model assumes an extra temperature dependent bag parameter which helps in restoring thermodynamic consistency. The effective fugacity model introduces a temperature dependent fugacity which shows promising results in the high temperature regime. We derive hydrodynamic transport coefficients and study the space-time evolution of QCD matter for purely longitudinal Bjorken expansion.

Collaboration name

Track

Hydrodynamics, chirality and vorticity

Authors: BHADURY, Samapan (NISER, HBNI); Mr KURIAN, MANU (INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR); Dr CHANDRA, VINOD (INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR); Dr JAISWAL, AMARESH (NISER, HBNI)

Presenter: BHADURY, Samapan (NISER, HBNI)

Session Classification: Hydrodynamics, Chirality and Vorticity

Contribution ID: **43** Type: **Poster**

Study of the multiplicity dependence of the (anti-)deuteron production in pp collisions at 5 TeV with ALICE at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

At the Large Hadron Collider light (anti-)nuclei are significantly produced in proton-proton (pp), proton-lead (p-Pb) and lead-lead (Pb-Pb) collisions.

The production mechanism of light (anti-)nuclei is an open question in high energy physics. The measurement of the production spectra and yields allows to improve our understanding of the late stages in the evolution of high energy collisions. The ALICE detector, thanks to its outstanding particle identification (PID) capabilities, provides the optimal conditions for the identification of rarely produced particles, such as light nuclei.

The measurement of (anti-)deuteron production in pp collisions at 5 TeV as a function of the multiplicity is presented and compared to the measurements available in other collision systems and at different energies. A detailed discussion of the result together with a comparison to the model predictions will be reported.

Collaboration name

ALICE

Track

Strangeness and Light Flavour

Author: BALBINO, Alessandro (Universita e INFN Torino (IT))

Presenter: BALBINO, Alessandro (Universita e INFN Torino (IT))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **44** Type: **Poster**

On the pair correlations of neutral K, D, B and B_s mesons with close momenta produced in inclusive multiparticle processes

Tuesday, June 11, 2019 6:45 PM (2 hours)

The phenomenological structure of inclusive cross-sections of the production of two neutral K mesons in hadron–hadron, hadron–nucleus and nucleus–nucleus collisions is theoretically investigated taking into account the strangeness conservation in strong and electromagnetic interactions. Relations describing the dependence of the correlations of two short-lived and two long-lived neutral kaons $K^0_S K^0_S$, $K^0_L K^0_L$ and the correlations of "mixed" pairs
$K^0_S K^0_L$ at small relative momenta upon the space-time parameters of the generation region of K^0 and $\bar{K}^0$ mesons
have been obtained. These relations involve the contributions of Bose-statistics and S-wave strong final-state interaction
of two K^0 ($\bar{K}^0$) mesons as well as of the K^0 and $\bar{K}^0$ mesons, and also the additional contribution of transitions $K^+K^- \to K^0\bar{K}^0$, and they depend upon the relative fractions of generated pairs K^0K^0,
$\bar{K}^0\bar{K}^0$ and $K^0\bar{K}^0$.
It is shown that under the strangeness
conservation the correlation functions of
the pairs $K^0_S K^0_S$ and $K^0_L K^0_L$, produced in the same inclusive process, coincide, and the difference between the
correlation functions of the pairs $K^0_S K^0_S$ and $K^0_S K^0_L$ is conditioned exclusively by the generation of pairs of non-identical neutral kaons $K^0\bar{K}^0$.

For comparison, analogous correlations for the pairs of neutral heavy mesons D^0, B^0 and B^0_s, produced in multiple inclusive processes with charm (beauty) conservation, are also theoretically analyzed – neglecting, just as for K^0 mesons, the weak effects of CP violation. These correlations have a quite similar character, and they are described by quite similar
expressions: in particular, just as for the case of K^0 mesons, the correlation
functions for the pairs of states with the same CP parity ($R_{SS} = R_{LL}$) and with different CP parity (R_{SL}) do not coincide, and the difference between them is conditioned exclusively by the production of pairs $D^0\bar{D}^0$, $B^0\bar{B}^0$ and $B^0_s\bar{B}^0_s$. However, contrary to the case of K^0 mesons, here the distinction of CP-even and CP-odd states (and, hence, the experimental observation of respective pair correlations) encounters difficulties –
due to the insignificant differences of their
lifetimes and the relatively small probability of purely CP-even and CP-odd decay channels. Nevertheless, one may expect that this will become possible at future colliders.

Collaboration name

Track

Strangeness and Light Flavour

Author: LYUBOSHITZ, Valery (Joint Institute for Nuclear Research, Dubna)

Co-author: Dr LYUBOSHITZ, Vladimir (Joint Institute for Nuclear Research, Dubna)

Presenter: LYUBOSHITZ, Valery (Joint Institute for Nuclear Research, Dubna)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **45** Type: **Poster**

On the coherent inelastic binary and multiparticle processes in ultra relativistic hadron-nucleus, photon-nucleus and nucleus-nucleus collisions

Tuesday, June 11, 2019 6:45 PM (2 hours)

The coherent inelastic processes of the type $a \to b$, which may take place in the interaction of hadrons and γ quanta with nuclei at very high energies (the nucleus remains the same, and its quantum state does not change), and - in particular - may lead to the production of strange and heavy-flavor mesons and baryons, are theoretically investigated. For taking into account the influence of matter inside the nucleus, the optical model based on the concept of refraction index is applied.
Analytical formulas for the effective cross section $\sigma_{\rm coh}(a \to b)$ are obtained, taking into account that at ultrarelativistic energies the main contribution into $\sigma_{\rm coh}(a \to b)$ is provided by very small transferred momenta in the vicinity of the minimum longitudinal momentum transferred to the nucleus. It is shown that the cross section $\sigma_{\rm coh}(a \to b)$ may be expressed through the "forward" amplitudes of inelastic scattering $f_{a+N\to b+N}(0)$ and elastic scattering $f_{a+N\to a+N}(0)$, $f_{b+N\to b+N}(0)$ on a separate nucleon, and it depends on the ratios L_a/R and L_b/R, where L_a, L_b are the respective mean free paths in the nucleus matter for the particles a, b and R is the nuclear radius.

In doing so, several characteristic cases with different relations of the magnitudes L_a, L_b, R are considered in detail. When
$L_a/R \gg 1$, but $L_b/R \ll 1$ (or, on the contrary, $L_a/R \ll 1$ but $L_b/R \gg 1$), then the cross section $\sigma_{\rm coh}(a \to b)$ is equal to the ratio of the "forward" cross sections of inelastic scattering $a+N \to b+N$ and elastic scattering of the particle b (or, respectively, a) on a nucleon, multiplied by the cross section of scattering on the "black" nucleus πR^2. The cases $L_a/R \gg 1$, $L_b/R \leq 1$ and $L_a/R \gg 1$, $L_b/R \ll 1$ (for heavy nuclei) correspond, in particular, to the coherent production of vector mesons ρ^0, ω, ϕ at the interaction of very high-energy photons with nuclei .

Meantime, when both the conditions $L_a/R \gg 1$ and $L_b/R \gg 1$ are satisfied, then the cross section $\sigma_{\rm coh}(a \to b)$ is proportional to the factor R^4/k^2, where k is the initial energy of the particle a in the laboratory frame.

The formalism described above is generalized also for the case of coherent inelastic multiparticle processes on a nucleus of the type $a \to \{b_1, b_2, b_3 ....b_i\}$ and for the case of coherent processes in collisions of two ultrarelativistic nuclei.

Collaboration name

Track

Others

Author: LYUBOSHITZ, Valery (Joint Institute for Nuclear Research, Dubna)

Presenter: LYUBOSHITZ, Valery (Joint Institute for Nuclear Research, Dubna)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **47** Type: **Contributed talk**

Radial flow induced by inhomogeneous magnetic field in heavy ion collisions

Thursday, June 13, 2019 5:10 PM (20 minutes)

We argue that the existence of an inhomogeneous external magnetic field can lead to radial flow in transverse plane. Our aim is to show how the introduction of a magnetic field generalizes the Bjorken flow. We investigate the effect of an inhomogeneous weak external magnetic field on the transverse expansion of in-viscid fluid created in high energy nuclear collisions. Finally we use the solutions for the transverse velocity and energy density in the presence of a weak magnetic field, to estimate the transverse momentum spectrum of protons and pions emerging from the Magneto-hydrodynamic solutions.

Collaboration name

Track

Hydrodynamics, chirality and vorticity

Author: HADDADI MOGHADDAM, Mohsen (University of Turin & INFN)

Co-authors: Prof. ALBERICO, Wanda (University of Turin & INFN); Dr FARZANEH KORD, Ahmad (Hakim Sabzevari University); Dr AZADEGAN, Behnam (Hakim Sabzevari University)

Presenter: HADDADI MOGHADDAM, Mohsen (University of Turin & INFN)

Session Classification: Hydrodynamics, Chirality and Vorticity

Contribution ID: **48** Type: **Poster**

Higher order Symmetric Cumulants

Tuesday, June 11, 2019 6:45 PM (2 hours)

In the exploration of the phase diagram of strong nuclear force, some of the most intriguing questions are associated with the phase dubbed Quark-Gluon Plasma (QGP). One of the most successful programs in ultra-relativistic nuclear collisions for the studies of QGP properties are the analyses of anisotropic flow phenomenon with correlation techniques. Many additional insights about QGP properties can be extracted with the recently introduced new flow observables, dubbed Symmetric Cumulants. These observables quantify the correlated fluctuations of two different flow harmonics and therefore extract information which is inaccessible to the traditional measurements of individual flow harmonics.

In this talk, the generalization of Symmetric Cumulants for the studies of correlated fluctuations of more than two flow harmonics is presented. A new set of independent, higher order, flow observables is introduced and outlined how in a unique way the genuine multi-harmonic correlations can be extracted from the flow harmonics estimated with two- and multi-particle azimuthal correlators. This generalization advocates the shift of paradigm in the use of correlation techniques in anisotropic flow analyses. By using the realistic iEBE-VISHNU model we demonstrate that the measurements of higher order Symmetric Cumulants are feasible and we provide the first predictions for their centrality dependence in Pb–Pb collisions at LHC energies. A separate study is presented for their values in the coordinate space. These new higher order observables contain information which is inaccessible to individual flow harmonics and correlated fluctuations of only two flow harmonics, and therefore they provide further and independent constraints for the properties of QGP in ultra-relativistic nuclear collisions.

Based on: C. Mordasini, AB, D. Karakoc, and S. F. Taghavi, 'Higher order Symmetric Cumulants', arXiv:1901.06968 (submitted to Phys. Rev. C)

Collaboration name

Track

QCD phase diagram and critical point

Author: BILANDZIC, Ante (Technische Universitaet Muenchen (DE))

Co-authors: MORDASINI, Cindy (Technische Universitaet Muenchen (DE)); TAGHAVI, Seyed Farid (Technische Universitaet Muenchen (DE)); KARAKOC, Deniz

Presenter: BILANDZIC, Ante (Technische Universitaet Muenchen (DE))

Session Classification: Poster session with "aperitivo"

Contribution ID: **49** Type: **Poster**

Production of charged pions in heavy-ion collisions at high μ_B

Tuesday, June 11, 2019 6:45 PM (2 hours)

In this contribution the results of a study of charged pion production at SIS18 energies using the HADES spectrometer at GSI will be presented. The main focus will be on 40% most central Au+Au collisions at $\sqrt{s_{\mathrm{NN}}} = 2.4$ GeV. At this energy matter gets compressed to densities of about two to three times the normal nuclear matter density (ρ_0) and the maximum temperature attained in this central zone is reaching values of few tens to about 100MeV. The production of pions at this energy proceeds primarily through the excitation and decay of baryonic resonances and is the only dominant meson production channel by which the hot, compressed baryonic matter de-excites. In addition, a precise knowledge of the pion production yields and kinematic distributions are important to estimate the amount of pion-induced production of penetrating, but rare probes like strange hadrons and vector mesons.
Our results contribute with an unprecedented statistics to systematic studies of pion produced in heavy ion collisions. We have performed a measurement of the transvers momentum distributions of π^+/π^- mesons covering a fairly large rapidity interval. The yields, transverse mass and azimuthal emission pattern are compared with transport model calculations as well as with existing data from other experiments.

Collaboration name

HADES

Track

Strangeness and Light Flavour

Presenter: Dr GUMBERIDZE, Malgorzata

Session Classification: Poster session with ”aperitivo”

Contribution ID: **50** Type: **Contributed talk**

Measurements of quarkonium production in heavy-ion collisions at the STAR experiment

Thursday, June 13, 2019 2:00 PM (20 minutes)

Quarkonium states produced in heavy-ion collisions serve as essential probes when studying the Quark-Gluon Plasma (QGP). In particular, suppression of quarkonium production in the QGP medium due to the color screening effect has been proposed as a direct signature of the QGP formation. However, there are also other phenomena, such as cold nuclear matter effects and regeneration, which can also modify the quarkonium yields measured in heavy-ion collisions. All of these effects need to be carefully taken into account when interpreting the observed suppression.

STAR is one of the running heavy-ion experiments in the world and it provides a large acceptance coverage to study quarkonium states at mid-rapidity. In this presentation, we will present the latest results of quarkonium measurements from the STAR experiment including the production cross sections of J/ψ and Υ mesons in $\sqrt{s}$ = 200 GeV and 500 GeV p+p collisions, J/ψ polarization in $\sqrt{s}$ = 200 GeV p+p collisions, and nuclear modification factors of J/ψ and Υ mesons in $\sqrt{s_{NN}}$ = 200 GeV p+Au and Au+Au collisions.

Collaboration name

STAR Collaboration

Track

Heavy Flavour

Author: HUANG, Te-Chuan (National Cheng Kung University)

Presenter: HUANG, Te-Chuan (National Cheng Kung University)

Session Classification: Heavy Flavour

Contribution ID: **53** Type: **Contributed talk**

Primordial fluctuations and anisotropic flow in heavy-ion collisions

Thursday, June 13, 2019 4:10 PM (20 minutes)

I present a first-principles description of the system created in relativistic heavy-ion collisions, whose primordial density fluctuations and anisotropy I evaluate in the color glass condensate (CGC) framework of high-energy QCD. Relating the primordial anisotropy of the system to the observed final-state anisotropic flow through a simple linear scaling, I achieve an excellent description of both RHIC and LHC data. I obtain, thus, a viable theory of anisotropic flow in which v_n coefficients are given by simple analytical expressions that depend on well-defined physical quantities.

This description implies a fundamental paradigm shift in our understanding of fluctuations in heavy-ion collisions. Indeed, density fluctuations in the CGC framework originate solely from QCD interactions, and do not require any knowledge about the positions of nucleons in the nuclear wavefunctions. Therefore, the standard Glauber modeling of nuclear collisions, along with all the related concepts of participant nucleons, binary collisions, etc., can (and should) be abandoned.

Based on:
https://arxiv.org/abs/1902.07168

Collaboration name

Track

Others

Author: GIACALONE, Giuliano (Université Paris-Saclay)

Co-authors: OLLITRAULT, Jean-Yves (CNRS); LUZUM, Matthew; MARQUET, Cyrille (CPHT - Ecole Polytechnique); GUERRERO RODRÍGUEZ, Pablo (UGR)

Presenter: GIACALONE, Giuliano (Université Paris-Saclay)

Session Classification: Hydrodynamics, Chirality and Vorticity

Contribution ID: **55** Type: **Poster**

Azimuthal anisotropy studies of beauty-decay electrons in Pb–Pb collisions with ALICE

Tuesday, June 11, 2019 6:45 PM (2 hours)

The study of the interaction of heavy quarks with the constituents of the medium created in heavy-ion collisions provides important information about the characteristics of the Quark-Gluon Plasma (QGP). The production of heavy quarks occurs prior to the formation of the QGP, implying that they experience the entire evolution of the system. To infer the properties of the partonic interactions of charm and beauty quarks in the medium, it is useful to investigate how heavy quarks are influenced by the collective expansion of the system. A sufficiently strong interaction could lead to a themalization of the heavy quarks which then would move along with the flow of the surrounding medium constituents leading to a substantial azimuthal anisotropy in non-central collisions.
The excellent particle-identification capabilities of the ALICE detector allow for an investigation of beauty production via the measurement of beauty-hadron decay electrons. The separation from background electrons is achieved stochastically, based on the track impact parameter distribution. This distribution is wider for the beauty-decay electrons due to the comparatively larger decay length of their parent hadrons ($c\tau \approx 500\,\mu\mathrm{m}$). This poster shows the current status of the measurements of the azimuthal anisotropy measurements of beauty-decay electrons in Pb–Pb collisions with ALICE.

Collaboration name

ALICE

Track

Heavy Flavour

Author: VOLKL, Martin Andreas (Eberhards Karls Universiy Tubingen (DE))

Presenter: VOLKL, Martin Andreas (Eberhards Karls Universiy Tubingen (DE))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **57** Type: **Poster**

A Principal Component Analysis of event-by-event fluctuations in hydrodynamic simulations at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

The expansion of the matter formed in nucleus-nucleus collisions at relativistic energies produces a collective transverse flow. This flow is the response to the density gradients in the initial fireball. It is azimuthally asymmetric because the initial fire-ball is anisotropic and contains hot spots. These inhomogeneities are of particular interest for two reasons. They reflect the poorly known mechanism of energy deposition (and the strong interaction) when two nuclei collide. In addition, the details of how they influence the final flow depends on also poorly known fluid properties, in particular, its shear and bulk viscosities. Therefore a lot of work has been done to relate initial inhomogeneities and final flow of produced particles.
In the beginning, the mapping between initial conditions and anisotropic flow has
been studied globally and event-by-event. The next step was to look at a more detailed level: the correlations of flow harmonics at different transverse momenta or pseudorapidities, encoded in the factorization breaking ratio rn, can bring new information on fluctuations in the initial state. More recently a new tool was proposed: the Principal Component Analysis (PCA) for event-by-event fluctuations is a more precise way to study the connection between initial and final stages. Last year experimental results for such an analysis have been presented by the CMS collaboration. The aim of this work is to present a first hydrodynamical study of these data and point out an interesting difference between data and some hydrodynamic simulations for the n=0 leading component. This leading component is the simplest possible observable for fluctuations: it shows the relative change of multiplicity in relation to the mean in a given transverse momentum bin. It is sensitive to physics not explored by standard anisotropic flow and can put new constraints on models.

Collaboration name

Track

Hydrodynamics, chirality and vorticity

Author: GARDIM, Fernando (Federal University of Alfenas)

Co-authors: GRASSI, Frederique; Prof. LUZUM, Matthew; OLLITRAULT, Jean-Yves (CNRS); ISHIDA, Pedro (Instituto de Física da Universidade de São Paulo)

Presenter: GARDIM, Fernando (Federal University of Alfenas)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **58** Type: **Poster**

Energy, multiplicity and event shape dependence of ϕ production in pp collisions with ALICE at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

The study of hadronic resonance production provides a unique tool to investigate the interplay of re-scattering and regeneration effects in the hadronic phase of heavy-ion collisions. The ϕ meson has a longer lifetime compared to other resonances. Thus, it is expected that its production will not be affected by regeneration and re-scattering processes. Measurements in small collision systems such as proton-proton (pp) collisions provide a necessary baseline for heavy-ion collisions and help to tune pQCD inspired event generators. Being a $s\bar{s}$ quark pair with zero net-strangeness content, measurements of ϕ meson production also contribute to the study of strangeness production in small systems. Event shape observables like transverse spherocity are sensitive to hard and soft processes and are useful tools to understand high multiplicity pp collisions. We report measurements of ϕ meson production in minimum bias pp collisions at different beam energies and as a function of charged particle multiplicity and transverse spherocity. The results include the transverse momentum (p_{T}) distributions of ϕ, $\langle p_{\mathrm{T}} \rangle$ values and particle yield ratios. The results will be compared to pQCD inspired models such as PYTHIA and EPOS-LHC.

Collaboration name

ALICE

Track

Hadron Resonances

Author: TRIPATHY, Sushanta (Indian Institute of Technology Indore (IN))

Presenter: TRIPATHY, Sushanta (Indian Institute of Technology Indore (IN))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **59** Type: **Contributed talk**

Quarkonia production in pPb collisions at LHCb

Thursday, June 13, 2019 2:20 PM (20 minutes)

We present LHCb results on quarkonia production in proton-lead collisions, using the data collected in 2016 at 8.16 TeV nucleon-nucleon centre-of-mass energy, in the forward region (pseudo-rapidity between 2 and 5), covering forward (pPb configuration) and backward (Pbp configuration) rapidities. Measurements include charmonia, where the prompt and from-b-decay components are disentangled, and bottomonia states. The large increase in size of the heavy flavour sample, compared to the 5 TeV sample collected in 2013, allows a remarkable improvement in the accuracy of the studies of nuclear matter effects.

Collaboration name

LHCb

Track

Heavy Flavour

Author: MUELLER, Katharina (Universitaet Zuerich (CH))

Presenter: LI, Hengne (South China Normal University (CN))

Session Classification: Heavy Flavour

Contribution ID: **60** Type: **Contributed talk**

Production of open heavy flavour hadrons in pPb collisions at LHCb

Tuesday, June 11, 2019 3:00 PM (20 minutes)

A rich set of open heavy flavour states is observed by LHCb in pPb collisions collected at 5 and 8.16 TeV nucleon-nucleon center-of-mass energies. Thanks to the LHCb forward acceptance that is complementary to general purpose detectors, heavy-flavor hadrons can be studied down to zero pT. Presented in this talk is the measurements of production of beauty hadrons and open charm states including the Lambda_c baryon, through cleanly reconstructed exclusive decays. Nuclear effects are studied, quantified by the nuclear modification factors, forward-to-backward production ratios and baryon-to-meson ratios.

Collaboration name

LHCb

Track

Heavy Flavour

Author: MUELLER, Katharina (Universitaet Zuerich (CH))

Presenter: YANG, Di (Tsinghua University (CN))

Session Classification: Heavy Flavour

Contribution ID: **61** Type: **Contributed talk**

LHCb fixed target results and prospects

Thursday, June 13, 2019 3:00 PM (20 minutes)

LHCb has the unique capability to study collisions of the LHC beams on fixed targets. Internal gas targets of helium, neon and argon have been used so far to collect samples corresponding to integrated luminosities up to 0.1 pb-1. An upgraded target, allowing a wider choice of target gas species and to increase the gas density by up to two orders of magnitude, is going to be installed for the LHC Run 3. Results and prospects on open and hidden charm productions will be presented, which can provide crucial constraints on cold nuclear matter effects and nPDF at large x. These measurements, together with production of antiprotons and other light hadrons, are of great interest to cosmic-ray physics as well.

Collaboration name

LHCb

Track

Upgrades and new experiments

Author: MUELLER, Katharina (Universitaet Zuerich (CH))

Presenter: PAPPALARDO, Luciano Libero (Universita e INFN, Ferrara (IT))

Session Classification: Upgrades and New Experiments

Contribution ID: **64** Type: **Contributed talk**

Parton-Hadron-Quantum-Molecular Dynamics (PHQMD) - A Novel Microscopic N-Body Transport Approach for Heavy-Ion Dynamics and Hypernuclei Production

Thursday, June 13, 2019 2:40 PM (20 minutes)

We present the novel microscopic n-body dynamical transport approach PHQMD (Parton-Hadron-Quantum-Molecular-Dynamics) for the description of particle production and cluster formation in heavy-ion reactions at relativistic energies. The PHQMD extends the established PHSD (Parton-Hadron-String-Dynamics) transport approach by replacing the mean field by density dependent two body interactions in a similar way as in the Quantum Molecular Dynamics (QMD) models. This allows for the calculation of the time evolution of the n-body Wigner density and therefore for a dynamical description of fragment and hypernuclei formation. The fragments are identified with the FRIGA ('Fragment Recognition In General Application') algorithm which - by regrouping the nucleons in single nucleons and noninteracting fragments - generates the most bound configuration of nucleons and clusters. Collisions among particles in PHQMD are treated in the same way as in PHSD. The PHQMD appraoch can be used in different modes for the hadron propagation: the mean-field based PHSD mode and the QMD mode based on density dependent two-body potential interactions between the nucleons. This allows to study the sensitivity of observables on the different ways of the description of the potential interactions among nucleons. Here we present the first results from the PHQMD for general 'bulk' observables such as rapidity distributions and transverse mass spectra for hadrons as well as for clusters production, including hypernuclei,at SIS and FAIR/NICA/BES RHIC energies.

Collaboration name

Track

Others

Authors: BRATKOVSKAYA, Elena (GSI, Darmstadt); AICHELIN, Joerg (Subatech/CNRS); Dr LE FEVRE, Arnaud (GSI, Darmstadt); Mr KIREYEV, Viktor (JINR, Dubna); KOLESNIKOV, Vadim (Joint Institute for Nuclear Research (RU)); LEIFELS, Yvonne (GSI Darmstadt)

Presenter: BRATKOVSKAYA, Elena (GSI, Darmstadt)

Session Classification: Strangeness and Light Flavour

Contribution ID: **65** Type: **Poster**

Measurement of open heavy-flavour hadron decay muons as a function of charged-particle multiplicity in pp and p—Pb collisions with ALICE

Tuesday, June 11, 2019 6:45 PM (2 hours)

Heavy quarks (charm and beauty) are produced in the early stages of hadronic collisions via hard scattering processes and therefore are efficient probes to study the properties of the Quark-Gluon Plasma produced in heavy-ion collisions at the LHC. Charged-particle multiplicity gives information on the global characteristics of the event and can be exploited to investigate the possible influence of the event hadronic activity on particle production. Heavy-quark production in pp and p—Pb collisions can have a substantial contribution from Multi-Parton Interactions (MPI), in which several interactions at the partonic level occur in a single collision. This implies a correlation between the particle production and the charged-particle multiplicity. This effect can be explored by studying the correlations between heavy-flavour production and the charged-particle multiplicity. Furthermore, the study of the multiplicity dependence of heavy-flavour production in p—Pb collisions might provide important information regarding Cold Nuclear Matter (CNM).

In this poster, we will present results of the production of heavy-flavour hadron decay muons as a function of charged-particle multiplicity in pp collisions at $\sqrt{s}$ = 8 TeV and in p—Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 8.16 TeV at both forward and backward rapidities. The results will be compared with theoretical predictions.

Collaboration name

ALICE

Track

Heavy Flavour

Author: MHLANGA, Sibaliso (University of Cape Town (ZA))

Presenter: MHLANGA, Sibaliso (University of Cape Town (ZA))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **66** Type: **Poster**

Using Ξ(1820) baryons to test for parity doubling at ALICE

Tuesday, June 11, 2019 6:45 PM (2 hours)

We investigate the production of Ξ(1820) baryons in pp collisions at 13 TeV by reconstructing their Λ-K decays. Recent lattice calculations on parity doubling indicate that the masses of negative-parity particles, such as Ξ(1820), may decrease at high temperatures, while the masses of positive-parity partners, i.e. the Ξ(1530), do not. Furthermore, the lifetime of the Ξ(1820) is short enough that it may be suppressed in high-multiplicity collisions, as has been observed for Λ(1520), K*(892), and ρ(770). Studying Ξ(1820) also allows us to better understand the spectrum of excited hyperon states, with implications for our understanding of the hadron resonance gas. Using ALICE data from 2015-2018, we have reconstructed the Ξ(1820) and measured its mass, width, and yield as functions of transverse momentum and collision multiplicity. The mass and width measurements are in general agreement with previous measurements, but could indicate a slight increase in the width as a function of charged particle multiplicity. These pp studies will inform future studies of the Ξ(1820) in p-Pb and Pb- Pb collisions.

Collaboration name

ALICE Collaboration

Track

Hadron Resonances

Author: MYERS, Corey James (University of Houston (US))

Presenter: MYERS, Corey James (University of Houston (US))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **67** Type: **Poster**

Multiplicity dependence of strangeness production in proton-proton collisions at $\sqrt{s}$ = 5.02 TeV with ALICE at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

In the ultra-relativistic heavy-ion collisions provided at the LHC nuclear matter undergoes, under extreme conditions of high temperature and high energy density, a transition to a phase in which quarks and gluons are deconfined: the Quark-Gluon Plasma (QGP). Unlike up and down quarks, which form ordinary matter, strange quarks are not present as valence quarks in the initial state and they are sufficiently light to be abundantly created during the time evolution of the collision. The study of strange and (multi-)strange particles such as K^0_S, Λ, Ξ, Ω via the measurements of their yields relative to pions yields, offers important and useful tools for the investigation of the QGP. On the other hand recent results about the strangeness production as a function of the multiplicity in small colliding systems has triggered a lot of interest because they show features similar to those observed in Pb-Pb collisions. We report on the measurement of the (multi-)strange hadron production in proton-proton collisions at $\sqrt{s}$= 5.02 TeV as a function of the multiplicity. The results are based on the analysis of the data sample collected in 2017 with the ALICE detector. This new results on (multi-)strange production in this collision system provide also an important reference for the measurement available in Pb-Pb collisions at the same energy.

Collaboration name

ALICE

Track

Strangeness and Light Flavour

Author: TROPP, Lukas (Pavol Jozef Safarik University (SK))

Co-author: DELSANTO, Silvia (Universita e INFN Torino (IT))

Presenter: TROPP, Lukas (Pavol Jozef Safarik University (SK))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **68** Type: **Poster**

Measurement of K$^{*\pm}$ in p-Pb collisions with ALICE at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

Short-lived resonances play an important role to understand the mechanism of particle production and the hadronic phase properties of heavy-ion collisions. Resonance yields are modified due to the interaction of their decay daughters within the hadronic medium via the processes like re-scattering and regeneration. p-Pb collision is a suitable system to study the multiplicity dependence of the resonance yields modification, in the range of multiplicities between pp and peripheral heavy-ion collisions like Pb-Pb and Xe-Xe. It also helps us in understanding the cold nuclear matter effects such as the Cronin enhancement and nuclear shadowing.

We report on the measurement of K$^{*\pm}$ production in p-Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 and 8.16 TeV in rapidity range -0.5 $< y <$ 0. The results include the transverse momentum spectra, integrated yields and mean transverse momenta. We will also present the nuclear modification factor in p-Pb collisions. These results will be compared with results from lower energy experiments and the available model predictions.

Collaboration name

ALICE

Track

Strangeness and Light Flavour

Author: MALLICK, Dukhishyam (NISER)

Co-author: Mr DE, Sudipan (NISER)

Presenter: MALLICK, Dukhishyam (NISER)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **69** Type: **Poster**

Study of Strange Particle Production in pp and pPb Collision at $\sqrt{s_{NN}} = 7\,TeV$ using the simulation data

Tuesday, June 11, 2019 6:45 PM (2 hours)

The yields of strange hadrons: K_s^0 -meson, Λ^- and $\bar{\Xi}$ -hyperon produced in proton-proton (*pp*) and proton-nucleus (pPb) collisions at $\sqrt{s_{NN}} = 7\,TeV$ (in rapidity interval of $|y| < 2$ and traverse momentum range of $0 < p_T < 10\,GeV/c$) as a function of p_T are presented. The simulation codes, $EPOS1.99$, $EPOS - LHC$ and $QGSJETII - 04$ are used as event generators. The predictions of simulation results for the *pp* collisions are compared with the experimental data obtained by ALICE and CMS detectors. It was observed that: for the *pp* collisions, the simulation codes cannot describe well the experimental data on strangeness production in *pp* collisions at $7\,TeV$. In the area of low p_T less than $1.6\,GeV/c$ for the K_S^0-mesons and $1.3\,GeV/c$ for the Λ^--hyperons, models predictions are systematically greater than the experimental data. Then in the II regions the simulation data and experimental ones cross each other. In the III regions experimental data are systematically greater than the models'predictions. For the $\bar{\Xi}$ -hyperons the production results were observed only from the $EPOS1.99$ and $EPOS - LHC$. In case of pPb, all 3 codes give almost same predictions for the p_T distributions of K_s^0 -mesons. But with increasing the mass of particles some deviations from $QGSJETII - 04$ model predictions for the Λ^- -hyperon is observed in the regions of $p_T > 1.5\,GeV/c$. For the p_T distributions of the $\bar{\Xi}$–hyperons the deviations observed even between the 2 tunes of the EPOS code in the interval of $p_T > 2\,GeV/c$. The codes predictions depend on the mass of the strange particles produced in the pPb interactions at $7\,TeV$. Unfortunately, there are not experimental data for the strange particles p_T distributions at this energy of pPb collisions. Then thethe ratios of the experimental data to model simulations give the quantitative results to characterized the differences between the model predictions and the experimental data for the *pp* and pPb collisions at $7\,TeV$.

Collaboration name

Track

Strangeness and Light Flavour

Author: TABASSAM, Uzma (COMSATS University Islamabad)

Presenter: TABASSAM, Uzma (COMSATS University Islamabad)

Session Classification: Poster session with "aperitivo"

Contribution ID: **70** Type: **Poster**

Suppression of Λ(1520) resonance production in central Pb—Pb collisions at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

Hadronic resonances with lifetimes of a few fm/c, shorter than or comparable to the timescale of the fireball evolution are sensitive probes of the dynamics and properties of the medium formed after the hadronisation of the QGP. Because of their short lifetimes, they can decay within the hadronic medium, which can alter or destroy the correlation among the decay daughters via interactions (re-scattering) with the surrounding hadrons, hence reducing the observed yields.

In this poster, we present the published results on the observation of the suppression of the Λ(1520) baryonic resonance in central Pb—Pb collisions at the LHC. The yield of the Λ(1520) is measured at mid-rapidity in Pb—Pb collisions at $\sqrt{s_{\rm NN}}$ = 2.76 TeV with the ALICE detector in the Λ(1520) $\rightarrow$ pK$^-$ (and charge conjugate) hadronic decay channel as a function of the transverse momentum ($p_{\rm T}$) and collision centrality. The ratio of the $p_{\rm T}$-integrated resonance production relative to its longer-lived counterpart, Λ, is suppressed by about a factor of 2 in central collisions with respect to peripheral collisions and it is smaller than the value predicted by statistical hadronisation model calculations. The shape of the measured $p_{\rm T}$ distributions and the centrality dependence of the suppression are reproduced by the EPOS3 Monte Carlo event generator, which incorporates UrQMD to describe the interactions among particles in the hadronic phase in a microscopic approach. The results highlight the relevance of the hadronic phase in the study of heavy-ion collisions and the importance of a microscopic description of the late hadronic interactions.

Finally, we present the perspectives for the analysis of Λ(1520) production with the full ALICE data sample collected with Pb—Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV in LHC Run2, which would allow one to improve the statistical significance with respect to the present measurement and perform the study more differentially and in narrower centrality classes.

Collaboration name

ALICE, CERN

Track

Hadron Resonances

Author: AGRAWAL, Neelima (Museo Storico della Fisica e Centro Studi e Ricerche Enrico Fer)

Presenter: AGRAWAL, Neelima (Museo Storico della Fisica e Centro Studi e Ricerche Enrico Fer)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **71** Type: **Contributed talk**

Perspectives on strangeness physics with the CBM experiment at FAIR

Thursday, June 13, 2019 3:20 PM (20 minutes)

The main goal of the CBM experiment at FAIR is to study the behavior of nuclear matter at very high baryonic density. This includes the exploration of the high density equation of state, search for the transition to a deconfined and chirally restored phase, critical endpoint. The promising diagnostic probes for this new states are the enhanced production of multi-strange (anti-)particles. The CBM detector is designed to measure such rare diagnostic probes multi-differentially with unprecedented precision and statistics. Important key observables are the production of hypernuclei and dibaryons. Theoretical models predict that single and even doubly-strange hypernuclei are produced in heavy-ion collisions with the maximum yield in the region of SIS100 energies. The discovery and investigation of new (doubly strange-)hypernuclei and of hyper-matter will shed light on the hyperon-nucleon and hyperon-hyperon interactions. Results of feasibility studies of these key CBM observables in the CBM experiment are discussed.

Collaboration name

CBM Collaboration

Track

Upgrades and new experiments

Author: VASSILIEV, Iouri (GSI)

Presenter: VASSILIEV, Iouri (GSI)

Session Classification: Upgrades and New Experiments

Contribution ID: **73** Type: **Poster**

$f_0(980)$ resonance production in pp collisions at $\sqrt{s}$ = 5.02 TeV with ALICE

Tuesday, June 11, 2019 6:45 PM (2 hours)

We report on the inclusive production of the $f_0(980)$ particle measured at midrapidiy in inelastic pp collisions at $\sqrt{s}$ = 5.02 TeV with ALICE.
The nature of the $f_0(980)$ remains elusive: different interpretations of this resonance including $q\overline{q}$ states, loosely-bound molecular states such as $K\overline{K}$, and as a tetra quark candidate are available. Studies in different collision systems are particularly interesting because they can provide information about the nature of this particle. In addition, being a short-lived hadronic resonance, measurements of $f_0(980)$ production in different systems contribute to the study of the lifetime of the hadronic phase.
The signal extraction using the dominant decay channel $f_0(980) \rightarrow \pi^+\pi^-$ is challenging due to the large background from correlated $\pi^+\pi^-$ pairs from other resonance decays in the invariant mass window under study, as well as due to the combinatorics from uncorrelated pairs. We present in detail the strategy followed for the signal extraction and the results in terms of p_{T}-dependent production yields.
Results are discussed and compared with production yields of stable hadrons and other resonances.

Collaboration name

ALICE

Track

Hadron Resonances

Author: BELLINI, Francesca (CERN)

Presenter: BELLINI, Francesca (CERN)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **74** Type: **Poster**

(Anti)(hyper)nuclei and exotica measurements with the ALICE upgrade

Tuesday, June 11, 2019 6:45 PM (2 hours)

The expected increase in the integrated luminosity foreseen for the LHC Runs 3 and 4, combined with the performance of the upgraded ALICE detector, will allow for the measurement of the production of rare light-flavour probes such as (anti)nuclei and exotic states. Not only are these important probes of the system created in high-energy proton-proton (pp) and heavy-ion collisions, but also provide crucial information on the internal composite structure of these objects as well as on the properties of the QCD interaction among their constituents.
In order to distinguish between the coalescence and thermal-statistical production scenarios, the coalescence parameter will be measured for (anti)(hyper)nuclei that differ by mass, size and internal wave-function, as a function of the system size. Projections based on the integrated luminosity expected during Runs 3 and 4 will be presented. Runs 3 and 4 will open a precision era for measurements of light (anti)nuclei with mass number A = 2 and A = 3 and of the (anti)hypertriton in heavy-ion as well as in pp collisions. Measurements of the (anti)alpha particle will be performed with unprecedented precision and anti-hypernuclei with A = 4 will be in reach for discovery in Pb–Pb collisions.
In the exotic sector, $f_0(980)$ and N(1875) measurements will be feasible in Runs 3 and 4 and will shed light on the highly-debated nature of these states (hadrons or hadronic molecules). The study of possible dibaryon bound states as the $N\Omega$, $N\Xi$ and $N\Lambda_c$, via direct detection or baryon-baryon correlations, will be useful for hyperon-correlation studies, providing new insights into the baryon-baryon attractive potential as well as upper limits on the formation of such bound states in central heavy-ion collisions.
The impact of measurements of anti-nuclei and baryon-baryon correlations in small systems in the astrophysical domain, in indirect dark matter searches and neutron star physics, will also be discussed.

Collaboration name

ALICE Collaboration

Track

Upgrades and new experiments

Author: MASTROSERIO, Annalisa (Universita degli studi di Foggia (IT))

Presenter: MASTROSERIO, Annalisa (Universita degli studi di Foggia (IT))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **75** Type: **Contributed talk**

Strange and non-strange light-flavour hadron production in Pb-Pb and p-Pb collisions at LHC energies with ALICE

Tuesday, June 11, 2019 3:00 PM (20 minutes)

The ALICE experiment is dedicated to the study of strongly interacting matter at the extremely high temperatures and energy densities reached at the LHC. Its excellent tracking and particle-identification capabilities allow characterising the hot nuclear matter via detailed measurements of particle production in nucleus-nucleus collisions. In addition, the study of proton-nucleus collisions provides a fundamental benchmark for initial state and cold nuclear matter effects.

During the LHC Run2, the ALICE collaboration recorded data from Pb–Pb and p–Pb collisions at the unprecedented energies of $\sqrt{s_{\rm NN}}$ = 5.02 and 8.16 TeV, respectively. Measurements of the production of light-flavour hadrons π, K, p, Λ, Ξ and Ω are reported.
Results are presented as a function of the collision centrality or multiplicity and include transverse momentum spectra, ratios of spectra, integrated yields and nuclear modification factors. Hydrodynamic model predictions are tested through comparison to the measured spectral shapes.

A systematic study of strangeness production is of fundamental importance for determining the thermal properties of the system created in ultra-relativistic heavy-ion collisions. In order to study strangeness enhancement, the measured particle yields are normalised to the yields of pions in the corresponding centrality or multiplicity classes. The results are compared to measurements performed at lower energies, to different collision systems and to predictions from statistical hadronisation models.

Collaboration name

ALICE Collaboration

Track

Strangeness and Light Flavour

Author: SEFCIK, Michal (Pavol Jozef Safarik University (SK))

Presenter: SEFCIK, Michal (Pavol Jozef Safarik University (SK))

Session Classification: Strangeness and Light Flavour

Contribution ID: **77** Type: **Contributed talk**

Hadronic resonance production with ALICE at the LHC

Thursday, June 13, 2019 5:10 PM (20 minutes)

Measurements of the production of short-lived hadronic resonances are used to probe the properties of the late hadronic phase in ultra-relativistic heavy-ion collisions. Since these resonances have lifetimes comparable to that of the fireball, they are sensitive to the competing effects of particle re-scattering and regeneration in the hadronic gas, which modify the observed particle momentum distributions and yields after hadronisation. Having different masses, quantum numbers and quark content, hadronic resonances carry a wealth of information on different aspects of ion-ion collisions, including the processes that determine the shapes of particle momentum spectra, insight into strangeness production and collective effects in small collision systems.

We present the most recent ALICE results on $\rho(770)^0$, K*(892)ˆ{\pm}, $K*(892)^0$, $\phi(1020)$, $\Sigma(1385)^{\pm}$, $\Lambda(1520)$, $\Xi(1530)^0$ and $\Xi(1820)$ production at the LHC. They include measurements performed in pp, p-Pb and Pb-Pb collisions at different energies, as well as the latest results from the LHC Run 2 with Xe-Xe collisions at $\sqrt{s_{\rm NN}}$ = 5.44 TeV and with Pb-Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV. Collision energy, centrality and multiplicity differential measurements of transverse momentum spectra, integrated yields, mean transverse momenta and particle ratios are discussed in detail. A critical overview of these results will be given through comparisons to measurements from other experiments and theoretical models.

Collaboration name

ALICE Collaboration

Track

Hadron Resonances

Author: TRIPATHY, Sushanta (Indian Institute of Technology Indore (IN))

Presenter: TRIPATHY, Sushanta (Indian Institute of Technology Indore (IN))

Session Classification: Hadron Resonances

Contribution ID: **79** Type: **Contributed talk**

Spin alignment measurements of vector mesons in Pb-Pb collisions with ALICE at the LHC

Tuesday, June 11, 2019 4:10 PM (20 minutes)

Spin alignment of vector mesons produced in non-central heavy-ion collisions could occur due to the large angular momentum and intense magnetic field expected in the initial stages of these collisions. This phenomenon leads to a non-uniform angular distribution of the decay products of the vector meson with respect to the quantization axis in the rest frame of vector meson. The quantization axis can be either the normal to the production plane (plane subtended by the momentum of vector meson and the beam axis) or the normal to the reaction plane of the system (defined by the impact parameter and the beam axis). The study of the angular distribution of the decay products leads to a measurement of the zeroth element of the spin density matrix element ρ_{00}. Any deviation of the value of ρ_{00} from 1/3 would indicate the presence of spin alignment.
We report on recent ALICE results from spin alignment studies of the $\phi(1020)$ vector meson at mid-rapidity in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 and 5.02 TeV and in pp collisions at $\sqrt{s}$ = 13 TeV. The p_T and centrality dependence of ρ_{00} with production and event plane in Pb-Pb collisions will be presented and compared to the corresponding results for the $K^*(892)^0$ vector meson. The extracted ρ_{00} values are found to be slightly below 1/3 at low transverse momentum for both $K^*(892)^0$ and phi(1020) and are consistent with 1/3 (no spin alignment) at higher p_T.

Collaboration name

ALICE Collaboration

Track

Hydrodynamics, chirality and vorticity

Author: KUNDU, Sourav (National Institute of Science Education and Research (IN))

Presenter: KUNDU, Sourav (National Institute of Science Education and Research (IN))

Session Classification: Hydrodynamics, Chirality and Vorticity

Contribution ID: **80** Type: **Contributed talk**

Measurement of elliptic and triangular flow of light (anti-)nuclei with ALICE at the LHC

Thursday, June 13, 2019 4:30 PM (20 minutes)

The measurement of the elliptic and the triangular flow of (anti-)nuclei is a powerful tool to have insight into the production mechanisms of particles in heavy-ion collisions.
Namely, it will help to distinguish between coalescence and hydrodynamic models.
The coalescence approach predicts light nuclei formation as the result of coalescence of nucleons which are close enough in the phase space, thus the elliptic and triangular flow are expected to scale with the number of constituent hadrons. On the other hand, if light nuclei are produced thermally at the phase boundary in heavy-ion collisions together with all the other hadrons, the evolution with transverse momentum of the elliptic and triangular flow can be describe by hydrodynamic models.
In this presentation, new results on the measurement of the elliptic and the triangular flow of deuteron and ^{3}He produced in Pb–Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.05 TeV will be presented and they will be compared to the lower energy results and to the expectations from coalescence and hydrodynamic models.

Collaboration name

ALICE Collaboration

Track

Hydrodynamics, chirality and vorticity

Author: CALIVA, Alberto (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))

Presenter: CALIVA, Alberto (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))

Session Classification: Hydrodynamics, Chirality and Vorticity

Contribution ID: **81** Type: **Contributed talk**

Testing coalescence and thermal models with the production measurement of light (anti-)nuclei as function of collision system size with ALICE at the LHC

Tuesday, June 11, 2019 4:30 PM (20 minutes)

The high energy pp, p-Pb, and Pb-Pb collisions at the LHC offer a unique tool to study the production of light (anti-)nuclei. The study of the production yield of (anti-)nuclei in heavy-ion collisions at the LHC energy probes the late stages in the evolution of the hot, dense nuclear matter created in the collision and serves as baseline for the search of exotic multi-baryon states.
The same measurements performed in smaller collision systems are crucial to understand how the particle production mechanism evolves going from small to large systems. Thanks to its excellent particle identification and tracking capabilities, the ALICE detector allows for the measurement of deuterons, tritons, ^{3}He, ^{4}He and their corresponding anti-nuclei.

Results on the production yields of light (anti-)nuclei in pp, p–Pb, and Pb–Pb collisions at energies going from 5.02 TeV to 13 TeV center-of-mass energies will be presented. A critical comparison of the experimental results with the predictions of statistical (thermal) model and baryon coalescence approach will be given to provide insight into the production mechanisms of light anti-nuclei in ultra-relativistic collisions.

Collaboration name

ALICE Collaboration

Track

Hadronisation and coalescence

Author: BARIOGLIO, Luca (Universita e INFN Torino (IT))

Presenter: BARIOGLIO, Luca (Universita e INFN Torino (IT))

Session Classification: Hadronization and Coalescence

Contribution ID: **82** Type: **Contributed talk**

Shedding light on the hyper-triton lifetime puzzle with ALICE at the LHC

Thursday, June 13, 2019 2:20 PM (20 minutes)

The measurement of the hyper-triton lifetime with the ALICE detector at the LHC is presented to address one of the open key question of hypernuclear physics: the hyper-triton lifetime puzzle. The Pb-Pb dataset collected during the LHC Run 2 at $\sqrt{s_{\rm NN}}$ = 5.02 TeV allows for a systematic study of light (anti-)hypernuclei production in heavy-ion collisions, in particular, for the hyper-triton lifetime determination, thus complementing the results obtained at lower energy ($\sqrt{s_{\rm NN}}$ = 2.76 TeV).

The analysis has been carried out exploiting the excellent particle identification performance by measuring the energy loss in the Time Projection Chamber. In addition, the Inner Tracking System is used to discriminate secondary vertices, originating from weak decays, from the primary vertex. This is of particular importance for the measurement of (anti-)(hyper-)triton, which decays weakly with a decay length of several centimetres.

The study of (anti-)(hyper-)triton production in Pb-Pb collisions at both energies available at the LHC will be discussed and compared.

Collaboration name

ALICE Collaboration

Track

Strangeness and Light Flavour

Author: BUFALINO, Stefania (Politecnico di Torino (IT))

Presenter: BUFALINO, Stefania (Politecnico di Torino (IT))

Session Classification: Strangeness and Light Flavour

Contribution ID: **83** Type: **Contributed talk**

ALICE ITS upgrade: construction and commissioning

Thursday, June 13, 2019 2:40 PM (20 minutes)

ALICE (A Large Ion Collider Experiment) is the CERN LHC experiment optimized for the study of the strongly interacting matter produced in heavy-ion collisions and devoted to the characterization of the quark-gluon plasma. Data were collected during LHC Run 1 and Run 2 in lead-lead, proton-lead and proton-proton collisions at several energies.

To achieve the physics program for LHC Run 3, ALICE foresee a major upgrade of the experimental apparatus during the ongoing second long LHC shutdown.
A key element of the ALICE upgrade is the substitution of the present Inner Tracking System (ITS) with a completely new silicon based detector whose features will allow the reconstruction of rare physics channels, not accessible with the present layout. The enabling technology for such performance boost is the adoption of custom- designed Monolithic Active Pixel Sensors (MAPS) as detecting element. The high pixel density, a seven-layer layout covering a radial extension from 22 mm to 430 mm and a very low material budget (0.3% X_0 for the three innermost layers), will significantly enhance the precision of the position determination of the particle decay vertexes and the tracking efficiency, especially for low transverse momenta particles.

The integration of the Inner Barrel, made of the three innermost layers, has been completed and the commissioning, first in laboratory, is ongoing. The construction of the Outer Barrel, the four outermost layers, is ongoing and their integration in the detector structure is proceeding in parallel.
In this talk, an overview of the physical motivation and layout as well as the status of the construction and commissioning of the detector will be given.

Collaboration name

ALICE Collaboration

Track

Upgrades and new experiments

Author: COLELLA, Domenico (Universita e INFN, Bari (IT))

Presenter: COLELLA, Domenico (Universita e INFN, Bari (IT))

Session Classification: Upgrades and New Experiments

Contribution ID: **84** Type: **Contributed talk**

News on in-medium modifications of properties of kaons measured around threshold

Thursday, June 13, 2019 5:10 PM (20 minutes)

A partial restoration of the chiral symmetry is the fundamental quantum process of interaction of the hadronic matter with the quark-antiquark condensate [1]. According to QCD a particle embedded in a hot and dense hadronic matter should change its basic properties like mass and decay constant with respect to their values in vacuum. Kaons produced in heavy ion collisions around threshold for their production appear to be a good probe of these effects.

Initially comparisons of experimentally found phase space distributions to the transport model calculations suggested a clear and strong sensitivity to this effect [2]. However, recent published and upcoming data on kaon emission from high-statistics experiments by FOPI and HADES groups reveal a much broader and complex landscape. In this talk the preliminary findings of comparison of the transport model predictions to the distributions of K^0_S emitted from Au+Au at 1.2A GeV [3] will be presented. Also new data on the emission of K^+ and K^- from the collisions of Ni+Ni at 1.9A GeV [4] will be shown. I will also point out the importance of the $\phi(1020)$ meson decays in the interpretation of the K^- spectra, consistently found in a recent decade [5,6].

[1] V. Koch, Intl. Jour. of Mod. Phys. E 06, 203 (1997).
[2] F. Laue *et al.* (KaoS Collaboration), Eur. Phys. J. A 9, 397 (2000).
[3] J. Adamczewski-Musch *et al.* (HADES Collaboration), arXiv:1812.07304.
[4] K. Piasecki *et al.* (FOPI Collaboration), Phys. Rev. C 99, 014904 (2019).
[5] J. Adamczewski-Musch *et al.* (HADES Collaboration), Phys. Lett. B 778, 403 (2018).
[6] K. Piasecki *et al.* (FOPI Collaboration), Phys. Rev. C 94, 014901 (2016).

Collaboration name

FOPI, HADES

Track

Strangeness and Light Flavour

Author: PIASECKI, Krzysztof (University of Warsaw)

Presenter: PIASECKI, Krzysztof (University of Warsaw)

Session Classification: Strangeness and Light Flavour

Contribution ID: **87** Type: **Poster**

Calculating hard probe radiative energy loss beyond soft-gluon approximation: how valid is the approximation?

Tuesday, June 11, 2019 6:45 PM (2 hours)

One of the most common assumptions when calculating radiative energy loss of high $p_\perp$ particles in quark-gluon plasma is the soft-gluon approximation, which considers that initial parton losses only a small amount of its energy via gluon's bremsstrahlung. Despite its convenience, the approximation sustainability was questioned by the reported notable radiative energy loss within different theoretical models.

To address this issue, we relax the soft-gluon approximation within DGLV formalism [1]. The obtained analytic expression beyond soft-gluon approximation is significantly more involved than its soft-gluon counterpart. Unexpectedly, however, the numerical results lead to similar predictions for the fractional radiative energy loss and the number of radiated gluons. Furthermore, the effect on these two variables is of an opposite sign, and results in nearly overlapping suppression predictions with and without soft-gluon approximation. We also show that this surprising result can be understood by the interplay of initial parton's $p_\perp$ distribution and its energy loss probability. Consequently, the results presented here provide confidence that, despite the concerns mentioned above, the soft-gluon approximation remains adequate within DGLV formalism. Finally, we also discuss generalizing this relaxation in the dynamical QCD medium, which suggests a more general applicability of the conclusions obtained here.

[1] B. Blagojevic, M. Djordjevic and M. Djordjevic, Phys. Rev. C **99**, no. 2, 024901 (2019).

Collaboration name

Track

Strangeness and Light Flavour

Author: BLAGOJEVIC, Bojana (Institute of Physics Belgrade)

Co-authors: DJORDJEVIC, Magdalena (Institute of Physics Belgrade); DJORDJEVIC, Marko (Faculty of Biology, Institute of Physiology and Biochemistry, University of Belgrade, Serbia)

Presenter: BLAGOJEVIC, Bojana (Institute of Physics Belgrade)

Session Classification: Poster session with "aperitivo"

Contribution ID: **88** Type: **Contributed talk**

Collectivity and electromagnetic fields in proton-induced collisions

Tuesday, June 11, 2019 4:30 PM (20 minutes)

Proton-nucleus collisions at relativistic energy, traditionally regarded as control measurements for heavy ion collisions, are now capturing the attention due to the recent experimental observations at RHIC and LHC that indicate the formation of quark-gluon plasma even in these small systems. In the early stage of relativistic heavy ion collisions extremely intense magnetic fields, with a magnitude up to 5-50 m_\piˆ2, are produced. In asymmetric collisions, and in particular in proton-nucleus collisions, not only the magnetic field but also the generated electric field is very high. Moreover, the particle rapidity distributions are strongly asymmetric inside the overlap region due to the different number of protons in the colliding nuclei. By means of microscopic calculations within the Parton-Hadron-String Dynamics (PHSD) approach we study central p+Au collisions, investigating the emergence of collectivity, the distributions of electromagnetic fields and the influence of these fields on final hadronic observables.

Collaboration name

Track

Collectivity in small systems

Author: OLIVA, Lucia (GSI, Darmstadt)

Co-authors: BRATKOVSKAYA, Elena (GSI, Darmstadt); CASSING, Wolfgang (University of Giessen)

Presenter: OLIVA, Lucia (GSI, Darmstadt)

Session Classification: Collectivity in Small Systems

Contribution ID: **89** Type: **Contributed talk**

Low-mass dielectron measurements in pp, p-Pb and Pb-Pb collisions with ALICE at the LHC

Tuesday, June 11, 2019 2:20 PM (20 minutes)

The production of low-mass dielectrons is the most promising tool for the understanding of the chiral symmetry restoration and of the properties of the Quark-Gluon Plasma (QGP) created in heavy-ion collisions. At low invariant mass, the dielectron production is sensitive to the properties of vector mesons in the medium related to the chiral symmetry restoration. In the intermediate-mass region, the main component of the dielectron continuum is coming from correlated electron pairs from heavy-flavour hadron decays, which carry information about heavy-quark energy loss and collectivity. In this mass region, thermal radiation from the QGP gives insight into the early temperature of the medium. Finally, at very low momenta initial photon annihilation processes, triggered by the coherent electromagnetic fields of the incoming nuclei, are expected to play a role in more peripheral collisions.

To study the dielectron production in heavy-ion collisions, it is crucial to first understand the primordial e$^{+}e^{-}pairproductioninvacuumwithminimum-biasproton-protoncollisionsandtodisentanglehotfromcold nuclearmattereffectswithp--Pbcollisions.Moreover,observationsofcollectiveeffectsinhigh-multiplicityppandp-Pbcollisionsshowsurprisingsimilarities withthoseinheavy-ioncollisions,whichcanbefurth

In this talk, we will give an overview of the latest measurements of e{+}e{-}$pairproductioninpp, p-PbandPb-Pbcollisionsrecorded byALICEatdifferentenergies.Itsimplications fortheproductionofheavy particlemultiplicityintheevent, orthecentralityofthecollision.Thecomparisonofthemeasureddielectronyi

Collaboration name

ALICE

Track

Heavy Flavour

Author: CAPON, Aaron (Stefan Meyer Institute for Subatomic Physics (SMI), Austrian Academy of Sciences (AT))

Presenter: CAPON, Aaron (Stefan Meyer Institute for Subatomic Physics (SMI), Austrian Academy of Sciences (AT))

Session Classification: Heavy Flavour

Contribution ID: **91** Type: **Contributed talk**

J/ψ production measurements in pp, p-Pb and Pb-Pb collisions at mid-rapidity using the ALICE detector at LHC

Thursday, June 13, 2019 2:40 PM (20 minutes)

J/ψ production provides a particular sensitivity to the medium, which can be produced in heavy-ion collisions at ultrarelativistic energies as delivered by the LHC. The vacuum production is modeled by a reference measured in proton-proton collisions and potential initial-state effects can be constrained using p-Pb collisions in the same collision-energy regime.

In this contribution J/ψ production measured at mid-rapidity ($|y| < 0.9$) with the ALICE detector down to zero transverse momentum is presented. Final results of the proton-proton collisions at $\sqrt{s} = 5.02$ TeV collected in 2017 are presented which serve also as a high-precision reference for the nuclear modification factors in p-Pb and Pb-Pb collisions at the corresponding centre-of-mass collision energy. The status of the analysis of the nuclear modification factor and the separation of the prompt and non-prompt components of J/ψ production in p-Pb collisions at $\sqrt{s_{\rm NN}} = 8.16$ TeV is shown. Available models are confronted with the data.

Collaboration name

ALICE

Track

Heavy Flavour

Author: KIM, Minjung (Ruprecht Karls Universitaet Heidelberg (DE))

Presenter: KIM, Minjung (Ruprecht Karls Universitaet Heidelberg (DE))

Session Classification: Heavy Flavour

Contribution ID: **92** Type: **Poster**

Measurement of electroweak-boson production in p-Pb and Pb-Pb collisions at the LHC with ALICE

Tuesday, June 11, 2019 6:45 PM (2 hours)

Electroweak bosons are created in the hard scattering processes at the initial stage of heavy-ion collisions and they are insensitive to the presence of the strongly-interacting medium. This makes them clean probes of the initial-state effects in heavy-ion collisions, such as the nuclear modification of the Parton Distribution Functions (nPDFs). Furthermore, their measurement in heavy-ion collisions is a powerful test of the binary scaling of hard processes as well as a reference for hot-matter effects on other probes.

The measurement of electroweak-boson production in p-Pb and Pb-Pb collisions at the LHC provides constraints on the nPDFs of (anti)quarks in phase-space regions which are poorly constrained from previous experiments.

At forward rapidity ($2.5 < y < 4$), ALICE can measure W and Z bosons via their muon decay in all collisions systems provided by the LHC. These measurements are complementary to those by ATLAS and CMS at central rapidity.

In this contribution, focus will be given to the most recent ALICE electroweak-boson measurements. Exploiting the data collected by ALICE in 2015 and 2018, centrality and rapidity-differential measurements of the Z-boson production yield in Pb-Pb collisions at $\sqrt{s_{\rm NN}} = 5.02$ will be discussed. The first measurement of the Z-boson production cross section in p-Pb collisions at $\sqrt{s_{\rm NN}} = 8.16$ TeV will also be shown as a function of rapidity. The status of ongoing W-boson analyses in various collision systems will also be reported. All the presented results will be compared to theoretical calculations including nPDFs.

Collaboration name

ALICE

Track

Others

Author: VALLE, Nicolo' (Universita and INFN (IT))

Presenter: VALLE, Nicolo' (Universita and INFN (IT))

Session Classification: Poster session with "aperitivo"

Contribution ID: **93** Type: **Contributed talk**

Quarkonium measurements at forward rapidity with ALICE at the LHC

Thursday, June 13, 2019 3:20 PM (20 minutes)

Heavy quarks are produced at the first instant of a nucleus-nucleus collision and therefore are an important tool to study the subsequent high energy-density medium formed in ultra-relativistic heavy-ion collisions. A series of experimental efforts for understanding the properties of the Quark-Gluon Plasma (QGP), a medium consisting of a deconfined state of quarks and gluons, are based on measuring the bound states of heavy quark-antiquark pairs known as quarkonia. However, the medium modification of heavy-flavour hadron production includes also the contribution of cold nuclear matter effects such as shadowing or nuclear breakup in addition to the QGP effects. Proton-nucleus collisions, where no QGP is expected, are used to measure cold nuclear matter effects on quarkonium production. Finally, quarkonium measurements in proton-proton collisions are used as reference for both heavy-ion and proton-ion collisions. ALICE measurements of quarkonia at forward rapidity for various energies and colliding systems (pp, pPb, Pb-Pb and Xe-Xe) during the LHC Run 1 and Run 2 periods will be discussed. Recent ALICE results of quarkonium nuclear modification factor, elliptic flow and polarization using the 2018 Pb-Pb data sample will be specially highlighted. A comparison of the results among the LHC experiments and theoretical models will be also presented.

Collaboration name

ALICE

Track

Heavy Flavour

Author: SHAIKH, Wadut (Saha Institute of Nuclear Physics (IN))

Presenter: SHAIKH, Wadut (Saha Institute of Nuclear Physics (IN))

Session Classification: Heavy Flavour

Contribution ID: **94** Type: **Contributed talk**

Direct photon and light neutral meson production in the era of precision physics at the LHC

Tuesday, June 11, 2019 5:30 PM (20 minutes)

The ALICE experiment is dedicated to the study of the quark-gluon plasma (QGP) formed in heavy-ion collisions. To investigate the initial state and space-time evolution of the medium, direct photons are excellent probes because they don't interact strongly. In particular, the low p_{T} thermal photon spectrum and flow measurements carry information about the medium's temperature and development of collective flow. Analogous studies in p-A collisions help to disentangle cold nuclear matter effects from modifications due to the presence of the medium.

The production of light neutral mesons in A-A collisions can on one hand provide important information on the energy loss of partons traversing the quark-gluon plasma. On the other hand, decays of π^0 and η mesons are the dominant background for all direct photon measurements. Therefore, pushing the limits of the precision of neutral meson production is key to learning about the properties of the QGP. In the ALICE experiment, photons can be detected with either of the two electromagnetic calorimeters, EMCal and PHOS, as well as via reconstruction of e^+ e^- pairs from conversions in the detector material using the central tracking system. Neutral mesons are measured via their decay to two photons. Combining the excellent momentum resolution of the conversion photons down to very low transverse momenta and the high reconstruction efficiency and triggering capability of calorimeters at higher p_{T}, we are able to measure neutral mesons and direct photons over a wide transverse momentum range. In addition, the statistics delivered by the LHC in Run 2 gives us the opportunity to enhance the precision of our measurements.

In this talk, the direct photon and neutral meson production in pp, p-Pb and Pb-Pb collisions at LHC energies, as measured with the ALICE experiment, will be discussed.

Collaboration name

ALICE

Track

QCD phase diagram and critical point

Author: DANISCH, Meike Charlotte (Ruprecht Karls Universitaet Heidelberg (DE))

Presenter: DANISCH, Meike Charlotte (Ruprecht Karls Universitaet Heidelberg (DE))

Session Classification: QCD Phase Diagram and Critical Point

Contribution ID: **96** Type: **Contributed talk**

Heavy-flavour jet production and charm fragmentation

Thursday, June 13, 2019 4:50 PM (20 minutes)

Heavy quarks (charm and beauty) are produced in hard parton scatterings in the early stage of hadronic collisions. Therefore, they are ideal probes to investigate the properties of the Quark-Gluon Plasma (QGP) produced in ultra-relativistic heavy-ion collisions. Measurements of heavy-flavour jets give a direct access to the initial parton kinematics and can provide constraints for heavy-quark energy-loss models, in particular adding information on how the radiated energy is dissipated in the medium. Studies of angular correlations between heavy-flavour particles and charged particles allow us to characterize the heavy-quark fragmentation process and its possible modification in a hot nuclear matter environment.

Measurements in pp collisions provide the necessary reference for the interpretation of heavy-ion collision results, allowing us to characterize the heavy-quark production and fragmentation in vacuum. Studies in p-Pb collisions give insight on how the heavy-quark production and hadronisation into jets is affected by the cold nuclear matter effects.

This contribution will focus on the latest studies of heavy-flavour jets and D-meson correlations with charged particles with the ALICE detector in pp collisions at $\sqrt{s}_{\rm NN} = 5.02$, 7, 13 TeV and in p-Pb and Pb-Pb collisions at $\sqrt{s}_{\rm NN} = 5.02$ TeV. In particular, the azimuthal correlations between D mesons and charged particles in pp and p-Pb collisions will be compared with various Monte Carlo event generators.

Production of charged jets tagged with D mesons and heavy-flavour hadron decay electrons will be reported in pp and p-Pb collisions. In addition, recent studies of the jet-momentum fraction carried by the D meson in pp collisions will be presented. Measurements of the nuclear modification factor of heavy-flavour jets in p-Pb and Pb-Pb collisions will be also discussed.

Collaboration name

ALICE

Track

Heavy Flavour

Author: MOHANTY, Auro Prasad (Utrecht University (NL))

Presenter: MOHANTY, Auro Prasad (Utrecht University (NL))

Session Classification: Heavy Flavour

Contribution ID: **98** Type: **Contributed talk**

Study of open heavy-flavour hadron production in pp and p-Pb collisions with ALICE

Tuesday, June 11, 2019 5:30 PM (20 minutes)

Heavy quarks (charm and beauty) are effective probes to test perturbative QCD-based calculations in pp collisions and to study cold nuclear matter (CNM) effects such as gluon saturation, shadowing, kT broadening and energy loss in CNM in p-Pb collisions. In addition, the positive elliptic flow (v_2) of open heavy-flavour particles observed in semi-central Pb-Pb collisions at LHC energies suggested that heavy quarks suffered strong interactions in the deconfined QCD medium in a wide rapidity window and participated in the collective motion of the medium. Recent observations in pp and p-Pb collisions shown remarkable similarities with Pb-Pb collisions, which might suggest the presence of collectivity. To further explore the origin the collective-like effects observed in pp and p-Pb collisions , the study of open heavy-flavour production as a function of the charged-particle multiplicity naturally links soft and hard processes that occur in the collision and allows one to study their interplay.

In this contribution, the production cross sections of D mesons and open heavy-flavour decay electrons measured at mid-rapidity, and open heavy-flavour decay muons measured at forward rapidity in pp collisions at $\sqrt{s} = 5.02$ TeV with ALICE will be presented. The results of production cross section of open heavy-flavour decay electrons in pp collisions at $\sqrt{s} = 13$ TeV measured down to the low-p_{T} region will be also discussed. The self-normalized yield of open heavy-flavour decay electrons and muons as a function of multiplicity in pp and p-Pb collisions will be presented. Finally, the nuclear modification factor (Q_{pPb}) of D mesons and the v_2 of open heavy-flavour decay electrons and muons in p-Pb collisions will be discussed as well.

Collaboration name

ALICE

Track

Collectivity in small systems

Author: DHANKHER, Preeti (IIT- Indian Institute of Technology (IN))

Presenter: DHANKHER, Preeti (IIT- Indian Institute of Technology (IN))

Session Classification: Collectivity in Small Systems

Contribution ID: **99** Type: **Contributed talk**

Measurement of non-strange D-meson production and azimuthal anisotropy in Pb-Pb collisions with ALICE at the LHC

Tuesday, June 11, 2019 4:10 PM (20 minutes)

Heavy quarks are effective probes of the properties of the Quark-Gluon Plasma (QGP) created in ultra-relativistic heavy-ion collisions. Charm and beauty quarks, due to their masses, are produced in hard scattering processes on timescales shorter than the QGP formation time. They experience the entire evolution of the medium, interacting with its constituents via in-medium gluon radiation and collisional processes. In addition, due to their formation time, heavy quarks are also ideal candidates to probe the properties of the strong magnetic field created in heavy-ion collisions by the charged nucleons of the colliding nuclei that do not participate in the collision.

The measurement of the nuclear modification factor (R_{AA}) of D mesons provides important information about the microscopic interactions of heavy quarks with the medium constituents, in particular on the colour-charge and parton-mass dependence of heavy-quark energy loss. Azimuthal anisotropy measurements give insight into the participation of low-momentum heavy quarks in the collective expansion of the system and their possible thermalization in the medium. At high transverse momentum, the path-length dependence of parton energy loss mechanisms can be tested. In addition, the measurement of the D-meson directed flow, which is sensitive to the effects of the magnetic field produced in heavy-ion collisions, gives access to fundamental properties of the QGP, such as conductivity and initial density.

In this contribution the latest D-meson R_{AA}, elliptic and directed flow results in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV with ALICE will be presented. Recent results on the D-meson production and azimuthal anisotropy measured with an Event-Shape Engineering technique will be shown. The comparison of the results with model predictions will be discussed as well.

Collaboration name

ALICE

Track

Heavy Flavour

Author: JAELANI, Syaefudin (Utrecht University (NL))

Presenter: JAELANI, Syaefudin (Utrecht University (NL))

Session Classification: Heavy Flavour

Contribution ID: **100** Type: **Contributed talk**

Latest results on D_s and Λ_c^+ in Pb-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV with ALICE at the LHC

Tuesday, June 11, 2019 3:20 PM (20 minutes)

Charm quarks are a powerful probe of the Quark-Gluon Plasma (QGP) formed in high energy heavy-ion collisions. Produced in hard scattering processes on a timescale shorter than the QGP formation time, they experience the whole system evolution. There have been extensive researches regarding the production of charm mesons, such as D^0, D^+, D^{*+}, in heavy-ion collisions to investigate the interactions of charm quarks with the QGP constituents and the transport properties of the medium.

At low and intermediate p_T, the D_s-meson measurements can reveal information about the heavy-quark hadronization mechanism. If recombination occurs, at low p_T the relative abundance of D_s mesons with respect to non strange D mesons is expected to be larger in Pb-Pb than in pp collisions.

The measurement of charm-baryon production, and in particular the baryon-to-meson ratio, provides unique information on hadronisation mechanisms, constraining the role of coalescence and testing the predicted presence of diquark states in the QGP.

In this contribution,a comprehensive review of ALICE results on D_s production will be presented, with particular emphasis on the latest ALICE results from the large-size 2018 Pb-Pb data taking campaign at $\sqrt{s_{NN}} = 5.02$ TeV, essential to provide more conclusive results on D_s-meson suppression at low-intermediate p_T and to improve the statistical precision of the v_2 measurement obtained with 2015 Pb-Pb data. In addition, the new results on charm-baryon production from the 2018 Pb-Pb sample will be shown. They will allow for a significant reduction of the uncertainties as well as for an extension of the accessible p_T interval with respect to the first measurement of Λ_c^+ in Pb-Pb collisions based on the 2015 data in the centrality range 0-80%. For both D_s and Λ_c^+ results, comparison to theoretical models will be shown.

Collaboration name

ALICE

Track

Hadronisation and coalescence

Author: ZAMPOLLI, Chiara (CERN)

Presenter: ZAMPOLLI, Chiara (CERN)

Session Classification: Hadronization and Coalescence

Contribution ID: **102** Type: **Contributed talk**

Beauty production with ALICE at the LHC

Tuesday, June 11, 2019 3:20 PM (20 minutes)

In hadronic collisions, beauty quarks are produced in hard scattering processes with large momentum transfer. Their production provides a very important test of perturbative QCD calculations in pp collisions. In heavy-ion collisions, the measurement of beauty-hadron production is a unique tool to investigate the properties of the Quark-Gluon Plasma. In particular, beauty quarks, being four times heavier than charm quarks, can be utilized to study the in-medium mass dependent energy loss. In addition, measurements in p-Pb collisions are crucial to investigate the effects of cold nuclear matter on their production.

With the ALICE detector, beauty quarks are studied by measuring electrons and non-prompt D mesons coming from beauty hadron decays at mid-rapidity. Finally, a more direct access to the initial parton kinematics is obtained by measuring beauty-tagged jets. They can provide further constraints for energy loss models adding information on how the radiated energy is dissipated.

In this contribution, the latest measurements of beauty production using beauty-decay electrons, non-prompt D mesons and beauty-tagged jets in pp collisions at $\sqrt{s}$ =5.02 TeV, and their comparison to pQCD calculations will be presented. New measurements of beauty-tagged jet production down to low p_{T} in p-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV will be discussed. The latest results on R_{AA} of beauty-decay electrons in central and semi-central Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV compared to different theoretical models will be presented. In addition, the status of the measurement of v_2 of beauty-decay electrons in semi-central Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV will also be discussed.

Collaboration name

ALICE

Track

Heavy Flavour

Author: GAUGER, Erin Frances (University of Texas at Austin (US))

Presenter: GAUGER, Erin Frances (University of Texas at Austin (US))

Session Classification: Heavy Flavour

Contribution ID: **105** Type: **Contributed talk**

Measurement of higher moments of net particle distributions in Au+Au collisions at $\sqrt{s_{NN}}$ = 54.4 GeV at RHIC

Thursday, June 13, 2019 2:20 PM (20 minutes)

Studying the QCD phase structure of the strongly interacting matter is one of the primary goals of relativistic heavy-ion collision experiments. The higher moments of conserved quantities for strong interaction such as net charge, net baryon and net strangeness are proposed to be sensitive observables for search of the QCD critical point and the phase transition between quark-gluon plasma and hadronic matter. Higher order moments such as variance (σ^2), skewness (S), kurtosis (κ) of event-by-event distributions of net charge, net proton and net kaon were measured by the STAR experiment in the phase I of Beam Energy Scan (BES) program. The moment products ($S\sigma$ and $\kappa\sigma^2$) of net proton distribution measured in the most central (0-5%) collisions show non-monotonic behaviour as a function of beam energy. The ratio of sixth- to the second-order cumulants (C_6/C_2) can also provide insight into the nature of phase transitsion. The C_6/C_2 ratio of net proton distribution in central collisions of gold nuclei at $\sqrt{s_{NN}}$ = 200 GeV shows negative sign.

The STAR experiment recently recorded high statistics data for Au+Au collision at $\sqrt{s_{NN}}$ = 54.4 GeV which allows us to perform precise measurements of higher order cumulants .We will present results of the higher moments (up to the 6^{th} order) measurement and moment products of event-by-event net particle distribution as a function of collision centrality. The results will also be compared with those obtained from the transport (UrQMD) and thermal (HRG) models. In addition, a beam energy dependence of the cumulant ratios will be presented.

Collaboration name

STAR Collaboration

Track

QCD phase diagram and critical point

Author: PANDAV, Ashish

Presenter: PANDAV, Ashish

Session Classification: QCD Phase Diagram and Critical Point

Contribution ID: **106** Type: **Contributed talk**

Hadrochemistry of particle production in small systems with ALICE at the LHC

Tuesday, June 11, 2019 4:10 PM (20 minutes)

Strangeness production has long been considered a golden observable to characterize the chemical composition of the deconfined state of matter produced in heavy ion collisions. One of the key results of the LHC Run 1 was the observation of an enhanced production of strange particles in high multiplicity pp and p-Pb collisions at 7 and 5.02 TeV, respectively. In addition, the multiplicity dependent results on particle production in pp collisions allowed the discovery of collective-like behaviour in small systems at the LHC.

In order to provide further insights into the origin of these new phenomena, new measurements of the multiplicity dependence of the transverse momentum (p_{T}) distributions of inclusive and identified charged particles from Run 2 at the top LHC energy will be presented. The p_{T} spectra are measured at mid-rapidity and over a broad transverse momentum range, providing important input to study particle production mechanisms in the soft and hard regime of QCD and to better understand the hard component of particle spectra. New results on Ξ and Ω production in p-Pb collisions at the unprecedented center-of-mass energy of 8.16 TeV will also be presented. These results allow a connection between the lowest multiplicities probed in elementary pp collisions to the peripheral and mid-central centrality ranges probed in Pb-Pb interactions to be made. They can also help to understand the interplay between canonical suppression and strangeness enhancement.

The energy and system-type invariance of light-flavor hadron production will be discussed and an extensive comparison with statistical hadronization and QCD-inspired models will be presented.

Collaboration name

ALICE Collaboration

Track

Collectivity in small systems

Author: WILLSHER, Emily Jade (University of Birmingham (GB))

Presenter: WILLSHER, Emily Jade (University of Birmingham (GB))

Session Classification: Collectivity in Small Systems

Contribution ID: **107** Type: **Contributed talk**

Quarkonia and its fate in the anisotropic hot QGP medium

Thursday, June 13, 2019 3:00 PM (20 minutes)

Signatures of a strongly coupled system of deconfined quarks and gluons have been observed in high energy heavy-ion collisions at RHIC and LHC facilities. A systematic measurement of quarkonia production has been carried out in these experiments and several theoretical models have been proposed to understand the measurements.

It has been argued that the hot QGP medium produced in the heavy-ion collisions could be anisotropic. Here, we have studied the quarkonia (a colorless and flavorless bound states of heavy quark-antiquark) suppression (ground state and first excited state) considering the hot anisotropic QCD medium. We obtained the real and imaginary parts of the medium modified quarkonia potential and then, in turn, obtained their binding energies (BE) and the dissociation widths. We have found that the binding energy decreases while the dissociation width increases with temperature. Whenever the BE overcomes the thermal width of a given quarkonia state, the quarkonia dissociates in the medium (the corresponding temperature is called the dissociation temperature of that quarkonia state). The hot QCD medium effects have also been considered employing a quasiparticle description using recent lattice equation of state. Finally, the presence of anisotropy has found to modify the dissociation temperature of each considered state significantly. Further, our calculations show a visible shift in the values of dissociation temperatures while considering the interaction effects in the hot QCD medium. Such non-ideal effects are observed to suppress the dissociation temperature as compared to the ideal case. We find out results on Quarkonia dissociation agree with the lattice QCD calculations [1].

1: S. Digal, P. Petreczky and H. Satz, hep-ph/0110406

Collaboration name

Track

Heavy Flavour

Author: JAMAL, Mohammad Yousuf (National Institute of Science Education and Research)

Presenter: JAMAL, Mohammad Yousuf (National Institute of Science Education and Research)

Session Classification: Heavy Flavour

Contribution ID: **108** Type: **Poster**

Heavy-flavour studies with the new ALICE pixel trackers in Runs 3 and 4

Tuesday, June 11, 2019 6:45 PM (2 hours)

The ALICE Collaboration is preparing a major upgrade of the detector apparatus during the second LHC long shutdown (LS2, 2019-20) in view of the LHC Runs 3 and 4 (2021 to 2029).

The objective of the ALICE upgrade for LS2 is two-fold: i) an improvement of the tracking precision and efficiency, in particular in the low-momentum range; ii) an improvement of the readout capabilities of the experiment, to fully exploit the LHC luminosity for heavy ions envisaged after LS2.

The first goal will be achieved by replacing the Inner Tracking System with a new tracker, composed of seven cylindrical layers of monolithic silicon pixel detectors (MAPS) with fast readout, high granularity and low material thickness, and by introducing a new telescope tracker, also composed of MAPS, in front of the muon spectrometer. Consequently, the resolution of the track spatial position will improve by about a factor of three in the direction transverse to the beam line. The second goal will be achieved by replacing the readout chambers of the Time Projection Chamber with Gas Electron Multiplier (GEM) detectors, by upgrading or replacing the readout electronics of several of the other detector systems, by adding a new fast trigger detector and by implementing a new integrated online-offline architecture. The upgraded ALICE detector will be capable of reading out Pb-Pb interactions in minimum-bias trigger mode at a rate of 50 kHz, corresponding to 50 times the current rate.

The prime physics goals of the ALICE upgrade are high-precision measurements of heavy-flavour, charmonium and low-mass dilepton production, with particular emphasis on the low-p_{T} region. For example, in the sector of open heavy flavour, the new silicon trackers, in conjunction with the high-rate capabilities, will allow us to extend the measurements of nuclear modification factor and flow coefficients of charm and beauty mesons down to or close to zero in p_{T}. The reconstruction of heavy-flavour baryon decays will be possible down to about 2 GeV/c. In the quarkonium sector, the production and elliptic flow of J/ψ and ψ(2S) states will be measured with unprecedented precision down to zero p_{T}, with the separation of prompt and B-decay contributions at both central and forward rapidity.

This presentation will summarise the expected performance of the new pixel trackers at central and forward rapidity and discuss its impact on the heavy flavour and quarkonium studies, with emphasis on the new results prepared for the CERN Yellow Report on HL-LHC Physics.

Collaboration name

ALICE

Track

Upgrades and new experiments

Author: URAS, Antonio (Centre National de la Recherche Scientifique (FR))

Presenter: URAS, Antonio (Centre National de la Recherche Scientifique (FR))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **109** Type: **Poster**

Measurement of the Λ_c production in pp, p-Pb, and Pb-Pb collisions with ALICE Run-2 data

Tuesday, June 11, 2019 6:45 PM (2 hours)

The study of production of particles which contain heavy quarks (charm and beauty) provides an exceptional tool to investigate the characteristics of the hot and dense QCD medium, the Quark-Gluon Plasma (QGP), created in ultra-relativistic heavy-ion collisions. In particular, heavy-flavour measurements allow one to study the basic properties of this medium, like its energy density, and to investigate the mechanisms in which quarks interact with the QGP. The measurement of the Λ_c production in Pb-Pb collisions, in addition, provides insights into the mechanisms of charm recombination in the medium and allows us to test the microscopic properties of the QGP.

In this poster, we will present the latest results for the Λ_c production in pp, p-Pb, and Pb-Pb collisions including the charm baryon-to-meson ratio. The impact of the new techniques based on machine learning and deep neural networks used for optimising the Λ_c signal will also be discussed.

Collaboration name

ALICE Collaboration

Track

Heavy Flavour

Author: VERMUNT, Lucas Anne (Utrecht University (NL))

Presenter: VERMUNT, Lucas Anne (Utrecht University (NL))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **112** Type: **Poster**

Hunting hyper-tritons in heavy ion collisions with the ALICE experiment using a machine learning approach.

Tuesday, June 11, 2019 6:45 PM (2 hours)

The extreme energy densities reached in Pb-Pb collisions at the LHC lead to a significant production of baryon states. Among the thousands of particles produced, light (anti-)hypernuclei are of special interest: their wide wave function and extremely low binding energy make them sensitive to the conditions created in high energy collisions. The study of their production can shed light on the formation mechanism of such loosely bound states.
Moreover, in the current understanding of the hypernuclear physics landscape, a new precise measurement of the hypertriton lifetime is of utter importance to solve the hypertriton lifetime puzzle. The puzzle is due to the fact that the available measurements report values of the lifetime different from the free Λ lifetime predicted by theory.

The ALICE collaboration has measured the hyper-triton production yield and lifetime in Pb-Pb collisions in the mesonic 2-body decay channel, and the possibility to perform the measurement in the mesonic 3-body decay channel is under study.

In this poster a new approach to the study of the hyper-triton via both mesonic decay channel, based on the Boosted Decision Tree classifier, is presented.
The use of a classifier trained on dedicated Monte Carlo data can significantly improve the capability to discriminate against signal and background leading to a better signal extraction.
The performance of this new analysis method are presented and compared with those of the standard invariant mass analysis.

Collaboration name

ALICE Collaboration

Track

Strangeness and Light Flavour

Author: FECCHIO, Pietro (Politecnico di Torino (IT))

Presenter: FECCHIO, Pietro (Politecnico di Torino (IT))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **113** Type: **Poster**

Multiplicity-dependent production of heavy-flavour decay electrons in pp and p–Pb collisions with ALICE at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

Heavy-flavour production studies in pp collisions, besides providing the necessary baseline for measurements in Pb—Pb collisions, constitute a precision test of perturbative QCD calculations. In complex systems such as p—Pb collisions, it gives insights into the cold nuclear matter (CNM) effects and also characterizes the nuclear parton distribution functions in the low-x region, where gluon saturation sets in. Furthermore, their production as a function of charged-particle multiplicity in pp and p—Pb collisions provides insights into the role of multiple-parton interactions (MPI) and the interplay between hard and soft mechanism in particle production. In p—Pb collisions, the production is also influenced by the concurrent multiple binary nucleon-nucleon collisions.
In this contribution, we will present the measurement of the yield of electrons from heavy-flavor hadron decays at mid-rapidity ($|\eta| < 0.8$) as a function of the transverse momentum and charged-particle multiplicity estimated at mid-rapidity ($|\eta| < 1$) in pp collisions at $\sqrt{s}$ = 13 TeV and in p—Pb collisions at $\sqrt{s_{\rm NN}}$ = 8.16 TeV.

Collaboration name

ALICE

Track

Heavy Flavour

Author: DHANKHER, Preeti (IIT- Indian Institute of Technology (IN))

Presenter: DHANKHER, Preeti (IIT- Indian Institute of Technology (IN))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **114** Type: **Contributed talk**

Higher moments of net-particle fluctuations in Pb-Pb collisions from ALICE

Tuesday, June 11, 2019 4:50 PM (20 minutes)

The fluctuations of conserved charges –such as electric charge, strangeness, and baryon number –in ultrarelativistic heavy-ion collisions provide insight into the properties of the quark-gluon plasma and the QCD phase diagram. They can be related to the higher moments of the multiplicity distributions of identified particles such as pions, kaons, protons, and lambda baryons. In this talk, we will show the latest results from the ALICE Collaboration on the higher moments of identified particles measured in Pb–Pb collisions, differentially with respect to collision energy, centrality, and the pseudorapidity acceptance of the measurement. These results will be compared to models to gain insight into the origin of dynamical fluctuations in heavy-ion collisions.

Collaboration name

ALICE Collaboration

Track

QCD phase diagram and critical point

Author: ARSLANDOK, Mesut (Ruprecht Karls Universitaet Heidelberg (DE))

Presenter: ARSLANDOK, Mesut (Ruprecht Karls Universitaet Heidelberg (DE))

Session Classification: QCD Phase Diagram and Critical Point

Contribution ID: **115** Type: **Contributed talk**

Strangeness enhancement from dynamical core-corona initialisation model

Tuesday, June 11, 2019 2:20 PM (20 minutes)

We investigate whether the quark gluon plasma (QGP) is created in small colliding systems focusing on hadron production mechanisms.

Recently the ALICE Collaboration reported strangeness enhancement in small colliding systems. The yield ratios of (multi-)strange hadrons to charged pions in various colliding systems show the monotonic increase and scaling with multiplicity [1]. Motivated by these ALICE data, we develop a unified and phenomenological description of the QGP formation based on the "dynamical initialisation model" [2].

In this work, we assume that all matters are generated from four-momentum deposition of initial partons. Here we extend the dynamical initialisation model [2] considering the core-corona picture [3]. We introduce four-momentum deposition rate from an initial traversing parton which depends on its transverse momentum and parton density surrounding it. We suppose the core region turns into QGP fluids due to the existence of high-density partons. While the rest part is supposed to be the corona region which cannot form QGP fluids due to few secondary parton interactions. QGP fluids as the core are particlised at hypersurface of fixed chemical freeze-out temperature, while partons as the corona are hadronized through string fragmentation processes. Thus yields of final hadrons is a sum of both contributions from the core and the corona in this model.

We show the (multi-)strangeness yield ratios monotonically increase with multiplicity and are reasonably consistent with the ALICE data. It follows that a key feature to explain this strangeness enhancement in small colliding systems is the continuous change of description from string fragmentation at small multiplicity to hadronisation from QGP fluids at intermediate to high multiplicities. This result strongly indicates that the QGP is partly formed in
high multiplicity small colliding systems.

[1] J.Adam *et al.*, [ALICE Collaboration], Nature Phys. **13**, 535 (2017).

[2] M.Okai, K.Kawaguchi, Y.Tachibana, T.Hirano, Phys.Rev.C **95**, no. 5, 054914 (2017).

[3] Y.Kanakubo, M.Okai, Y.Tachibana and T.Hirano, Progress of Theoretical and Experimental Physics **2018**, no.12, 121D01 (2018).

Collaboration name

Track

Strangeness and Light Flavour

Author: KANAKUBO, Yuuka (Sophia Univ.)

Co-authors: OKAI, Michito (Sophia University); TACHIBANA, Yasuki (Wayne State University); HIRANO, Tetsufumi (Sophia Univ)

Presenter: KANAKUBO, Yuuka (Sophia Univ.)

Session Classification: Strangeness and Light Flavour

Contribution ID: **117** Type: **Poster**

Non-prompt D^0-meson production in pp collisions at $\sqrt{s}$ = 5.02 TeV with ALICE

Tuesday, June 11, 2019 6:45 PM (2 hours)

The heavy-flavor quarks (charm, beauty) play an important role in probing the Quark-Gluon Plasma (QGP) formed in the heavy-ion collisions. They are produced in hard partonic scattering processes, and have shorter formation time than the QGP. As a result, they experience all the phases of the plasma evolution propagating through the QGP and losing energy interacting with its constituents. Therefore, measuring heavy-flavor hadron production helps us understanding heavy-quark mass-dependent in-medium energy loss and their hadronization mechanism.

In this regard, the study of non-prompt D^0-meson production in Pb-Pb collisions provides an indirect measurement in the beauty sector, while the same study in pp collisions, beside providing the needed reference for Pb-Pb studies, is an excellent tool to investigate perturbative Quantum ChromoDynamics (pQCD) calculations.

This poster shows the production cross section of non-prompt D^0 mesons ($b \longrightarrow c \longrightarrow D^0$) at mid-rapidity, measured in pp collisions at $\sqrt{s}$ = 5.02 TeV collected with the ALICE detector.

Collaboration name

ALICE

Track

Heavy Flavour

Author: CAI, Mengke (Central China Normal University CCNU (CN))

Presenter: CAI, Mengke (Central China Normal University CCNU (CN))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **119** Type: **Poster**

Multiplicity dependence of $f_0(980)$ resonance production in pp collisions at $\sqrt{s}$ = 13 TeV with ALICE at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

Short-lived resonances are powerful probes to understand the hadronic phase in ultra-relativistic heavy-ion collisions, due to their lifetimes of ∼10 fm/c, comparable to the time span between chemical and kinetic freeze-out. The measurements of short-lived resonances in pp collisions provide the baseline for heavy-ion collisions measurement. In this respect, we present the multiplicity dependence of the production of $f_0(980)$ at mid-rapidity ($| y | < 0.5$) in pp collisions at $\sqrt{s}$ = 13 TeV.

The measurement has been performed with ALICE at the LHC and the particles have been reconstructed in the $f_0(980) \rightarrow \pi^+\pi^-$ decay channel. The poster will include the description of the signal extraction of other resonances having comparable mass to $f_0(980)$, the study of the combinatorial background, the transverse momentum spectra and the mean transverse momentum. In addition, the multiplicity dependence of the $f_0(980)$ yields will be studied and compared to the dependence of other hadrons, in order to shed light on the $f_0(980)$ quark content.

Collaboration name

ALICE

Track

Strangeness and Light Flavour

Author: KIM, Junlee (Chonbuk National University (KR))

Presenter: KIM, Junlee (Chonbuk National University (KR))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **120** Type: **Poster**

Charged-particle multiplicity dependence of Xi(1530)0 production in pp collisions at 13 TeV with ALICE at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

Strangeness enhancement has been observed in high-multiplicity proton-proton (pp) collisions at the LHC for several multi-strange hadrons and shown to be in remarkable agreement with the measurements performed in p-Pb collisions. Resonance particles with different lifetimes can provide an interesting insight into the properties of the hadronic phase in high-multiplicity proton-proton (pp) collisions, in particular when compared to p-Pb results. In this poster, the measurement at mid-rapidity of the $\Xi(1530)^0$ production in pp collision at 13 TeV as a function of the charged-particle multiplicity will be presented and discussed.

Collaboration name

ALICE

Track

Strangeness and Light Flavour

Author: LIM, Bong-Hwi (Pusan National University (KR))

Presenter: LIM, Bong-Hwi (Pusan National University (KR))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **121** Type: **Poster**

D-tagged jet production and fragmentation measurements in pp collisions with ALICE.

Tuesday, June 11, 2019 6:45 PM (2 hours)

Heavy quarks are produced in hard scattering processes during the early stages of a heavy-ion collision at ultra-relativistic energies. Their annihilation rate is negligible, and they participate in the whole medium evolution losing their energy via radiative and collisional processes while traversing through the Quark-Gluon Plasma (QGP) formed in such collisions. This allows us to study the dynamical properties of the QGP.

The measurement of heavy-flavour jets gives a more direct access to the initial parton kinematics and can provide further constraints for heavy-quark energy loss models, in particular adding information on how the radiated energy is dissipated. In order to assess the heavy-flavour production modification in heavy-ion collisions, baseline measurements in pp and p-Pb collisions are needed. In addition, measurements in pp collisions are a fundamental tool to validate models based on perturbative QCD (pQCD).

In this poster, measurements of the production of D^0-tagged charged jets in pp collisions will be discussed. In addition, the jet momentum fraction carried by the D-meson in different intervals of jet p_T is reported. Comparison to different predictions from Monte-Carlo generators and pQCD calculations with PYTHIA and POWHEG is shown.

Collaboration name

ALICE

Track

Heavy Flavour

Author: TRZECIAK, Barbara Antonina (Utrecht University)

Co-author: MOHANTY, Auro Prasad (Utrecht University (NL))

Presenters: TRZECIAK, Barbara Antonina (Utrecht University); MOHANTY, Auro Prasad (Utrecht University (NL))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **122** Type: **Poster**

Λ (1520) as a new potential source of K^- meson emission in heavy-ion collisions around kaon threshold.

Tuesday, June 11, 2019 6:45 PM (2 hours)

The modifications of basic properties of hadrons inside a hot and dense nuclear matter are a consequence of the partial restoration of the chiral symmetry and are an intensively studied topic for the last 30 years [1]. Whereas the effects for K^+ and K^0_S appear to be theoretically more straightforward and experimentally established [2,3], it seems not to be the case for K^-. A series of analyses of heavy-ion collisions performed by the HADES and FOPI Collaborations at beam energy of 1–2A GeV have shown that a relevant source of negative kaons is the $\phi \rightarrow K^+K^-$ decay channel [4,5]. However, the kinematics of K^- mesons produced in this channel is different than that of kaons emitted directly from the collision zone.

This talk will be devoted to the recent finding that the Λ (1520) $\rightarrow pK^-$ channel, not analysed yet at energies around the kaon threshold, is another potentially relevant source of K^- meson emission. Two sets of experimentally obtained yields from Au+Au at 1.2A GeV (HADES) and Ni+Ni at 1.9A GeV (FOPI) were fitted with the THERMUS statistical model code [6]. Based on the obtained parameters, the yields of Λ (1520) were estimated in each case, and hence the contributions to the K^- yield. As the HADES Collaboration prepares to perform the Ag+Ag collisions at beam energy of 1.65A GeV, a prospect for an extraction of the Λ (1520) yield from these collisions will also be covered in this talk.

[1] V. Koch, Intl. Jour. of Mod. Phys. E 06, 203 (1997).
[2] M. Benabderrahmane et al. (FOPI Collaboration), Phys. Rev. Lett. 102, 182501 (2009).
[3] C. Hartnack et al., Phys. Rep. 510, 119 (2012).
[4] G. Agakishiev et al. (HADES Collaboration), Phys. Rev. C 80, 025209 (2009).
[5] K. Piasecki et al. (FOPI Collaboration), Phys. Rev. C 94, 014901 (2016).
[6] S. Wheaton and J. Cleymans, Comput. Phys. Commun. 180, 84 (2009).

Collaboration name

Track

Strangeness and Light Flavour

Author: WÓJCIK, Dominika (University of Warsaw)

Presenter: WÓJCIK, Dominika (University of Warsaw)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **124** Type: **Poster**

ϒ production in p+p collisions at STAR

Tuesday, June 11, 2019 6:45 PM (2 hours)

Suppression of the production yield of ϒ states in heavy-ion collisions relative to expectation from p+p collisions is a tool for studying the properties of quark-gluon plasma. Such suppression is expected to be caused by Debye-like screening of color charges happening at a high temperature in the plasma. In order to correctly interpret this effect, the ϒ production mechanism itself has to be well understood. This is still an open question which can be studied in p+p collisions. Recently, an interesting strong dependence of normalized quarkonium production yields on normalized charged particle multiplicity has been observed. By studying such a dependence for ϒ an insight can be gained into the interplay of hard and soft QCD processes affecting the quarkonium production.

This poster will present the results of ϒ production measurements in p+p collisions from the STAR experiment. The ϒ rapidity distributions will be shown both at $\sqrt{s} = 200\mathrm{GeV}$ and $\sqrt{s} = 500\mathrm{GeV}$. The data at $\sqrt{s} = 500$ GeV allowed the separation of $\Upsilon(1S)$ and $\Upsilon(2S + 3S)$ and to obtain the corresponding transverse momentum spectra. The cross section ratios will be presented. Finally the normalized $\Upsilon(1S)$ yield is studied as a function of normalized charged particle multiplicity. All the presented results will be compared to theoretical production models.

Collaboration name

STAR

Track

Heavy Flavour

Author: KOSARZEWSKI, Leszek (Czech Technical University in Prague)

Presenter: KOSARZEWSKI, Leszek (Czech Technical University in Prague)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **126** Type: **Poster**

QCD Thermodynamic Geometry

Tuesday, June 11, 2019 6:45 PM (2 hours)

The QCD phase transition is studied within the thermodynamic geometry. Through the definition of a metric in the thermodynamic space, one builds a scalar thermodynamic geometry curvature, R, in the usual way and investigates the nature of the interactions. R, indeed, reflects some important features of the system: e.g. the so-called interaction hypothesis, $|R| \sim \xi^d$, where ξ is the correlation length and d the effective spatial dimension of the underling thermodynamic system. Moreover, the sign of R seems to provide information on the system interactions (attractive or repulsive, fermionic or bosonic). We have studied R in different model: Nambu-Jona-Lasinio model with two and three flavors, Linear Sigma model, Hadron Resonance Gas model and Lattice-QCD. In all of these models, R shows a characteristic behavior, different for each transition type (if present): I or II order or crossover.

Collaboration name

Track

QCD phase diagram and critical point

Author: LANTERI, Daniele (Catania University)

Presenter: LANTERI, Daniele (Catania University)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **127** Type: **Poster**

Femtoscopic studies on proton-Ξ^- and proton-Ω^- correlations in p-Pb and pp collisions with ALICE

Tuesday, June 11, 2019 6:45 PM (2 hours)

Two-particle correlations can be used to probe the strong interaction between nucleons and multi-strange baryons. We will show measurements of correlation functions of proton-Ξ^- pairs in p-Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV, and proton-Ω^- pairs produced in high-multiplicity pp collisions at $\sqrt{s}$ = 13 TeV. Utilising newly developed femtoscopic techniques, we will demonstrate how these measurements can be compared to Lattice QCD and phenomenological model predictions for the strong potentials between protons and multi-strange baryons. Using the measured proton-proton correlation function to constrain the size and shape of the baryon-emitting source, and the excellent precision of the ALICE data, we will demonstrate that our measurements are highly discriminating with respect to these predictions. The measured proton-Ξ^- correlation function indicates the corresponding strong interaction is attractive, while the proton-Ω^- correlation function will be compared to models predicting a bound nucleon-Ω^- di-baryon state. A precise evaluation of these models of the nucleon-hyperon interaction is crucial for the modelling of the core of neutron stars. We will discuss the consequences of our measurements for the equation of state of neutron-rich matter including hyperons.

Collaboration name

ALICE Collaboration

Track

Strangeness in astrophysics

Author: VAZQUEZ DOCE, Oton (Technische Universitaet Muenchen (DE))

Presenter: VAZQUEZ DOCE, Oton (Technische Universitaet Muenchen (DE))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **128** Type: **Contributed talk**

Lambda-Kaon Femtoscopy in Pb-Pb Collisions at $\sqrt{s_{\mathrm{NN}}}$ = 2.76 TeV with ALICE

Thursday, June 13, 2019 3:00 PM (20 minutes)

We present the first determination of the scattering parameters of ΛK pairs (ΛK^+, ΛK^-, and ΛK^0_{S}) associated with strong final state interactions. The parameters are extracted from measured femtoscopic ΛK correlation functions in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 2.76 TeV, with the widely used Lednicky and Lyuboshitz model. The THERMINATOR 2 event generator is used to characterize the non-femtoscopic backgrounds, which arise from collective effects and feed-down from resonances. A striking difference between the ΛK^+ and ΛK^- correlation functions is observed for pairs with low relative momenta. As a consequence, the ΛK^+ system exhibits a negative real component of the scattering parameter ($\Re f_0$), while that of the ΛK^- system is positive. These observations might arise from different quark-antiquark interactions between the hadron pairs (ss in ΛK^+ and uu in ΛK^-), or from the different net strangeness in each system (S = 0 for ΛK^+, and S = −2 for ΛK^-). To investigate this further, we will present the femtoscopic correlation functions of $\Xi^- K^\pm$ pairs.

Collaboration name

ALICE Collaboration

Track

Strangeness and Light Flavour

Author: BUXTON, Jesse Thomas (Ohio State University (US))

Presenter: BUXTON, Jesse Thomas (Ohio State University (US))

Session Classification: Strangeness and Light Flavour

Contribution ID: **130** Type: **Poster**

Chiral Vortical Effect: the role of acceleration

Tuesday, June 11, 2019 6:45 PM (2 hours)

The mean value of the axial current in a medium of fermions that has both acceleration and vorticity is calculated using two different methods: the covariant Wigner function for fermions and the local thermodynamic equilibrium density operator in the Zubarev approach. The existence of the Chiral Vortical Effect is confirmed, and the higher order corrections in vorticity and acceleration are calculated. The two methods give the same result when describing effects associated with vorticity, but differ when describing the effects of acceleration. It is shown on the basis of the Wigner function that acceleration plays the role of an imaginary chemical potential in the hydrodynamics of fermions. This fact leads to instability at temperatures below the Unruh temperature, which may be an indication of the Unruh effect for fermions. In conclusion, we discuss the possibility of observing quantum effects associated with acceleration and vorticity in experiments on particle accelerators.

Collaboration name

Track

Hydrodynamics, chirality and vorticity

Author: PROKHOROV, George

Co-authors: TERYAEV, Oleg (Joint Institute for Nuclear Research (RU)); ZAKHAROV, Valentin (I)

Presenter: PROKHOROV, George

Session Classification: Poster session with ”aperitivo”

Contribution ID: **131** Type: **Poster**

Dielectron simulations for the CBM-TRD

Tuesday, June 11, 2019 6:45 PM (2 hours)

The Compressed Baryonic Matter (CBM) experiment will access a wide range of physics observables for heavy-ion collisions in the regime of highest net-baryon densities. Two of the core topics of its physics program are on one hand the measurement of dilepton production and on the other hand the study of hypernuclei, which were both not measured before with other experiments in this energy range. For both theses cases a powerful particle identification is needed. Especially for the study of thermal radiation into dielectrons at intermediate masses the electron identification capabilities of the Transition Radiation Detector (TRD) are crucial. For the hypernuclei program, the dE/dx measurement of the TRD allows the separation of states with different charges, which is not possible with a TOF measurement alone and is therefore an essential contribution to the accessibility of this probe. This contribution will present the newest simulations at different collision energies of spectra of dielectrons and the extraction of the fireball parameters from dielectrons at intermediate masses.

Collaboration name

CBM

Track

QCD phase diagram and critical point

Author: BECHTEL, Etienne (Goethe University)

Co-author: BLUME, Christoph (Johann-Wolfgang-Goethe Univ. (DE))

Presenter: BECHTEL, Etienne (Goethe University)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **132** Type: **Poster**

Low-Mass dimuon measurements in pp collisions with ALICE at the LHC

Tuesday, June 11, 2019 6:45 PM (2 hours)

Low-mass dimuon production, including pairs from the light neutral mesons η, ρ, ω and φ, provide key information on the hot and dense state of strongly interacting matter produced in ultra-relativistic heavy-ion collisions. The properties of this medium and its effect on particle production, such as the strangeness enhancement and chiral symmetry restoration, can be studied via the observation of the modified yields of these mesons. The dimuon decay channel of these mesons provides a clean probe without strong final state interactions. The study in pp collisions, in the absence of cold nuclear matter effects, provides a baseline for a better understanding of the different processes contributing to the production of dimuons.

ALICE studies low-mass dimuon production with the Muon Spectrometer at forward rapidity $2.5 < y < 4$. Observations in pp collisions at different center-of-mass energies $\sqrt{s}$ = 2.76, 5.02, 7, 8 and 13 TeV allow the characterization of the φ and ω meson production as a function of transverse momentum (p_{T}) covering a maximal range from $0 < p_{\mathrm{T}} < 10$ GeV/c at $\sqrt{s}$ = 13 TeV. These measurements allow the possibility to test the energy dependence of the different cross sections for $1.5 < p_{\mathrm{T}} < 5$ GeV/c.

The large amount of data collected by ALICE at $\sqrt{s}$ = 5.02 and 13 TeV allows a new study of the double-differential p_{T}-y dependence of the cross section for the ω and the φ mesons.

Collaboration name

ALICE

Track

Strangeness and Light Flavour

Author: CHAUVIN, Alex Henri Jean (Universita e INFN, Cagliari (IT))

Presenter: CHAUVIN, Alex Henri Jean (Universita e INFN, Cagliari (IT))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **133** Type: **Poster**

Measurement of prompt and non-prompt J/ψ production at mid-rapidity in p-Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV with ALICE

Tuesday, June 11, 2019 6:45 PM (2 hours)

J/ψ mesons have long been proposed as ideal probes capable of providing evidences of the formation of Quark–Gluon Plasma (QGP) in ultra-relativistic heavy-ion collisions. Various Cold Nuclear Matter (CNM) effects are however expected to affect J/ψ production in addition to the modifications due to the presence of the QGP, and the study of p–Pb collisions represents a crucial tool to assess the influence of CNM on J/ψ production.
From the analysis of LHC Run 1 data (2009-2013), ALICE produced measurements of J/ψ production in p–Pb collisions at mid-rapidity down to zero transverse momentum ($p_{\rm T}$). The statistical separation of the non-prompt J/ψ component resulting from beauty-hadron decays has also been performed down to $p_{\rm T}$ = 1.3 GeV/c, allowing an evaluation of nuclear effects also on beauty quark production. Data of p–Pb collisions with J/ψ produced at mid-rapidity have been subsequently made available during LHC Run 2 data taking campaign (2015-2018), granting a six-fold increase in luminosity and allowing more precise measurements to be performed.
In this poster, ALICE results for the production of prompt and non-prompt J/ψ in p–Pb collisions at mid-rapidity will be presented. The status of analyses for the measurement of J/ψ production on the Run 2 data sample will also be reported.

Collaboration name

ALICE

Track

Heavy Flavour

Author: TROMBETTA, Giuseppe (Universita e INFN, Bari (IT))

Presenter: TROMBETTA, Giuseppe (Universita e INFN, Bari (IT))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **134** Type: **Contributed talk**

Transport properties of Heavy Quarks and their correlations to the bulk dynamics and the initial Electromagnetic field

Tuesday, June 11, 2019 4:50 PM (20 minutes)

We study the propagation of heavy quarks (HQ), charm and bottom, in the QGP by means of a relativistic Boltzmann transport approach. The non-perturbative interaction between HQs and light quarks is described by means of a quasi-particle approach that permits to have an Equation of State close to lattice QCD and it is able to describe the main feature of the non-perturbative dynamics: the enhancement of the interaction strength near the critical temperature. The resulting charm in-medium evolution correctly describe both the experimental data for the D mesons R_{AA} and the elliptic flow $v_2(p_T)$ from RHIC to LHC energies. The extracted T-dependence of the space-diffusion coefficient D_s is in a agreement with lattice QCD results within the systematic uncertainties. In the same scheme we present novel predictions also for B mesons at LHC energies. It will be discussed the role of initial state fluctuations that allows to extend the analysis to high order D meson anisotropic flows $v_3(p_T)$ and $v_4(p_T)$. This allows to match the recent and upcoming experimental efforts of ALICE and permits to investigate the role of QCD interaction in developing correlations between light and heavy flavor anisotropic flows (v_n^{light},v_n^{heavy}) providing a proof that the heavy flavor anisotropies are induced by the bulk expansion and powerful constraints for the transport coefficients. Finally, as recently recognized, very strong initial electromagnetic (e.m.) fields are created in Heavy-Ion Collision that induce a vorticity in the reaction plane that is odd under charge exchange. We show that the strong initial e.m. field entails a transverse motion of HQ, resulting in a splitting of directed flow v_1 of D and anti-D mesons of few percent much larger compared to the observed light charged particles v_1. Moreover, we discuss for both RHIC and LHC, the role played by the initial large bulk vorticity.

[1] S. Plumari, Eur.Phys.J. C79 (2019) no.1, 2.
[2] S. Plumari et al., Eur. Phys. J. C78 (4) (2018) 348.
[3] F. Scardina et al., Phys.Rev. C96 (2017) no.4, 044905.
[4] S. K. Das et al., Phys.Lett. B768 (2017) 260.
[5] S. K. Das et al., Phys.Lett. B747 (2015) 260.

Collaboration name

Track

Heavy Flavour

Authors: COCI, Gabriele (INFN - National Institute for Nuclear Physics); MINISSALE, Vincenzo (INFN); DAS, Santosh Kumar (School of Physical Science, Indian Institute of Technology Goa, India); GRECO, Vincenzo (University of Catania); PLUMARI, Salvatore (University of Catania (Italy))

Presenter: PLUMARI, Salvatore (University of Catania (Italy))

Session Classification: Heavy Flavour

Contribution ID: **135** Type: **Contributed talk**

Dynamical energy loss: exploring the QGP with high pt theory and data

Tuesday, June 11, 2019 2:00 PM (20 minutes)

We will present our newly developed DREENA framework - a numerical implementation of our dynamical energy loss formalism that allows generating predictions for a wide range of high pt observables, centralities, collision energies, different experiments and collision systems. To demonstrate its utility, we will first show that our postdictions agree well with a wide range of available high pt experimental data. Furthermore, the predictions, which were published well before the data became available, also agree with the data, and moreover explain some of the experimentally observed, but intuitively unexpected suppression patterns. This gives us a confidence that our method realistically describes parton-medium interactions in QGP. Based on this, we also propose new observables [2,3], which allow clearly distinguishing between different energy loss mechanisms, as well extracting some of QGP bulk properties from high pt experimental data. The first steps in our work towards the application of this model as a novel high-precision tomographic tool of QGP medium, will also be discussed.
[1] D. Zigic, I. Salom, M. Djordjevic and M. Djordjevic, Phys. Lett. B (in press, 2019).
[2] M. Djordjevic, D. Zigic, M. Djordjevic and J. Auvinen, arXiv:1805.04030 [nucl-th].
[3] M. Djordjevic, S. Stojku, M. Djordjevic, P. Huovinen, in preparation.

Collaboration name

Track

Heavy Flavour

Author: DJORDJEVIC, Magdalena (Institute of Physics Belgrade)

Presenter: DJORDJEVIC, Magdalena (Institute of Physics Belgrade)

Session Classification: Heavy Flavour

Contribution ID: **136** Type: **Contributed talk**

Chemical equilibration of QGP in hadronic collisions

Tuesday, June 11, 2019 3:20 PM (20 minutes)

We performed state-of-the-art QCD effective kinetic theory simulations of chemically equilibrating QGP in longitudinally expanding systems. We find that chemical equilibration takes place after hydrodynamization, but well before local thermalization. By relating the transport properties of QGP and the system size we estimate that hadronic collisions with final state multiplicities dNch/dη⊠10ˆ2 live long enough to reach approximate chemical equilibrium for all collision systems. Therefore we expect the saturation of strangeness enhancement to occur at the same multiplicity in proton-proton, proton-nucleus and nucleus-nucleus collisions.

References: arXiv:1811.03040, arXiv:1811.03068

Collaboration name

Track

Strangeness and Light Flavour

Author: MAZELIAUSKAS, Aleksas (Universität Heidelberg)

Co-author: KURKELA, Eero Aleksi (CERN)

Presenter: MAZELIAUSKAS, Aleksas (Universität Heidelberg)

Session Classification: Strangeness and Light Flavour

Contribution ID: **137** Type: **Contributed talk**

Heavy quark baryon and meson production in pp and AA at RHIC and LHC within a coalescence plus fragmentation model

Tuesday, June 11, 2019 3:00 PM (20 minutes)

The hadronization process of heavy hadrons with bottom and charm quarks, especially for baryons Λ_c and Λ_b, in a dense QGP medium is largely not understood.
We present predictions obtained with a coalescence plus fragmentation model, for D^0, D_s, Λ_c, B and Λ_b spectra, the related baryon to meson ratios and the D_s/D^0 ratio, both at RHIC and LHC energies in a wide range of transverse momentum region up to 10 GeV.
We discuss the effects of the hadronization process and how it plays a fundamental role to describe simultaneously the experimental data for the nuclear suppression factor R_{AA} and the elliptic flow $v_2(p_T)$ from RHIC to LHC energies.
We point out that also the nuclear modification factor for D meson is strongly modified by Λ_c production, explaining the $R_{AA}(p_T) < 1$ observed by STAR at low momenta and also present first prediction about the R_{AA} for Λ_c at LHC energy that should be greatly enhanced at variance with all the other light hadrons.
We will discuss how our model can naturally predict values of the order of $O(1)$ for Λ_c/D^0 as recently measured at both RHIC and LHC, and we present the novel predictions for Λ_b/B not yet measured, which are much larger than the expectations from fragmentation.
Moreover assuming that at the LHC top energies there can be the formation of QGP, we show that in the same scheme due to considerable volume effect a still large $\Lambda_c/D^0 \approx 0.5$ is predicted as seen by ALICE in pp collisions

[1] S. Plumari, V. Minissale, S.K. Das, G. Coci and V. Greco, Eur.Phys.J. C **78** (2018) no.4, 348
[2] V. Minissale, F. Scardina, and V. Greco, Phys. Rev. C **92**, 054904 (2015)
[3] F. Scardina, S. K. Das, V. Minissale, S. Plumari, V. Greco, Phys.Rev. C **96** (2017) no.4, 044905
[4] STAR Collaboration, Nucl.Phys. A **967** (2017) 620-623
[5] ALICE collaboration, JHEP **1804** (2018) 108

Collaboration name

Track

Hadronisation and coalescence

Authors: MINISSALE, Vincenzo (INFN); Dr PLUMARI, Salvatore (Department of Physics and Astronomy, University of Catania); COCI, Gabriele (INFN - National Institute for Nuclear Physics); GRECO, Vincenzo (University of Catania)

Presenter: MINISSALE, Vincenzo (INFN)

Session Classification: Hadronization and Coalescence

Contribution ID: **138** Type: **Contributed talk**

Fluctuations of net Λ distributions in Au+Au collisions measured as a function of collision energy with the STAR detector at RHIC

Thursday, June 13, 2019 3:20 PM (20 minutes)

The measurement of conserved charge distributions have generated considerable interest in understanding the cumulants of conserved quantum numbers in the crossover region of the QCD phase diagram, in particular near a possible critical end point and near a postulated common chemical freeze-out line. Initially net protons and net kaons have been used as proxies for the net baryon and strangeness numbers. We present the measurement of efficiency and feed-down corrected cumulant ratios (C2/C1, C3/C2) of net Λ as a function of centrality and rapidity for Au+Au collisions in the √sNN = 19.6 - 200 GeV range. Net Λ fluctuations are unique in that they are sensitive to strangeness (S) and baryon number (B) conservation effects as well as providing the main contribution to the baryon-strangeness (BS) correlator. Net Λ fluctuations also contribute to the determination of baryon number and strangeness freeze-out, in particular when combined with net proton and net kaon measurements. A comparison to the hadron resonance gas (HRG) model, which uses the latest hadronic spectrum from the 2016 PDG listings, seems to indicate a flavor dependence in the chemical freeze-out. In this context, we also compare our results to the previous STAR measurements, Poisson and negative binomial expectations, as well as UrQMD model predictions.

Collaboration name

STAR Collaboration

Track

QCD phase diagram and critical point

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

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

Session Classification: QCD Phase Diagram and Critical Point

Contribution ID: **140** Type: **Contributed talk**

Cross-correlators of conserved charges

Thursday, June 13, 2019 2:00 PM (20 minutes)

We present our results on the cross-correlators of baryon number B, electric charge Q and strangeness S, obtained from lattice QCD simulations, and we compare them to the predictions of the Hadron Resonance Gas (HRG) model. We discuss possible comparisons to the available experimental results and we suggest additional measurements to bring the data closer to the theoretical calculations.

Collaboration name

Track

Strangeness and Light Flavour

Authors: RATTI, Claudia (University of Houston); BELLWIED, Rene (University of Houston (US)); BORSANYI, Szabolcs (University of Wuppertal); FODOR, Zoltan; GÜNTHER, Jana (University of Wuppertal); KATZ, Sandor (Eotvos University); Prof. NORONHA-HOSTLER, Jacquelyn (Rutgers University); PASZTOR, Attila (Wuppertal University); PORTILLO, Israel (University of Houston); STAFFORD, Jamie (Univeristy of Houston); PAROTTO, Paolo

Presenter: PAROTTO, Paolo

Session Classification: Strangeness and Light Flavour

Contribution ID: **141** Type: **Contributed talk**

Lambda Polarization in Au+Au collisions at sqrt(s)_NN = 2.4 GeV measured with HADES

Tuesday, June 11, 2019 5:10 PM (20 minutes)

To observe a possible vortical structure of the system created in relativistic heavy-ion collisions, the spin directions of produced particles with respect to the total angular momentum need to be measured. The Λ hyperon is a good candidate to look for a possible spin polarization. Due to the parity violation of the weak interaction, the daughter proton is predominantly emitted in the spin direction of the Λ. On the other hand the direction of the total angular momentum can be estimated from the event plane reconstructed from the spectators of the collision. Having all the informations one can calculate the percentage of vector polarization of the Λ.\\
In april 2012 the HADES experiment collected a high statistics sample of Au+Au collisions at $\sqrt{s}_{NN} = 2.4\,\text{GeV}$. $7 \cdot 10^9$ minimum bias events have been recorded. Using the decay topology and combining measured proton and pion tracks to Λ candidates, this allows to clearly distinguish between signal and background. The use of the multi-variant analysis further improves this identification procedure significantly. Overall, $N_\Lambda \approx 2 \cdot 10^5$ Λs have been reconstructed in the $40\,\%$ most central collisions.\\
In this contribution, preliminary results of the Λ polaritzation in Au+Au collisions at $\sqrt{s}_{NN} = 2.4\,\text{GeV}$ measured with HADES will be shown. They will be put in the context of the STAR measurements which show a non-zero polarization with an increasing trend towards lower beam energies. The lowest measurement at $\sqrt{s}_{NN} = 7.7\,\text{GeV}$ indicates a polarization of a few percent, so a mesurement at even lower beam energies will shed light onto the question whether this increase continues or the polarization vanishes again.

Collaboration name

HADES collaboration

Track

Hydrodynamics, chirality and vorticity

Author: KORNAS, Frederic (TU Darmstadt)

Presenter: KORNAS, Frederic (TU Darmstadt)

Session Classification: Hydrodynamics, Chirality and Vorticity

Contribution ID: **142** Type: **Poster**

From R_{AA} to energy loss temperature proportionality factor

Tuesday, June 11, 2019 6:45 PM (2 hours)

When traversing QCD medium, high $p_\perp$ partons lose energy, which is measured by suppression, and also predicted by various energy loss models. A crucial test of different energy loss mechanisms is their dependence on the medium temperature. Though it is commonly assumed that this dependence is cubic, different effects such as Debye screenings, finite parton masses, infrared cutoffs, etc., modify it differently for different energy losses models. Therefore, providing a theoretical procedure which is able to extract this temperature proportionality factor directly from the suppression data, would enable both differentiating between different energy loss models and gaining better understanding of parton-QGP interactions. In this work [1], we propose a method (based on our recently developed DREENA framework [2]) to infer the energy loss temperature dependence from high $p_\perp$ suppression, and demonstrate that our procedure presents a reliable tool for such a purpose.

[1] S. Stojku, et al., in preparation (2019).

[2] D. Zigic, I. Salom, J. Auvinen, M. Djordjevic and M. Djordjevic, Phys. Lett. B (in press, 2019); arXiv:1805.03494.

Collaboration name

Track

Heavy Flavour

Author: STOJKU, Stefan (Institute of Physics Belgrade)

Co-author: Dr DJORDJEVIC, Magdalena (Institute of Physics Belgrade)

Presenter: STOJKU, Stefan (Institute of Physics Belgrade)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **143** Type: **Contributed talk**

Determination of chemical freeze-out parameters from net-kaon fluctuations at RHIC

Thursday, June 13, 2019 3:00 PM (20 minutes)

We calculate the mean-over-variance ratio of the net-kaon fluctuations in the Hadron Resonance Gas (HRG) Model for the five highest energies of the RHIC Beam Energy Scan (BES) for different particle data lists. We compare these results with the latest experimental data from the STAR collaboration in order to extract sets of chemical freeze-out parameters for each list. We focused on the PDG2014 and PDG2016+ particle lists, which differ largely in the number of resonant states. Our analysis determines the effect of the amount of resonances included in the HRG on the freeze-out conditions. Our findings have a potential impact on various other models in the field of relativistic heavy ion collisions.

Collaboration name

Track

QCD phase diagram and critical point

Authors: RATTI, Claudia (University of Houston); PORTILLO, Israel (University of Houston); NORONHA-HOSTLER, Jacquelyn (Rutgers University); STAFFORD, Jamie (Univeristy of Houston); ALBA, Paolo Giuseppe; PAROTTO, Paolo (University of Houston); BELLWIED, Rene (University of Houston (US)); MANTOVANI SARTI, Valentina (Technical University of Munich (TUM))

Presenter: STAFFORD, Jamie (Univeristy of Houston)

Session Classification: QCD Phase Diagram and Critical Point

Contribution ID: **144** Type: **Poster**

Multipomeron model for strange particle production in heavy-ion collisions

Tuesday, June 11, 2019 6:45 PM (2 hours)

Multipomeron model for strange particle production in heavy-ion collisions
G. A. Feofilov, V. N. Kovalenko, A. M. Puchkov, F. F. Valiev
(Saint-Petersburg State University)

The generalized multi-pomeron exchange model \cite{1} - \cite{5} is proposed for the production in high energy heavy-ion collisions of hadrons containing heavy quarks. The main feature of this approach is the effective consideration of collectivity on the base of quark-gluon string fusion concept that provides the formation of new types of particle emitting sources –strings with higher tension. In this model, an increase in the string tension, in a certain class of events of in pp and $A-A$ collisions characterized by high multiplicity, allows, in the process of string fragmentation, the creation of particles containing strange or charm quarks.
The model parameters are fixed from the previous analysis of data on the multiplicity dependence of the mean transverse momentum in pp collisions over a wide energy range (from ISR to LHC). The yields of strange, multi-strange and charm particles as a function of charged multiplicity are obtained for pp and $Pb-Pb$ collisions at the LHC energy and compared with the experimental data.

\bibitem{1} N. Armesto, D. Derkach, and G. Feofilov // Phys. Atom. Nucl. 2008, V. 71, P. 2087.
\bibitem{2} E. Bodnia, D. Derkach, G. Feofilov, V. Kovalenko, A. Puchkov // PoS (QFTHEP 2013) 060 (2013), arXiv:1310.1627.
\bibitem{3} E. O. Bodnia, V. N. Kovalenko, A. M. Puchkov, G. A. Feofilov // AIP Conf. Proc. 2014,V. 1606, P. 273-282, arXiv:1401.7534.
\bibitem{4}Feofilov G., Kovalenko V., Puchkov A. // arXiv:1710.08895. 2017.
\bibitem{5}Feofilov G., Kovalenko V., Puchkov A. // EPJWeb of Conferences. 2018. Vol. 171, P. 18003, arXiv:1711.00842.

Collaboration name

Track

Strangeness and Light Flavour

Author: FEOFILOV, Grigori (St Petersburg State University (RU))

Co-authors: Dr KOVALENKO, Vladimir (St Petersburg State University (RU)); VALIEV, Farkhat (St Petersburg State University (RU)); PUCHKOV, Andrei (SPbSU)

Presenter: FEOFILOV, Grigori (St Petersburg State University (RU))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **145** Type: **Poster**

Dependence of observables on the hadronic equation of state.

Tuesday, June 11, 2019 6:45 PM (2 hours)

The novel microscopic n-body dynamical transport approach PHQMD (Parton-Hadron-Quantum-Molecular-Dynamics) extends the established PHSD (Parton-Hadron-String-Dynamics) transport approach by introducing n-body quantum molecular dynamic type propagation of hadrons and by allowing to choose the equations of state with different compression modulus.
We present first results of the study on the sensitivity of the strangeness roduction and anisotropic flow harmonics for (pi,K,p) on “hard” and “soft” equation of state within PHQMD model.

Collaboration name

Track

Strangeness and Light Flavour

Author: KIREYEU, Viktar (Joint Institute for Nuclear Research (RU))

Co-authors: AICHELIN, joerg (Subatech/CNRS); BRATKOVSKAYA, Elena (GSI, Darmstadt); Dr LE FEVRE, Arnaud (GSI, Darmstadt); LEIFELS, Yvonne (GSI Darmstadt)

Presenter: KIREYEU, Viktar (Joint Institute for Nuclear Research (RU))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **146** Type: **Poster**

Kaon femtoscopy in STAR

Tuesday, June 11, 2019 6:45 PM (2 hours)

Properties of nuclear matter can be studied by relativistic heavy-ion collisions in high energy experiments like the STAR experiment. One of the methods to learn something about this matter is the femtoscopy, which relies on information carried by the particles produced in the collisions. Using correlation functions, the source parameters, such as space-time characteristics, are provided. The collisions produce mainly pions and therefore pion interferometry is a particularity useful tool. High statistics data sets from RHIC have also made it possible to study the strange particle correlations. The lightest strange particles are charged and neutral kaons. Kaons provide a cleaner probe of the particle-emitting region ascompared to pions because they are less affected by resonance decays and have smaller cross section with hadronic matter. Thanks to these properties, kaon correlation functions can be sensitive to the early stage of the collisions evolution and also provide different information about particle-emitting source.
On this poster, one-dimensional correlation functions of two-kaon system in Au+Au collisions at Beam Energy Scan energies measured by the STAR experiment at RHIC will be presented.

Collaboration name

STAR Collaboration

Track

Strangeness and Light Flavour

Author: PAWŁOWSKA, Diana (Warsaw University of Technology)

Presenter: PAWŁOWSKA, Diana (Warsaw University of Technology)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **148** Type: **Contributed talk**

Particle production as a function of system size and underlying-event activity measured with ALICE at the LHC

Tuesday, June 11, 2019 4:50 PM (20 minutes)

ALICE has performed several measurements aimed at understanding the heavy-ion-like patterns observed in small collision systems. New approaches can be helpful to clarify particle production mechanisms in pp collisions, as well as the similarities observed among the systems created in pp, p-A and A-A collisions.

In this talk we report on charged particle transverse momentum distributions as a function of event multiplicity. The distributions are obtained using a 2D-unfolding procedure. We compare unidentified charged-particle production at different collision energies, as well as that for pp, p-Pb and Pb-Pb collisions at the same energy. In order to understand the role of autocorrelations in small systems, it has been proposed to exploit the usage of the underlying event as a multiplicity estimator to factorize the hardest and the softer components of the events. This approach can also be used to study collective effects in events with exceptionally large activity in the underlying-event region with respect to the event-averaged mean. To this purpose, in this talk we also present the charged particle transverse momentum distributions as a function of underlying-event activity in pp collisions. All results will be compared with QCD-inspired event generators, as well as with existing measurements adopting the mid- and forward-pseudorapidity multiplicity estimators.

Collaboration name

ALICE Collaboration

Track

Collectivity in small systems

Author: ZACCOLO, Valentina (Universita e INFN Trieste (IT))

Presenter: ZACCOLO, Valentina (Universita e INFN Trieste (IT))

Session Classification: Collectivity in Small Systems

Contribution ID: **149** Type: **Contributed talk**

Strangeness production with respect to high momentum hadrons in p-Pb collisions with ALICE at the LHC

Thursday, June 13, 2019 4:50 PM (20 minutes)

In order to understand strangeness and resonance production mechanisms, one can study the correlations of hadrons with hidden (e.g. the ϕ meson) and open strangeness (K^0_S, Λ and $\bar{\Lambda}$) in hard (jet) processes and in soft (bulk) processes. Two-particle jet-like angular correlations with ϕ mesons in p-Pb collisions probe both the jet and the underlying event components of strange particle production. These studies can lead to insights into the observed enhancement in the $\phi(1020)/\pi$ ratio in p-Pb and high multiplicity pp collisions. Furthermore, the jet hadrochemistry is investigated by studying the ratios in the near and away-side jet peaks separately, and the results are compared to previously measured inclusive ϕ/h yield ratios in different collision systems.

In this talk we present new measurements of the ϕ/h ratio in jets as a function of multiplicity using jet-like hadron-$\phi(1020)$ angular correlations in p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV. In order to further investigate strangeness production in jet processes, the hadron yields associated with high-momentum K^0_S mesons and Λ ($\bar{\Lambda}$) baryons are presented. Results will be shown for the near and away-side jet-like yields as a function of the associated particle momentum in pp collisions at $\sqrt{s} = 13$ TeV and as a function of collision multiplicity.

Collaboration name

ALICE Collaboration

Track

Hadronisation and coalescence

Author: BLAIR, Justin Thomas (University of Texas at Austin (US))

Presenter: BLAIR, Justin Thomas (University of Texas at Austin (US))

Session Classification: Strangeness and Light Flavour

Contribution ID: **151** Type: **Contributed talk**

Equation of state of QCD matter within the Hagedorn bag-like model

Thursday, June 13, 2019 2:40 PM (20 minutes)

The QCD equation of state at zero and finite baryon densities is considered in the framework of a Hagedorn bag-like model with a crossover transition from hadronic matter to quark-gluon plasma. The model, augmented with non-zero masses of quarks and gluons in the bag spectrum, provides a fair quantitative description of lattice data on thermodynamic functions, the (higher-order) fluctuations and correlations of conserved charges, as well as the Fourier coefficients of net-baryon density at imaginary chemical potential. Signatures of a possible first-order phase transition at finite baryon densities are discussed within this framework as well.

Collaboration name

Track

QCD phase diagram and critical point

Author: VOVCHENKO, Volodymyr (Goethe University Frankfurt)

Co-authors: GREINER, Carsten (University of Frankfurt); STOECKER, Horst (GSi); GORENSTEIN, Mark (Bogolyubov Institute for Theoretical Physics)

Presenter: VOVCHENKO, Volodymyr (Goethe University Frankfurt)

Session Classification: QCD Phase Diagram and Critical Point

Contribution ID: **152** Type: **Poster**

Transport coefficients of the hot and dense matter

Tuesday, June 11, 2019 6:45 PM (2 hours)

Transport properties of the quark-gluon plasma in a hot and dense QCD medium have been studied. We have calculated transport coefficients for massive interacting quasi-particles with non-zero widths described by the Dynamical Quasi-Particle Model(DQPM). The DQPM enable to calculate the quark and gluon collisional interaction rates using the cross-sections. The shear and bulk viscosities have been calculated using the collisional interaction rates as an inverse relaxation time on the base of the relaxation time approximation(RTA) for a range T and μ_B. The obtained viscosities are in good agreement with the lattice results at $\mu_B = 0$. The shear viscosity has been also calculated using the DQPM spectral widths and masses according to the Green-Kubo method. In case of the shear viscosity the lattice results within the error bars lie in the corridor between this two values.

Collaboration name

Track

Others

Author: SOLOVEVA, Olga (Goethe University Frankfurt)

Co-authors: MOREAU, Pierre (Goethe University Frankfurt); OLIVA, Lucia (GSI, Darmstadt); SONG, Taesoo; BRATKOVSKAYA, Elena (GSI, Darmstadt); CASSING, Wolfgang (University of Giessen)

Presenter: SOLOVEVA, Olga (Goethe University Frankfurt)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **155** Type: **Poster**

Vorticity structure and helicity separation in heavy-ion collision.

Tuesday, June 11, 2019 6:45 PM (2 hours)

Simulations of peripheral Au+Au collisions at NICA energies are performed in the PHSD transport model. The properties of velocity and vorticity fields, hydrodynamic helicity are studied at different impact parameters. The general structure of velocity field follows the ”little bang”pattern which may be quantified by the velocity dependence allowing to extract the ”little Hubble” constant. Quadrupole structures of the vorticity field in all planes are obtained. A thin layer of large vorticity is found at the boundary of the fireball, the so-called vortex sheet. The effect of helicity separation is detected. The thermal vorticity is calculated and its structure is compared with the classical one. Calculation of hyperon polarization in thermodynamic and anomalous models is performed.

Collaboration name

Track

Hydrodynamics, chirality and vorticity

Authors: ZINCHENKO, Aleksei (JINR); TERYAEV, Oleg (Joint Institute for Nuclear Research (RU)); SORIN, Alexander (Joint Institute for Nuclear Research (RU)); BAZNAT, Mircea (JINR)

Presenter: ZINCHENKO, Aleksei (JINR)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **156** Type: **Poster**

Two-particle correlations with high-p_{T} Λ baryons and K^0_S mesons in pp collisions at ALICE

Tuesday, June 11, 2019 6:45 PM (2 hours)

Due to the high particle multiplicities produced in Pb-Pb collisions, low-energy jets are difficult to be reconstructed using standard jet algorithms. Two-particles correlations in $\Delta\eta$ and $\Delta\varphi$ can instead be used to study jets, their properties and their particle composition. In this work, two-particle correlations between a high-momentum K^0_S meson, Λ baryon, or $\bar{\Lambda}$ baryon and charged hadrons are used to study strange particle production in jets. Recent ALICE results on the production of strange particles in small systems (pp and p-Pb collisions) reveal the possibility that similar strange quark production mechanisms could be present in all collision systems. The per-trigger yields of the associated hadrons were studied on both the near-side and away-side of the V^0-h correlation functions as a function of the transverse momenta of the trigger and associated particles as well as the event multiplicity in pp collisions at $\sqrt{s} = 13$ TeV collected with the ALICE experiment at the LHC.

Collaboration name

ALICE Collaboration

Track

Strangeness and Light Flavour

Author: HUSOVA, Lucia Anna (University of Münster (DE))

Presenter: HUSOVA, Lucia Anna (University of Münster (DE))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **157** Type: **Contributed talk**

Measurements of open charm hadrons in Au+Au collisions at $\sqrt{(}s_N N)$ = 200 GeV by the STAR experiment

Tuesday, June 11, 2019 5:10 PM (20 minutes)

At RHIC energies, charm quarks are primarily produced at early stages of ultra-relativistic heavy-ion collisions, in hard partonic scatterings. This makes them an ideal probe of the Quark-Gluon Plasma (QGP) since they experience the whole evolution of the hot and dense medium. STAR is able to measure the production of charm quarks and their interaction with the QGP through direct reconstruction of hadronic decays of $D^{\pm}$, D_0, D_s, and $\Lambda_c^{\pm}$ hadrons. This is possible thanks to an excellent vertex resolution provided by the Heavy Flavor Tracker (HFT). In this talk, we will present the most recent results on open charm hadron production from the STAR experiment. In particular, we will discuss the nuclear modification factors of $D^{\pm}$ and D_0 mesons which give access to the charm quark energy loss in the QGP, and also D_0 elliptic and triangular flow coefficients which can probe the charm quark transport in the QGP. We show D_s/ D_0 and $\Lambda_c^{\pm}$/D_0 yield ratios as functions of transverse momentum and collision centrality which help us better understand the charm quark hadronization process in heavy-ion collisions. In addition, we present the rapidity-odd directed flow of D_0 mesons, which can be used to probe the initial tilt of the QGP bulk and effects of early-time magnetic field.

Collaboration name

STAR

Track

Heavy Flavour

Author: VANĚK, Jan (Nuclear Physics Institute, Czech Academy of Sciences)

Presenter: VANĚK, Jan (Nuclear Physics Institute, Czech Academy of Sciences)

Session Classification: Heavy Flavour

Contribution ID: **158** Type: **Contributed talk**

Polarization of quarks and hadrons in heavy-ion collisions

Tuesday, June 11, 2019 4:30 PM (20 minutes)

The role of kinetic and hydrodynamic degrees of freedom in generation of vorticity and hydrodynamic helicity is considered. The structure of emerging vortex sheets and quadrupole vorticity patterns is studied in detail. The emergence of compressibility in the framework of kinetic description is explored. The transition of vorticity and hydrodynamic helicity to polarization of quarks and hadrons is considered and compared. The robust and specific features of different mechanisms of polarization transition are discussed and the experimental tests of their discrimination are suggested. THe specific role of experiments at NICA complex at JINR is outlined.

Collaboration name

Track

Hydrodynamics, chirality and vorticity

Authors: TERYAEV, Oleg (JINR); SORIN, Alexander (Joint Institute for Nuclear Research (RU)); BAZNAT, Mircea (JINR); ZINCHENKO, Aleksei (JINR)

Presenter: TERYAEV, Oleg (JINR)

Session Classification: Hydrodynamics, Chirality and Vorticity

Contribution ID: **159** Type: **Poster**

Enhanced yield of strange and heavy-flavour particles from few-nucleon clusters in high energy pA collisions

Tuesday, June 11, 2019 6:45 PM (2 hours)

The possible correlation between the yield of strange and heavy-flavour particles and the emission of particles in the region outside pN-kinematics (the so-called cumulative region) in pA collisions is studied. The particle production in the cumulative area is considered as a trigger, confirming participation in the process of a dense few-nucleon cluster. From the modern point of view this cold dense nuclear matter clusters (fluctons), intrinsically presented in nuclei, could be regarded as multi-quark bags. For the description of particle production from such objects, the scheme based on the evaluation of the diagram near thresholds is applied.
In present work, using the string fusion model, we analyze the fragmentation of the nuclear cluster residue after the emission of a particle in cumulative region. Previous studies show that the diagrams are dominant, in which all rest quarks of the cluster (the donors, compensating the momentum of the fast cumulative quark) must interact with the projectile. At the same time these donor quarks belong to a shrunk configuration in transverse plane of the reaction. As a consequence the strings formed in the interactions of all remnant quarks of the cluster with the projectile occur strongly overlapped in the impact parameter plane, what leads to the enhanced yield of strange and charm particles due to sting fusion processes. Along with the standard Schwinger-based version of a string fragmentation we consider also the modified version characterized by the thermal-like spectra. In this model the additional increase of the strange and heavy-flavour particle production is observed.
Basing on this picture we calculate the strength of the correlation between the yield of particles in the backward cumulative hemisphere and the magnitude of additional forward strange and charm particles production in relativistic pA collisions. The possibility of experimental observation of the given phenomenon is also discussed.
The work was supported by the RFBR grant 18-02-40075.

Collaboration name

Track

Collectivity in small systems

Author: VECHERNIN, Vladimir (St Petersburg State University (RU))

Presenter: VECHERNIN, Vladimir (St Petersburg State University (RU))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **160** Type: **Poster**

Detection of residual nucleus for Short Range Correlations studies at BM@N

Tuesday, June 11, 2019 6:45 PM (2 hours)

The BM@N (Baryonic Matter at Nuclotron) is the first working fixed-targeted experiment at the Nuclotron-based Ion Collider fAcility (NICA). The properties of hadrons and formation of (multi-)strange hyperons will be studied at BM@N. Also, the experiment involves the searching of hypernuclei.
In 2018 a new topic was added to the BM@N physics program - the studies of Short Range Correlations (SRC) in nuclei. Short Range Correlation occurs when two nucleons inside a nucleus happen to be at a close proximity. Approximately 20% of nucleons in a given nucleus belong to strongly interacting, short-lived correlated pairs.
SRC pairs are not only an important part of the nuclear wave function but also the densest objects which are available on Earth. SRC properties are relevant for understanding of neutron stars and dense baryonic matter in general. The nucleons in SRC pairs have a high absolute and a low center of mass momentum (relative to the Fermi momentum). Traditionally, properties of SRC pairs are studied using hard knock out reactions in which the beam probe interacts with a single nucleon.
At BM@N, the reaction kinematics, a carbon beam hits a liquid hydrogen target, is used. Therefore, the nucleus after interaction continues moving along the beam direction and can be detected. The residual nucleus at the beam momentum as high as 4 GeV/c/N has never been investigated before.
At the conference we would like to present a brief overview of the experimental setup and first results of the charged particle track reconstruction in detector systems, which were located upstream of the magnet. This detector systems were used to monitor the beam and to determine the trajectory of residual nucleus.

Collaboration name

BM@N

Track

Collectivity in small systems

Author: LENIVENKO, Vasilisa (Joint Institute for Nuclear Research (RU))

Presenter: LENIVENKO, Vasilisa (Joint Institute for Nuclear Research (RU))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **161** Type: **Contributed talk**

Charmed hadron production by recombination in heavy ion collisions

Tuesday, June 11, 2019 2:40 PM (20 minutes)

Starting from the investigation on recent experiments about charmed hadrons, e.g., nuclear modification factor ratios between charmoinum states and measurements of doubly charmed hadrons, we discuss the production of those charmed hadrons by recombination in heavy ion collisions. We adopt the coalescence model, and evaluate transverse momentum distributions of not only charmonium states but also charmed hadrons such as Ξcc baryons and X(3872) mesons produced from quark-gluon plasma. We discuss the important characteristics of charmed hadron production in heavy ion collisions by showing the transverse momentum distribution ratio between various charmed hadrons. We also discuss elliptic flows of charmonium states, and argue the possible relation between elliptic flows and wave function distributions in momentum space.

Collaboration name

Track

Heavy Flavour

Author: CHO, Sungtae (Kangwon National University)

Presenter: CHO, Sungtae (Kangwon National University)

Session Classification: Hadronization and Coalescence

Contribution ID: **162** Type: **Contributed talk**

CMS upgrade plan for high-luminosity era and outlook on heavy-quark production in nuclear collisions

Thursday, June 13, 2019 5:10 PM (20 minutes)

The CMS Collaboration has a major detector upgrade plan during the long shutdown 3 (LS3) starting in 2019 to prepare the high-luminosity runs. It includes the new tracking system, the muon system, the electromagnetic and hadronic calorimeters, and the trigger system. This upgrade will significantly enhance the physics performance of the CMS detector for not only proton-proton collisions, but also heavy-ion collisions in high-luminosity environment. In this presentation we, firstly, give an overview of the CMS upgrade plan during LS3. Then, we present the impact of the detector upgrade to the various observables for heavy-ion physics, particularly for heavy-quark production, to better understand the interaction of quarks and gluons in hot, dense medium.

Collaboration name

CMS

Track

Upgrades and new experiments

Author: HONG, Byungsik (Korea University (KR))

Presenter: HONG, Byungsik (Korea University (KR))

Session Classification: Heavy Flavour

Contribution ID: **163** Type: **Contributed talk**

Λ_C production in pp and PbPb collisions at 5.02 TeV with the CMS detector

Tuesday, June 11, 2019 2:20 PM (20 minutes)

Due to their large masses, the interactions of heavy quarks with the quark-gluon plasma (QGP) may be different from those of light quarks. The lightest charm baryon is the Λ_c^+, composed of a charm quark and two light quarks. Measurements of Λ_c^+ production in both pp and PbPb collisions can provide important inputs to the understanding of heavy quark transport in the QGP and the creation of heavy quark mesons and baryons via coalescence. Models involving quark coalescence predict a large enhancement of Λ_c^+ production in PbPb collisions compared to pp collisions. The high luminosity datasets collected at a nucleon-nucleon center-of-mass energy of 5.02 TeV using the CMS detector have been used to measure Λ_c^+ production in both pp and PbPb collisions via the $\Lambda_c^+ \to p^+K^-\pi^+$ decay channel. Results for differential cross sections for Λ_c^+ and ratios of Λ_c^+ over D^0 yields in pp and PbPb collisions, as well as the nuclear modification factors for Λ_c^+, are presented.

Collaboration name

CMS

Track

Hadronisation and coalescence

Author: XIAO, Rui (Purdue University (US))

Presenter: XIAO, Rui (Purdue University (US))

Session Classification: Hadronization and Coalescence

Contribution ID: **164** Type: **Contributed talk**

Strange and non-strange charm production in pp and PbPb collisions at 5.02 TeV with the CMS detector

Tuesday, June 11, 2019 4:30 PM (20 minutes)

The heavy-flavour particles are produced in the earlier stage in heavy-ion collision and experience the full evolution of the QGP medium. The measurement of D mesons could provide us important inputs for flavour and charge dependent transport properties. On the other hand, with abundant strange quarks presented in heavy-ion collision, the D_S^+ production is expected to be enhanced hadronization via recombination. Large statistics proton-proton and PbPb samples collected at 5.02 TeV with CMS detector are used for the measurement of D^0 and D_S^+ production over a wide transverse momentum range. Result of D-meson p_T-differential cross section, nuclear modification factor R_{AA}, and the ratio of D_S^+ over D^0 for both pp and PbPb collisions are presented.

Collaboration name

CMS

Track

Heavy Flavour

Author: PENG, Cheng-Chieh (Purdue University (US))

Presenters: PENG, Cheng-Chieh (Purdue University (US)); PENG, Cheng-Chieh (Purdue University (US))

Session Classification: Heavy Flavour

Contribution ID: **165** Type: **Contributed talk**

Measurements of strange and non-strange beauty production in PbPb collisions at 5.02 TeV with the CMS detector

Tuesday, June 11, 2019 5:30 PM (20 minutes)

Beauty quarks are considered to be one of the golden probes of the strong interacting medium created in heavy-ion collisions as they are mainly produced via initial hard scatterings and strongly interact with the medium. They are sensitive to the transport properties of the medium and may interact with the QCD matter differently from light quarks. High-precision measurement of B mesons will shed light on our knowledge of flavour-dependence of in-medium energy loss. In addition, the measurements of the production of strange and non-strange beauty mesons provides fundamental insights into relevance of mechanisms of beauty recombination in the quark-gluon plasma. Using the large statistics PbPb data collected in 2018, measurements of B_S^0 and B^+ have been performed with the CMS detector. In this talk, we will present the ratio of production yield between B_S^0 and B^+ in PbPb collisions with full hadronic reconstruction. The result will be compared with the same observable measured in pp collisions and we will also discuss the comparison with several theoretical predictions. We will also present the latest measurements of production of fully reconstructed B^+ and non-prompt D^0 and J/ψ from b decay in PbPb collisions at 5.02 TeV.

Collaboration name

CMS

Track

Heavy Flavour

Author: SHI, Zhaozhong (Massachusetts Inst. of Technology (US))

Presenter: WANG, Fuqiang (Purdue University (US))

Session Classification: Heavy Flavour

Contribution ID: **168** Type: **Contributed talk**

Bottomonium production in pp, pPb and PbPb collisions at 5.02 TeV with the CMS detector

Tuesday, June 11, 2019 5:10 PM (20 minutes)

Measurements of bottomonium production are reported for the $\Upsilon(1S)$, $\Upsilon(2S)$, and $\Upsilon(3S)$ mesons in pp, pPb and PbPb collisions at 5.02 TeV. The analysis was performed as a function of rapidity and transverse momentum. In addition, the dependence on the event activity and collision centrality is studied in pPb and PbPb collisions, respectively. New results of the upsilon production in pPb collisions will be presented, compared with the results from PbPb collisions. In this presentation, the results are discussed in terms of the 'cold nuclear matter'effects in pPb collisions and sequential melting scenario in dense partonic matter, as well as the effect from recombination of uncorrelated quarks. The results are also compared with theory models, which can help to improve and constrain the theoretical calculations.

Collaboration name

CMS

Track

Heavy Flavour

Author: FASANELLA, Daniele (CERN)

Presenter: FASANELLA, Daniele (CERN)

Session Classification: Collectivity in Small Systems

Contribution ID: **170** Type: **Contributed talk**

Study of Jet Fragmentation in J/psi and D mesons with CMS

Thursday, June 13, 2019 4:30 PM (20 minutes)

A study of the production of J/psi mesons in conjunction with jets in pp collisions at sqrt(s) = 8 TeV is presented. The analysis is based on data corresponding to an integrated luminosity of 19.1 fb−1 collected with the CMS detector at the LHC. For events with at least one reconstructed jet in the gluon-dominated central region |etajet| < 1, the angular separation between the J/psi meson and the jet is used to test whether the J/psi meson is a jet fragment. The analysis shows that most J/psi mesons with energy above 15 GeV and rapidity |y| < 1.0 are jet fragments. The differential distributions of jet fragmentation probability as a function of jet energy for a fixed J/psi energy fraction z are compared to a theoretical model based on the fragmenting jet function (FJF) approach. These data distinguish clearly between different nonrelativistic quantum chromodynamics (NRQCD) long distance matrix element (LDME) parameter sets and also between different NRQCD terms. The data show that for the z range from 0.40 to 0.65, the NRQCD 1S(8) term dominates jet fragmentation to J/psi mesons 0 for one LDME parameter set. This indicates that the polarization of high energy J/psi mesons in the central region should be small. The other possible parameter sets do not describe the data over the full z range. This analysis shows that data on jet fragmentation to J/psi mesons and FJF analysis is a new way to test predictions for charmonium production from NRQCD and to evaluate LDME parameter sets.
The measurement of D-meson production in jets can provide important insights into the interactions of heavy-flavour quarks with the quark-gluon plasma created in heavy ion collisions. In particular, the role of gluon splitting processes in the production of heavy flavour, which is fundamental for a complete understanding of the quenching mechanisms for both light and heavy quarks, can be explored. Large datasets for proton-proton and PbPb collisions at a nucleon-nucleon center-of-mass energy of 5.02 TeV were collected with the CMS detector during the 2015 LHC run. These data enable measurements of D-meson production as a function of the radial distance between the jet axis and the D meson in different intervals of D-meson transverse momentum. The ratio of the results for PbPb and pp collisions will be compared to similar measurements of jet radial profiles using light particles from the CMS experiment at the same center-of-mass energy.

Collaboration name

CMS

Track

Heavy Flavour

Presenter: WANG, Xiao (University of Illinois at Chicago (US))

Session Classification: Heavy Flavour

Contribution ID: **172** Type: **Contributed talk**

Higher order net-proton number cumulants dependence on the centrality definition and other spurious effects

Tuesday, June 11, 2019 5:10 PM (20 minutes)

We study the dependence of the normalized moments of the net-proton multiplicity distributions on the definition of centrality in relativistic nuclear collisions at a beam energy 7.7 GeV. Using the UrQMD model as event generator we find that the centrality definition has a large effect on the extracted cumulant ratios. Furthermore we find that the finite efficiency for the determination of the centrality introduces an additional systematic uncertainty. Finally, we quantitatively investigate the effects of event-pile up and other possible spurious effects which may change the measured proton number. We find that pile-up alone is not sufficient to describe the data and show that a random double counting of events, adding significantly to the measured proton number, effects mainly the higher order cumulants in most central collisions.

Collaboration name

Track

QCD phase diagram and critical point

Author: SOMBUN, Sukanya (School of Physics and Center of Excellence in High Energy Physics & Astrophysics, Suranaree University of Technology)

Co-authors: Dr HEROLD, Christoph (School of Physics and Center of Excellence in High Energy Physics & Astrophysics, Suranaree University of Technology); Dr LIMPHIRAT, Ayut (School of Physics and Center of Excellence in High Energy Physics & Astrophysics, Suranaree University of Technology); Prof. YAN, Yu-peng (School of Physics and Center of Excellence in High Energy Physics & Astrophysics, Suranaree University of Technology); Prof. BLEICHER, Marcus (Frankfurt Institute for Advanced Studies)

Presenter: SOMBUN, Sukanya (School of Physics and Center of Excellence in High Energy Physics & Astrophysics, Suranaree University of Technology)

Session Classification: QCD Phase Diagram and Critical Point

Contribution ID: **173** Type: **Poster**

Observing a first-order chiral phase transition from a nonequilibrium entropy increase

Tuesday, June 11, 2019 6:45 PM (2 hours)

We propose to use the entropy-per-baryon number ratio as a clear signal for a first-order phase transition in heavy-ion collisions. Our study uses the chiral fluid dynamics model, coupling the nonequilibrium dynamics of the chiral order parameter to an expanding quark fluid. As the system is driven out of equilibrium, dissipation and noise lead to a significant increase in entropy during the phase transition, in particular for events at low beam energies crossing the phase boundary. For upcoming experiments at FAIR and NICA which are able to create a medium with large baryochemical potential, this could provide a prospect to search for a characteristic behavior in the pion-to-proton ratio as a function of beam energy. Here, our results would qualitatively predict a kink at the energy above which the chirally restored phase is created, such signalling the onset of the QCD phase transition.

Collaboration name

Track

QCD phase diagram and critical point

Author: KITTIRATPATTANA, Apiwit (Suranaree University of Technology)

Co-author: HEROLD, Christoph (Suranaree University of Technology)

Presenter: KITTIRATPATTANA, Apiwit (Suranaree University of Technology)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **174** Type: **Contributed talk**

Status and performance of the detector upgrades for STAR in the BES-II and beyond

Thursday, June 13, 2019 2:20 PM (20 minutes)

The phase I RHIC beam energy scan program (BES-I) has provided promising hints in the search for a first-order transition in the QCD phase diagram and the turn-off of QGP signatures at collision energies below 20 GeV.
Several observables warrant closer investigation during the beam energy scan phase II program (BES-II) that covers the center-of-mass energy range 7.7 GeV to 19.6 GeV in collider mode and 3 GeV to 7.7 GeV in the fixed-target mode. High statistics at low collision energies will be made possible through the newly developed low-energy electron cooling at RHIC. The three dedicated BES-II STAR detector upgrades will strengthen the physics potential even further. The Event Plane Detector (EPD)
improves the event plane resolution and centrality definition. The new inner Time Projection Chambers (iTPC) increase the rapidity coverage and low pT acceptance, while the endcap Time Of Flight (eTOF) detector complements the particle identification capabilities at forward-to-midrapidities.

For the time after BES-II the STAR collaboration plans to install a suite of new detectors in the forward rapidity region (2.5 < eta < 4) consisting of a Forward Tracking System (FTS) and a Forward Calorimeter System (FCS). This will enable novel measurements in pp, pA and AA motivated by cold QCD physics in the regions of partonic momentum fraction inaccessible so far by other machines, and the exploration of the longitudinal structure of the initial state in heavy-ion collisions.

First results from commissioning the new detectors and their performance during the first year of running in BES-II will be presented together with the general progress of BES-II. Additionally the details of the proposed forward upgrade and its scientific opportunities will be discussed.

Collaboration name

STAR

Track

Upgrades and new experiments

Author: SECK, Florian (TU Darmstadt)

Presenter: SECK, Florian (TU Darmstadt)

Session Classification: Upgrades and New Experiments

Contribution ID: **175** Type: **Poster**

Reconstruction of Bottom Jets in Proton-Proton Collisions at $\sqrt{s} = 13$ TeV with ALICE

Tuesday, June 11, 2019 6:45 PM (2 hours)

When partons traverse the Quark-Gluon Plasma (QGP), they lose energy via collisional and radiative processes. This manifests in a suppression of the measured jet yield and a modification of the jet fragmentation pattern in heavy-ion collisions relative to proton-proton collisions, for which no QGP is expected to form. The amount of energy that is lost is expected to depend on the respective parton flavour and mass. Thus, a detailed understanding not only of the light-flavour but also of the charm and bottom-jet production is needed for the characterisation of the QGP via parton energy loss.
The long lifetime of B hadrons ($c\tau \sim 500\,\mu$m) is reflected in a displacement of their decay tracks with respect to the primary vertex. Signed impact parameter distributions, as a measure for this distance, therefore offer a great opportunity for the construction of a bottom-jet tagger. First steps of a respective analysis on signed impact parameter distributions for tracks from light-flavour, charm and bottom jets in proton-proton collisions at $\sqrt{s}$ = 13 TeV are presented and discussed.

Collaboration name

ALICE Collaboration

Track

Heavy Flavour

Author: GARNER, Katharina (Westfaelische Wilhelms-Universitaet Muenster (DE))

Presenter: GARNER, Katharina (Westfaelische Wilhelms-Universitaet Muenster (DE))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **178** Type: **Poster**

Past, present and future of open charm measurements at the CERN SPS energies

Tuesday, June 11, 2019 6:45 PM (2 hours)

The study of open charm meson production provides an important tool for detailed investigations of the properties of hot and dense matter formed in nucleus-nucleus collisions. In particular, charm meson data is of vivid interest in the context of the phase-transition between confined hadronic matter and the quark-gluon plasma as well as it is needed for interpretation of data on J/ψ production.

The first estimate of the upper limit of mean multiplicity of D and $\bar{D}$ mesons by a direct measurement was done by the NA49 experiment in Pb+Pb collisions at the top SPS energies. The NA38/NA50 and NA60 experiments measured precisely charmonia production at the top SPS energies, i.e. 158A GeV/c corresponding to $\sqrt{s_{NN}}$ = 17.3 GeV for Pb+Pb, via measurements of dimuon production. Moreover, an indirect estimate of open charm was provided.

The first direct observation of D^0 signal via it's $D^0 \to \pi^+ + K^-$ decay channel was done recently by the NA61/SHINE experiment in Pb+Pb collisions at 150A GeV/c in 2016 with new Vertex Detector setup. The NA61/SHINE physics data taking on open charm production in Xe+La and Pb+Pb collisions at 150A GeV/c was conducted in 2017 and 2018.

NA61/SHINE plans a systematic measurements of open charm production in Pb+Pb collisions in the period 2021-2024 after the major detector upgrade conducted during the Long Shutdown 2. The results will be significantly extended by measurements by future experiments at the new facilities –CBM at FAIR, Germany, MPD at NICA, Russia and J-PARC-HI, Japan.

Collaboration name

Track

Heavy Flavour

Author: MERZLAYA, Anastasia (St Petersburg State University (RU), Jagiellonian University (PL))

Presenter: MERZLAYA, Anastasia (St Petersburg State University (RU), Jagiellonian University (PL))

Session Classification: Poster session with "aperitivo"

Contribution ID: **179** Type: **Contributed talk**

Upgrade of the NA61/SHINE detector

Thursday, June 13, 2019 2:00 PM (20 minutes)

The NA61/SHINE detector is facing major upgrade process during Long Shutdown 2 period (2019-2021). Which is required to fulfill all assumptions of the open charm measurement program. The main purpose of the upgrade is to increase the readout rate by factor 10 and increase acceptance in the high density tracks environment.
The following elements of the detector are parts of the upgrade: Time Projection Chambers (TPC), Vertex Detector (VD), Beam Position Detectors (BPD) and Particle Spectator Detector (PSD) On top of detectors, new Trigger and Data Acquisition (TDAQ) system has to be developed. This means completely new design of trigger system and readout scheme. Finally data analysis software also needs to be redesigned.
In the proposed talk the progress on design and development of new detectors and TDAQ system for NA61/SHINE experiment will be presented.

Collaboration name

NA61/SHINE

Track

Upgrades and new experiments

Author: TEFELSKI, Dariusz (Warsaw University of Technology (PL))

Presenter: TEFELSKI, Dariusz (Warsaw University of Technology (PL))

Session Classification: Upgrades and New Experiments

Contribution ID: **180** Type: **Contributed talk**

Sensitivity of heavy flavours to system size, structure and initial conditions.

Tuesday, June 11, 2019 2:40 PM (20 minutes)

Heavy flavour probes provide important information about the in-medium properties of the quark gluon plasma produced in heavy-ion collisions. In this work, we investigate the effects of (2+1)d event-by-event fluctuating hydrodynamic backgrounds on the nuclear suppression factor and momentum anisotropies of heavy flavour mesons and non-photonic electrons [1,2]. Using the state-of-the-art D and B mesons modular code (the so-called "DAB-mod"), updated recently with heavy-light quark coalescence, we perform a systematic comparison of different transport equations, including a few energy loss models and a relativistic Langevin model with different drag parametrizations [3]. To explore the effects of system size and structure on hard probes [4], we compare the D0 meson R_{AA} and two-particle cumulants $v_2\{2\}$ and $v_3\{2\}$ for various colliding nuclei and energies: Au-Au^{197} collisions at 200 GeV, Pb-Pb^{208} collisions at 5.02 TeV, prolate and spherical Xe-Xe^{129} collisions at 5.44 TeV [5], Ar-Ar^{40} collisions at 5.85 TeV and O-O^{16} collisions at 6.5 TeV and compare them to the latest experimental data. To investigate the sensitivity of hard probes to initial fluctuations, we compare MCKLN and Trento (tuned to IP-Glasma) initial conditions in Pb-Pb collisions at 5.02 TeV. We show the small dependence of the R_{AA} , $v_2\{2\}$ and $v_3\{2\}$ observables over these initial fluctuations within our model, but also their strong impact on the trend of the multiparticle cumulant $v_2\{4\}/v_2\{2\}$ ratio as a function of centrality and its value in most central collisions. This ratio, known to be a probe of the initial conditions and flow fluctuations in the soft sector [6], is shown to be also driven in the hard sector by the system size and geometry [3]. We finally study the correlations and decorrelations of the heavy meson and all charged particle flows for different harmonics and compare our predictions with ALICE measurements of D meson v_2 vs bulk q_2 in Pb-Pb collisions at 5.02 TeV [7].

[1] C. Prado, J. Noronha-Hostler, R. Katz, A. Suaide, J. Noronha and M. Munhoz, Nucl. Phys. A 967 (2017) 664-667 [arXiv:1704.04654].
[2] C. Prado, J. Noronha-Hostler, R. Katz, A. Suaide, J. Noronha and M. Munhoz, Phys. Rev. C96 (2017) no.6, 064903 [arXiv:1611.02965].
[3] R. Katz, C. Prado, J. Noronha-Hostler, A. Suaide, J. Noronha and M. Munhoz, Hard Probes 2018 proceeding, Heavy-flavor dynamics in event-by-event viscous hydrodynamic backgrounds [arXiv:1812.08009].
[4] Z. Citron et al., ''Future physics opportunities for high-density QCD at the LHC with heavy-ion and proton beams," [arXiv:1812.06772]
[5] See J. Noronha-Hostler's talk at Santa Fe Jets and Heavy Flavor workshop 2019, https://indico.bnl.gov/event/5039/contributions/26266/
[6] P. Alba, V. Mantovani Sarti, J. Noronha, J. Noronha-Hostler, P. Parotto, I. Portillo Vazquez, and C. Ratti, Phys. Rev. C 98, 034909 (2018) [arXiv:1711.05207v2].
[7] See ALICE collaboration CERN-EP-2018-260 paper and R. Katz's flash talk at Hard Probes for our preliminary predictions (https://indico.cern.ch/event/634426/contributions/3003663/)

Collaboration name

Track

Heavy Flavour

Author: ROLAND, Katz (Subatech - Nantes)

Co-authors: NORONHA-HOSTLER, Jacquelyn (Rutgers University); Dr PRADO, Caio (Central China Normal University (CN)); ALARCON DO PASSO SUAIDE, Alexandre (Universidade de Sao Paulo (BR)); NORONHA, Jorge (University of Sao Paulo); GAMEIRO MUNHOZ, Marcelo (Universidade de Sao Paulo (BR))

Presenter: ROLAND, Katz (Subatech - Nantes)

Session Classification: Heavy Flavour

Contribution ID: **182** Type: **Contributed talk**

Strangeness production at the CERN SPS energies

Tuesday, June 11, 2019 2:00 PM (20 minutes)

Strangeness production in nucleus-nucleus collisions has been a subject of studies over 40 years. It has played a key role in a search for the quark-gluon plasma and the onset of deconfinement in the collisions. Here of particular importance are results of the NA49 and NA61/SHINE experiments at CERN SPS and the STAR BES experiment at RHIC. They have conducted measurements of hadron production properties in nucleus-nucleus, proton-proton and proton-nucleus interactions as a function of collision energy and size of the colliding nuclei. In this talk, results on strangeness production from these experiments will be reviewed and compared. The collision energy dependence will be extended by presenting results from SIS/AGS and LHC. in from NA61/SHINE and p+p, Be+Be and Ar+Sc collisions in the SPS energy range are reviewed. An overview of statistical and dynamical models of strangeness production in the vicinity of phase transition will be presented as well. Predictions of the models will be compared with the experimental results and, most importantly, with new results on collisions of intermediate mass nuclei.

Collaboration name

NA61

Track

Strangeness and Light Flavour

Author: PODLASKI, Piotr (University of Warsaw (PL))

Presenter: PODLASKI, Piotr (University of Warsaw (PL))

Session Classification: Strangeness and Light Flavour

Contribution ID: **183** Type: **Contributed talk**

Geometry and dynamics of particle production seen by femtoscopic probes in the STAR experiment

Thursday, June 13, 2019 3:20 PM (20 minutes)

The main goal of studying heavy-ion collisions is to understand the properties of the matter under extreme conditions. The spatial and temporal characteristics of particle emission can be extracted using femtoscpy technique. From non-identical particle correlations one can obtain information about asymmetry in emission process between those two kind of particles. Such asymmetry can provide insight into which type of particles on average are emitted earlier and/or from which region of the source. Using different combinations of pion, kaon and proton pairs one can obtain complete knowledge of the geometric and dynamic (times of emission) properties of the source. This knowledge could provide information about differences between emission of light mesons (pions), strange mesons (kaons) and baryons (protons). Femtoscopy analysis can also provide information about meson-meson, meson-baryon and baryon-baryon interactions.

In this talk, the centrality, energy and transverse mass dependence of the three-dimensional femtoscopic observables for charged kaons in Au+Au collisions at energies $\sqrt{s_{NN}}$ = 7.7 - 200 GeV will be presented. Also results on femtoscopic observables of various particle combinations of pions, kaons and protons from Au+Au collisions at Beam Energy Scan energies ($\sqrt{s_{NN}}$ = 7.7, 11.5 and 39 GeV) will be reported. Finally, the results of proton-Omega femtoscopic measurements in Au+Au collisions at $\sqrt{s_{NN}}$ =˜200 GeV will be shown and compared to (2+1)-flavor lattice QCD simulations.

Collaboration name

STAR Collaboration

Track

Strangeness and Light Flavour

Author: SZYMAŃSKI, Paweł (Warsaw University of Technology)

Presenter: SZYMAŃSKI, Paweł (Warsaw University of Technology)

Session Classification: Strangeness and Light Flavour

Contribution ID: **184** Type: **Poster**

Collision energy dependence of the kinetic freeze-out parameters

Tuesday, June 11, 2019 6:45 PM (2 hours)

We report on results of fitting pt spectra of identified particles with the blast-wave model with included resonances and chemical potentials according to the model of partial chemical equilibrium. Bayesian technique with Gaussian emulator is used in the fitting procedure. Spectra from the RHIC BES programme and LHC are included in the analysis. For central collisions, the freeze-out temperature decreases with increasing collision energy, while for centralities above 30% a maximum around the energy per nucleon pair of 39 GeV appears. Transverse flow always grows monotonically with the energy. Owing to the non-equillibrium chemical potentials a larger portion of particles is produced directly and not from resonance decays, comparing with the composition at the chemical freeze-out.

Collaboration name

Track

Strangeness and Light Flavour

Author: TOMASIK, Boris (Univerzita Mateja Bela (SK))

Co-author: MELO, Ivan (University of Zilina (SK))

Presenter: TOMASIK, Boris (Univerzita Mateja Bela (SK))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **185** Type: **Contributed talk**

The spatial sub-separation of strangeness from anti strangeness in heavy-ion collisions at energies of FAIR and NICA

Thursday, June 13, 2019 4:10 PM (20 minutes)

The heavy-ion collisions at energies of FAIR and NICA are studied within the microscopic transport models. The whole interaction area is subdivided into the smaller cells. We perform the analysis of the space-time evolution of all particles in all cells, in the T-mu_B and T-mu_S planes, and the analysis in x-t of the finally emitted strange and non-strange particles.
Following the time evolution of both distributions, we clearly see the spacial separation of strangeness from anti-strangeness, as well as earlier freeze-out times of kaons and pions compared to those of protons and Lambdas. The latter appear to be frozen out at lower temperature and larger strangeness chemical potential.

Collaboration name

Track

Strangeness and Light Flavour

Authors: BRAVINA, Larisa (University of Oslo); Ms PANOVA, Oleksandra (Taras Shevchenko University of Kyiv); Prof. STOECKER, Horst (FIAS, Frankfurt a.M.); Dr ZABRODIN, Evgeny (SINP MSU and UiO)

Presenter: BRAVINA, Larisa (University of Oslo)

Session Classification: Strangeness and Light Flavour

Contribution ID: **186** Type: **Contributed talk**

Directed flow, vorticity and Lambda-Polarisation in heavy-ion collisions at FAIR and NICA energies

Tuesday, June 11, 2019 4:50 PM (20 minutes)

The directed flow, vorticity and polarisation of Lambda were calculated within the UrQMD model for intermediate-centrality A+A collisions at FAIR and NICA energies. Also, we investigated vorticity and helicity development of protons and pions in these reactions. The slope of the directed flow dv_1/dy at midrapidity in calculations with and without mean-field potentials is obtained as a function of the beam energy for p, p^-, Λ, Λ^-, K^+, K^-, π^+, π^-. Results of the calculations are compared to the STAR experimental data.

Collaboration name

Track

Hydrodynamics, chirality and vorticity

Authors: ZABRODIN, Evgeny (University of Oslo (NO)); BRAVINA, Larisa (University of Oslo (NO)); VITIUK, Oleksandr (Taras Shevchenko National University of Kyiv); SORIN, Alexander (Joint Institute for Nuclear Research (RU)); TERYAEV, Oleg (JINR)

Presenter: VITIUK, Oleksandr (Taras Shevchenko National University of Kyiv)

Session Classification: Hydrodynamics, Chirality and Vorticity

Contribution ID: **187** Type: **Poster**

Freeze-out of strange particles in heavy-ion collisions at NICA and FAIR energies

Tuesday, June 11, 2019 6:45 PM (2 hours)

The conditions of production and freeze-out of strange particles in central heavy-ion collisions at energies of NICA and FAIR are studied within two microscopic transport models. The system of final particles can be sub-divided into a core, containing the still interacting particles, and a halo with particles already decoupled from the system. In microscopic calculations hadrons are continuously emitted from the whole reaction volume. Different hadron species decouple at different times. Strange mesons (kaons and φ) are frozen at earlier times and, therefore, can probe earlier stages of the reaction.

Collaboration name

Track

Strangeness and Light Flavour

Author: ZABRODIN, Evgeny (University of Oslo (NO))

Co-authors: Mr SACHENKO, Dmitry (Taras Shevchenko University of Kyiv); BRAVINA, Larisa (University of Oslo (NO))

Presenter: ZABRODIN, Evgeny (University of Oslo (NO))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **188** Type: **Contributed talk**

Heavy flavour momentum correlations and suppression at RHIC and LHC via AdS/CFT

Thursday, June 13, 2019 4:10 PM (20 minutes)

We derive a diffusion coefficient for heavy quarks in a strongly-coupled plasma using the AdS/CFT correspondence. Crucially, unlike some prior calculations, our novel diffusion coefficient does not increase with heavy quark velocity: instead, we find that the effect of momentum fluctuations smoothly interpolates between light and heavy flavours. Taking our diffusion coefficient derivation as fundamental, we use the fluctuation-dissipation theorem to predict a strong-coupling heavy quark drag that differs slightly from the original calculations of Gubser and Herzog et al.
We then show numerical work that supports the key assumptions made in our analytic derivation. Incorporating our heavy flavour drag and diffusion into an energy loss model, we compare with pQCD predictions of Nahrgang et al. at the partonic level, and with suppression data from LHC for heavy flavour observables.
The partonic momentum correlations exhibit an order of magnitude difference in low momentum correlations to the pQCD calculations. We thus propose heavy flavour momentum correlations as a distinguishing observable of weakly- and strongly-coupled energy loss mechanisms.
For the LHC predictions, our numerical framework interfaces with FONLL for LO production, and Herwig++ and Pythia8 for NLO production. Our LHC suppression predictions are in good agreement with data from both ALICE and CMS, when accounting for the physics missing in each particular framework combination.

Collaboration name

Track

Heavy Flavour

Authors: HAMBROCK, Robert (University of Cape Town); HOROWITZ, William Alexander (University of Cape Town (ZA))

Presenter: HAMBROCK, Robert (University of Cape Town)

Session Classification: Heavy Flavour

Contribution ID: **189** Type: **Poster**

DREENA framework: predictions and comparison with experimental data

Tuesday, June 11, 2019 6:45 PM (2 hours)

We will present our newly developed DREENA framework [1], which allows predicting energy loss of high $p_\perp$ partons traversing quark gluon plasma (QGP). DREENA framework is based on state-of-the-art dynamical energy loss formalism, which takes into account finite size medium composed of dynamical (that is moving) constituents. In DREENA-B, this formalism is applied to 1+1D Bjorken medium expansion. Joint R_{AA} and v_2 predictions are generated for both light and heavy probes, and for all centrality regions in both $Pb + Pb$ and $Xe + Xe$, collisions at the LHC. DREENA-B framework leads to a good agreement with both R_{AA} and v_2 experimental data, which is a major step towards introducing complex medium evolution into DREENA framework. Examining influence of different initial conditions (stages) of QGP evolution on joint R_{AA} and v_2 predictions with DREENA framework, will also be discussed.

Collaboration name

Track

Heavy Flavour

Author: ZIGIC, Dusan (Institute of Physics Belgrade)

Co-authors: Dr SALOM, Igor (Institute of Physics Belgrade); AUVINEN, Jussi (Institute of Physics Belgrade); DJORDJEVIC, Magdalena (Institute of Physics Belgrade); DJORDJEVIC, Marko

Presenter: ZIGIC, Dusan (Institute of Physics Belgrade)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **190** Type: **Contributed talk**

Jet-fluid interaction in EPOS3-HQ framework

Thursday, June 13, 2019 4:50 PM (20 minutes)

A consistent modelling of back reaction of the hydrodynamic medium on the jet evolution is important for understanding the substructure of jets produced in heavy ion collisions. The majority of existing models implement only one-way jet-hydro interaction by coupling jets to a fixed hydrodynamic expansion and not including the energy deposition in the medium itself.

In this talk, we show the results for PbPb collisions at 2.76 TeV LHC energy from a parton shower integrated with hydrodynamic evolution within the EPOS3-HQ model. The initial hard (jet) partons are produced along with soft partons in the initial state EPOS approach. The soft partons, represented by strings, melt into a thermalized medium which is described with a 3 dimensional event-by-event viscous hydrodynamic approach. The jet partons then propagate in the hydrodynamically expanding medium. The total jet energy gets progressively "degraded"as the partons reaching a certain lower cut off are "melted"into the hydrodynamic medium via the source terms. The full evolution proceeds in a concurrent mode, without separate hydrodynamic and jet parts.

We demonstrate both the medium modification effects on the jet evolution and the perturbations in the hydrodynamic expansion from the energy lost by the jets. The perturbations translate into irregularities in the transverse momentum spectra of hadrons produced out of the fluid. We show how this affects the jet shape observable. Last but not least, we show how the hadronization and jet reconstruction procedures modify the manifested jet shape.

Collaboration name

Track

Hydrodynamics, chirality and vorticity

Authors: KARPENKO, Iurii (SUBATECH Nantes); Prof. AICHELIN, Joerg (Subatech/CNRS); Prof. GOSSIAUX, Pol (Subatech); ROHRMOSER, Martin (Jan Kochanowski University Kielce); Prof. WERNER, Klaus (SUBATECH)

Presenter: KARPENKO, Iurii (SUBATECH Nantes)

Session Classification: Hydrodynamics, Chirality and Vorticity

Contribution ID: **191** Type: **Poster**

Dualities of the QCD phase diagram with chiral imbalance

Tuesday, June 11, 2019 6:45 PM (2 hours)

In the talk the phase structure of the dense baryonic/quark matter has been investigated in the presence of baryon, isospin, chiral and chiral isospin chemical potentials in the framework of Nambu–Jona-Lasinio model. It has been shown that in the large-Nc limit there exist several dualities of the phase portrait. One of the key conclusions of our studies is the fact that chiral imbalance generates charged pion condensation in dense baryonic/quark matter even in the case of charge neutral matter, which is interesting in the context of the astrophysics of neutron stars. It was also shown that our results in particular cases are consistent with the simulation of lattice QCD. Our studies show that different types of chiral imbalances can occur in the cores of neutron stars or in heavy ion collision experiments where large baryon densities can be reached, due to the so-called chiral separation and chiral vortical effects.

Collaboration name

Track

QCD phase diagram and critical point

Author: ZHOKHOV, Roman (IHEP)

Presenter: ZHOKHOV, Roman (IHEP)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **192** Type: **Poster**

Neutron stars from a unified equation of state

Tuesday, June 11, 2019 6:45 PM (2 hours)

Heavy ions collisions, astronomical observations of neutron stars and their collisions, ab-initio lattice QCD calculations cover only small fractions of QCD phase diagram, leaving the phase structure of QCD still unclear. We propose a unified flavour SU(3) phenomenological model for the QCD thermodynamics with all known hadrons and u,d, and s quarks as degrees of freedom. The model incorporates most known aspects of the QCD phenomenology: nuclear matter properties, agreement with lattice QCD data, deconfinement transition, parity doubling among baryons, chiral symmetry restoration, and excluded volume corrections. This set of interactions among hadrons and quarks provides a reliable approach to QCD thermodynamics among a wide range of temperatures and densities. Parameters of the model are set to reproduce nuclear matter properties, lattice QCD data on interaction measure, and properties of hadrons. The model then can be used to predict properties of neutron stars and neutron stars mergers.

In the contribution the properties of neutron stars obtained from the model will be presented. The model is able to produce observed heavy neutron stars with masses $\approx 2M_{\odot}$. The stars have small radii and are mainly populated by a quark-hadron mixture. The resulting mass-radius diagram will be discussed and compared with available results from GW170817 neutron star merger. The role of hyperons and strange quarks will be discussed. We also present tidal deformabilities and compare them with results form gravitational wave signal analysis.

[1] J. Steinheimer, S. Schramm and H. Stoecker, J.Phys. G38, 035001 (2011) doi:10.1088/0954-3899/38/3/035001 [arXiv:1009.5239 [hep-ph]].
[2] J. Steinheimer, S. Schramm and H. Stoecker, Phys. Rev. C 84, 045208 (2011) doi:10.1103/PhysRevC.84.045208 [arXiv:1108.2596 [hep-ph]].
[3] A. Mukherjee, J. Steinheimer and S. Schramm, Phys. Rev. C 96, no. 2, 025205 (2017) doi:10.1103/PhysRevC.96.025205 [arXiv:1611.10144 [nucl-th]].
[4] A. Motornenko, V. Vovchenko, J. Steinheimer, S. Schramm, H. Stoecker, Nucl. Phys. A 982, 891 (2019) doi:10.1016/j.nuclphysa.2018.11.028 [arXiv:1809.02000 [hep-ph]]
[5] M. Hanauske, J. Steinheimer, A. Motornenko, V. Vovchenko, L. Bovard, E. Most, J. Papenfort, S. Schramm, H. Stoecker, Particles 2, no. 1, 44 (2019). doi:10.3390/particles2010004

Collaboration name

Track

Strangeness in astrophysics

Author: MOTORNENKO, Anton (Frankfurt Institute for Advanced Studies)

Co-authors: SCHRAMM, Stefan; Dr STEINHEIMER, Jan (Frankfurt Institute for Advanced Studies); VOVCHENKO, Volodymyr (Goethe University Frankfurt); Prof. STOECKER, Horst (FIAS, Frankfurt a.M.)

Presenter: MOTORNENKO, Anton (Frankfurt Institute for Advanced Studies)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **193** Type: **Contributed talk**

Constraint of Compact Star Observales for Walecka-type Nuclear Matter Equation of State

Tuesday, June 11, 2019 3:00 PM (20 minutes)

Compact star observables are robust and not in one-to-one functional relationship with the microscopical parameters of the applied equation of state. This, the Masquarade problem, which means many types of equation of state parametrization and various parameter settings lead to the same macroscopic observation parameters.

So far we investigated a one-fermion-one-boson model with a simplistic Yukawa-type interaction, where we presented the uncertainty of the compact star observables taking into account the quantum fluctuation in the FRG framework.

In this talk we present a similar study based on a realistic, Walecka type model, with several physical parameters. We present the scaling and the uncertainty of the mass and radius of the compact stars, which exhibit linear connection between them. Comparison with astrophysical observation data will be also presented.

Collaboration name

Track

Strangeness in astrophysics

Authors: BARNAFOLDI, Gergely Gabor (Wigner RCP Hungarian Academy of Sciences (HU)); PÓSFAY, Péter (Wigner Research Centre for Physics); JAKOVAC, Antal (Eotvos University Budapest)

Presenter: BARNAFOLDI, Gergely Gabor (Wigner RCP Hungarian Academy of Sciences (HU))

Session Classification: Strangeness in Astrophysics

Contribution ID: **194** Type: **Contributed talk**

Studying the effect of the hadronic phase in nuclear collisions with PYTHIA and UrQMD

Thursday, June 13, 2019 4:30 PM (20 minutes)

The extreme conditions reached in ultra-relativistic heavy-ion collisions at the LHC are expected to produce a state of matter in which quarks and gluons are deconfined, the quark-gluon plasma (QGP). As a consequence, several features, such as elliptic flow and chemically equilibrated particle production, are expected and observed in these collision systems. However, it has to be noted that, once hadronization takes place, inelastic and elastic interactions may still take place. A proper distentanglement of the effects of this final hadronic phase and any features emerging from previous stages of the system evolution is fundamental to the understanding of heavy-ion collisions.

In this work, we couple Pb-Pb events generated with PYTHIA Angantyr at $\sqrt{s_{\mathrm{NN}}} = 2.76$ and 5.02 TeV with the hadronic cascade simulator UrQMD to study the effect of the hadronic phase on observables such as charged-particle multiplicity densities, transverse momentum spectra and identified particle ratios, giving special emphasis to short-lived resonances. As a perturbative QCD-inspired event generator, PYTHIA does not consider any QGP phase in its system evolution, and therefore these results are not only relevant to understand the effect of the hadronic phase but also provide a crucial baseline for hybrid models that include a QGP phase.

Collaboration name

Track

Hadron Resonances

Authors: VIEIRA, Andre (unicamp); BIERLICH, Christian (Lund University (SE)); DOBRIGKEIT CHINELLATO, David (University of Campinas UNICAMP (BR)); TAKAHASHI, Jun (University of Campinas UNICAMP (BR))

Presenter: BIERLICH, Christian (Lund University (SE))

Session Classification: Hadron Resonances

Contribution ID: **195** Type: **Poster**

Mass Scaling in the Non-extensive Hadronization Model

Tuesday, June 11, 2019 6:45 PM (2 hours)

Hadronization in the non-extensive statistical approach can be described well, by the Tsallis-Pareto based fragmentation Functions [1]. We investigate the mass scaling of the fragmentation parameters in case of massive identified hadron production, like in Ref [2,3]. We present the comparison of global cross section and channel contributions as well.

[1] Á. Takács & G.G. Barnaföldi: arXiv:1811.01974 (In press MDPI Universe)
[2] G. Biró et al: Entropy 19 (2017) 88
[3] G. Biró et al: EPJ Web Conf. 171 14008 (2018)

Collaboration name

Track

Hadronisation and coalescence

Author: BARNAFOLDI, Gergely Gabor (Wigner RCP Hungarian Academy of Sciences (HU))

Co-authors: TAKÁCS, Ádám (Wigner Research Centre for Physics); BIRO, Gabor (Hungarian Academy of Sciences (HU))

Presenter: BARNAFOLDI, Gergely Gabor (Wigner RCP Hungarian Academy of Sciences (HU))

Session Classification: Poster session with ”aperitivo”

Contribution ID: **199** Type: **Contributed talk**

Critical dynamics of net-baryon density fluctuations

Thursday, June 13, 2019 2:00 PM (20 minutes)

The search for the QCD critical point is one of the major goals in current and future heavy-ion collision experiments. The matter created in such collisions is spatially finite, evolves highly dynamically, and near the critical point homogeneous temperature distributions may be expected at most in regions of a couple of fm. Moreover, to observe fluctuations for a globally conserved order parameter such as the net-baryon density the volume of observation must be small compared to the size of the full system. Therefore, deviations from our analytic, thermodynamic predictions for an infinite and long-lived system must be expected. In this talk, we study the diffusive dynamics of the net-baryon density near the QCD critical point for a finite size and dynamically evolving medium. Numerical simulations indicate that the Gaussian and non-Gaussian fluctuations, which evolve as fluid dynamical response to intrinsic white noise fluctuations due to non-linear couplings, show a different scaling behavior with the correlation length than is expected in a static and infinite medium. We argue that this observation may be understood as finite size corrections in the ratio of correlation length over typical observation length scale. Interesting structures and even sign changes around the critical point compared to leading-order expectations are possible in both skewness and kurtosis, as is qualitatively confirmed in the numerics. This highlights that finite size and dynamical effects are essential ingredients for our interpretation of experimental data from CERN-SPS and the beam energy scan at RHIC.

Collaboration name

Track

QCD phase diagram and critical point

Authors: NAHRGANG, Marlene (Subatech); BLUHM, Marcus (Subatech, Nantes)

Presenter: BLUHM, Marcus (Subatech, Nantes)

Session Classification: QCD Phase Diagram and Critical Point

Contribution ID: **200** Type: **Poster**

Maximum mass of a Quark Star in the light of Combustion adiabat

Tuesday, June 11, 2019 6:45 PM (2 hours)

The Combustion adiabat (CA) or the Chapman-Jouget adiabat equation can be useful tool to study the phase transition (PT) of a neutron star (NS) to a quark star (QS).
CA is a relation connecting the initial and final state of matter across a shock or a combustion discontinuity, where the initial and the final state belong to different equation of state (EoS).
In this problem we assume the hadronic matter as an input and it is the upstream state and we solve the CA to obtain the corresponding quark matter values in the downstream state.
The hadronic matter and quark matter EoS are used to calculate the matter velocities on either side of the combustion front. Solving the CA we get a maximum of the quark pressure.
The maximum of the quark pressure is also reflected in the retracing of the path in the CA curve.
The downstream quark pressure maximum indicates towards a maximum mass limit
of the QS formed after the phase transition (PT) of NS. This maximum mass limit on QS is different from the regular mass limit of an ordinary QS. The characterization of velocities of the
upstream and downstream phase suggest that the PT from NS to QS is not always feasible. Further, the possible mode of combustion in most of the NS is likely to be a slow deflagration.
The result is crucial in understanding the nature of phase transition and in some cases the PT from NS to QS is not possible.

Collaboration name

Track

Strangeness in astrophysics

Author: MALLICK, Ritam (INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH BHOPAL)

Presenter: MALLICK, Ritam (INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH BHOPAL)

Session Classification: Poster session with ”aperitivo”

Contribution ID: **201** Type: **Contributed talk**

Production of light flavor hadrons measured by PHENIX at RHIC

Tuesday, June 11, 2019 2:40 PM (20 minutes)

Light flavor hadrons are copiously produced in hadronic and heavy-ion interactions and bring a wealth of information about properties of the produced medium and reaction dynamics. Having different masses, quark content and lifetimes, light flavour hadrons do not only serve as general observables in the soft sector, but also play an important role as high transverse momentum probes and signatures of the onset of collectivity in collisions of small systems.
We present review of the most recent PHENIX results on the production of pi0, eta, Ks, phi and omega mesons in p+p, p(d, 3He)+Au, Cu+Cu, Cu+Au, Au+Au and U+U collisions at top RHIC energies with emphasis on study of the parton energy loss in heavy ion collisions, cold nuclear matter effects in small systems and baseline measurements in p+p collisions. The obtained results are compared to higher energy experiments and theoretical model predictions where available.

Collaboration name

PHENIX

Track

Strangeness and Light Flavour

Author: MITRANKOVY, Iurii

Presenter: MITRANKOVY, Iurii

Session Classification: Strangeness and Light Flavour

Contribution ID: **205** Type: **Poster**

Multiplicity dependence in the non-extensive hadronization model calculated by the HIJING++ framework

Tuesday, June 11, 2019 6:45 PM (2 hours)

The non-extensive statistical description of the identified final state particles measured in high energy collisions is well-known by it's wide range of applicability. However, there are many open questions that need to be answered, including but not limited to the question of the observed mass scaling of massive hadrons or the size and multiplicity dependence of the model parameters. This latter is especially relevant, since currently the amount of the available experimental data with high multiplicity at small systems is very limited.

In this contribution the role of the size of the colliding system and multiplicity dependence of the parameters in the non-extensive hadronization model is investigated with HIJING++ calculations. We present cross-check comparisons of HIJING++ with existing experimental data to verify it's validity in our range-of-interest, as well as calculations at high-multiplicity regions where we have insufficient experimental data.

Collaboration name

Track

Hadronisation and coalescence

Author: BÍRÓ, Gábor

Co-authors: BARNAFOLDI, Gergely Gabor (Wigner RCP Hungarian Academy of Sciences (HU)); BIRO, Tamas Sandor (MTA Wigner RCP)

Presenter: BÍRÓ, Gábor

Session Classification: Poster session with "aperitivo"

Contribution ID: **206** Type: **Contributed talk**

Signatures of quark-hadron phase transitions in general-relativistic neutron-star mergers

Tuesday, June 11, 2019 3:20 PM (20 minutes)

Merging binaries of neutron stars are not only strong sources of gravitational waves, but also have the potential of revealing states of matter at densities and temperatures not accessible in laboratories. A crucial and long-standing question in this context is whether quarks are deconfined as a result of the dramatic increase in density and temperature following the merger. I will present the first fully general-relativistic simulations of merging neutron stars including quarks at finite temperatures that can be switched off consistently in the equation of state. Within the approach considered, it is possible to determine clearly what signatures a quark-hadron phase transition would leave in the gravitational-wave signal. In particular, I'll show that if the conditions are met for a phase transition to take place at several times nuclear saturation density, they would lead to a post-merger signal considerably different from the one expected from the inspiral, that can only probe the hadronic part of the equations of state, and to an anticipated collapse of the merged object. I will also show that the phase transition leads to a very hot and dense quark core that, when it collapses to a black hole, produces a ringdown signal different from the hadronic one. Finally, in analogy with what is done in heavy-ion collisions, I will make use of the evolution of the temperature and density in the merger remnant to illustrate the properties of the phase transition in a QCD phase diagram.

Collaboration name

Track

Strangeness in astrophysics

Author: REZZOLLA, Luciano (Institute for Theoretical Physics)

Presenter: REZZOLLA, Luciano (Institute for Theoretical Physics)

Session Classification: Strangeness in Astrophysics

Contribution ID: **208** Type: **Contributed talk**

Collision geometry in HI collisions: a short tribute to Glauber

Monday, June 10, 2019 9:15 AM (15 minutes)

Track

Collaboration name

Author: STOCK, Reinhard (University Frankfurt)

Presenter: STOCK, Reinhard (University Frankfurt)

Session Classification: Plenary 1: State-of-the-art

Contribution ID: **209** Type: **Contributed talk**

Theory view

Monday, June 10, 2019 9:30 AM (30 minutes)

Collaboration name

Track

Presenter: WIEDEMANN, Urs (CERN)

Session Classification: Plenary 1: State-of-the-art

Contribution ID: **210** Type: **Contributed talk**

Experimental view

Monday, June 10, 2019 10:00 AM (30 minutes)

Presenter: SAFARIK, Karel (Czech Technical University (CZ))

Session Classification: Plenary 1: State-of-the-art

Contribution ID: **211** Type: **Contributed talk**

Recent results from HADES

Monday, June 10, 2019 11:00 AM (30 minutes)

Presenter: LORENZ, Manuel (University Frankfurt)

Session Classification: Plenary 2: Highlights from theory and experiments

Contribution ID: **212** Type: **Contributed talk**

First results from BM@N

Monday, June 10, 2019 11:30 AM (30 minutes)

Presenter: KAPISHIN, Mikhail (JINR, Dubna)

Session Classification: Plenary 2: Highlights from theory and experiments

Contribution ID: **213** Type: **Contributed talk**

Hyperons in thermal QCD

Monday, June 10, 2019 12:00 PM (30 minutes)

Presenter: ALLTON, Chris (Swansea University)

Session Classification: Plenary 2: Highlights from theory and experiments

Contribution ID: **214** Type: **Contributed talk**

Recent results from NA61/SHINE

Monday, June 10, 2019 2:00 PM (30 minutes)

Presenter: PULAWSKI, Szymon Mateusz (University of Silesia (PL))

Session Classification: Plenary 3: Highlights from experiments

Contribution ID: **215** Type: **Contributed talk**

Recent results from PHENIX

Monday, June 10, 2019 2:30 PM (30 minutes)

Collaboration name

Track

Author: ROSATI, Marzia (Iowa State University)

Presenter: ROSATI, Marzia (Iowa State University)

Session Classification: Plenary 3: Highlights from experiments

Contribution ID: **216** Type: **Contributed talk**

Recent results on HF from STAR

Monday, June 10, 2019 3:00 PM (30 minutes)

Presenter: XIE, Guannan (University of Illinois at Chicago)

Session Classification: Plenary 3: Highlights from experiments

Contribution ID: **217** Type: **Contributed talk**

Recent results from ATLAS

Monday, June 10, 2019 3:30 PM (30 minutes)

Collaboration name

Track

Presenter: SPOUSTA, Martin (Charles University)

Session Classification: Plenary 3: Highlights from experiments

Contribution ID: **218** Type: **Contributed talk**

Open and hidden HF production and medium interaction with ALICE

Monday, June 10, 2019 4:30 PM (30 minutes)

Collaboration name

Track

Presenter: ROSSI, Andrea (Universita e INFN, Padova (IT))

Session Classification: Plenary 4: Highlights from experiments

Contribution ID: **219** Type: **Contributed talk**

Recent results on HF from CMS

Monday, June 10, 2019 5:00 PM (30 minutes)

Collaboration name

Track

Presenter: CHISTOV, Ruslan (National Research Nuclear University MEPhI (RU))

Session Classification: Plenary 4: Highlights from experiments

Contribution ID: **220** Type: **Contributed talk**

Recent results from LHCb

Monday, June 10, 2019 5:30 PM (30 minutes)

Collaboration name

Track

Presenter: CHEN, Shanzhen (Universita e INFN, Cagliari (IT))

Session Classification: Plenary 4: Highlights from experiments

Contribution ID: **221** Type: **Contributed talk**

The first image of a black hole

Monday, June 10, 2019 6:00 PM (30 minutes)

Presenter: REZZOLLA, Luciano (Institute for Theoretical Physics)

Session Classification: Special topic talk

Contribution ID: **222** Type: **Contributed talk**

Recent results on LF from STAR

Tuesday, June 11, 2019 9:00 AM (30 minutes)

Presenter: ZHAO, Jie (Purdue University)

Session Classification: Plenary 5: Highlights from theory and experiments

Contribution ID: **223** Type: **Contributed talk**

Newest results from lattice HAL QCD on hyperon-nucleon and hyperon-hyperon interaction

Tuesday, June 11, 2019 9:30 AM (30 minutes)

Presenter: HATSUDA, Tetsuo (RIKEN)

Session Classification: Plenary 5: Highlights from theory and experiments

Contribution ID: **224** Type: **Contributed talk**

Probing interaction potentials with femtoscopy measurements in ALICE

Tuesday, June 11, 2019 10:00 AM (30 minutes)

Track

Collaboration name

Author: FABBIETTI, Laura (Technische Universitaet Muenchen (DE))

Presenter: FABBIETTI, Laura (Technische Universitaet Muenchen (DE))

Session Classification: Plenary 5: Highlights from theory and experiments

Contribution ID: **225** Type: **Contributed talk**

High-energy hadron production as self-organized criticality

Tuesday, June 11, 2019 11:00 AM (30 minutes)

Presenter: CASTORINA, Paolo

Session Classification: Plenary 6: Highlights from theory and experiments

Contribution ID: **226** Type: **Contributed talk**

Recent results in small systems from CMS

Tuesday, June 11, 2019 11:30 AM (30 minutes)

Presenter: PUJAHARI, Prabhat Ranjan (Indian Institute of Technology Madras (IN))

Session Classification: Plenary 6: Highlights from theory and experiments

Contribution ID: **227** Type: **Contributed talk**

Production and flow of LF and nuclei in small and large systems with ALICE

Tuesday, June 11, 2019 12:00 PM (30 minutes)

Presenter: OTWINOWSKI, Jacek Tomasz (Polish Academy of Sciences (PL))

Session Classification: Plenary 6: Highlights from theory and experiments

Contribution ID: **228** Type: **Contributed talk**

Strangeness and LF production at low baryon density (LHC + top RHIC)

Wednesday, June 12, 2019 9:00 AM (30 minutes)

Presenter: BELLINI, Francesca (CERN)

Session Classification: Plenary 7: Strangeness and Light Flavour

Contribution ID: **229** Type: **Contributed talk**

Strangeness and LF at intermediate baryon density (RHIC BES + SPS)

Wednesday, June 12, 2019 9:30 AM (30 minutes)

Presenter: ZHU, Xianglei (Tsinghua University)

Session Classification: Plenary 7: Strangeness and Light Flavour

Contribution ID: **230** Type: **Contributed talk**

Strangeness and LF production at high baryon density

Wednesday, June 12, 2019 10:00 AM (30 minutes)

Presenter: BLASCHKE, David (University of Wroclaw)

Session Classification: Plenary 7: Strangeness and Light Flavour

Contribution ID: **231** Type: **Contributed talk**

Snowballs from hell: light nuclei production in HI collisions

Wednesday, June 12, 2019 11:00 AM (30 minutes)

Presenter: OLIINYCHENKO, Dmytro (Lawrence Berkeley National Laboratory)

Session Classification: Plenary 8: Hadron resonances, hadronization and coalescence

Contribution ID: **232** Type: **Contributed talk**

Resonance production and interaction from low to high energy

Wednesday, June 12, 2019 11:30 AM (30 minutes)

Presenter: KNOSPE, Anders Garritt (University of Houston (US))

Session Classification: Plenary 8: Hadron resonances, hadronization and coalescence

Contribution ID: **233** Type: **Contributed talk**

Hadronization from the QGP in the Light and Heavy Flavour sectors

Wednesday, June 12, 2019 12:00 PM (30 minutes)

Presenter: PRINO, Francesco (Universita e INFN Torino (IT))

Session Classification: Plenary 8: Hadron resonances, hadronization and coalescence

Contribution ID: **234** Type: **Contributed talk**

Overview talk about hidden heavy flavour results

Thursday, June 13, 2019 9:00 AM (30 minutes)

Presenter: ARNALDI, Roberta (Universita e INFN Torino (IT))

Session Classification: Plenary 9: Heavy Flavour

Contribution ID: **235** Type: **Contributed talk**

Heavy Quarkonia in medium

Thursday, June 13, 2019 9:30 AM (30 minutes)

Presenter: GONZALEZ FERREIRO, Elena (Universidade de Santiago de Compostela (ES))

Session Classification: Plenary 9: Heavy Flavour

Contribution ID: **236** Type: **Contributed talk**

Overview talk about open heavy flavour results

Thursday, June 13, 2019 10:00 AM (30 minutes)

Presenter: TERREVOLI, Cristina (University of Houston (US))

Session Classification: Plenary 9: Heavy Flavour

Contribution ID: **237** Type: **Contributed talk**

Extraction of heavy quark transport coefficients

Thursday, June 13, 2019 10:30 AM (30 minutes)

Presenter: NAHRGANG, Marlene (Subatech)

Session Classification: Plenary 9: Heavy Flavour

Contribution ID: **238** Type: **Contributed talk**

Quark matter in neutron stars: where do we stand?

Thursday, June 13, 2019 11:30 AM (30 minutes)

Presenter: ALFORD, Mark (Washington University, St Louis)

Session Classification: Plenary 10: Strangeness in astrophysics

Contribution ID: **239** Type: **Contributed talk**

Hyperon interaction with dense nuclear matter and link to neutron stars

Thursday, June 13, 2019 12:00 PM (30 minutes)

Presenter: TOLOS, Laura

Session Classification: Plenary 10: Strangeness in astrophysics

Contribution ID: **240** Type: **Contributed talk**

Update on BEST collaboration and status of lattice QCD

Friday, June 14, 2019 9:00 AM (30 minutes)

Presenter: RATTI, Claudia (University of Houston)

Session Classification: Plenary 11: QCD phase diagram and critical point

Contribution ID: **241** Type: **Contributed talk**

Overview of experimental searches on CP (RHIC BES + SPS)

Friday, June 14, 2019 9:30 AM (30 minutes)

Presenter: CZOPOWICZ, Tobiasz (Warsaw University of Technology (PL))

Session Classification: Plenary 11: QCD phase diagram and critical point

Contribution ID: **242** Type: **Contributed talk**

Patterns and partners within the QCD phase diagram including strangeness

Friday, June 14, 2019 10:00 AM (30 minutes)

Presenter: GOMEZ NICOLA, Angel (Universidad Complutense Madrid)

Session Classification: Plenary 11: QCD phase diagram and critical point

Contribution ID: **243** Type: **Contributed talk**

Reviewing hydro, transport and CGC in small systems

Friday, June 14, 2019 11:00 AM (30 minutes)

Track

Collaboration name

Presenter: VENUGOPALAN, Raju (Brookhaven National Laboratory)

Session Classification: Plenary 12: Collectivity in small systems

Contribution ID: **244** Type: **Contributed talk**

Experimental overview on Strangeness and LF in small systems

Friday, June 14, 2019 11:30 AM (30 minutes)

Presenter: PREGHENELLA, Roberto (INFN, Bologna (IT))

Session Classification: Plenary 12: Collectivity in small systems

Contribution ID: **245** Type: **Contributed talk**

Experimental overview on HF in small systems

Friday, June 14, 2019 12:00 PM (30 minutes)

Presenter: CHAPON, Émilien (CERN)

Session Classification: Plenary 12: Collectivity in small systems

Contribution ID: **246** Type: **Contributed talk**

Hydro and approach to equilibrium

Friday, June 14, 2019 2:00 PM (30 minutes)

Presenter: HEINZ, Ulrich (The Ohio State University)

Session Classification: Plenary 13: Hydrodynamics, chirality and vorticity

Contribution ID: **247** Type: **Contributed talk**

Topical talk on Chirality and Vorticity in HI collisions

Friday, June 14, 2019 2:30 PM (30 minutes)

Presenter: UPSAL, Isaac (Ohio State University)

Session Classification: Plenary 13: Hydrodynamics, chirality and vorticity

Contribution ID: **248** Type: **Contributed talk**

Correlations and fluctuations

Friday, June 14, 2019 3:00 PM (30 minutes)

Presenter: OHLSON, Alice (Ruprecht Karls Universitaet Heidelberg (DE))

Session Classification: Plenary 13: Hydrodynamics, chirality and vorticity

Contribution ID: **249** Type: **Contributed talk**

Detector upgrades and related physics at RHIC

Friday, June 14, 2019 4:00 PM (30 minutes)

Track

Collaboration name

Author: YE, Zhenyu (University of Illinois at Chicago)

Presenter: YE, Zhenyu (University of Illinois at Chicago)

Session Classification: Plenary 14: Detector upgrades

Contribution ID: **250** Type: **Contributed talk**

Concepts for a next generation heavy-ion experiment at the LHC

Friday, June 14, 2019 4:30 PM (25 minutes)

Presenter: MUSA, Luciano (CERN)

Session Classification: Plenary 14: Detector upgrades

Contribution ID: **251** Type: **Contributed talk**

Physics with the detector upgrades at LHC

Friday, June 14, 2019 4:55 PM (25 minutes)

Presenter: WEBER, Michael (Stefan Meyer Institute for Subatomic Physics (SMI), Austrian Academy of Sciences (AT))

Session Classification: Plenary 14: Detector upgrades

Contribution ID: **252** Type: **Contributed talk**

NuPECC Poster Award

Friday, June 14, 2019 5:20 PM (10 minutes)

Track

Collaboration name

Presenter: FINI, Rosanna (Universita e INFN, Bari (IT))

Session Classification: Awards

Contribution ID: **253** Type: **Contributed talk**

Andre Mischke Award

Friday, June 14, 2019 5:30 PM (30 minutes)

Presenter: MARKERT, Christina (University of Texas at Austin (US))

Session Classification: Awards

Contribution ID: **254** Type: **Contributed talk**

FAIR

Saturday, June 15, 2019 9:30 AM (20 minutes)

Presenter: SELYUZHENKOV, Ilya (GSI, Darmstadt)

Session Classification: Plenary 15: Future experiments, facilities and physics perspectives

Contribution ID: **255** Type: **Contributed talk**

NICA

Saturday, June 15, 2019 9:50 AM (20 minutes)

Presenter: KEKELIDZE, Vladimir (Joint Institute for Nuclear Research (RU))

Session Classification: Plenary 15: Future experiments, facilities and physics perspectives

Contribution ID: **256** Type: **Contributed talk**

JPARC-HI

Saturday, June 15, 2019 10:10 AM (20 minutes)

Presenter: OZAWA, Kyoichiro (High Energy Research Institute, KEK)

Session Classification: Plenary 15: Future experiments, facilities and physics perspectives

Contribution ID: **257** Type: **Contributed talk**

EICs

Saturday, June 15, 2019 10:30 AM (20 minutes)

Presenter: DALLA TORRE, Silvia (Universita e INFN Trieste (IT))

Session Classification: Plenary 15: Future experiments, facilities and physics perspectives

Contribution ID: **258** Type: **Contributed talk**

Summary theory

Saturday, June 15, 2019 11:20 AM (30 minutes)

Presenter: NORONHA-HOSTLER, Jacquelyn (Rutgers University)

Session Classification: Plenary 16: Summary and closing

Contribution ID: **259** Type: **Contributed talk**

Summary experiment

Saturday, June 15, 2019 11:50 AM (30 minutes)

Presenter: DOBRIGKEIT CHINELLATO, David (University of Campinas UNICAMP (BR))

Session Classification: Plenary 16: Summary and closing

Contribution ID: **260** Type: **Contributed talk**

SQM 2021 presentation

Saturday, June 15, 2019 12:30 PM (15 minutes)

Track

Collaboration name

Author: YOO, In Kwon (Pusan National University (KR))

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

Session Classification: Plenary 16: Summary and closing

Contribution ID: **261** Type: **Contributed talk**

SQM 2019 closing

Saturday, June 15, 2019 12:20 PM (10 minutes)

Presenter: ELIA, Domenico (INFN Bari)

Session Classification: Plenary 16: Summary and closing

Contribution ID: **262** Type: **Contributed talk**

Perspectives for HI at the High Energy Frontier within the European Strategy of Particle Physics

Saturday, June 15, 2019 9:00 AM (30 minutes)

Presenter: STACHEL, Johanna (Ruprecht Karls Universitaet Heidelberg (DE))

Session Classification: Plenary 15: Future experiments, facilities and physics perspectives

Contribution ID: **264** Type: **not specified**

Welcome

Monday, June 10, 2019 9:00 AM (5 minutes)

Presenter: ELIA, Domenico (INFN Bari)

Session Classification: Welcome and opening

Contribution ID: **265** Type: **not specified**

Address

Monday, June 10, 2019 9:05 AM (10 minutes)

Session Classification: Welcome and opening

Contribution ID: **266** Type: **Contributed talk**

From Starbucks to the academia: unconscious bias and what can we do about it?

Tuesday, June 11, 2019 6:05 PM (30 minutes)

Presenter: JONA, Meytal Eran

Session Classification: Diversity

Contribution ID: **268** Type: **Contributed talk**

Address, IUPAP C12

Tuesday, June 11, 2019 6:00 PM (5 minutes)

Track

Collaboration name

Presenter: STROTH, Joachim (Johann-Wolfgang-Goethe Univ. (DE))

Session Classification: Diversity