SQM2026

Report of Contributions

https://indico.global/e/sqm2026

Contribution ID: **2** Type: **Oral Presentation**

Hyperon physics at BESIII

Tuesday, March 24, 2026 4:25 PM (20 minutes)

With the large data sets of e^+e^- annihilation at the J/ψ and $\psi(3686)$ resonances collected by the BESIII experiment, multi-dimensional analyses utilizing polarization and entanglement can provide new insights into the production and decay properties of hyperon-antihyperon pairs. In a series of recent studies conducted at BESIII, significant transverse polarization of the (anti)hyperons has been observed in J/ψ or $\psi(3686) \to$ hyperon-antihyperon pairs. The decay parameters for the most common hadronic weak decay modes were measured, and due to the non-zero polarization, the parameters of hyperon and antihyperon decays could be determined independently of each other for the first time. Comparing the hyperon and antihyperon decay parameters enables precise tests of direct CP-violation, complementing studies performed in the kaon sector.

Author: XIAO, Yunlong (Fudan University)

Presenter: XIAO, Yunlong (Fudan University)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **3** Type: **Poster Presentation**

Centrality Dependence of Global and Azimuthal of Λ Hyperon Polarization In heavy-ion collisions

Tuesday, March 24, 2026 6:29 PM (1 minute)

We employ a (3+1)-dimensional hydrodynamic framework to investigate the polarization of Λ hyperons in heavy-ion collisions at $\sqrt{s_{nn}}$ = 200 GeV. Our findings reveal a pronounced sensitivity to the choice of initial-state modeling and the viscous properties of the quark–gluon plasma. The model successfully reproduces key hadronic flow measurements and forecasts non-trivial azimuthal modulation patterns in the longitudinal polarization. We introduce novel relations linking polarization observables with anisotropic flow coefficients, which open up promising avenues for future experimental validation. Additionally, a comparative study across different collision system sizes demonstrates behavior consistent with a vorticity-driven polarization mechanism, offering stringent constraints on the interplay between QGP hydrodynamics and spin-polarization effects.

Author: ALZHRANI, Sahr (Jazan University, Saudi Arabia)

Presenter: ALZHRANI, Sahr (Jazan University, Saudi Arabia)

Session Classification: Poster Session

Contribution ID: **4** Type: **Poster Presentation**

Nuclear equation of state modifications from spacetime structure

Tuesday, March 24, 2026 6:48 PM (1 minute)

In the **Kaluza–Klein** model, where one **extra** compactified spatial **dimension** is added to usual spacetime, one can consider **hadronic states** emerging from extra dimensional excitations. These can be associated with e.g., **strangeness** or higher mass states appearing in the nuclear equation of state, with a non-trivial modification to the **speed of sound**, especially in the **conformal limit** [1].

Macroscopic neutron star **observables** using a multi-dimensional zero-temperature Fermi-gas equation of state with a linear repulsive potential have been calculated and compared to observational data. A regime for **constraining** extra-dimension sizes based on compact star mass measurements has been determined [2,3]. Microscopic effects of a **strong gravitational field** on the equation of state are investigated [4].

[1] A. Horváth, E. Forgács-Dajka, G.G. Barnaföldi: "Speed of sound in Kaluza-Klein Fermi gas", https://arxiv.org/abs/2502.04974
[2] A. Horváth, E. Forgács-Dajka, G.G. Barnaföldi: "Application of Kaluza-Klein Theory in Modeling Compact Stars: Exploring Extra Dimensions", MNRAS, https://doi.org/10.1093/mnras/ (2024)
[3] A. Horváth, E. Forgács-Dajka, G.G. Barnaföldi: "The effect of multiple extra dimensions on the maximal mass of compact stars in Kaluza-Klein space-time", IJMPA, https://doi.org/10.1142/ (2025)
[4] A. Horváth, A. Wojnar, G.G. Barnaföldi: "The effects of strong gravity on the dispersion relation of massive particles in the Kaluza–Klein theory", https://arxiv.org/pdf/2510.16631

Authors: WOJNAR, Aneta (Complutense University of Madrid); HORVATH, Anna (Eötvös Loránd University); FORGÁCS-DAJKA, Emese (Eötvös Loránd University); Dr BARNAFOLDI, Gergely Gabor (HUN-REN Wigner Research Centre for Physics (HU))

Presenter: HORVATH, Anna (Eötvös Loránd University)

Session Classification: Poster Session

Contribution ID: **6** Type: **Oral Presentation**

Extract the QCD speed of sound in the presence of quantum fluctuations

Tuesday, March 24, 2026 3:15 PM (20 minutes)

It has recently been realized that in the ultra-central heavy-ion collisions, mean transverse momentum of hadrons contains the information of the fundamental thermodynamic properties of quark-gluon plasma (QGP). In particular, in nucleus-nucleus collisions, the linear correlation between the mean transverse momentum and the charged multiplicity is attributed to the QCD speed of sound, which promotes both theoretical and experimental investigations. However, in realistic collisions, these studies suffer from the contamination of fluctuations, especially the quantum fluctuations from the initial state, which bias the extracted value. Traditional analyses struggle to separate this fluctuating background from the genuine thermodynamic signal.

In this talk, we present a systematic subtraction scheme to resolve this issue. In a thermalized QGP, the quantum fluctuations δ are independent from the thermodynamic responce and vary randomly across events. According to the Central Limit Theorem, the distribution of δ should approach Gaussianity allowing us to extract the physical speed of sound statistically even in the presence of these fluctuations. Crucially, this approach can also serve as a direct probe of QGP thermalization. In a non-thermalized system, the distribution of δ deviates from Gaussianity and the extracted value of speed of sound is non-physical. The deviations from thermalization can be quantified by the standardized kurtosis κ_4 of δ.

Validated by the event-by-event hydrodynamic simulations, the extracted speed of sound in our framework is successfully consistant with the predictions from lattice QCD, from large to small collision systems. To enhance statistical robustness, we also employ AI-powered diffusion model for data augmentation, which further strengthen the reliability of our results.

Authors: YAN, Li (Fudan University); Prof. HUANG, Xu-Guang; MU, Yushan (Fudan University)

Presenters: YAN, Li (Fudan University); MU, Yushan (Fudan University)

Session Classification: Parallel V: Phase Structure

Contribution ID: **7** Type: **Oral Presentation**

Influence of the residual magnetic field on the azimuthal distribution of final-state particles in photonuclear processes

Tuesday, March 24, 2026 11:15 AM (20 minutes)

In relativistic heavy-ion collisions, charged particles are accelerated to nearly the speed of light, and their external electromagnetic fields can be effectively approximated as quasi-real photons. These photons interact with another nucleus via photon-nuclear interactions, producing vector mesons. These vector mesons possess extremely low transverse momentum ($p_T \sim 0.1$ GeV/c), distinguishing them from particles produced via hadronic interactions. STAR and ALICE have observed J/ψ, ρ^0 and other vector mesons with very low p_T, which are well described by photoproduction models. This unique characteristic of having extremely low transverse momentum allows them to serve as a novel experimental probe. Recent STAR results show that the equivalent photons in photoproduction processes are fully linearly polarized, affecting the azimuthal distribution of final-state particles like $\rho^0 \to \pi^+\pi^-$. Since the polarization links to the initial collision geometry, the ρ^0 azimuthal modulation can probe nuclear structure. However, the post-collision magnetic field may deflect these particles, distorting the azimuthal distribution and complicating structure measurements. We simulated the distribution of residual magnetic fields over time under different collision conditions using UrQMD for Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV and calculated their effects on the azimuthal modulation ($\langle cos2\phi \rangle$) of photoproduced ρ^0. Our results show that in peripheral collisions, the field significantly alters the $\langle cos2\phi \rangle$ for photoproduced ρ^0 with $p_T \approx 0.1$ GeV/c. This provides key insights for future nuclear structure studies via photoproduction in peripheral collisions.

Author: ZHANG, Zhan (University of Science and Technology of China (CN))

Presenter: ZHANG, Zhan (University of Science and Technology of China (CN))

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

Contribution ID: **8** Type: **Poster Presentation**

Strangeness Production from Color Field Overlap: Comparing Rope Hadronization and Hydrodynamics

Tuesday, March 24, 2026 6:18 PM (1 minute)

Strangeness production is a key signature of the formation of a hot and dense medium in heavy-ion collisions. Hybrid approaches combining transport theory and hydrodynamics within the core–corona framework have been successful in describing this enhancement.

At the same time, collective behavior and strangeness enhancement have also been observed in small systems such as proton–proton collisions, suggesting that some of the phenomena associated with QGP formation may already emerge from the coherent superposition of multiple nucleon–nucleon interactions.

One approach is provided by Pythia/Angantyr, where overlapping color flux tubes increase the effective color field strength through color field overlap (color ropes). The enhanced string tension boosts strange-quark production and transverse momentum through the Schwinger mechanism. Although Angantyr is not intended as a QGP model, a dense network of overlapping strings can be interpreted as the earliest stage of QGP formation, a non-thermal precursor that transitions into a deconfined medium as the string tension melts during thermalization.

We implement a rope-based mechanism in the SMASH transport framework using the Pythia/Angantyr rope hadronization approach. By comparing this mechanism to a hydrodynamical evolution using SMASH+vHLLE, we identify where each description succeeds or fails and explore potential transition regions between rope-dominated dynamics and hydrodynamic behavior.

The study focuses on Pb+Pb collisions at 158 A GeV and 40 A GeV, confronting both scenarios with NA49 data on strange mid-rapidity yields and average transverse mass as a function of participating nucleons. This allows us to establish a quantitative baseline for strangeness production and to explore the connection between strong color fields and QGP-like behavior.

Authors: ROSENKVIST, Carl (Frankfurt Institute for Advanced Studies); ELFNER, Hannah

Presenter: ROSENKVIST, Carl (Frankfurt Institute for Advanced Studies)

Session Classification: Poster Session

Contribution ID: **11** Type: **Poster Presentation**

Open heavy flavor studies at the future EIC to probe final-state effects

Tuesday, March 24, 2026 6:19 PM (1 minute)

Heavy flavor (charm and bottom) production is a unique probe for testing perturbative Quantum Chromodynamics (pQCD) and for investigating the transport properties of nuclear matter. The identification of heavy flavor signals remains one of the most challenging measurements in collider experiments due to their extremely low production rate and substantial background contributions. The forthcoming Electron-Ion Collider (EIC) will employ high-luminosity, high-energy electron+proton ($e + p$) and electron+nucleus ($e + A$) collisions across a broad range of center of mass energies (29 - 141 GeV) to address several fundamental questions in QCD, including the mechanisms of hadronization. A series of studies on heavy flavor hadron and jet production at the EIC have been carried out using standalone simulations incorporating parameterized EIC detector performance. In this work, we present the projected heavy flavor jet reconstruction capabilities at the EIC, together with corresponding analyses of heavy flavor jet production and substructure, such as energy-energy correlator observables, compared with recent theoretical calculations. The implications of these studies for advancing our understanding of flavor dependent parton energy loss and the flavor dependent hadronization process will be discussed as well.

Author: LI, Xuan (Los Alamos National Laboratory)

Presenter: LI, Xuan (Los Alamos National Laboratory)

Session Classification: Poster Session

Contribution ID: **12** Type: **Oral Presentation**

Local spin polarization by color-field correlators and momentum anisotropy

Tuesday, March 24, 2026 9:05 AM (20 minutes)

We study the local spin polarization of quarks induced by color-field correlators stemming from the correlation of chromo-Lorentz force and chromo-magnetic polarization or chromo-spin Hall effect in the presence of momentum anisotropy.
Such effects can trigger longitudinal polarization from fluctuating color fields in glasma or quark gluon plasma phases with transverse expansion for relativistic heavy ion collisions. Especially, from the glasma effect, the resulting longitudinal polarization spectrum of $\Lambda/\bar{\Lambda}$ hyperons has a sinusoidal structure with twice the azimuthal angle relative to the anisotropic direction. An order-of-magnitude estimate of the effect aligns with experimental observations. Our findings highlight the significant role of coherent gluon fields as a novel source for spin polarization phenomena in high-energy nuclear collisions.

Author: SUNG, Haesom (Academia Sinica)

Co-authors: MUELLER, Berndt; YANG, Di-Lun (Institute of Physics, Academia Sinica)

Presenter: SUNG, Haesom (Academia Sinica)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

Contribution ID: **13** Type: **Oral Presentation**

Heavy quark transport in quark-gluon plasma beyond the non-relativistic limit

Tuesday, March 24, 2026 5:05 PM (20 minutes)

The dynamics of heavy quarks in quark-gluon plasma (QGP) formed in heavy ion collisions provide a unique window to characterize its properties. Existing approaches to describe heavy quarks in medium rely either on quasiparticle-based models of QGP, or on assuming that the momentum transfer from the medium follows Gaussian statistics. However, neither of these assumptions can be taken for granted in QCD. In fact, in the prototypical theory that is strongly coupled $\mathcal{N} = 4$ SYM, it has been long known there are no momentum-carrying quasipaticles, and furthermore, we have recently shown that the momentum transfer from the medium is far from being Gaussian [1]. Since then, we showed that the asymmetry of said momentum transfer between energy loss and energy gain —which affects all moments of the distribution, not only its Gaussian characteristics —is, in fact, universal [2]. The deviations from Gaussianity can be substantial even at moderate Lorentz boost factors $\gamma = E/M$
$gtrsim2$.

Therefore, in order to connect the initial heavy quark production cross section with the final hadron p_T spectrum in a way that is consistent with QFT principles, new methods are needed. In this talk, we present a new transport description of heavy quarks that encodes all of the non-Gaussian features of the momentum transfer from the medium, all of which can be defined and in principle calculated in QCD, without relying on any assumptions regarding the strength of the coupling. As a demonstrative example, we discuss how heavy quark stopping and equilibration takes place in $\mathcal{N} = 4$ SYM. This paves the way towards extracting information about novel fundamental properties of QGP.

[1] 2501.06289
[2] 2504.21139

Authors: SCHEIHING, Bruno (Kavli Institute for Theoretical Physics, University of California Santa Barbara); RAJAGOPAL, Krishna (Massachusetts Inst. of Technology (US)); WIEDEMANN, Urs (CERN)

Presenter: SCHEIHING, Bruno (Kavli Institute for Theoretical Physics, University of California Santa Barbara)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **14** Type: **Oral Presentation**

Improved Description of Hot and Dense Hadronic Matter in an Extended Chiral Mean Field Model with Medium-Modified Mesons

Tuesday, March 24, 2026 11:15 AM (20 minutes)

We investigate the equation of state (EoS) for hot and dense hadronic matter within an extended Chiral Mean Field (CMF) model framework that incorporates the interactions of thermally excited mesons, including both non-strange and strange species. In this approach, the in-medium masses of pseudoscalar and vector mesons are evaluated through the explicit chiral symmetry-breaking and vector-interaction terms in the Lagrangian, respectively, before applying the mean-field approximation. These medium-modified meson properties, particularly the inclusion of strange mesons such as kaons and phi mesons, introduce additional feedback into the CMF equations of motion, leading to a revised equation of state. The impact of this refinement is analyzed by comparing the model predictions with recent lattice QCD data and other hadronic descriptions, such as the hadron resonance gas model. The modified CMF framework, featuring an improved meson treatment (mCMF), demonstrates enhanced consistency with lattice-QCD results for thermodynamic observables across a broad range of temperatures and baryon chemical potentials.

Authors: RATTI, Claudia; KUMAR, Rajesh (MRPD Government College Talwara); RAPP, Ralf; Prof. DEXHEIMER, Veronica (Kent Stae University)

Presenter: KUMAR, Rajesh (MRPD Government College Talwara)

Session Classification: Parallel VII: EoS and Astrophysics

Contribution ID: **17** Type: **Poster Presentation**

Bayesian inference of the magnetic components in quark-gluon plasma and predictions for heavy flavor observables

Tuesday, March 24, 2026 6:34 PM (1 minute)

The chromo-magnetic monopoles (CMM), emergent topological excitations of non-Abelian gauge fields carrying chromo-magnetic charge, have long been postulated to play an important role in the vacuum confinement of quantum chromodynamics (QCD), the deconfinement transition at temperature $T_c \approx 160\mathrm{MeV}$, as well as the strongly coupled nature of quark-gluon plasma (QGP). While such CMMs have been found to provide solutions for challenging puzzles from heavy-ion collision measurements, they were typically introduced as model assumptions in the past. Here we show how their very existence can be determined and their abundance extracted in a data-driven way for the first time. Using the CUJET3 framework for calculations of jet energy loss and analyzing a comprehensive experimental data set for light hadrons' nuclear modification factor (R_{AA}) and elliptic flow (v_2) of high-transverse-momentum hadrons, the fraction of CMMs in the QGP is obtained by Bayesian inference and is found to be substantial in the $1 \sim 2T_c$ region. The posterior CMM fraction is further validated by excellent agreement with additional data. Such a microscopic picture of QGP is also shown to predict QGP transport properties, such as specific shear viscosity, jet transport coefficient and heavy quark diffusion constant, that are quantitatively consistent with the state-of-the-art knowledge. With the model parameters now constrained by light-flavor observables, we present Bayesian predictions for the R_{AA} and v_2 of high-p_T charm and bottom hadrons. These predictions provide a decisive, independent test for the existence and abundance of CMMs in the QGP.

Authors: LIAO, Jinfeng; Dr SHI, Shuzhe (Tsinghua University); GUO, Yu (Tsinghua University)

Presenter: GUO, Yu (Tsinghua University)

Session Classification: Poster Session

Contribution ID: **18** Type: **Poster Presentation**

ϕ meson production in Pb–Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.36 TeV via the dimuon channel with ALICE

Tuesday, March 24, 2026 6:35 PM (1 minute)

Strangeness production serves as a powerful probe of the properties of the hot and dense strongly interacting medium created in ultra-relativistic heavy-ion collisions. The enhancement of strange particle yields has long been considered a key signature of the formation of the quark-gluon plasma (QGP). Among strange hadrons, the ϕ meson, composed of an $s\bar{s}$ quark pair, plays a crucial role, as it is sensitive to both strangeness dynamics and possible medium modifications, and at the same time is relatively unaffected by hadronic re-scattering due to its small interaction cross section.
In this work, we report on the measurement of ϕ-meson production via the dimuon decay channel in the forward rapidity region ($2.5 < y < 4.0$) in Pb–Pb collisions at $\sqrt{s_{\rm NN}} = 5.36$ TeV, with the ALICE experiment at the CERN LHC. The measurement of ϕ meson production via its dimuon decay channel offers several experimental advantages. The dimuon channel, with a relatively low combinatorial background and no strong final-state interactions, allows for a clean reconstruction of the ϕ signal, particularly in the forward rapidity region where the ALICE Muon Spectrometer provides a good acceptance and resolution. The transverse momentum spectra and integrated yields are presented in the transverse momentum range down to p_T
$gtrsim$ 2 GeV/c. These new results extend previous ALICE measurements at $\sqrt{s_{\rm NN}} = 5.02$ TeV and $\sqrt{s_{\rm NN}} = 2.76$ TeV, allowing a systematic study of the energy dependence of ϕ-meson production and the $p_{\rm T}$ spectra for different centrality classes. The comparison with model predictions and lower-energy results provides further insight into strangeness enhancement, hadronization mechanisms, and the evolution of QGP properties with increasing collision energy.

Author: SINGH, Kamaljeet (Indian Institute of Technology Indore (IN))

Presenter: SINGH, Kamaljeet (Indian Institute of Technology Indore (IN))

Session Classification: Poster Session

Contribution ID: **20** Type: **Poster Presentation**

Charm-baryon measurements via strangeness tracking with ALICE at the LHC

Tuesday, March 24, 2026 6:36 PM (1 minute)

Heavy quarks, i.e., charm and beauty, in proton-proton collisions at the LHC are mainly produced in hard-parton scatterings at the early stages of the collisions. Owing to the large masses of the charm and beauty quarks compared to the QCD scale parameter ($\Lambda_{\rm QCD} \sim 200$ MeV), their production can be described using perturbative quantum chromodynamics (pQCD) calculations. During LHC Run 2, observations by ALICE have revealed a significant enhancement in charm-baryon production in hadronic collisions compared to electron–positron and electron–proton collisions. This challenges the conventional assumption of fragmentation universality. LHC Run 3 now offers the opportunity to extend these studies with improved detector performance, higher precision, and larger statistics.

A new method for detection of charmed baryons via their decays into strange baryons, called 'strangeness tracking', is adopted. Exploiting the upgraded silicon Inner Tracking System in ALICE during LHC Run 3, this method enables the novel possibility of tracking strange hadrons (Ξ, Ω) directly before they decay, leading to a significant improvement in secondary-vertex resolution. This enhanced precision not only allows more precise studies of charm-baryon decay modes, but also offers advantages for measurements of $\Omega_{\rm c}^0$ lifetimes, which are important for understanding their internal structure and decay dynamics.

This poster presents the $\Xi_{\rm c}^0$- and
$Omgea_{\rm c}^0$-baryon production measurements via the decay channels $\Omega_{\rm c}^0 \rightarrow {}^-\pi^+$, and the rare modes $\Omega_{\rm c}^0 \rightarrow {}^-\pi^+$ and $\Xi_{\rm c}^0 \rightarrow {}^-{\rm K}^+$ in pp collisions at $\sqrt{s}$ = 13.6 TeV in Run 3. It also discusses the prospects for a precise measurement of the $\Omega_{\rm c}^0$ lifetime. These results demonstrate the enhanced capability of strangeness tracking for reconstructing charm–strange baryons and will provide important constraints for hadronization models and theoretical descriptions of charm-baryon production.

Author: Dr CHENG, Tiantian (Fudan University)

Presenter: Dr CHENG, Tiantian (Fudan University)

Session Classification: Poster Session

Contribution ID: **22** Type: **Oral Presentation**

Self-energy corrections for quantum kinetic theory and spin polarization

Tuesday, March 24, 2026 11:55 AM (20 minutes)

Quantum kinetic theory (QKT) of relativistic fermions is one of useful theoretical frameworks to track non-equilibrium evolution of spin transport albeit in weakly coupled systems. Except for the quantum corrections, characterized by the gradient expansion in phase space, from the imaginary part of (retarded and advanced) self-energies responsible for the spin-orbit interaction in collisions, we derive the QKT with also the real part of the self-energies modifying the on-shell condition. The quantum correction, especially given by the gradient of vector self-energy, plays a similar role to the background electromagnetic fields, which can accordingly generate spin polarization. We further discuss how such self-energy corrections lead to the radiative correction upon vortical spin polarization in thermal equilibrium. Moreover, we introduce a more systematic and general approach through the Keldysh equation from Wigner functions to analyze the radiative corrections in hot QCD matter. By applying the hard-thermal-loop approximation, we obtain new corrections upon the spin-polarization spectrum and also the axial-charge current in connection to the axial/chiral vortical effect for massive quarks up to the leading order of the QCD coupling.

Authors: YANG, Di-Lun (Institute of Physics, Academia Sinica); PU, Shi (University of Science and Technology of China); FANG, Shuo (University of Science and Technology of China)

Presenter: YANG, Di-Lun (Institute of Physics, Academia Sinica)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

Contribution ID: **23** Type: **Oral Presentation**

Baryon and electric charge stoppings in nuclear collisions and the role of strangeness

Tuesday, March 24, 2026 12:15 PM (20 minutes)

It has been challenging to quantitatively understand the stopping of incoming nucleons in nuclear collisions, and recently it has been proposed that comparing the baryon stopping with electric charge stopping can help address the question. In this study [1] we focus on the B/Q×Z/A ratio, which can strongly depend on rapidity although its value is one for the full phase space. We find that this ratio is very sensitive to the difference between strange and anti-strange rapidity distributions (the s–sbar asymmetry), and slightly more anti-strange quarks at mid-rapidity would lead to a ratio well below one. This is the case for Zr+Zr and Ru+Ru isobar collisions at 200A GeV from a multi-phase transport (AMPT) model. Without the s–sbar asymmetry, the AMPT model would give a mid-rapidity B/Q×Z/A ratio at or above one. In addition, the AMPT model gives B/ΔQ×ΔZ/A < 1 at mid-rapidity for isobar collisions at all centralities, which strongly contradicts the recent data from the STAR Collaboration. We further find that the B/ΔQ×ΔZ/A ratio is very sensitive to the net-light quark (u,d) stoppings, but it is less sensitive to the s–sbar asymmetry than the B/Q×Z/A ratio by a factor of 3.
[1] M.A. Ross and Z.-W. Lin, arXiv:2510.22793.

Authors: LIN, Zi-Wei (East Carolina University); ROSS, Mason (East Carolina University)

Presenter: LIN, Zi-Wei (East Carolina University)

Session Classification: Parallel VI: Correlations

Contribution ID: **25** Type: **Oral Presentation**

Heavy quark thermalization using phonon-heavy quark EFT (ϕ-EFT)

Tuesday, March 24, 2026 4:45 PM (20 minutes)

The description of heavy quarks inside the QGP medium, especially at low momenta, remains challenging from first principles, due to large coupling strength and gluon occupation numbers. An alternative way to formulate a description in terms of perturbative degrees of freedom is the interaction of the heavy quarks with the collective excitations of the medium in the form of phonons. This description is derived as an effective field theory (EFT) and therefore allows for a natural occurring power counting of the allowed interactions. This EFT has already been established in our previous work (arXiv:2510.13942), where we have derived the phonon-heavy quark interactions and calculated their thermal scattering cross section.
In this work, we use these results, together with the heavy quark expansion, to calculate the heavy quark drag coefficient A. Subsequently, we compare our results with the drag coefficient obtained from AdS/CFT calculations to determine the previously unknown Wilson coefficients for the quark-phonon coupling. Finally, we will use these coefficients to solve the Boltzmann equation for the heavy quark distribution, studying its thermalization in the QGP via soft phonon interactions.

Authors: KIRCHNER, Andreas (Duke University); MUELLER, Berndt; ROY, Jyotirmoy (Duke University); Dr WAEBER, Sebastian

Presenter: KIRCHNER, Andreas (Duke University)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **26** Type: **Poster Presentation**

Measurement of $\Xi(1530)^0$ production in pp collisions with ALICE

Tuesday, March 24, 2026 6:26 PM (1 minute)

Measurement of resonances provides a tool to study the hadronic phase, the phase between chemical and kinematic freeze-out in the evolution of the quark-gluon plasma (QGP). Baryonic resonances, such as $\Xi(1530)^0$ (net-strangeness = -2) with a relatively long lifetime ($\sim$ 22 fm/c), serve as key probes to investigate the effects of rescattering and regeneration in the hadronic phase by comparing resonances with different lifetimes and by studying their yields across different colliding systems. In addition, the study of these resonances can provide insights into strangeness enhancement. The multiplicity-dependent production of the $\Xi(1530)^0$ in pp collisions at $\sqrt{s} = 13.6$ TeV, measured with ALICE in Run 3, is presented and compared with corresponding results at 13 TeV. Based on these results, the effects of the hadronic phase and strangeness enhancement as a function of multiplicity in pp collisions will be discussed.

Author: Mr KIM, Minjae (Pusan National University (KR), on behalf of the ALICE collaboration)

Presenter: Mr KIM, Minjae (Pusan National University (KR), on behalf of the ALICE collaboration)

Session Classification: Poster Session

Contribution ID: **27** Type: **Poster Presentation**

Event-by-event mean p_T fluctuations in Pb-Pb collisions at LHC Run 3 with ALICE

Tuesday, March 24, 2026 6:46 PM (1 minute)

Event-by-event mean transverse momentum fluctuations of relativistic charged particles produced in Pb–Pb collisions at $\sqrt{s}_{NN} = 5.36$ TeV are studied in terms of normalized two-particle correlator $\sqrt{C_m}/\langle\langle p_T\rangle\rangle$. Data collected using the ALICE detector during Run 3 are analyzed for this purpose and the results are compared with those reported earlier for large collision systems. The findings reveal presence of dynamical fluctuations. It is also observed that the correlation strength decreases monotonically with increasing charged-particle density. The observed trend of $\sqrt{C_m}/\langle\langle p_T\rangle\rangle$ with $\langle dN_{ch}/d\eta\rangle$ is found to be in qualitative agreement with the previous measurements in Pb–Pb collisions at $\sqrt{s_{NN}} = 2.76$ and 5.02 TeV. Cumulative values of $\sqrt{C_m}/\langle\langle p_T\rangle\rangle$ for the 0-5 % central collisions are also obtained and compared with those reported for Pb–Pb, Au–Au and Pb–Au collisions by the ALICE, STAR, and CERES Collaborations.

Author: SINGH, Sweta (Aligarh Muslim University (IN))

Presenter: SINGH, Sweta (Aligarh Muslim University (IN))

Session Classification: Poster Session

Contribution ID: **28** Type: **Poster Presentation**

Event-by-event net-charge fluctuations in pp, OO, Ne–Ne, and Pb–Pb collisions with ALICE at the LHC

Tuesday, March 24, 2026 6:38 PM (1 minute)

Investigations involving the event-by-event fluctuations of conserved quantities, like net charge, net baryon number, and strangeness in heavy-ion collisions, provide insights into the properties of QGP and the phase diagram of strongly interacting matter. Event-by-event fluctuations of net-electric charge in pp collisions at $\sqrt{s} = 13$ and 13.6 TeV and for OO, Ne–Ne, and Pb–Pb collisions at $\sqrt{s_{\rm NN}} = 5.36$ TeV are studied by analysing the data collected by the ALICE detector at CERN Large Hadron Collider.

The analysis is carried out in terms of the variable $\nu_{\rm dyn}[+,-]$, chosen for its robustness against the detector efficiency losses. The observed dependence of $\nu_{\rm dyn}[+,-]$ on the charged-particle multiplicity exhibits an energy-independent smooth increase of net-charge fluctuations from smaller to larger collision systems.

The negative values of $\nu_{\rm dyn}[+,-]$ indicate a dominance of correlations between oppositely charged particle pairs compared with those arising from like-sign charge pairs. Since $\nu_{\rm dyn}[+,-]$ is known to have an intrinsic dependence on multiplicity, an appropriate scaling is applied. The variable is therefore scaled by the factors (i) $N_{\rm ch}$ and (ii) $\frac{1}{N^{+}+N^{-}}$. The dependence of the scaled values of $\nu_{\rm dyn}[+,-]$ on particle multiplicity is also looked into.

Author: MALIK, Nida (Aligarh Muslim University (IN))

Presenter: MALIK, Nida (Aligarh Muslim University (IN))

Session Classification: Poster Session

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

Probing the evolution of light-ion collisions using resonances with ALICE

Tuesday, March 24, 2026 6:27 PM (1 minute)

Collisions of light ions (OO, Ne–Ne, and pO) at the LHC bridge the gap between small and large systems, offering new insight into the onset of collective behavior and hadronic medium effects. Hadronic resonances, owing to their lifetimes comparable to the hadronic phase, serve as sensitive probes of late-stage dynamics where re-scattering and regeneration compete.

We present measurements of the production and elliptic flow (v_2) of the K^{*0} and ϕ mesons in light-ion collisions with ALICE. System-size–dependent observables, including transverse momentum spectra, integrated yields, mean transverse momentum and yield ratios to stable hadrons, are compared to corresponding results from pp and heavy-ion collisions. These comparisons elucidate the evolution of hadronic medium effects and collective behavior with increasing system size. The ϕ/K^{*0} yield ratio, together with model comparisons, further constrains the role of hadronic rescattering and regeneration in determining the final resonance yields and flow.

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Presenter: GAMI, Sarjeeta (National Institute of Science Education and Research (NISER) (IN))

Session Classification: Poster Session

Contribution ID: **30** Type: **Oral Presentation**

Charmonium production at SPS and FAIR energies

Wednesday, March 25, 2026 11:55 AM (20 minutes)

Quarkonium states, and in particular charmonium, have been recognized as sensitive probes of the properties of hot and dense strongly interacting matter created in relativistic heavy-ion collisions. Since the pioneering work of Matsui and Satz, who proposed that the suppression of the J/ψ meson could signal the onset of quark–gluon plasma (QGP) formation, numerous theoretical and experimental efforts have been devoted to understanding the mechanisms governing charmonium production, dissociation, and regeneration in such environments.

At finite baryon chemical potential (μ_B), lattice QCD predicts a smooth crossover transition between hadronic and partonic matter, whereas at larger μ_B, beyond the conjectured critical end point, the transition possibly becomes first order. Studying charmonium behavior in baryon-rich systems—such as those accessible at SPS and the upcoming GSI/FAIR facilities—therefore provides a unique opportunity to explore the QCD phase diagram in regions of high net baryon density.

In this work, we employ the Parton–Hadron–String Dynamics (PHSD) transport approach to investigate the influence of baryon-rich matter on charmonium production and dissociation. The Remler coalescence formalism is implemented to dynamically model charmonium formation from charm–anticharm pairs. As a validation step, the formalism is first benchmarked against experimental data from elementary p+p collisions and then extended to p+A systems to extract the effective nuclear absorption cross section of charmonium. This extracted cross section is subsequently applied in A+A collisions to quantify medium-induced effects.

Our results demonstrate that the Remler formalism provides a quantitatively consistent description of charmonium production at SPS energies when the charmonium interaction rate in the QGP phase is comparable to that of open-charm pairs. The approach is then extrapolated to GSI/FAIR energies, where predictions for charmonium yields and survival probabilities are presented. These findings highlight the relevance of the Remler formalism as a dynamical framework for studying heavy-quark bound-state formation in strongly interacting baryon-rich matter and offer theoretical guidance for future experimental programs at FAIR and NICA aimed at mapping the QCD phase structure.

Author: SONG, Taesoo (GSI)

Co-authors: BRATKOVSKAYA, Elena (GSI, Darmstadt); Dr ZHAO, Jiaxing (Johann Wolfgang Goethe Univ.); AICHELIN, Joerg

Presenter: SONG, Taesoo (GSI)

Session Classification: Parallel VIII: Open Questions and Future

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

Event-shape dependent identified particle production in Pb–Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV using EPOS4.

Tuesday, March 24, 2026 6:23 PM (1 minute)

Transverse spherocity is an event-shape observable that quantifies the azimuthal distribution of transverse momentum, enabling a clean separation between jetty-like (low spherocity) and isotropic (high spherocity) final states. By using event topology with spherocity, one can disentangle soft, collective-dominated particle production from hard, jet-driven processes without relying solely on multiplicity. Spherocity differential study of charged-particle production in Pb–Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV using events from EPOS4 model are presented. Charged-particle pseudorapidity densities versus centrality are evaluated. Identified hadron spectra ($\pi^{\pm}$, $K^{\pm}$, $p(\overline{p})$) at mid-rapidity ($|\eta| < 0.8$) are measured for jetty and isotropic classes across centrality intervals, and "crossing points"in transverse momentum are mapped as a function of centrality and particle species.

Authors: HAIDER, Fakhar Ul (University of Jammu (IN)); MALIK, Salman Khurshid (University of Jammu (IN))

Co-authors: ASHRAF, Muhammad Usman (Wayne State University); GUPTA, Ramni (University of Jammu (IN))

Presenters: HAIDER, Fakhar Ul (University of Jammu (IN)); ASHRAF, Muhammad Usman (Wayne State University); MALIK, Salman Khurshid (University of Jammu (IN))

Session Classification: Poster Session

Contribution ID: **32** Type: **Oral Presentation**

Realistic Few-Body Calculations of Wigner Phase-Space Densities for Nuclear Clusters and Hypernuclei

Tuesday, March 24, 2026 5:05 PM (20 minutes)

Nuclear clusters and hypernuclei serve as essential probes of the strong interaction.
The production of clusters and hypernuclei in heavy-ion collisions is an intricate process that involves the formation of few-body bound systems within a dynamic many-body environment. Accurate knowledge of their static properties is essential input for transport approaches, as it directly determines their production in nuclear matter.

In this talk, we will present solutions of the Schrödinger equation with realistic nucleon–nucleon and nucleon–Λ interactions for few-body systems to obtain the wave functions of light nuclear clusters and hypernuclei, including d, t, ^{3}He, $^3_\Lambda$H, ^{4}He, $^4_\Lambda$He, $^4_\Lambda$H, $^5_\Lambda$He, and $^5_{\Lambda\Lambda}$He. The solutions are projected onto hyperspherical harmonic basis states to construct corresponding density matrices and Wigner phase-space distributions. The calculated binding energies and root-mean-square (rms) radii reproduce the available experimental data with high accuracy and also provide reliable predictions for unmeasured systems. The resulting Wigner densities offer a solid foundation for improving coalescence models used to identify clusters formed in relativistic heavy-ion collisions. Finally, we will present results for the production of these nuclear clusters and hypernuclei in heavy-ion collisions based on the obtained Wigner densities.

Authors: BRATKOVSKAYA, Elena (GSI, Darmstadt); Dr ZHAO, Jiaxing (HFHF/Goethe University); AICHELIN, Joerg

Presenter: Dr ZHAO, Jiaxing (HFHF/Goethe University)

Session Classification: Parallel I: Strangeness and HF

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

A Covariant Molecular Dynamics Framework for Relativistic N-Body Systems with both scalar and vector potentials

Tuesday, March 24, 2026 6:39 PM (1 minute)

Since the formation of nuclear clusters, the probing of the nuclear matter equation of state, and the interpretation of hadron correlations at beam energies above 1 GeV all involve strong dynamical correlations and relativistic effects, a covariant
N-body dynamical framework becomes essential for a consistent theoretical description.

In this talk, we will present our recent work on a fully covariant Molecular Dynamics framework that provides a consistent description of relativistic
N-body systems based on the constrained Hamiltonian dynamics formalism. For the first time, we derive relativistic equations of motion incorporating both scalar and vector interactions within a manifestly covariant formulation. This approach resolves several fundamental issues in relativistic many-body dynamics, including the implications of different time-constraint choices, the emergence of the nonrelativistic limit, the frame independence of system evolution, and the distinct dynamical roles of scalar and vector potentials.

We further discuss the relationship of our framework to established models such as RQMD, UrQMD, and JAM, and present illustrative applications to two- and four-body systems, providing new insights into the consistency and physical interpretation of relativistic interactions in a covariant setting. Finally, we outline prospects for implementing this framework in relativistic heavy-ion collision simulations.

Authors: BRATKOVSKAYA, Elena (GSI, Darmstadt); Dr ZHAO, Jiaxing (HFHF/Goethe University); AICHELIN, Joerg

Presenter: Dr ZHAO, Jiaxing (HFHF/Goethe University)

Session Classification: Poster Session

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

Production and polarization of the ϕ meson in pp collisions at $\sqrt{s} = 13.6$˜TeV with ALICE

Tuesday, March 24, 2026 6:25 PM (1 minute)

In non-central heavy-ion collisions, due to a non-zero impact parameter, a substantial angular momentum is produced. Through spin–orbit coupling, this angular momentum can induce quark polarization, which may subsequently manifest as a net polarization of the produced hyperons and vector mesons. In contrast, the hyperon and vector meson polarization in pp collisions provides an essential baseline for disentangling medium effects from those arising purely from initial partonic interactions. In this work, we present the first measurement of ϕ meson polarization in the dimuon decay channel ($\phi \rightarrow \mu^+\mu^-$) in the forward rapidity region˜($-4.0 < y < -2.5$) in pp collisions at $\sqrt{s} = 13.6$˜TeV. The data have been collected during the LHC Run 3 period with the upgraded ALICE detector. We use the helicity frame for this polarization analysis, where the quantization axis is along the direction of momentum of the ϕ meson. This study presents, for the first time, the polarization measurement of a light vector meson at forward rapidity, providing a unique opportunity to explore possible rapidity dependence of the ϕ meson polarization.

Author: GOSWAMI, Kangkan (Indian Institute of Technology Indore)

Presenter: GOSWAMI, Kangkan (Indian Institute of Technology Indore)

Session Classification: Poster Session

Contribution ID: **35** Type: **Poster Presentation**

Effect of transverse spherocity in (mutli-)strange and charged particle production in O-O, Ne-Ne, p-O and p-Ne collisions at RHIC and LHC energies using AMPT

Tuesday, March 24, 2026 6:28 PM (1 minute)

Understanding the event geometry in high-energy collisions is essential for exploring the underlying particle production mechanisms. In this work, we employ transverse spherocity as a novel tool to classify events by their geometrical structure and analyze global observables of (multi-)strange and charged particles in oxygen-oxyegn (O-O) and neon-neon (Ne-Ne) collisions at $\sqrt{s_{NN}}$ = 5.36 TeV and 200 GeV along with proton-oxygen (p-O) and proton-neon (p-Ne) for comparison using AMPT. Events are divided into isotropic (soft) and jetty (hard) classes to explore soft and hard processes. The results reveal a clear evolution of event topology with system size and collision energy, offering insights into particle-production dynamics.

Authors: BASHIR, Hafiza Rabia (Department of Physics, University of the Punjab, Lahore, Pakistan.); ASHRAF, Muhammad Usman (Wayne State University); Dr SHEHZADI, Ramoona (University of the Punjab, Lahore, Pakistan.)

Presenters: BASHIR, Hafiza Rabia (Department of Physics, University of the Punjab, Lahore, Pakistan.); ASHRAF, Muhammad Usman (Wayne State University)

Session Classification: Poster Session

Contribution ID: **36** Type: **Oral Presentation**

Probing the QCD Phase Structure with Dileptons from SIS to LHC Energies

Tuesday, March 24, 2026 5:05 PM (20 minutes)

We explore the properties of strongly interacting matter at finite temperature and baryon chemical potential as created in relativistic heavy-ion collisions, focusing on the QCD phase structure probed via dilepton observables. The equilibrium description of the non-perturbative quark–gluon plasma (QGP) is realized within the Dynamical QuasiParticle Model (DQPM), which reproduces lattice QCD results for the equation-of-state (EoS) above the deconfinement temperature. Using this framework, we evaluate transport coefficients at finite baryon chemical potential, including the specific shear viscosity and the ratios of electric, baryon, and strange conductivities to temperature, as well as the thermal rates incorporating both elastic and inelastic (for the first time within quasiparticle model) partonic processes.

The dynamical, non-equilibrium evolution of strongly interacting matter is described within the off-shell transport approach Parton–Hadron–String Dynamics (PHSD), which consistently propagates partonic and hadronic degrees-of-freedom and their interactions based on Kadanoff–Baym theory. This allows for a microscopic realization of the QCD phase transition while maintaining energy–momentum and quantum number conservation. Chiral symmetry restoration effects are included, leading to in-medium modifications of hadronic spectral functions and strange hadron properties.

We present results for the space–time evolution of heavy-ion collisions across a wide energy range, demonstrating that a deconfined QGP core can emerge (in a small volume) even at low invariant energies of $\sqrt{s_{NN}} \simeq 3.5$ GeV. Dileptons serve as penetrating probes of the QCD medium, providing insight into its thermal and transport properties. For the first time, we report on the baryon-chemical-potential dependence of QGP thermal radiation calculated within PHSD, showing that its influence increases with decreasing collision energy. The excitation function of thermal QGP dileptons, accounting for μ_B-dependent quasiparticle masses, widths, and interactions, reveals that QGP radiation surpasses the dilepton yiels from the correlated charm decays in central Au+Au collisions at $\sqrt{s_{NN}} \leq 25 - 30$ GeV, accessible at RHIC–BES and future FAIR experiments. Furthermore, we find an increasing QGP contribution to dilepton spectra in proton–proton reactions toward LHC energies. Our results suggest that, after careful subtraction of dilepton contributions from correlated heavy-flavor and Drell–Yan sources, direct observation of QGP thermal radiation may be achieved. which demonstrates that dileptons provide a sensitive electromagnetic probe of the QCD phase structure over a broad range of temperatures and baryon densities.

References:
1. A. W. R. Jorge et al., Phys. Rev. C 111 (2025) 064904
2. I. Grishmanovskii et al., Phys. Rev. C 109 (2024) 024911

Authors: ROMERO JORGE, Adrian William (Frankfurt Institute for Advanced Studies/Goethe University Frankfurt); SONG, Taesoo (GSI, Darmstadt); GRISHMANOVSKII, Ilia (ITP, Goethe University Frankfurt); BRATKOVSKAYA, Elena (GSI, Darmstadt & Goethe Universisty Frankfurt)

Presenter: BRATKOVSKAYA, Elena (GSI, Darmstadt & Goethe Universisty Frankfurt)

Session Classification: Parallel V: Phase Structure

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

Identified charged particle production in Pb–Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.02 TeV for EPOS4

Tuesday, March 24, 2026 6:40 PM (1 minute)

The production of identified charged particles ($\pi^{\pm}$, $K^{\pm}$, $p(\overline{p})$) in Pb−Pb collisions at $\sqrt{s_{\rm NN}} = 5.02$ TeV is investigated using the EPOS4 model. Two configurations are examined: EPOS4 with and without the Ultra-relativistic Quantum Molecular Dynamics (UrQMD) hadronic transport, allowing isolation of late-stage hadronic effects. Charged-particle multiplicity ($\mathrm{d}N_{\rm ch}/\mathrm{d}\eta$), transverse momentum ($p_{\rm T}$) spectra, $p_{\rm T}$-differential and integrated yield ratios (K/π, p/π) are studied to explore the underlying dynamics of particle production. Low-$p_{\rm T}$ behavior is found to be dominated by hadronic rescattering and strangeness enhancement, evident from the centrality-dependent increase in the K/π ratio. At intermediate $p_{\rm T}$, a baryon-to-meson enhancement in the p/π ratio is observed, consistent with radial flow and quark recombination mechanisms. EPOS4 with UrQMD demonstrates improved agreement with experimental data from the ALICE collaboration, particularly in describing radial flow, and the shape of identified hadron spectra. The hadronic afterburner plays a significant role in modifying spectral shapes via baryon-antibaryon annihilation and resonance decays, demonstrating its necessity for accurate modeling of the hadronic phase. Overall, EPOS4, especially with UrQMD, provides a quantitative and coherent description of centrality and mass-dependent features of charged-particle production, highlighting the essential role of late-stage hadronic dynamics in shaping spectra and yields.

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Presenter: BHASIN, Anju (University of Jammu (IN))

Session Classification: Poster Session

Contribution ID: **38** Type: **Poster Presentation**

Decoupling the collision energy when tracking quantum number balance in small systems at LHC Run 3 with ALICE

Tuesday, March 24, 2026 6:42 PM (1 minute)

Balance functions have been extensively used to elucidate the time evolution of quark production in heavy-ion collisions. Early models predicted two stages of quark production, one for light quarks and one for the heavier strange quark, separated by a period of isentropic expansion. This led to the notion of clocking particle production and tracking radial flow effects, which drive the expansion of the system. Recent successful light-ions runs at the LHC pave the way for decoupling the potential center of mass energy contribution to such clocking and tracking.

Balance functions of identified particles in different multiplicity classes of pp, O-O, and Ne-Ne collisions at $\sqrt{s_{\rm NN}} = 5.36$ TeV recorded by the ALICE experiment during LHC Run 3 are reported. The results track the balancing of electric charge, baryon number, and strangeness by measuring how the widths and integrals of the charge, baryon number, and strangeness balance functions evolve across multiplicity classes. The different collision systems focus on system size impact decoupling the center of mass energy influence. Results from pp and p-O collisions at $\sqrt{s_{\rm NN}} = 13.6$ TeV, and 9.62 TeV, respectively, will also be shown and will provide a glimpse of the energy impact in the smallest and intermediate system sizes. Presented models comparisons will allow to constrain particle production mechanisms as well as systems evolution dynamics.

Author: GONZALEZ, Victor (Wayne State University (US))

Presenter: GONZALEZ, Victor (Wayne State University (US))

Session Classification: Poster Session

Contribution ID: **39** Type: **Poster Presentation**

Measurement of $K^{*0,\pm}$ in Au+Au Collisions at RHIC BES-II

Tuesday, March 24, 2026 6:41 PM (1 minute)

Isospin symmetry, a fundamental feature of the strong interaction, predicts similar production rates of charged and neutral kaons in high-energy collisions. However, recent measurements by NA61/SHINE indicate an excess production of charged over neutral kaons, suggesting significant isospin symmetry breaking that challenges the expectation, and the underlying origin of this effect remains unresolved [1]. Such deviations could arise from Landau-level splitting under intense magnetic fields, which can lift the degeneracy between hadrons containing up and down quarks [2]. The study of neutral and charged vector mesons in heavy-ion collisions may serve as a probe for possible isospin symmetry-breaking mechanisms triggered by strong magnetic fields in QCD matter. A notable example is the $K^{*0}(d\bar{s})$ and $K^{*\pm}(u\bar{s})$ pair, which share the same isospin but have quarks with magnetic moments differing by nearly a factor of five.

In this poster, we present precise measurements of the transverse momentum (p_T) spectra, p_T -integrated yields (dN/dy), and average transverse momentum ($\langle p_T \rangle$) of $K^{*0,\pm}$ at mid-rapidity in Au+Au collisions at $\sqrt{s_{NN}}$= 7.7 - 27 GeV, using data from the STAR Beam Energy Scan II (BES-II) program at RHIC. Centrality- and p_T- dependent yield ratios, such as $K^{*\pm}/K^{*0}$ and K^{*}/K, will be used to assess the medium effects and possible isospin-violating trends.

References

[1] NA61/SHINE Collaboration, G. Giacosa et al., "Evidence of isospin-symmetry violation in high-energy collisions of atomic nuclei", *Nat Commun* 16, 2849 (2025).

[2] K. Xu et al., "Extracting the magnitude of magnetic field at freeze-out in heavy-ion collisions", *Phys. Lett. B* 809, 135706 (2020).

Author: Mr BARIK, Pranjal (Indian Institute of Science Education and Research (IISER) Berhampur)

Presenter: Mr BARIK, Pranjal (Indian Institute of Science Education and Research (IISER) Berhampur)

Session Classification: Poster Session

Contribution ID: **40** Type: **Oral Presentation**

Probing of Equation-of-State at High Baryon Density with Baryons and (Hyper)nuclei with the PHQMD Model

Wednesday, March 25, 2026 10:55 AM (20 minutes)

Authors: Y. Zhou, J. Aichelin, C. Blume, E. Bratkovskaya, G. Coci, N. Herrmann, S. Gläßel, V. Kireyeu, Y. Leung, V. Voronyuk, I. Vassiliev, M. Winn, N. Xu, J. Zhao

The equation-of-state (EoS) at high baryon density is crucial for understanding the behavior of nuclear matter under extreme conditions. The directed flow of protons and Λ baryons has long been recognized as a sensitive probe of the high-density equation of state (EoS). Moreover, the transverse momentum and rapidity distributions, as well as the collective flow of light nuclei and hypernuclei, offer valuable opportunities to further explore and enhance the sensitivity to the properties of high-baryon-density matter.

We employ the Parton-Hadron-Quantum-Molecular Dynamics (PHQMD) model to investigate the sensitivity of various observables to different equation-of-state scenarios. We consider two static EoS models, labeled "soft"and "hard", which differ in compressibility modulus, as well as a momentum-dependent soft EoS model. In PHQMD, (hyper)nuclei are formed dynamically throughout the entire heavy-ion collision by the potential interaction between nucleons, which is sensitive to the EoS.

In this talk, we will show our recent PHQMD results compared with experimental data from STAR at $\sqrt{s_{\rm NN}} = 3$ GeV, HADES at $E_{\rm kin} = 1.23A$ GeV, and FOPI at $E_{\rm kin} = 1.2A$ and $1.5A$ GeV in Au+Au collisions. We find that the production and collective flow of light nuclei and hypernuclei are very sensitive to the choice of the nuclear equation of state. By studying these observables, we can extract valuable information about the underlying nuclear interactions and the properties of dense baryonic matter. Our results demonstrate that hypernuclei can serve as powerful probes of the high-density EoS, offering new insights for upcoming experiments such as CBM at FAIR.

Ref: arXiv:2507.14255, arXiv:2411.04969

Author: ZHOU, Yingjie (FAIR, GSI)

Presenter: ZHOU, Yingjie (FAIR, GSI)

Session Classification: Parallel VII: EoS and Astrophysics

Contribution ID: **42** Type: **Oral Presentation**

Charm-strange meson production by recombination in heavy ion collisions at \sqrt{s_{NN}}=5.02 TeV

Wednesday, March 25, 2026 9:05 AM (20 minutes)

We discuss charm-strange mesons, Ds, Ds*, Ds0*(2317), Ds1(2460), and X(3915) mesons produced from charm and strange quarks in the quark-gluon plasma in heavy-ion collisions at \sqrt{s_{NN}}=5.02 TeV. We first investigate the transverse momentum distribution of charm and strange quarks at \sqrt{s_{NN}}=5.02 TeV in the quark-gluon plasma based on transverse momentum distributions of \phi and Dˆ0 mesons. Then, we calculate the yields and transverse momentum distributions of Ds, Ds*, Ds0*(2317), Ds1(2460), and X(3915) mesons. We demonstrate that our results agree well with experimental measurements for the Ds meson and argue that the strangeness enhancement has a significant impact on the production of charm-strange mesons in heavy-ion collisions. We also present, in particular, the transverse momentum distributions and yields of Ds0*(2317) and X(3915) mesons for their various possible states, and show how their yields and transverse momentum distributions depend on their internal structures.

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

Presenter: CHO, Sungtae (Kangwon National University)

Session Classification: Parallel III: Resonances

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

Inclusive J/ψ production at midrapidity in pp collisions at $\sqrt{s} = 5.36\ \mathrm{TeV}$ with ALICE in Run3

Tuesday, March 24, 2026 6:22 PM (1 minute)

Charmonium mesons are bound states formed by a charm quark and its antiquark ($c\bar{c}$). The creation of the heavy charm–anticharm pair results from a hard partonic scattering that can be described within perturbative QCD, whereas the subsequent hadronization into a bound state is governed by non-perturbative QCD dynamics. Therefore, the study of charmonium production provides a key probe of both perturbative and non-perturbative aspects of QCD, helping to validate and constrain their theoretical descriptions. In addition, charmonium production in relativistic heavy-ion collisions serves as an important probe of the hot and dense medium known as the quark–gluon plasma (QGP), providing valuable insights into its properties through the interaction with the medium. Thus, this measurement not only provides a stringent test of theoretical predictions at the new LHC energy but also establishes an essential baseline for future studies in larger collision systems such as OO, Ne–Ne, and Pb–Pb.

In this work, we present the first measurement of inclusive J/ψ production at midrapidity ($|y| < 0.9$) via the dielectron decay channel in pp collisions at $\sqrt{s} = 5.36\ \mathrm{TeV}$, using Run 3 data collected with the ALICE detector.

Author: LEE, Hyungjun (Sungkyunkwan university)

Presenter: LEE, Hyungjun (Sungkyunkwan university)

Session Classification: Poster Session

Contribution ID: **44** Type: **Oral Presentation**

Probing the onset of collectivity with identified hadrons and ultra-long-range correlations in light-ion collisions at LHC-ALICE

Wednesday, March 25, 2026 8:45 AM (20 minutes)

Collective behaviors in pp and p–Pb collisions have sparked debate on the onset of hydrodynamics in small systems. However, the proton's poorly constrained geometry has hindered definitive conclusions. The 2025 LHC runs with OO and Ne–Ne collisions provide a unique solution: their well-defined initial states allow a direct test of whether collectivity stems from hydrodynamic flow or initial-state correlations.

In this talk, we present the first ALICE measurements of anisotropic flow (v_n) for identified hadrons ($\pi^{\pm}$, $K^{\pm}$, p($\bar{\text{p}}$), K^0_S, and Λ) and ultra-long-range two-particle azimuthal correlations with pseudo-rapidity separation $|\Delta\eta| > 6.5$ in Ne–Ne and OO collisions at the LHC. A clear mass ordering at low p_{T} and baryon–meson v_2 grouping and splitting at intermediate p_{T} are observed in light-ion collisions, consistent with partonic collectivity seen in heavy-ion systems. Combined with the long-range correlation results, these data provide stringent constraints on initial-state models and medium dynamics. This comprehensive study bridges the gap between pp and heavy-ion collisions, offering decisive insights into the origin and onset of hydrodynamic behavior in the smallest QCD systems.

Authors: ALICE COLLABORATION; PATI, Preet Bhanjan (Niels Bohr Institute, Copenhagen)

Presenter: PATI, Preet Bhanjan (Niels Bohr Institute, Copenhagen)

Session Classification: Parallel VI: Correlations

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

Anisotropic flow in ultra-central Pb–Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.36 TeV with ALICE

Tuesday, March 24, 2026 6:43 PM (1 minute)

Anisotropic flow measurements in heavy-ion collisions are sensitive to the spatial distribution of the initial state and to the transport properties of the quark–gluon plasma, such as the shear viscosity to entropy density ratio (η/s). Hydrodynamic models provide a successful description of flow observables over a wide centrality range, yet deviations from data are observed in ultra-central collisions. An intrinsic octupole deformation of the ^{208}Pb nucleus has been proposed as a possible explanation for these deviations in Pb–Pb collisions, as it could influence the ratio $v_3\{2\}/v_2\{2\}$ and induce characteristic fluctuations in triangular flow, quantified through $v_3\{4\}/v_3\{2\}$.

Measurements of the anisotropic flow coefficients in ultra-central Pb–Pb collisions at $\sqrt{s_{\rm NN}} = 5.36$ TeV with LHC Run 3 data collected by ALICE are presented. The ratios $v_3\{2\}/v_2\{2\}$ and $v_3\{4\}/v_3\{2\}$ are discussed in the context of possible octupole deformation, together with the performance of recent hydrodynamic models in reproducing these observations.

Authors: ALICE COLLABORATION; LIKMETA, Iris (Univ. of Houston)

Presenter: LIKMETA, Iris (Univ. of Houston)

Session Classification: Poster Session

Contribution ID: **46** Type: **Poster Presentation**

Probing collectivity and quantum number conservation with strange baryon balance function with ALICE at LHC energies

Tuesday, March 24, 2026 6:32 PM (1 minute)

Balance function (BF) of strange baryons is sensitive to the production and transport of strange quarks and their hadronization to strange baryons during the evolution of the system formed in nuclear collisions. It is also sensitive to quark diffusion in the hot and dense QCD matter as well as to the strangeness and baryon susceptibilities.

In this work, measurements of the Λ balance function in different multiplicity classes of pp collisions at $\sqrt{s} = 13.6$ TeV with the ALICE detector at the LHC are presented. The longitudinal and azimuthal widths, as well as the integral of the BF, are studied. These observables provide information on the time of hadronization, collective expansion, and possible formation of baryon junctions in the system, while their evolution with multiplicity offers insight into how these processes change from dilute to dense collision environments.

Comparisons with Monte Carlo event generators provide further understanding of the correlated production of strange–antistrange baryons and help constrain the relevant parameters of these models. The results demonstrate that the Λ balance function is an excellent tool to probe the simultaneous production of strangeness and baryon number in different density scenarios of high-energy nucleon–nucleon collisions.

Authors: ALICE COLLABORATION; PATLEY, Yash (IIT Mumbai)

Presenter: PATLEY, Yash (IIT Mumbai)

Session Classification: Poster Session

Contribution ID: **49** Type: **Oral Presentation**

Exploring nuclear structure and sub-nucleonic geometry with multi-particle correlations in Ne-Ne and OO collisions with ALICE at the LHC

Tuesday, March 24, 2026 11:35 AM (20 minutes)

Recent LHC results have demonstrated that small collision systems can exhibit collective behavior reminiscent of that observed in heavy-ion collisions, opening a new frontier for exploring the connection between nuclear structure and collective dynamics at ultrarelativistic energies. In this talk, we present the first measurements of multi-particle cumulants (up to eight-particle) for v_2 and v_3, along with mixed-harmonic observables such as $\mathrm{NSC}(2,3)$, $\mathrm{NSC}(2,4)$, and $\mathrm{NSC}(2,3,4)$, in Ne–Ne and OO collisions at the LHC. These measurements carry unique sensitivity to the initial-state geometry and its event-by-event fluctuations, enabling direct investigation of the nuclear structure, i.e., α-cluster configurations, of ^{20}Ne and ^{16}O at the TeV energy scale for the first time.

Additionally, the correlation between anisotropic flow and mean transverse momentum, $\rho(v_n, [p_\mathrm{T}])$, has been measured for the first time in light-ion collisions, offering a direct probe of the shape-size correlations in the initial conditions. These new results exhibit novel sensitivity to the effective nucleon and sub-nucleon density widths, which play a critical role in defining the initial QCD energy density and, consequently, the emergence of collective flow. Together, these measurements provide unprecedented constraints on models of the initial state, connecting the domains of nuclear structure and QGP collectivity in small, well-defined collision systems.

Authors: ALICE COLLABORATION; MACHACEK, Vojtech (Niels Bohr Institute, Copenhagen)

Presenter: MACHACEK, Vojtech (Niels Bohr Institute, Copenhagen)

Session Classification: Parallel VII: EoS and Astrophysics

Contribution ID: **52** Type: **Poster Presentation**

Measurement of the transverse-momentum fraction of (multi-)strange particles in mini-jets and its multiplicity dependence in pp collisions at $\sqrt{s}$=13 TeV with ALICE

Tuesday, March 24, 2026 6:33 PM (1 minute)

The enhancement of the strange baryon-to-meson yield ratio at intermediate transverse momentum (p_{T}) observed by ALICE across small to large collision systems is usually attributed to collective radial flow and quark recombination effects. Nevertheless, it remains under discussion whether jet fragmentation also contributes to the observed enhancement, as strange particles in the enhanced p_{T} range may also come from low-energy partons. ALICE has previously measured the production rates of (multi-)strange particles in high-energy jets in pp and p–Pb collisions to probe the hadronization mechanism in small systems. Recently, ALICE investigated the momentum fraction carried by the (multi-)strange particles with respect to their originating partons using a novel angular correlation method. This method allows access to a significantly lower-p_{T} region and provides further insights into the hadronization process.

In this contribution, the average transverse-momentum fractions ($\langle z \rangle$) of the strange particles in mini-jets in pp collisions at $\sqrt{s} = 13$ TeV are reported as a function of the strange particles' p_{T}. The observed $\langle z \rangle$ values suggest that (multi-)strange particles are predominantly produced via fragmentation of low-energy partons. Furthermore, the charged-particle multiplicity dependence of $\langle z \rangle$ is presented. No significant multiplicity dependence is observed for $\Lambda(\bar{\Lambda})$ and $\Xi^{+}(\Xi^{-})$, challenging the picture in which quark recombination is considered the dominant production mechanism in high-multiplicity hadronic collisions.

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Presenter: XU, Lang (IP2I, CNRS-Lyon U, Lyon)

Session Classification: Poster Session

Contribution ID: **53** Type: **Oral Presentation**

Study of charm fragmentation with charm meson and baryon angular correlation measurements with ALICE

Tuesday, March 24, 2026 2:55 PM (20 minutes)

The study of charm-quark production and hadronisation provides crucial insights into the mechanisms of Quantum Chromodynamics (QCD) at the interface between the perturbative and non-perturbative regimes. Differential measurements of jets containing charm hadrons further shed light on QCD processes such as parton-shower evolution and hadronisation. In particular, angular correlations between charm hadrons and charged particles provide valuable information on charm-jet topology and charm-quark hadronisation. Such studies also help to test and constrain theoretical models and Monte Carlo generators describing charm production in proton–proton (pp) collisions.
This contribution presents ALICE measurements of angular correlations between charm hadrons and charged particles in pp collisions at $\sqrt{s} = 13.6$ TeV. The azimuthal correlations are studied separately for charm mesons with and without strange quarks and for charm baryons, providing tools to characterise charm hadronisation via the structure and composition of the associated charm jet. Measurements of heavy-flavour correlations with identified particles are also presented, aimed at testing local quantum-number conservation. Together, these results provide new insights into charm fragmentation and hadron formation in small collision systems.

Authors: COLLABORATION, ALICE; SINGH, Ravindra (INFN Padova)

Presenter: SINGH, Ravindra (INFN Padova)

Session Classification: Parallel VI: Correlations

Contribution ID: **54** Type: **Oral Presentation**

In-medium modification of azimuthal correlations of charm mesons and charged particles in light- and heavy-ion collisions with ALICE

Tuesday, March 24, 2026 2:15 PM (20 minutes)

Due to their large masses, heavy quarks (charm and beauty) are predominantly produced in the initial hard-scattering processes. They serve as effective probes of the quark–gluon plasma (QGP) expected to form in heavy-ion collisions, as they traverse and interact with the constituents of the medium throughout its entire evolution. In these collisions, the measurement of the angular correlations of charm mesons with charged hadrons complements the measurement of single-particle observables as the nuclear modification factor and the elliptic flow providing insights into the interplay between parton energy loss in the medium and hadronisation mechanisms.

In this contribution, we present the azimuthal correlation of prompt D_s^+–h and prompt D^+–h pairs in Pb–Pb (O–O) collisions. These measurements provide a multidifferential characterisation of the charm hadronisation process and new insights into charm-jet structure. A comparison between the two mesons allows us to study the different properties of charm jets when charm hadronises to a strange rather than a non-strange hadron. In addition, azimuthal correlation distributions of heavy-flavour hadron decay electrons–h pairs in pp, p–Pb and Pb–Pb collisions will be reported to investigate possible medium-induced modifications. The results are compared to Monte Carlo simulations to provide further constraints on charm fragmentation and hadronisation models.

Authors: COLLABORATION, ALICE; CATTARUZZI, Samuele (Univ. of Trieste)

Presenter: CATTARUZZI, Samuele (Univ. of Trieste)

Session Classification: Parallel VI: Correlations

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

Probing space–time characteristics and collective dynamics of light-ion collisions via femtoscopy with ALICE

Tuesday, March 24, 2026 6:37 PM (1 minute)

Identical-particle femtoscopy is a powerful tool to probe the space–time structure of the particle-emitting source created in relativistic heavy-ion collisions, through correlations of particle pairs at small relative momenta. Femtoscopic correlations measured by ALICE with Run 3 data for both identical charged pions and protons in OO and Ne–Ne collisions at $\sqrt{s_{\mathrm{NN}}} = 5.36$ TeV are presented.

The 3D pion–pion and 1D proton–proton femtoscopic radii are extracted in several intervals of pair transverse momentum and event multiplicity, also employing spherical harmonic decomposition. These measurements provide new insights into the space–time structure of the particle-emitting source in small collision systems, its relation to collective effects, and extend previous heavy-ion results to offer a more comprehensive picture of the evolution of source sizes across different collision systems.

Author: ALICE, Collaboration

Presenter: ALICE, Collaboration

Session Classification: Poster Session

Contribution ID: **56** Type: **Oral Presentation**

Probing strong interactions in charm hadron-–light particle systems with femtoscopy with ALICE

Tuesday, March 24, 2026 10:55 AM (20 minutes)

Studies of strong interactions between hadrons provide a unique opportunity to test Quantum Chromodynamics calculations at nucleon-scale distances. The femtoscopy technique, based on measuring correlations of hadron pairs in momentum space, has proven to be a powerful tool to study interactions involving short-lived particles. While strong interactions among light and strange hadrons have been extensively investigated, corresponding studies for charm hadrons remain scarce. Such measurements can provide insights into the possible formation of exotic charm states or, in the baryon sector, nuclei containing charm quarks.

In this contribution, we present femtoscopic measurements of the strong interaction between charm and light-flavor hadrons. The first-ever measurements of correlation functions of protons with Λ_c^+ baryons and D^+ mesons in pp collisions at $\sqrt{s} = 13.6$ TeV, using the large LHC Run 3 dataset, are presented. Moreover, a new measurement of the proton–D^- meson correlation function obtained with pp collisions collected during LHC Run 3, which significantly improves the precision of the previous ALICE result based on Run 2 data, is discussed. These measurements open a new avenue for exploring charm–hadron interactions and their role in the formation of charm-baryon bound states.

Authors: COLLABORATION, ALICE; LIU, Yunfan (Central China Normal University)

Presenter: LIU, Yunfan (Central China Normal University)

Session Classification: Parallel VI: Correlations

Contribution ID: **57** Type: **Oral Presentation**

Charm-quark collectivity from small to large systems with ALICE

Tuesday, March 24, 2026 4:25 PM (20 minutes)

Charm quarks, produced in the earliest stages of high-energy heavy-ion collisions due to their large masses, are sensitive to the full evolution of the strongly interacting medium and serve as unique probes of its collective properties. Measuring the elliptic flow (v_2) of open-charm hadrons across different collision systems provides crucial insight into the onset and strength of collectivity in QCD matter and constrains the parameters governing heavy-quark dynamics.

In this contribution, we present a comprehensive overview of charm-hadron elliptic flow measurements with the ALICE detector, offering a unified picture of charm-quark collectivity from small to large collision systems.
Measurements of D^0–hadron angular correlations reveal collective-like effects even in in pp collisions at $\sqrt{s} = 13.6$ TeV, challenging conventional expectations. The first measurement of charm-hadron v_2 in O–O collisions at $\sqrt{s_{\mathrm{NN}}} = 5.36$ TeV extends heavy-flavour flow studies to an intermediate system bridging pp and Pb–Pb, and offering new constraints on the charm spatial diffusion coefficient (D_{s}). The O–O results are discussed alongside the latest Pb–Pb measurements at $\sqrt{s_{\mathrm{NN}}} = 5.36$ TeV, which provide the most precise determination to date of D-meson and Λ_{c} v_2. The comparison between strange and non-strange D mesons and between mesons and baryons sheds light on the partonic origin of charm flow and the role of quark recombination in hadronization.

Authors: COLLABORATION, ALICE; DI COSTANZO, Marcello (Politecnico Torino)

Presenter: DI COSTANZO, Marcello (Politecnico Torino)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **58** Type: **Oral Presentation**

First experimental study of axial-vector meson–nucleon interactions using p–f_1 correlations with ALICE

Tuesday, March 24, 2026 11:55 AM (20 minutes)

Chiral symmetry in QCD is expected to be partially restored at high temperature and/or baryon density, where the chiral condensate that generates most hadron masses decreases. A key manifestation of this restoration is the degeneracy in mass of chiral partners such as vector and axial-vector mesons. To identify these effects, it is essential to achieve a precise understanding of the interaction between vector mesons and nucleons, which plays a crucial role in their in-medium modifications. However, this has long been inaccessible to experiments due to the short lifetimes of these mesons.

ALICE has demonstrated that such residual strong interactions can be probed via femtoscopy through two-particle relative-momentum correlations. In this contribution, the first experimental study of strong interaction effects in the axial-vector meson sector is presented, via the p–f_1 correlation function measured in pp collisions by ALICE and enabled by the large data samples collected during LHC Run 3. Together with p–ρ results and chiral-unitary calculations, these results provide new constraints on nucleon–(axial-)vector meson interactions and their connection to chiral dynamics.

Authors: ALICE COLLABORATION; KUNDU, Sourav (CERN)

Presenter: KUNDU, Sourav (CERN)

Session Classification: Parallel VI: Correlations

Contribution ID: **59** Type: **Oral Presentation**

Probing three-body dynamics of Λ and Ξ^- hyperons with nucleons in ALICE

Wednesday, March 25, 2026 9:25 AM (20 minutes)

Understanding the interaction of strange baryons with nucleons is a key ingredient for describing dense baryonic matter, where the appearance of hyperons in the cores of neutron stars is expected to strongly soften the equation of state, hence limiting the maximum stellar mass. New constraints, not only on two-body but also on multi-body hyperonic interactions, are necessary to address this problem. So far, several attempts to include three-body forces have relied on scarce experimental information from hypernuclei, where existing data on Λ hypernuclei are far less precise than theoretical predictions, and only a few Ξ^- hypernuclei events have been observed.

In this contribution, new high-precision femtoscopic measurements from the ALICE experiment are presented, probing three-body systems containing protons and hyperons via the Λ–p–p and Ξ^-–p–p correlation functions in pp and Pb–Pb collisions. Preliminary theoretical studies indicate that the effect of three-body forces on the p–p–Λ correlation function could reach 40%, a level achievable with Run 3 statistics. Comparisons across different collision systems and centralities provide information on the extent to which three-body forces can be tested with increasing source size. The coupled-channel nature of p–Ξ^- pairs is addressed by confronting recently updated calculations with the p–Ξ^- correlation function measured in pp collisions at 13.6 TeV. These results open a new path toward quantifying three-body effects in the strangeness sector, with direct implications for modeling dense nuclear matter and the neutron star equation of state.

Authors: ALICE, Collaboration; DEL GRANDE, Raffaele (CT University Prague)

Presenter: DEL GRANDE, Raffaele (CT University Prague)

Session Classification: Parallel VI: Correlations

Contribution ID: **60** Type: **Oral Presentation**

New femtoscopic constraints on the ΣN interaction from pp collisions at $\sqrt{s} = 13.6$ TeV with ALICE

Wednesday, March 25, 2026 11:35 AM (20 minutes)

The properties of dense astrophysical objects, such as neutron stars, are governed by the equation of state of nuclear matter. At the extreme baryon densities reached in their cores, hyperons are expected to appear as energetically favorable degrees of freedom. Constraining hyperon–nucleon interactions is therefore essential for accurate astrophysical modeling. However, in the case of the ΣN interaction, the experimental information scarce.

In this contribution, unprecedented precision results on Σ^-p and Σ^+p correlations measured by ALICE in pp collisions at $\sqrt{s} = 13.6$ TeV during the LHC Run 3 are presented. These measurements are made possible thanks to the excellent tracking capabilities of the new Inner Tracking System, which allows the reconstruction of charged Σ hyperons via their decay to a neutral particle and a charged daughter, identified by the characteristic kink topology of the decay.

The measured correlation functions provide direct access to the strong interaction effects, enabling comparisons with different theoretical interaction potentials. These new results complement the previous Σ^+p femtoscopic measurements performed by ALICE in Run 2, and pave the way for improved constraints on the strength and isospin dependence of the ΣN interaction, offering essential insights for the equation of state of dense nuclear matter.

Authors: ALICE COLLABORATION; FRIBERT, Henrik (TU Munchen)

Presenter: FRIBERT, Henrik (TU Munchen)

Session Classification: Parallel VII: EoS and Astrophysics

Contribution ID: **61** Type: **Oral Presentation**

Searching for echoes of criticality in OO collisions with ALICE

Tuesday, March 24, 2026 2:35 PM (20 minutes)

Lattice QCD calculations predict the existence of a crossover between a deconfined, thermalised partonic phase and the hadronic phase under conditions of exact baryon–antibaryon symmetry. Fourth-order baryon-number susceptibilities show significant deviations from the hadron resonance gas across the crossover, carrying information on residual criticality associated with the chiral phase transition. Ratios of these susceptibilities correspond to baryon-number cumulant ratios, making them ideal observables to probe the nature of the phase transition at the LHC, where the baryon chemical potential is compatible with zero.

Recent results from the ALICE Collaboration in OO collisions suggest that phenomena typically associated with a deconfined phase, such as geometry-driven hydrodynamic flow, also emerge in light-ion interactions. This highlights the need for detailed measurements to characterise the system created in such collisions.

The first measurement of net-proton cumulant ratios up to the fourth order in OO collisions at $\sqrt{s_{\mathrm{NN}}} = 5.36$ TeV is presented. These quantities, serving as proxies for net-baryon cumulants, provide new insight into a possible crossover in light-ion collisions. Comparisons of multiplicity-dependent results with pp collisions, where no phase transition is expected, and with models describing a non-critical baseline, enable a quantitative assessment of criticality in light-ion systems and the onset of the crossover at the LHC.

Authors: ALICE COLLABORATION; CIACCO, Mario (Univ. of Torino)

Presenter: CIACCO, Mario (Univ. of Torino)

Session Classification: Parallel V: Phase Structure

Contribution ID: **63** Type: **Oral Presentation**

Quarkonia collectivity from small to large collision systems with ALICE

Wednesday, March 25, 2026 11:15 AM (20 minutes)

Quarkonia are key probes of the quark-gluon plasma (QGP). Their azimuthal anisotropies, quantified by flow coefficients, provide insight into the collective behavior and degree of thermalization of heavy quarks in the medium. In particular, the elliptic flow v_2 of the J/ψ meson in Pb-Pb collisions at the LHC has revealed significant collectivity, supporting scenarios of charm-quark thermalization and (re)generation at low transverse momentum. Complementary measurements of the Y(1S) elliptic flow provide information on the response of beauty quarks, which are expected to couple less strongly with the medium than charm quarks, due to their larger mass. In addition, the observation of collective-like effects in high-multiplicity pp and p-Pb collisions raises questions about the origin of collectivity and the minimal conditions needed for QGP formation.

In this contribution, measurements of quarkonium elliptic flow from small (pp) to large (Pb-Pb) collision systems carried out by ALICE using Run 3 data will be presented. Elliptic flow of J/ψ in Pb-Pb collisions at $\sqrt{s_{\rm NN}}$ = 5.36 TeV using the event-plane, scalar product, and multi-particle cumulants will be discussed, as well as the v_2 of Y(1S). These results will be compared with theoretical models. Finally, new results on J/ψ flow in pp collisions at $\sqrt{s}$ = 13.6 TeV at midrapidity will be presented, further investigating the emergence of collective behavior in high-energy collisions.

Authors: COLLABORATION, ALICE; YADAV, Ankur (Bonn University)

Presenter: YADAV, Ankur (Bonn University)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **64** Type: **Poster Presentation**

Measurement of A>2 (anti)nuclei production in pp at $\sqrt{s}$ = 13.6 TeV by ALICE

Tuesday, March 24, 2026 6:30 PM (1 minute)

The production of light antinuclei with mass number A>2 in cosmic rays has long been regarded as a promising indirect signature of dark matter annihilation in the Galaxy, owing to the extremely low expected astrophysical background. A precise understanding of these background contributions, arising from interactions of primary cosmic rays with the interstellar medium, is therefore essential. Equally important is a detailed description of the formation mechanisms of these bound states, which govern their production both in dark matter–induced and standard astrophysical processes. Such mechanisms can be experimentally studied in pp collisions at the LHC. In this talk, the ALICE Collaboration presents high-precision measurements of (anti)He3 and (anti)He4 production in pp collisions at 13.6 TeV, based on the large data samples collected during Run 3. The measured integrated yields and transverse momentum spectra are compared with predictions from state-of-the-art coalescence and statistical hadronisation models. These results provide new insights into the mechanisms governing (anti)nuclei production and shed light on the differences observed in the modeling of A=3 and A=4 states across different collision systems.

Author: ALICE, Collaboration

Presenter: ALICE, Collaboration

Session Classification: Poster Session

Contribution ID: **66** Type: **Oral Presentation**

Measurement of He^3 and hypertriton flow in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.36 TeV with ALICE

Tuesday, March 24, 2026 4:45 PM (20 minutes)

Among the various light-flavoured species produced in heavy-ion collisions, light (anti)nuclei present a unique challenge to hadronization models due to their small binding energies compared to the chemical freeze-out temperature of the system. The statistical hadronization model describes their production as part of the same thermal framework that successfully reproduces the yields of all light-flavoured hadrons. In contrast, coalescence models assume that nuclear clusters form from nearby nucleons being close in phase space. Recent measurements of the absolute yields of A=3 (hyper)nuclei in Pb–Pb collisions by the ALICE Collaboration show a slight preference for the coalescence picture, although no definitive conclusion has been reached, motivating further investigations of the production mechanism. In this contribution, the ALICE Collaboration presents measurements of the elliptic flow of ^{3}He and $^3_\Lambda$H. This observable, which quantifies the transverse-momentum anisotropy arising from the initial collision geometry, provides additional means to constrain models of (hyper)nuclear formation. The results, obtained from Pb–Pb collisions at 5.36 TeV collected during Run 3 of the LHC, are compared with state-of-the-art hydrodynamical calculations, also including nuclear coalescence effects in the final state, providing new insights into the production of loosely bound states in heavy-ion collisions.

Authors: ALICE COLLABORATION; BARIOGLIO, Luca (INFN Torino)

Presenter: BARIOGLIO, Luca (INFN Torino)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **67** Type: **Oral Presentation**

Strangeness production in light-ion collisions with ALICE at the LHC

Tuesday, March 24, 2026 8:45 AM (20 minutes)

Measurements in pp and p–A collisions have revealed that small collision systems exhibit most of the signs traditionally attributed to heavy-ion collisions, such as the smooth increase of the strange hadron yields with the collision multiplicity (strangeness enhancement). A key question is how these effects evolve with system size and whether they can be described within a unified framework.

The recently collected data by ALICE of OO collisions at $\sqrt{s_{NN}} = 5.36$ TeV provide an unprecedented opportunity to explore an intermediate-size system that naturally bridges the gap between pp/p–A and Pb–Pb collisions. In this contribution, we present results on the production of strange particles (K^0_S, Λ, Ξ, and Ω) as a function of charged-particle multiplicity in OO collisions. This allows us to investigate strangeness enhancement across different system sizes at comparable multiplicities, providing new insights into the mechanisms of strangeness production. The experimental results are compared with model predictions from various Monte Carlo generators.

Authors: ALICE COLLABORATION; PUCILLO, Sara (Univ. & INFN Salerno)

Presenter: PUCILLO, Sara (Univ. & INFN Salerno)

Session Classification: Parallel I: Strangeness and HF

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

Multiplicity dependence of strange hadron production in- and out-of-jets in pp collisions with ALICE

Tuesday, March 24, 2026 6:31 PM (1 minute)

At the LHC, the ALICE experiment has observed that the yield ratios of strange to non-strange hadrons increase with charged-particle multiplicity at midrapidity, following a smooth evolution across collision systems, spanning over three orders of magnitude in multiplicity and saturating in central Pb–Pb events. Various models have been proposed to explain the origin of strangeness production in small systems, including statistical hadronization with canonical suppression and color rope hadronization including color reconnection. Experimental efforts focus on identifying observables and phase-space regions where these models make distinct predictions in order to disentangle their underlying mechanisms.

In this contribution, we present the first measurement of strange-hadron production inside and outside fully reconstructed jets as a function of event multiplicity in pp collisions, exploiting the unprecedented statistics collected during Run 3. These results provide new insights into the relative roles of hard and soft QCD processes in shaping the observed evolution of strangeness production with multiplicity.

Author: ALICE, Collaboration

Presenter: ALICE, Collaboration

Session Classification: Poster Session

Contribution ID: **69** Type: **Oral Presentation**

Beauty production studies via quarkonia measurements with ALICE

Wednesday, March 25, 2026 9:05 AM (20 minutes)

Charm and beauty quarks are produced at the earliest stages of ultrarelativistic heavy-ion collisions through hard scattering processes. Quarkonium production serves as a probe of the perturbative aspects of quantum chromodynamics (QCD) through heavy-quark production in the initial hard scattering, while the non-perturbative aspects play a crucial role in the subsequent formation of the heavy quark-antiquark bound state. Moreover, charmonium production can be separated into two main components: a prompt contribution from directly produced charm–anticharm pairs and a non-prompt contribution originating from the decays of beauty hadrons.
In this talk, measurements of prompt and non-prompt J/ψ production performed by the ALICE Collaboration in pp and Pb–Pb collisions will be presented at midrapidity ($|y| < 0.8$) and forward rapidity ($2.5 < y < 3.6$). Thanks to the upgraded ALICE detector in Run 3 and the high-luminosity data collected, the first preliminary measurements of the $B^{\pm}$ meson production cross section at midrapidity in pp collisions at $\sqrt{s}$ = 13.6 TeV will be shown, along with the first results on prompt and non-prompt ψ(2S) production at midrapidity. The experimental results will be compared with existing theoretical model predictions.

Authors: COLLABORATION, ALICE; STOREHAUG, Ida (Univ. of Oslo)

Presenter: STOREHAUG, Ida (Univ. of Oslo)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **72** Type: **Oral Presentation**

Local Lambda polarization in light-ion with ALICE at LHC

Tuesday, March 24, 2026 9:45 AM (20 minutes)

Ultra-relativistic nuclear collisions create strongly interacting matter at extreme temperatures and energy densities, forming a quark–gluon plasma (QGP). Its space-time evolution is characterized by strong collective expansion, giving rise to anisotropic flow and demonstrating its nearly perfect fluid nature. This anisotropic motion generates local shear and vorticity along the beam direction, which induces a longitudinal component of hadron polarization via spin-orbit coupling. Measurements in heavy-ion collisions have revealed non-zero local Λ[uds] polarization, establishing it as a sensitive probe of the local vortical structure of the QGP. In contrast, light-ion collisions provide smaller, shorter-lived systems, where collectivity may be reduced or only emerging, offering a unique opportunity for testing the limits of hydrodynamics, the role of initial-state effects, and the mechanisms of angular-momentum transport at the smallest scales.
In this talk, we present new measurements of local Λ polarization in light-ion collisions with the ALICE detector at the LHC. By comparing these results with observations in Pb–Pb, theoretical predictions and the available measurements from the CMS collaboration in p-Pb collisions, we probe the onset of vortical phenomena in small systems and assess the minimal conditions required for the emergence of spin-vorticity coupling in QCD matter.

Author: ALICE COLLABORATION

Presenter: ALICE COLLABORATION

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

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

System-size dependence of charged-particle production at both mid and forward pseudorapidity with ALICE

Tuesday, March 24, 2026 6:16 PM (1 minute)

Particle production at LHC energies arises from the interplay between hard and soft QCD processes and is sensitive to non-linear QCD evolution in the initial state. In July 2025, the LHC delivered short light-ion runs, pO, OO, and Ne−Ne collisions, providing a unique opportunity to bridge the gap between proton−proton and heavy−ion collisions. These systems allow us to study and investigate how nuclear geometry and system size influence the mechanisms of underlying particle production. In this talk, we present new measurements of charged-particle pseudorapidity densities ($\mathrm{d}N_{\mathrm{ch}}/\mathrm{d}\eta$) in light-ion collisions, at both mid and forward rapidities, and compare them with earlier results from pp and Pb−Pb collisions. The results will be compared with various theoretical models based on different initial interactions, e.g., to what degree the nucleon/nuclei interact as dilute (partons) or dense (Color Glass Condensate-like) fields.

Author: ALICE, Collaboration

Presenter: ALICE, Collaboration

Session Classification: Poster Session

Contribution ID: **76** Type: **Oral Presentation**

Constraining the hadronic phase in light-ions with resonance measurements with ALICE

Tuesday, March 24, 2026 10:05 AM (20 minutes)

Hadronic resonances are a valuable tool for studying the strongly interacting matter created in relativistic heavy-ion collisions. Their short lifetimes make them sensitive probes of the late hadronic stage, where competing rescattering and regeneration processes can modify momentum and azimuthal distributions. Rescattering of decay daughters can alter their momenta, preventing the reconstruction of the parent resonance, while regeneration through pseudo-elastic interactions can enhance the signal. These effects can modify final-state observables such as spectra, yields, and flow harmonics in the hadronic phase. Light-ion collisions (OO and Ne–Ne) can bridge small (pp) and large (Pb–Pb) collision systems. A comparative study of short-lived (K^0_s) and long-lived (ϕ) resonances offers an ideal probe of the onset and duration of the hadronic phase and the underlying interaction dynamics.

This contribution will present new ALICE results on K^0_s and ϕ meson production in light-ion collisions, including their yields, transverse momentum spectra, flow harmonics, and nuclear modification factors. The measurements are compared with previous results and state-of-the-art model predictions, providing new insights into the properties of the hadronic medium and the mechanisms governing resonance production.

Authors: ALICE COLLABORATION; GAMI, Sarjeeta (NISER, India)

Presenter: GAMI, Sarjeeta (NISER, India)

Session Classification: Parallel III: Resonances

Contribution ID: **77** Type: **Oral Presentation**

Search of exotic resonances in proton-proton and Λnn hypernuclei in Pb–Pb collisions with ALICE

Tuesday, March 24, 2026 9:25 AM (20 minutes)

Exotic particles are those whose internal structure is not well understood and cannot be accurately described by state-of-the-art theoretical models or predictions. Current hypotheses regarding the nature of these exotic particles range from conventional mesons and baryons to multiquark configurations (such as tetraquarks), glueballs composed of valence gluons, and molecularly bound states formed between hadrons. The internal structure of some of these molecular states remains uncertain as well, with interpretations varying from traditional hadronic bound states to more complex three-body resonance configurations. Understanding the underlying structure and dynamics of these states can provide valuable constraints to hadronization mechanisms and improve our comprehension of non-perturbative effects in the strong interaction.

This contribution will present a broad array of different measurements from ALICE measured during both LHC Run 2 and Run 3. We present the first measurement of the transverse momentum spectra of the lightest resonance scalar glueball candidate in the $K^0_s K^0_s$ decay channel in pp collisions at 13.6 TeV. This is followed by a measurement of the upper limit on the production of bound Λnn hypernuclei in Pb–Pb collisions at 5.36 TeV, which is compared to predictions from the statistical hadronization model. Lastly, the production of $f_0(980)$ and $f_1(1285)$ measured from pp collisions at both 13 and 13.6 TeV are presented, accompanied by comparisons to conventional resonances with well-known quark structures.

Authors: ALICE COLLABORATION; SAWAN, Sawan (NISER, India)

Presenter: SAWAN, Sawan (NISER, India)

Session Classification: Parallel III: Resonances

Contribution ID: **78** Type: **Oral Presentation**

Quarkonia production and collectivity in light-ion collisions with ALICE

Wednesday, March 25, 2026 11:55 AM (20 minutes)

Quarkonium production has long been considered as one of the golden probes to study the quark-gluon plasma (QGP). In fact, the early production of heavy quarks ($c\bar{c}$ and $b\bar{b}$) makes quarkonia an ideal tool to investigate the evolution of the hot and dense medium produced in ultra-relativistic heavy-ion collisions. Moreover, at LHC energies the recombination of uncorrelated charm quarks pairs, namely (re)generation, was found to significantly affect charmonium observables, in contraposition to the well known suppression mechanism. On the other hand, measurements in smaller collision systems as p-Pb have highlighted the possibility to observe QGP-like effects, such as the larger relative suppression of the ψ(2S) with respect to the J/ψ. In this context, the study of charmonia production in intermediate collision systems, as light-ion collisions, becomes more and more interesting, representing an ideal test ground for the state-of-the art theoretical models.

In this contribution the new measurements of charmonia production and elliptic flow will be shown using the data collected for the first time at the LHC in 2025 in light-ion collisions (Oxygen-Oxygen, proton-Oxygen and Neon-Neon). The results will be shown exploiting the full ALICE rapidity coverage at mid ($|y| < 0.8$) and forward ($2.5 < y < 4$) rapidity. Finally, the measurements will be compared with the existing theoretical models.

Authors: COLLABORATION, ALICE; CERRI, Rebecca (Univ. of Torino)

Presenter: CERRI, Rebecca (Univ. of Torino)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **81** Type: **Poster Presentation**

Measurement of the $\mathrm{B}^{\pm}$-meson production cross section in proton-proton collisions at $\sqrt{s} = 13.6$ TeV with ALICE

Tuesday, March 24, 2026 6:49 PM (1 minute)

Beauty quarks, produced in the initial hard scatterings of heavy-ion collisions, are sensitive to the entire evolution of the quark–gluon plasma (QGP) and thus serve as excellent probes of its properties. Since beauty quarks are detected through their hadronic decays, understanding both their production and subsequent hadronization is essential if we want to use them as reliable QGP probes. The production cross section of $\mathrm{B}^{\pm}$ mesons provides an important test of perturbative QCD (pQCD) calculations and beauty hadronization models. The latter remains under active investigation, as measurements indicate tensions between data and model predictions, particularly at low transverse momentum (p_{T}).

With Run 3, ALICE can access beauty production in the low-p_{T} region for the first time at LHC energies. The improved vertex resolution and increased interaction rate enable beauty measurements through the direct reconstruction of the secondary vertex, down to $p_{\mathrm{T}} \approx 0$ GeV/c at midrapidity. In this poster, we present the first measurement of the $\mathrm{B}^{\pm}$-meson production cross section in ALICE in pp collisions at $\sqrt{s} = 13.6$ TeV, reconstructed via $\mathrm{B}^{\pm} \to \mathrm{J}/\psi\, K^{\pm}, \mathrm{J}/\psi \to e^{+}e^{-}$, and compare them with theoretical calculations. These studies aim at contributing to a more complete understanding of beauty production and hadronization, laying the groundwork for using $\mathrm{B}^{\pm}$ mesons as probes of the QGP in Pb–Pb collisions in ALICE.

Author: STOREHAUG, Ida (University of Oslo (NO))

Presenter: STOREHAUG, Ida (University of Oslo (NO))

Session Classification: Poster Session

Contribution ID: **84** Type: **Poster Presentation**

Glueball search in pp collisions at $\sqrt{s} = 13.6$ TeV with the ALICE detector

Tuesday, March 24, 2026 6:24 PM (1 minute)

Quantum Chromodynamics (QCD) predicts the existence of gluonic bound states known as \textit{glueballs}, composed entirely of gluons. Their experimental identification remains elusive due to possible mixing with nearby scalar mesons. The high-statistics proton–proton data at $\sqrt{s} = 13.6$ TeV recorded with the ALICE detector provide a new opportunity to explore such states. In this work, resonances reconstructed via the $\mathrm{K^0_S K^0_S}$ decay channel are studied at midrapidity. Masses and widths are extracted and compared with lattice-QCD predictions for the lightest scalar glueball candidate. Transverse-momentum spectra and yields are measured to investigate the production mechanism of these states. These measurements provide new insights into the search for glueballs in high-energy collisions.

Author: Mr SAWAN, Sawan (National Institute of Science Education and Research (NISER) (IN))

Presenter: Mr SAWAN, Sawan (National Institute of Science Education and Research (NISER) (IN))

Session Classification: Poster Session

Contribution ID: **85** Type: **Oral Presentation**

Cosmic Trajectories calculation with state of the art lattice QCD equation of state

Wednesday, March 25, 2026 11:55 AM (20 minutes)

We compute the full cosmic trajectories of the early Universe across the QCD phase diagram as the plasma cools from $T \simeq 500\,\mathrm{MeV}$ to $30\,\mathrm{MeV}$, assuming β-equilibrated matter.
The trajectories are obtained by simultaneously solving baryon-number, electric-charge, and lepton-asymmetry conservation, closed by a state-of-the-art lattice-QCD equation of state: a fourth-order Taylor expansion in the chemical potentials that merges the latest $(2{+}1)$-flavor susceptibilities with charm-quark contributions, thus delivering a consistent $(2{+}1{+}1)$-flavor equation of state.
Results are compared with an ideal quark-gluon plasma and with a hadron-resonance gas to highlight interaction effects.
Two cases of primordial lepton asymmetries are analyzed: a symmetric configuration ($\ell_e = \ell_\mu = \ell_\tau = \ell/3$) and an asymmetric one ($\ell_e = 0,\ \ell_\mu = -\ell_\tau$).
Increasing $|\ell|$ systematically drives the trajectories toward larger values of μ_B and more negative μ_Q. In the asymmetric case, a non-monotonic "bounce"develops when the τ chemical potential reaches m_τ, generating a maximum in $\mu_B(T)$, the position of which depends on ℓ_τ. Assuming a modest μ_Q-dependence of the lattice-QCD critical end point estimates (obtained at $\mu_Q = 0$), the trajectories for all lepton asymmetries explored ($|\ell|$
$lesssim 0.1$) lie to their left, implying that in a standard cosmological scenario the QCD transition is almost certainly a smooth crossover. Nevertheless, we estimate the magnitude of baryon and lepton asymmetries needed to obtain a cosmic trajectory closer to the QCD critical point, providing inputs for future studies of the strong-interaction epoch.

Author: FORMAGGIO, Lorenzo (University of Houston)

Co-authors: Prof. DRAGO, Alessandro (Università degli Studi di Ferrara); Prof. RATTI, Claudia (University of Houston); Dr DI CLEMENTE, Francesco (University of Houston); Ms YADAV, Geetika (University of Houston)

Presenter: FORMAGGIO, Lorenzo (University of Houston)

Session Classification: Parallel VII: EoS and Astrophysics

Contribution ID: **86** Type: **Poster Presentation**

Insight into Quick Production and Slow Decay of Strange Particles from the New Quantum World of Quarks

Tuesday, March 24, 2026 6:44 PM (1 minute)

The strange quark is the third lightest quark. Particles containing with strange quarks can be produced easily and quickly via the strong interaction but decayed much more slowly through the weak interaction. Based on his newly well-developed four-element theory of nature, the author has recently developed a new two-flavor (up and down) multi-excitation (ground and excited states) quark model, which brings us a new quantum world of quarks for insights into mysteries of the universe. The heavy quarks: charm, strange, top, and bottom are considered as the second and third excitations of the up and down quarks. The fundamental weak interaction is found to be an interaction between electric and color charges, so that occurs inside quark and causes quark decay and get excited via emitting and absorbing quark-antiquark pairs. Leptons are products rather than participants of the weak interaction. Combinations of two quarks, in which one is antiquark, can form eight types of particles, via different levels of annihilations, including massive and massless mesons and gluons, electrically neutral and charged leptons and bosons including photons, and Weyl fermions. Combinations of three quarks can form four types of baryons with charge states to be 2e, e, 0, and -e, respectively. This study explores and shows indetail from the new quantum world how strange particles are produced and decayed, what the fine structures of the Feynman diagrams for these processes. The work was supported by NSF HBCU-UP Research Initiation Award (#2400021) and IBM-HBCU Quantum Center.

Author: Dr ZHANG, Tianxi (Alabama A&M University)

Presenter: Dr ZHANG, Tianxi (Alabama A&M University)

Session Classification: Poster Session

Contribution ID: **87** Type: **Oral Presentation**

Bayesian constraints on flavor equilibration in the quark-gluon plasma

Tuesday, March 24, 2026 9:45 AM (20 minutes)

Most current initial condition models for ultra-relativistic heavy-ion collisions assume an initial state based on gluon saturation, such as IP-Glasma and EKRT. However, conventional hydrodynamics models rely on an assumption of chemical equilibrium between quarks and gluons, even though the timescales of equilibration remain an open question. Here we test this equilibrium assumption, using Bayesian parameter estimation to quantitatively extract the timescales of light and strange flavor production from experimental data produced at RHIC and the LHC.

In our model, we initialize the QCD medium in a gluon dominated state, with the light and strange quark fugacities at hydrodynamization left as free parameters. Local quark production during the hydrodynamic phase is simulated through the evolution of these time-dependent fugacities for each quark flavor, which dynamically modify the equation of state according to the medium's flavor composition. Using this framework, we present here the first Bayesian analysis that simultaneously constrains the light and strange fugacities at hydrodynamization, their equilibration timescales, and the transport coefficients of the QGP.

Author: GORDEEV, Andrew (Duke University)

Co-authors: MUELLER, Berndt; PAQUET, Jean-Francois (Vanderbilt University); Prof. BASS, Steffen A. (Duke University)

Presenter: GORDEEV, Andrew (Duke University)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **88** Type: **Poster Presentation**

Precision Studies of Strangeness Production in Small Collision Systems with ALICE Run 3

Tuesday, March 24, 2026 6:15 PM (1 minute)

The study of strangeness production in small collision systems provides crucial insights into the mechanisms governing particle production at the LHC. Recent observations in proton–proton (pp) and proton–lead (p–Pb) collisions have revealed features reminiscent of those seen in heavy-ion collisions, such as collective-like behaviour and strangeness
enhancement, which appear to scale with event multiplicity rather than system size.

With the advent of Run 3, the upgraded ALICE detector enables precision measurements of light-flavour and (multi-)strange hadron production across an extended range of collision energies and multiplicities. This contribution presents recent results from pp collisions at $\sqrt{s}$ = 0.9 TeV and $\sqrt{s}$ = 13.6 TeV, offering an unprecedented opportunity to explore the evolution of strangeness production from the lowest to the highest LHC energies. The measured (multi-)strange-to-non-strange particle yield ratios, reaching multiplicities comparable to those in peripheral Pb–Pb collisions, provide new constraints on strangeness enhancement and its dependence on system size and energy in the precision era of ALICE.

Author: BHASIN, Anju (University of Jammu (IN))

Presenter: BHASIN, Anju (University of Jammu (IN))

Session Classification: Poster Session

Contribution ID: **89** Type: **Poster Presentation**

System-Size and Nuclear-Structure Effects in Light-Ion Collisions from AMPT at RHIC and LHC Energies

Tuesday, March 24, 2026 6:45 PM (1 minute)

Light-ion collisions offer a unique opportunity to investigate system-size scaling in relativistic heavy-ion collision dynamics. Using the AMPT model, we study O–O and Ne–Ne collisions at 5.36 TeV and 200 GeV to examine charged-particle production, strangeness enhancement, and collective flow. By comparing systems of similar mass but different nuclear structure, we explore the sensitivity of these observables to the initial nuclear geometry. Furthermore, by analyzing different collision energies, we explore the energy dependence of nuclear-structure effects within the model. Our results provide constraints on nuclear structure measurements using relativistic heavy-ion collisions.

Authors: STOJANOVIC, Milan (University of Belgrade (RS)); ASHRAF, Muhammad Usman (Wayne State University)

Presenters: STOJANOVIC, Milan (University of Belgrade (RS)); ASHRAF, Muhammad Usman (Wayne State University)

Session Classification: Poster Session

Contribution ID: **93** Type: **Poster Presentation**

Studies of ϕ-meson production at LHCb

Tuesday, March 24, 2026 6:20 PM (1 minute)

The ϕ meson is a unique probe of strange quark dynamics in high-energy nuclear collisions. The ϕ meson's mass lies at the threshold between perturbative and nonperturbative QCD. Consequently, ϕ production provides sensitivity to both regimes. In heavy-ion collisions, ϕ-meson production is senstive to strange-quark coalescence in quark-gluon plasma. The ϕ meson's net-zero strangeness means that ϕ production measurements can help disentangle the physical mechanisms behind strangeness enhancement in high-energy hadron and nucleaer collisions. The LHCb detector's hadron identification capabilities allow for precise studies of ϕ meson production in nuclear collisions. In addition, the SMOG system allows LHCb to study ϕ production in fixed-target collisions. New measurements of ϕ production in both collider and fixed-target configurations will be presented.

Authors: LIN, Jiazhao (Indiana University); LHCB COLLABORATION

Presenter: LIN, Jiazhao (Indiana University)

Session Classification: Poster Session

Contribution ID: **94** Type: **Poster Presentation**

Strangeness production at LHCb

Tuesday, March 24, 2026 6:47 PM (1 minute)

The production of strange hadrons in high-energy collisions provides insight into hadronization, parton fragmentation, and nuclear effects. While strangeness enhancement has been linked to quark-gluon plasma formation in heavy-ion collisions, recent observations in small systems challenge conventional hadronization models. In this context, proton–nucleus measurements further probe the influence of the nuclear environment, including cold nuclear matter effects and nuclear modifications. To shed light on this complex scenario, the LHCb detector, with its unique forward acceptance and excellent particle identification, enables detailed studies of strangeness production in pp and pPb collisions over a unique kinematic range. New results on strange hadron production will be presented, providing new constraints on hadronization dynamics and nuclear effects in small systems.

Authors: BERKEY, Julie Lane Marie (Los Alamos National Laboratory); LHCB COLLABORATION

Presenter: BERKEY, Julie Lane Marie (Los Alamos National Laboratory)

Session Classification: Poster Session

Contribution ID: **96** Type: **Oral Presentation**

First results from light-ion collisions at LHCb

Tuesday, March 24, 2026 10:55 AM (20 minutes)

The LHCb experiment collected large samples of pO, OO, and NeNe collisions in the summer of 2025. These samples will allow for precise studies of nucleon structure in light ions in the unexplored low-x region. In addition, these samples will allow for probing the onset of QGP production in light-ion collisions. First results from the light-ion run with the LHCb detector will be presented, including studies of heavy-flavor and quarkonia production.

Authors: LIN, Jiazhao (Indiana University); LHCB COLLABORATION

Presenter: LIN, Jiazhao (Indiana University)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **97** Type: **Poster Presentation**

New results in Ultra-Peripheral collisions at LHCb

Tuesday, March 24, 2026 6:17 PM (1 minute)

Ultra-peripheral collisions provide a unique environment to study pomeron- and photon-induced reactions with heavy nuclei. These interactions can produce a wide range of final state particles, from light vector mesons to heavy quarkonia, and probe potentially exotic phenomena. With a fast and flexible DAQ, full particle ID, and the ability to reconstruct very low pt particles, LHCb is uniquely well suited to study final states with leptons, hadrons or photons. Also, using the HeRSCheL detector, the far forward event activity can be detected and used to tag events with nuclear break-up. In this contribution, we will present recent LHCb results from ultra-peripheral heavy ion collisions and discuss how these impact our understanding new exotic phenomena, the partonic structure of nuclei and hadronization in small systems.

Authors: LHCB COLLABORATION; SCHMIDT, Nicolas (Los Alamos National Laboratory)

Presenter: SCHMIDT, Nicolas (Los Alamos National Laboratory)

Session Classification: Poster Session

Contribution ID: **98** Type: **Poster Presentation**

Bulk physics in small systems at LHCb

Tuesday, March 24, 2026 6:21 PM (1 minute)

Light hadrons constitute the bulk of particle production in heavy-ion collisions. Its properties, such as the production cross-sections of different hadron species or their average transverse momentum, are sensitive to both collective phenomena and the initial state of heavy-ion collisions. Bulk physics measurements in small collision systems can reveal the interplay between initial- and final-state effects in heavy-ion collisions, and can provide new insights into the origins of collective phenomena. The LHCb detector, with its high-resolution tracking system and its hadron ID capabilities, is perfectly suited for these studies in the forward region. In this contribution, new results on bulk measurements in small systems will be presented.

Authors: LHCB COLLABORATION; DURHAM, Matthew (Los Alamos National Laboratory)

Presenter: DURHAM, Matthew (Los Alamos National Laboratory)

Session Classification: Poster Session

Contribution ID: **100** Type: **Oral Presentation**

Λ polarization measurements at LHCb

Tuesday, March 24, 2026 8:45 AM (20 minutes)

Leveraging its precise vertex reconstruction and advanced particle identification, the LHCb detector offers a unique environment to study spin dynamics and hadronization in high-energy collisions. Measurements of baryon polarization in unpolarized proton-nucleus collisions probe how quark spins contribute to the final-state hadron, providing insight into parton spin transfer and fragmentation mechanisms. In particular, charm-baryon polarization provides a sensitive test of heavy-quark spin transfer, while light-baryon polarization explores spin effects in the hadronization of light quarks. Recent LHCb results on baryon polarization in both fixed-target and collider-mode data are presented, highlighting their implications for hadronization dynamics, spin transfer mechanisms, and transverse-momentum-dependent fragmentation functions.

Authors: BRANDENBURG, James Daniel (Ohio State University); LHCB COLLABORATION (Universidade da Coruña (ES))

Presenter: BRANDENBURG, James Daniel (Ohio State University)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

Contribution ID: **101** Type: **Oral Presentation**

Femtoscopy studies at LHCb

Tuesday, March 24, 2026 11:35 AM (20 minutes)

Femtoscopic techniques provide unique insights into particle production mechanisms in hadron collisions, as well as interactions between short-lived hadrons. The LHCb detector's excellent momentum resolution makes it well-suited for studies of femtoscopic correlations. In addition, LHCb's vertex reconstruction and particle identification capabilities allow for studies of femtoscopic correlations between pairs of heavy hadrons. Recent results on femtoscopic correlations between both light and heavy hadrons will be presented.

Authors: PYBUS, Jackson Reeves (Los Alamos National Laboratory); LHCB COLLABORATION

Presenter: PYBUS, Jackson Reeves (Los Alamos National Laboratory)

Session Classification: Parallel VI: Correlations

Contribution ID: **102** Type: **Oral Presentation**

Light and Heavy Meson Production in Small Collision Systems at the LHC

Wednesday, March 25, 2026 11:55 AM (20 minutes)

Recent results from the LHC on oxygen–oxygen (O-O) and xenon–xenon (Xe-Xe) collisions open a new window for investigating the interplay of cold nuclear matter (CNM) and quark–gluon plasma (QGP) effects in small collision systems. Building upon recent theoretical work on particle production dynamics in heavy ion reactions, we present an updated study of light and heavy hadron modification relative to the proton-proton baseline in these systems for selected centralities. Our analysis combines perturbative QCD and hydrodynamic simulations to quantify initial-state effect, collisional energy loss, and medium-induced radiative corrections. We will present theoretical predictions at both midrapidity and forward rapidity that can be confronted with ALICE, ATLAS, CMS, and LHCb measurements. Through comparison to the available data, we will discuss the relative importance of CNM and QGP effects in O-O and Xe–Xe systems and the role of the heavy quark mass. Our analysis aims to clarify the onset of collective and deconfined behavior in small systems and to provide new insights into the transport properties of matter.

Authors: VITEV, Ivan (Los Alamos National Laboratory); KE, Weiyao (CCNU)

Presenter: VITEV, Ivan (Los Alamos National Laboratory)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **103** Type: **Poster Presentation**

Ω_c^0 production vs. multiplicity in proton–proton collisions at $\sqrt{s} = 13.6$ TeV with ALICE

Tuesday, March 24, 2026 7:10 PM (1 minute)

Charm-baryon production measurements in proton–proton (pp) collisions at the LHC provide valuable input for understanding charm-quark hadronization mechanisms and testing perturbative quantum chromodynamics (QCD) based calculations. Recent measurements show baryon-to-meson ratios significantly higher than those measured in e^+e^- collisions, suggesting a collision-system dependence of the fragmentation fractions, and challenging predictions based on a factorization approach. Several QCD-inspired models (e.g., Catania, POWLANG, QCM) and Monte Carlo event generators (e.g., PYTHIA 8, EPOS 4) attempt to describe charm-quark hadronization, but most fail to simultaneously reproduce the yields of both strange and non-strange charm baryons. Measurements of charm-baryon multiplicity-differential yields probe the interplay between fragmentation and coalescence processes and their evolution as a function of the event multiplicity, providing stringent constraints on hadronization models and improving our understanding of hadronization in small systems.

We present the status of the measurement of Ω_c^0-baryon production as a function of charged-particle multiplicity in pp collisions at $\sqrt{s} = 13.6$ TeV with ALICE, using data samples collected during LHC Run 3. The analysis reconstructs Ω_c^0 candidates via the hadronic decay channel $\Omega_c^0 \to \Omega^-\pi^+$ and its charge conjugate using a multiclass machine-learning classifier. The latest results on Ω_c^0 production as a function of p_T in inelastic events in the 0–100%, 0–10%, 10–50%, and 50–100% multiplicity-percentile intervals of the pp cross section will be shown.

Author: TORRES CABRERA, Maria Fernanda (University of Houston (US))

Presenter: TORRES CABRERA, Maria Fernanda (University of Houston (US))

Session Classification: Poster Session

Contribution ID: **105** Type: **Oral Presentation**

Chiral transport and its dependence on collision beam energy

Tuesday, March 24, 2026 2:15 PM (20 minutes)

Chirality is a fundamental element in the construction of the Standard Model and a key feature for understanding non-perturbative aspects of Quantum Chromodynamics (QCD). Chiral Magnetic Effect (CME) provides a unique access for experimental probe of chirality in heavy ion collisions. Recent measurements from Beam Energy Scan II data by the STAR Collaboration demonstrate very interesting beam energy dependence of CME observables. In particular, robust CME signals are extracted between 10 to 20 GeV energies while a disappearance of such signal is found for even lower energy region. This talk reports results providing theoretical interpretations of those measurements. First, we develop a data-driven approach to decipher the implications of these data. Utilizing machine learning methods based on large scale simulations of AVFD (anomalous-viscous fluid dynamics) framework, we are able to extract, for the first time, the values of key input parameters from the inclusive gamma and delta correlators at 19.6GeV, including the initial axial charge density, the magnetic field lifetime, and the local charge conservation (LCC) strength. The results unambiguously confirm both a dominance of LCC and a robust presence of CME transport. Second, we perform a theoretical calculation of axial charge dynamics with an effective model for QCD chiral dynamics. We demonstrate that with decreasing temperature and density, the spontaneous breaking of chiral symmetry leads to an increased chiral condensate that causes significant damping effect on any initial axial charge. This result supports the interpretations of the CME disappearance at very low collision energy as the indication of QCD chiral symmetry breaking.

Author: LIAO, Jinfeng (Indiana University)

Presenter: LIAO, Jinfeng (Indiana University)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

Contribution ID: **106** Type: **Poster Presentation**

$\Xi_c^{0,+}$ in pp collisions at $\sqrt{s} = 5.36$ TeV with the ALICE Experiment

Tuesday, March 24, 2026 7:24 PM (1 minute)

Recent measurements of the charm baryon-to-meson ratios in pp collisions show an enhancement with respect to the measurement in e^+e^- collisions indicating that coalescence could be a charm-quark hadronization mechanism at play in pp collisions in addition to charm-quark fragmentation. We further investigate charm-quark hadronization by studying the production of $\Xi_c^0 \rightarrow \Xi^-\pi^+$ and $\Xi_c^+ \rightarrow \Xi^-\pi^+\pi^+$ baryons with data from LHC Run 3, the largest dataset ever recorded by the ALICE experiment. The selection of the signal of interest out of the large combinatorial background is performed with machine learning techniques. In this poster, the status of the charm-baryon production measurement in pp collisions at $\sqrt{s} = 5.36$ TeV will be discussed, with a focus on the performance of the machine learning models used for the selection of the Ξ_c^0 and Ξ_c^+ baryons.

Author: SMITH, Krista Lizbeth (Pusan National University (KR))

Co-author: PARK, Jinhyun (Pusan National University (KR))

Presenter: SMITH, Krista Lizbeth (Pusan National University (KR))

Session Classification: Poster Session

Contribution ID: **107** Type: **Oral Presentation**

Contributions of critical fluctuations and baryon annihilation to proton number cumulants at $\sqrt{s_{\rm NN}} = 7.7 - 200$˜GeV from hydrodynamics

Tuesday, March 24, 2026 4:25 PM (20 minutes)

We present a study of net-proton number fluctuations in central Au+Au collisions at $\sqrt{s_{\rm NN}} = 7.7 - 200$ GeV using viscous hydrodynamic simulations. Proton and antiproton fluctuations are evaluated on the hydrodynamic freeze-out hypersurface via a Cooper–Frye procedure adapted to an interacting hadron resonance gas. Effects of limited experimental acceptance and global charge conservation are incorporated through a density-density correlation function. Critical fluctuations and effects of baryon annihilation are introduced into baryon number susceptibilities, utilizing the Ising-2DTExS equation of state. We discuss deviations of the resulting cumulants from the noncritical baseline, and their sensitivity to the presence of a QCD critical point. We also discuss acceptance dependence of reduced factorial cumulants as a signature of local correlations among baryons.

Author: PIHAN, Gregoire Marvin Nelson (University of Houston)

Co-authors: Mr PARRA, Johnatan; Dr KAHANGIRWE, Micheal (Kent State University); Dr VOVCHENKO, Volodymyr (University of Houston)

Presenter: PIHAN, Gregoire Marvin Nelson (University of Houston)

Session Classification: Parallel V: Phase Structure

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

Measurement of $f_0(980)$ resonance production in pp collisions at $\sqrt{s} = 13.6$ TeV with ALICE

Tuesday, March 24, 2026 7:29 PM (1 minute)

Short-lived resonances are powerful probes to study the hadronic phase in high-energy collisions, as their lifetimes are comparable to the duration of the hadronic stage. Their yields and spectral properties are affected by the interplay between rescattering and regeneration processes in the hadronic phase. Among them, the $f_0(980)$ resonance, with a lifetime of about 3–5 fm/c as reported by ALICE, is particularly sensitive to these effects and remains of special interest due to its debated internal structure, which may correspond to an exotic meson, tetraquark, or meson−molecule configuration. This contribution presents a study of $f_0(980)$ production in pp collisions at $\sqrt{s} = 13.6$ TeV recorded by the ALICE detector during LHC Run 3. The resonance was reconstructed through its main decay channel, the $f_0(980) \rightarrow \pi^+\pi^-$, with particular attention to tracking of charged-pion and particle identification in the central barrel. The significantly increased Run 3 statistics allow for a more precise determination of the yields and mass spectra as functions of transverse momentum and charged-particle multiplicity. The multiplicity dependence of the $f_0(980)$ yield is compared with previous Run 2 measurements and other short-lived resonances, providing insight into the rescattering dynamics and possible modification of the resonance properties in small collision systems. The results also contribute to the ongoing discussion on the internal structure of the $f_0(980)$ and serve as a reference for future measurements in p–Pb and Pb–Pb collisions.

Author: BAE, Yunseul (Sungkyunkwan University (KR))

Presenter: BAE, Yunseul (Sungkyunkwan University (KR))

Session Classification: Poster Session

Contribution ID: **110** Type: **Oral Presentation**

Global Λ Polarization Without Vorticity: Insights from a 50-Year Spin Puzzle

Tuesday, March 24, 2026 10:05 AM (20 minutes)

Over fifty years after the first observation of unexpectedly large transverse Λ polarization, the underlying mechanism remains a long-standing puzzle seen across many collision systems, from e^+e^- to proton–nucleus collisions. Only in heavy-ion collisions has this phenomenon been understood in terms of strong vorticity in the Quark Gluon Plasma. In this talk, we present an alternative interpretation that does not rely on vorticity, yet can naturally produce the global Λ polarization phenomena. Using realistic event simulations, we find qualitative trends consistent with the energy dependence observed by the STAR Collaboration. These findings may point to a more universal origin of Λ polarization across different systems, offering new perspectives on the link between spin phenomena and the emergent fluid-like properties of QCD matter.

Authors: LIU, Feng (Stony Brook University); Dr TU, Zhoudunming (BNL)

Presenter: LIU, Feng (Stony Brook University)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

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

Measurement of flow of $\mathrm{K}^{\pm}(892)$ in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.36$ TeV with ALICE

Tuesday, March 24, 2026 7:25 PM (1 minute)

In ultrarelativistic heavy-ion collisions, the Quark–Gluon Plasma (QGP) is formed, and the study of anisotropic flow serves as a key tool to probe its properties in detail. While the flow of light and strange hadrons reflects the collectivity developed during the partonic stage, resonance particles can experience additional effects during the hadronic phase due to interactions of their decay daughters. These hadronic interactions may modify the observed flow patterns, especially at low transverse momentum, where rescattering processes are dominant. Previous ALICE measurements have shown that the relative yield of $\mathrm{K}^{\pm}(892)$ to K decreases with increasing particle multiplicity in heavy-ion collisions, suggesting significant hadronic-phase effects. By comparing the flow coefficients of resonance and stable particles, we can investigate how hadronic interactions influence the collective motion of the system. Such a study provides valuable insight into the influence of hadronic phase on elliptic flow measurements. This poster presents an analysis of the rescattering effects on $\mathrm{K}^{\pm}(892)$ in the hadronic phase by measuring its anisotropic flow coefficients and comparing them to those of longer-lived particles in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.36$ TeV, using data collected with the ALICE detector.

Author: JI, Su-Jeong (Pusan National University (KR))

Presenter: JI, Su-Jeong (Pusan National University (KR))

Session Classification: Poster Session

Contribution ID: **113** Type: **Oral Presentation**

Non-Monotonicity of p_{T} Correlations in Au + Au Collisions at RHIC

Tuesday, March 24, 2026 2:15 PM (20 minutes)

We report the first measurements of two-particle transverse momentum correlations for mid-rapidity charged particles in Au+Au collisions at $\sqrt{s_{\mathrm{NN}}}$ = 3.0, 3.2, 3.5, 3.9, 4.5, and 7.7 GeV recorded by the STAR experiment.The results are compared with previous STAR measurements from the Beam Energy Scan Phase I (BES-I) and with transport model calculations. The measured two-particle p_{T} correlators exhibit an approximate power-law scaling with the number of participating nucleons (N_{part}), consistent with expectations from an independent-source scenario. For the first time, we identify a collision-energy region where this scaling behavior breaks down at collision energies of $\sqrt{s_{NN}}$ = 3.0 and 3.2 GeV. Furthermore, a non-monotonic energy dependence of the p_{T} correlations is observed in central collisions, representing the first systematic observation of such behavior as a function of collision energy. Transport model calculations without a critical point fail to reproduce the observed trend.

Authors: MANIKANDHAN, Rutik (Univ. of Houston); STAR COLLABORATION

Presenter: MANIKANDHAN, Rutik (Univ. of Houston)

Session Classification: Parallel V: Phase Structure

Contribution ID: **114** Type: **Oral Presentation**

Measurements of p-Ξ⁻ Correlation Functions in Au+Au Collisions from STAR Beam Energy Scan II

Tuesday, March 24, 2026 11:15 AM (20 minutes)

Two-particle femtoscopy provides a powerful tool for studying the spatial-temporal characteristics of particle emission source and final-state interactions in high-energy nuclear collisions. The particle emission source size R, and interaction parameters, such as the scattering length f_0 and effective range d_0, are key to understanding the freeze-out dynamics in such collisions. In particular, as a hyperon-nucleon (S = -2) pair, the proton-Ξ⁻(p=uud, Ξ⁻=dss) system offers an important chance to study the hyperon-nucleon interactions, which serve as basic inputs for constructing the equation of state and understanding the inner structure of neutron stars.

In this talk, we present measurements of p-Ξ⁻ correlation functions in Au+Au collisions over a broad energy range, from $\sqrt{s_{\rm NN}} = 3.0$ to 27 GeV, using data from STAR's Beam Energy Scan II. The correlation functions are analyzed within the Lednicky-Lyuboshitz formalism, allowing us to extract the Y-N interaction parameters - f_0 and d_0, and emission source size R. The inferred f_0, d_0 will be compared with recent calculations from Lattice QCD and effective theory models. The energy and centrality dependence of the correlation functions are further compared with simulations from the UrQMD hadronic transport model combined with the CRAB afterburner accounting for strong and Coulomb interactions.

[1] First Observation of an Attractive Interaction between a Proton and a Cascade Baryon, Phys. Rev. L 123, 112002 (2019)

[2] Femtoscopic study of coupled-channels NΞ⁻ and ΛΛ interactions, Phys. Rev. C 105, 014915 (2022)

The collision energies for which results are presented in this talk:
$\sqrt{s_{\rm NN}} = 3.0,\ 3.2,\ 3.5,\ 3.9,\ 7.7,\ 14.6, 19.6,\ 27$ GeV

Authors: AN, Jing (Central China Normal University); STAR COLLABORATION

Presenter: AN, Jing (Central China Normal University)

Session Classification: Parallel VI: Correlations

Contribution ID: **115** Type: **Oral Presentation**

p-p-Λ Correlation in 3 GeV Au+Au Collisions with the STAR Detector

Tuesday, March 24, 2026 12:15 PM (20 minutes)

Understanding hyperon-nucleon interactions is crucial for describing strange nuclear matter and for resolving the hyperon puzzle in neutron stars. Three-body forces are expected to play a key role in this context [1]. In this work, we report the measurement of the p-p-Λ three-particle correlation functions in Au+Au collisions at $\sqrt{s_{NN}}$=3 GeV. At this beam energy, the system features a high baryon density and lies close to the hyperon production threshold. This unique condition enables a controlled study of hyperon–nucleon and hyperon–nucleon–nucleon interactions in dense baryonic matter. Utilizing the high-statistics datasets collected by the STAR experiment in 2021, a precise measurement of the p–p–Λ correlation at low relative momentum is expected to provide valuable constraints on the three-body interactions involving hyperons [2].

[1] D. Lonardoni, et al, Phys. Rev. Lett. 114, 092301 (2015)

[2] E. Garrido, et al, Phys. Rev. C 110, 054004 (2024)

Authors: GU, Jing (Fudan University); STAR COLLABORATION

Presenter: GU, Jing (Fudan University)

Session Classification: Parallel VII: EoS and Astrophysics

Contribution ID: **118** Type: **Oral Presentation**

Observation of Strong Directed Flow for ϕ meson in High Baryon Density Region at RHIC

Tuesday, March 24, 2026 4:45 PM (20 minutes)

Directed flow v_1 has been used to probe early dynamics in high-energy nuclear collisions. The vector meson $\phi(s\bar{s})$, with a mass comparable to that of light baryons, exhibits a small interaction cross section with other hadrons. Therefore, the measurement of ϕ-meson directed flow v_1 provides clean access to the early collision dynamics and the production mechanisms of the vector-mesons.

In this talk, we report the measurement of ϕ-meson directed flow (v_1) from Au+Au collisions at center-of-mass energies of 3.0, 3.2, 3.5, 3.9 and 4.5 GeV, using data collected by the STAR experiment as part of the RHIC Beam Energy Scan II program. These energies correspond to the high–baryon-density region (μ_B: 760 - 590 MeV) of the QCD phase diagram. In this region, the observed ϕ-meson v_1 values are all positive and comparable to those of baryons (protons and Λ), while the v_1 values of lighter mesons, such as pions and kaons, are much smaller than those of ϕ mesons. The new results will be compared within the framework of hadronic transport model calculations, and the role of vector meson–baryon coupling in ϕ-meson production will be discussed.

Authors: ZHENG, Guangyu (Univ. of Chinese Academy of Sciences); STAR COLLABORATION

Presenter: ZHENG, Guangyu (Univ. of Chinese Academy of Sciences)

Session Classification: Parallel V: Phase Structure

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

Engineering the shapes of quark-gluon plasma droplets by comparing anisotropic flow in small symmetric and asymmetric collision systems

Tuesday, March 24, 2026 7:30 PM (1 minute)

The observation of collective flow phenomena in small collision systems challenges our understanding of quark-gluon plasma (QGP) formation and evolution. This complexity lies in the initial geometries, which are influenced by both nucleon configuration and subnucleonic fluctuations, introducing uncertainties in interpreting flow patterns. We disentangle these contributions through comparative measurements of elliptic (v_2) and triangular (v_3) flow in asymmetric d+Au and symmetric ^{16}O+^{16}O collisions at $\sqrt{s_{NN}} = 200$ GeV, which produce medium of comparable sizes but with vastly different initial geometries. The larger v_2 in d+Au reflects its dominant elliptic geometry, while the similar v_3 in both systems is better explained by considering subnucleonic fluctuations. These contrasting flow patterns are quantitatively described by a state-of-the-art hydrodynamic model tuned to large-system Au+Au data, indicating efficient transformation of initial geometries to final-state anisotropies. The v_2 and v_3 are also measured for identified pion, kaon, proton and ϕ to test the expected mass-ordering and quark-number scaling for a hydrodynamical, partonic medium. These results provide evidence for droplet formation in small systems with transport properties that are similar to those observed in large collision systems, consistent with QGP-like behavior.

Authors: ZHANG, Chunjian (Fudan University); STAR COLLABORATION

Presenter: ZHANG, Chunjian (Fudan University)

Session Classification: Poster Session

Contribution ID: **120** Type: **Oral Presentation**

Differential measurements of ϕ-meson global spin alignment and off-diagonal spin density matrix elements in Au+Au collisions at STAR

Tuesday, March 24, 2026 2:55 PM (20 minutes)

A significant global spin alignment (ρ_{00}) signal for ϕ-mesons was observed by the STAR collaboration in Au+Au collisions using the data from the first phase of the Beam Energy Scan at RHIC (BES-I) [1]. Conventional physical mechanisms which contribute to ρ_{00} fail to explain the observed signal; however, it may be attributable to the presence of a ϕ-meson strong force field [2] or to non-zero ρ_{00} in the helicity frame induced by the relative motion of $s\bar{s}$ pairs to the thermal background in heavy-ion collisions [3]. Recently, a quark recombination model with quark-antiquark spin correlations was developed and is able to simultaneously explain lambda polarization (P_Λ) and ϕ-meson ρ_{00} measurements, in addition to predicting non-zero off-diagonal spin density matrix elements [4]. Therefore, measurements of off-diagonal matrix elements of ϕ-mesons may provide a probe of $s\bar{s}$ spin correlations. Off-diagonal spin density matrix elements could also be important when measuring Chiral Magnetic Effect (CME) observables involving vector meson decay products, as these elements represent a possible physics background [5]. Previous ρ_{00} measurements in [1] use a 1D angular distribution in θ^* (polar angle of a daughter kaon in the ϕ-meson's rest frame with respect to the orthogonal of the harmonic plane), which cannot account for possible contributions to ρ_{00} from off-diagonal spin density matrix elements. In this talk, we address this by measuring ϕ-meson ρ_{00} and off-diagonal spin density matrix elements using both angular dimensions θ^* and β of a daughter kaon in the ϕ-meson's rest frame, where β is the azimuthal angle within the reaction plane, measured relative to the beam axis. We will present differential measurements of ϕ-meson global ρ_{00} and off-diagonal spin density matrix elements with respect to rapidity and transverse momentum, using data from the second phase of RHIC BES (BES-II) in Au+Au collisions at $\sqrt{s_{NN}} = 19.6$ GeV collected by STAR.

[1] STAR Collaboration., Nature **614**, 244–248 (2023)
[2] X.L. Sheng et al., Physical Review C **108**, 054902 (2023).
[3] X.L. Sheng et al., Physical Review D \textbf{110}, 056047 (2024).
[4] J.P. Lv et al., Physical Review D \textbf{109}, 114003 (2024).
[5] Z. Wang et al., Physical Review C \textbf{111}, 014910 (2025)

Authors: WILKS, Gavin (Univ. of Illinois Chicago); STAR COLLABORATION

Presenter: WILKS, Gavin (Univ. of Illinois Chicago)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

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

Measurement of the hypertriton relative branching ratio with ALICE

Tuesday, March 24, 2026 7:04 PM (1 minute)

Hypernuclei are nuclei containing both nucleons and hyperons. Studying
their properties provides essential insights into the hyperon–nucleon interaction —a key component of the strong force that remains poorly understood. The lightest known hypernucleus is the hypertriton ($^3_\Lambda$H). In recent years, ALICE has performed the most precise measurements of the $^3_\Lambda$H lifetime and binding energy through the reconstruction of its two-body decay channel $^3_\Lambda\mathrm{H} \rightarrow {}^3\mathrm{He} + \pi^-$. However, the three-body decay $^3_\Lambda\mathrm{H} \rightarrow \mathrm{d} + \mathrm{p} + \pi^-$ has not yet been measuredby ALICE. This channel is crucial for providing additional constraints on the $^3_\Lambda$H properties, particularly through the determination of the relative branching ratio between the two- and three-body decay modes: $\mathrm{R}_3 = \frac{\Gamma(^3_\Lambda\mathrm{H}\rightarrow{}^3\mathrm{He}+\pi^-)}{\Gamma(^3_\Lambda\mathrm{H}\rightarrow{}^3\mathrm{He}+\pi^-)+\Gamma(^3_\Lambda\mathrm{H}\rightarrow\mathrm{d}+\mathrm{p}+\pi^-)}$

The R_3 is directly connected to both the internal structure and the spin of the $^3_\Lambda$H. Previous determinations of R_3 suffer from large experimental uncertainties,underscoring the need for more precise measurements. In this talk, the first ALICE measurement of the hypertriton three-body decay and the determination of R_3 are presented. The analysis exploits the largest pp dataset ever collected by ALICE at the LHC, and introduces novel techniques to suppress and model the combinatorial background. The obtained results are compared with existing measurements and discussed in the context of theoretical predictions, providing new insight into the hypertriton spin and the hyperon–nucleon interaction.

Authors: ALICE COLLABORATION; JAUCH, Carolina (GSI)

Presenter: JAUCH, Carolina (GSI)

Session Classification: Poster Session

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

Measurement of two-particle correlations in proton-proton collisions with sPHENIX

Tuesday, March 24, 2026 6:55 PM (1 minute)

The sPHENIX experiment at RHIC, commissioned in 2023, provides large pseudorapidity coverage and full azimuthal acceptance, enabling detailed studies of collectivity in small-collision systems. Data were collected in proton–proton collisions at $\sqrt{s}$ = 200 GeV in 2024. In this poster, we present the current status of two-particle correlation analyses in proton–proton collisions, using silicon tracklets reconstructed with the Monolithic Active Pixel Vertex Detector (MVTX) and the Intermediate Silicon Tracker (INTT), together with the sPHENIX Event Plane Detector (sEPD). The sEPD provides large forward and backward pseudorapidity coverage, allowing long-range correlations up to $\Delta\eta \approx 9.8$ to be explored.

Author: SEKIGUCHI, Yuko (RIKEN)

Presenter: SEKIGUCHI, Yuko (RIKEN)

Session Classification: Poster Session

Contribution ID: **123** Type: **Oral Presentation**

Evidence of $\overline{^4\mathrm{Li}}$ signal from $\bar{\mathrm{p}} + \overline{^3\mathrm{He}}$ femtoscopy

Tuesday, March 24, 2026 5:45 PM (20 minutes)

At the LHC, matter and antimatter are produced in equal abundance, making it a true antimatter factory. Among the many antiparticles observed, antinuclei are of particular interest, as their production mechanism in high-energy hadronic collisions remains a topic of active discussion and fascination. The ALICE Collaboration has previously measured, for the first time, the production of anti-alpha ($\overline{^4\mathrm{He}}$) nuclei in pp and Pb–Pb collisions. However, ^{4}He isnot the only known A = 4 nucleus: the unstable ^{4}Li nucleus has also been observed in a few experiments and is experimentally accessible by ALICE. In this talk, the first evidence of the antimatter counterpart of ^{4}Li, the anti-^{4}Li nucleus ($\overline{^4\mathrm{Li}}$), is presented. The particle is reconstructed via its two-body decay channel $\overline{^4\mathrm{Li}} \rightarrow \overline{^3\mathrm{He}}$+p, using both invariant-mass analysis and femtoscopic correlations.
A dedicated analysis procedure has been developed to subtract the correlated and uncorrelated $\overline{^3\mathrm{He}} - \bar{\mathrm{p}}$ combinatorial background. The production yield of $\overline{^4\mathrm{Li}}$ is compared with that of $\overline{^4\mathrm{He}}$. Owing to its resonance nature and its spin degeneracy, the production of $\overline{^4\mathrm{Li}}$ is expected to be enhanced relative to the compact $\overline{^4\mathrm{He}}$, making this new measurement a sensitive probe for testing nucleosynthesis models in high-energy hadronic collisions.

Authors: ALICE COLLABORATION; LUCIA, Giorgio Alberto (Politecnico Torino)

Presenter: LUCIA, Giorgio Alberto (Politecnico Torino)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **124** Type: **Oral Presentation**

The ALICE Inner Tracking System 3, a bent wafer-scale monolithic active pixel detector

Wednesday, March 25, 2026 10:55 AM (20 minutes)

ALICE will commission the Inner Tracking System 3 (ITS3), replacing the three innermost layers of the existing vertex spectrometer during the Long Shutdown 3 (2026-30) of the LHC at CERN. It will consist of six truly cylindrical, bent, wafer-scale monolithic active pixel sensors based on the TPSCo 65 nm technology. ITS3 will have a low material budget (0.09% X0 per layer) and the innermost layer will be closer to the interaction point (19 mm). This will ensure an improvement in pointing resolution by a factor of two at very low pT (O(100 MeV/c)), achieving, for example, 20 μm and 15 μm in the transversal and longitudinal directions, respectively, for 1 GeV/c particles. After the initial R&D qualified the technology and validated the feasibility of the detector concept, the first full scale prototype, MOSAIX, is being fabricated. The mechanics and the off-detector electronic developments are proceeding towards their completion.

This contribution will review the conceptual design, the current activities and road to completion and installation. It concludes with a projection of the improved physics performance, in particular for heavy flavour mesons and baryons, as well as for thermal dielectrons, which will be accessible with ITS3.

Authors: COLLABORATION, ALICE; SIDDHANTA, Sabyasachi (INFN Cagliari)

Presenter: SIDDHANTA, Sabyasachi (INFN Cagliari)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **125** Type: **Oral Presentation**

ALICE 3: a next-generation heavy-ion detector for LHC Run 5

Wednesday, March 25, 2026 12:15 PM (20 minutes)

The ALICE Collaboration has proposed a completely new apparatus, ALICE 3, for the LHC Run 5 (LoI, arXiv:2211.02491). The detector consists of a large pixel-based tracking system covering eight units of pseudorapidity, complemented by multiple systems for particle identification, including silicon time-of-flight layers, a ring-imaging Cherenkov detector, a muon identification system, and forward detectors for event characterisation. Track pointing resolution of better than 10 micron for $p_T > 200$ MeV/c can be achieved by placing the vertex detector on a retractable structure inside the beam pipe. ALICE 3 will, on the one hand, enable novel studies of the quark-gluon plasma and, on the other hand, open up important physics opportunities in other areas of QCD and beyond. The main new studies in the QGP sector focus on low-p_T heavy-flavour production, including beauty hadrons, multi-charm baryons and charm-charm correlations, as as well as on precise multi-differential measurements of dielectron emission to probe the mechanism of chiral-symmetry restoration and the time-evolution of the QGP temperature. Besides QGP studies, ALICE 3 can uniquely contribute to hadronic physics, with femtoscopic studies of the interaction potentials between charm mesons and searches for nuclei with charm, and to fundamental physics, with tests of the Low theorem for ultra-soft photon emission. The presentation will cover the detector concept, the physics performance, and the status of detector R&D.

Authors: COLLABORATION, ALICE; KARLSSON GUMPRECHT, Jesper (Marietta Blau Institute, Austria)

Presenter: KARLSSON GUMPRECHT, Jesper (Marietta Blau Institute, Austria)

Session Classification: Parallel VIII: Open Questions and Future

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

The underlying event and global event-structure observables in p+p collisions at STAR

Tuesday, March 24, 2026 7:26 PM (1 minute)

Observations in small collision systems have revealed features reminiscent of collective behavior, traditionally associated with the formation of quark–gluon plasma in heavy-ion collisions. Whether such effects arise from genuine collective dynamics or from the interplay of softer and harder components of particle production remains an open question. The underlying event (UE), the softer activity unrelated to the primary scattering, and global event-structure observables provide sensitive probes of these mechanisms by linking event topology to particle production. Related measurements at the LHC have shown that collective-like signatures in small systems are not universally driven by multiplicity alone, but also depend on the event substructure. At RHIC energies, where the relative importance of softer and harder processes is markedly different, the properties of the UE and event topology, and their influence on particle production, remain largely unexplored.

In this poster, we examine proton-proton collisions at $\sqrt{s} = 510$ GeV recorded by the STAR experiment, focusing on the UE as well as relevant global event-structure observables, such as transverse activity R_{T} and transverse spherocity S_0. We investigate particle production in different azimuthal regions defined relative to the leading particle and in events with varying topologies.

This work seeks to clarify how soft and hard QCD processes shape particle production at RHIC energies and to constrain phenomenological models in environments with less abundant multi-parton interactions. This contributes to a deeper understanding of the mechanisms behind the collective-like phenomena observed in hadronic collisions.

Author: MATONOHA, Oliver (CTU in Prague (CZ))

Presenter: MATONOHA, Oliver (CTU in Prague (CZ))

Session Classification: Poster Session

Contribution ID: **128** Type: **Oral Presentation**

Out-of-equilibrium contributions to charm hadrons in a fluid-dynamic approach

Wednesday, March 25, 2026 11:35 AM (20 minutes)

The charm quark serves as a powerful probe for investigating the properties of the hot and dense QCD medium, the quark-gluon plasma (QGP), created in high-energy heavy-ion collisions. Building on previous studies that demonstrated the applicability of a fluid-dynamic description of charm quarks in the quark-gluon plasma, the present work (https://arxiv.org/abs/2510.25601) extends this framework by computing the out-of-equilibrium contributions to the distribution function of charm hadrons. The analysis accounts corrections arising from the initial out-of-equilibrium distribution of charm quarks following a free-streaming phase, from the freeze-out hypersurface within the fluid dynamic evolution. These results enable the exact computation of integrated yields and transverse momentum distributions of charm hadrons for different values of the spatial diffusion coefficient, thereby providing the basis for a systematic determination of the charm transport coefficients. In addition, the limits of applicability of the approach are identified by determining the transverse-momentum region in which charm hadrons are described by a well-defined, positive distribution function.

Authors: Dr DUBLA, Andrea (GSI); GROSSI, Eduardo; CAPELLINO, Federica (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE)); FACEN, Rossana (Heidelberg University (DE)); MASCIOCCHI, Silvia (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))

Presenter: FACEN, Rossana (Heidelberg University (DE))

Session Classification: Parallel II: Bulk Properties

Contribution ID: **129** Type: **Poster Presentation**

Xic0 production as a function of multiplicity by XicZeroToPiXi in pp collision at $\sqrt{s} = 13.6$ TeV with ALICE

Tuesday, March 24, 2026 7:11 PM (1 minute)

Heavy quarks, such as charm and beauty, are produced in hard-scattering processes occurring in the early stages of the collisions at the LHC. Therefore, the production of heavy-flavour hadrons in proton–proton (pp) collisions provide an important test of quantum chromodynamics (QCD). A significant enhancement of the \Lambdac/\Dzero\ production yield ratio was observed in pp collisions compared to low multiplicity electron–positron and electron–proton collisions, challenging the conventional assumption of fragmentation universality. Furthermore, the baryon-to-meson \pt-differential \Lambdac/\Dzero\ ratio shows a multiplicity-dependent enhancement. The \Xiczeroplus/\Dzero\ and \Xiczeroplus/\Lambdac\ were also measured during LHC Run 2 by ALICE. However, no significant multiplicity dependence was observed due to the limited precision. To further provide experimental constraints for such a new hadronisation mechanism, the current measurement can be improved by exploiting the large data sample of \pp\ collisions at \thirteensix\ during the Run˜3. In this contribution, a more precise production yield of \Xiczero\ baryons as a function of charged-particle multiplicity at midrapidity in pp collisions at \thirteensix\ will be presented.

Author: FANG, Tao (Central China Normal University CCNU (CN))

Co-authors: ZHU, Jianhui (Fudan University); YIN, Zhong-Bao (Central China Normal University CCNU (CN))

Presenter: FANG, Tao (Central China Normal University CCNU (CN))

Session Classification: Poster Session

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

Measurements of $\Sigma_c^{0,++}$ (2455, 2520) baryon productions in proton–proton collisions with ALICE

Tuesday, March 24, 2026 6:59 PM (1 minute)

Recent measurements of charm-baryon production at midrapidity in small collision systems show a baryon-to-meson ratio significantly higher than that measured in e+e- and e-p collisions. These results indicate that the charm-baryon production in hadronic collisions is not fully understood and suggest a non-universality of fragmentation functions among different collision systems. Models that better describe the Λ_c^+/D^0 ratio in pp collisions point to a significant contribution to Λ_c^+ yield from decays of heavier charm-baryon states. Therefore, measurements of the production of charm-baryon states decaying to Λ_c^+ are crucial to understand the charm-quark hadronization in the presence of a surrounding partonic environment.

In this contribution, the measurements of $\Sigma_c(2455)^{0,++}$ and $\Sigma_c^*(2520)^{0,++}$ production in pp collisions at midrapidity obtained from the anlysis of the large datasets collected by ALICE during LHC Run 3 are presented. The classification of prompt and non-prompt $\Sigma_c^{0,++}$ baryons is performed by exploiting machine-learning techniques, taking advantage of the excellent tracking and vertexing performance of the upgraded ALICE detectors. The baryon-to-baryon ratio $\Sigma_c^*(2520)^{0,++}/\Sigma_c(2455)^{0,++}$ is presented and compared with model predictions. The baryon-to-meson ratios $\Sigma_c^{0,++,+++}/D^0$ and the feed-down contribution to Λ_c^+ production from $\Sigma_c^{0,++,+++}$ are also reported, with a more detailed p_T-differential study compared to Run 2 measurements. These measurements provide important constraints on the hadronization models and represent a fundamental contribution for the comprehension of charm quark hadronization.

Author: Mr ZHANG, Mingyu (Central China Normal University, University of Padova)

Presenter: Mr ZHANG, Mingyu (Central China Normal University, University of Padova)

Session Classification: Poster Session

Contribution ID: **134** Type: **Oral Presentation**

Probing deconfinement and related phenomena from small to large systems with Υ˜meson measurements with the CMS experiment

Wednesday, March 25, 2026 10:55 AM (20 minutes)

One of the most unanticipated findings of the LHC heavy ion program is the observation of stronger suppressions of the excited Υ states compared to the lower $\Upsilon(1S)$˜state in \mbox{proton-lead} collisions, with the same hierarchy as seen in the larger \mbox{lead-lead}˜(PbPb) collision events. Together with other observations of signatures of quark-gluon plasma formation in "small systems", this feature raises the question of whether a hot medium can be produced in such systems and motivates studies for ions with different sizes. At the same time, polarization observables remain to be investigated since the observed suppression patterns could be caused (to a large extent) by variations in quarkonium polarization rather than by changes in a genuine medium-induced modification of the production yields.
We report the first measurement of Υ˜mesons in \mbox{oxygen-oxygen} and \mbox{neon-neon} collisions and the observation of stronger suppression for the excited states. The yield ratios relative to the $\Upsilon(1S)$ production rate are compared with similar results from other collision systems as well as with models describing the nuclear modification of quarkonium production in (deconfined) media. In addition, we present a measurement of $\Upsilon(1S)$ polarization in PbPb collisions in the helicity and Collins-Sopper frames. These measurements represent important steps in establishing a comprehensive picture of quarkonium dynamics from small to large collision systems.

Authors: CMS COLLABORATION; KRINTIRAS, Georgios (Univ. of Kansas)

Presenter: KRINTIRAS, Georgios (Univ. of Kansas)

Session Classification: Parallel I: Strangeness and HF

Track Classification: 1. Strangeness and heavy flavor production in nuclear collisions

Contribution ID: **135** Type: **Oral Presentation**

Strange Hadrons at Intermediate p_T: Probing Collectivity and Hadronization in OO and NeNe Collisions at the LHC

Tuesday, March 24, 2026 9:25 AM (20 minutes)

Collective phenomena and the baryon-to-meson ratio in high-energy nuclear collisions provide unique insights into the formation and evolution of the quark–gluon plasma (QGP). For the first time, elliptic (v_2) and triangular (v_3) flow coefficients of strange hadrons (Λ and K^0_S), together with Λ/K^0_S ratios, are measured in light-ion (OO and NeNe) collisions at $\sqrt{s_{NN}}$=5.36 TeV with the CMS detector at the LHC. The measurements investigate the particle-species and transverse momentum (p_T) dependence of collective behavior and the potential scaling with the number of constituent quarks (n_q), highlighting the interplay of hydrodynamic expansion, partonic collectivity, and hadronization via quark coalescence. The centrality and p_T dependence of the Λ/K^0_S ratio underscores the role of radial flow and quark coalescence in particle production. Comparisons with pp, pPb, and PbPb collisions provide fresh insights into collective expansion and the evolution of the QGP from small to large collision systems. In addition, the centrality dependence of v_2 and v_3 of charged hadrons in OO and NeNe collisions is presented to characterize the hydrodynamic response to the initial geometry.

Authors: CMS COLLABORATION; PUJAHARI, Prabhat Ranjan (IIT Madras India)

Presenter: PUJAHARI, Prabhat Ranjan (IIT Madras India)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **136** Type: **Oral Presentation**

Spin-dependent azimuthal asymmetry of coherent J/ψ photoproduction in peripheral PbPb collisions with CMS

Tuesday, March 24, 2026 12:15 PM (20 minutes)

The Lorentz-boosted electromagnetic fields of relativistic heavy ions serve as intense sources of linearly polarized quasi-real photons. Under the s-channel helicity conservation hypothesis, a coherently photoproduced vector meson inherits this polarization, leading to a characteristic second-harmonic ($cos2\phi$) modulation in the azimuthal distribution of its decay products. Such modulation was recently observed for $\rho^0 \to \pi^+\pi^-$ in heavy-ion UPCs at mid-rapidity, where interference between two indistinguishable photon–nucleus production paths induces a strong correlation between the meson's transverse momentum and its polarization direction. This correlation diminishes at forward rapidity or in asymmetric collision systems, where the interference is suppressed. In this talk, we present the first measurement of the $cos2\phi$ modulation in coherently photoproduced $J/\psi \to \mu^+\mu^-$ decays relative to the impact-parameter direction, estimated using event-plane techniques, providing a more robust estimator of the polarization axis. Both the centrality and rapidity dependence of the modulation are investigated. Compared with previous results for spin-0 final states (pions from coherent ρ^0 decays), this new study provides a direct test of the spin-state dependence of azimuthal asymmetries. Furthermore, we discuss the potential application of the intrinsic polarization of coherently photoproduced vector mesons as a complementary reaction-plane estimator in heavy-ion collisions and small systems (e.g., p-A).

Authors: CMS COLLABORATION; HUA, Xueli (South China Normal University)

Presenter: HUA, Xueli (South China Normal University)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

Contribution ID: **137** Type: **Poster Presentation**

The first energy-dependent measurement of coherent ρ^0 photoproduction in PbPb UPCs with CMS

Tuesday, March 24, 2026 7:12 PM (1 minute)

Coherent vector meson photoproduction in ultraperipheral heavy-ion collisions (UPCs) provides a powerful probe of the nuclear gluon structure at small Bjorken-x. Vector mesons with different masses exhibit varying sensitivities to nonlinear QCD dynamics: lighter mesons probe lower energy scales and are therefore more sensitive to gluon saturation and nuclear shadowing effects. Among them, ρ^0-the lightest vector meson-serves as one of the most sensitive probes of these nonlinear phenomena in coherent photoproduction, despite the inherent challenges associated with non-perturbative QCD calculations. In this talk, we present the measurement of coherent ρ^0 photoproduction in Pb+Pb UPCs at $\sqrt{s_{NN}} = 5.36$ TeV with the CMS detector. The differential cross section is reported as a function of rapidity over a broad kinematic range $|y| < 2$. A two-fold ambiguity in the photon direction, intrinsic to symmetric nucleus–nucleus UPCs, has traditionally limited access to the photon–nucleus center-of-mass energy and the corresponding small-x region. We will present the measurement that resolves this ambiguity, enabling the first extraction of the coherent ρ^0 photoproduction cross section as a function of the photon–nucleon center-of-mass energy up to about 160 GeV, corresponding to x values down to $\sim 1.9 \times 10^{-5}$. These results provide new constraints on nuclear shadowing and gluon saturation effects in the small-x regime.

Authors: CMS COLLABORATION; Ms VERMA, Pranjal (Indian Inst. of Tech. Madras)

Presenter: Ms VERMA, Pranjal (Indian Inst. of Tech. Madras)

Session Classification: Poster Session

Contribution ID: **138** Type: **Oral Presentation**

Charm quark and QGP interactions through the spectra and anisotropic flow of D0 over the widest pT interval using Event-Shape Engineering at CMS

Tuesday, March 24, 2026 5:25 PM (20 minutes)

The charm quark is formed almost exclusively during the initial stages of the collision, and a significant fraction of the charm quarks fragment into the D^0 meson, the lightest open-charm hadron. We can gain insights into the interactions between the charm quark and the quark-gluon plasma (QGP) medium by studying the production and the flow of D^0 mesons in heavy-ion collisions. We study the effect of the initial shape of the collision system on the elliptic flow (v_2) of promptly produced D^0 using event-shape engineering (ESE) in PbPb collisions at 5.02 TeV, at CMS. A correlation between the initial shape anisotropy, accessed via the low-p_{T} charged hadron v_2, with the D^0 v_2 would suggest that the flow gets driven by the interactions between the charm quark and the QGP and comparison with theoretical predictions allow us to unravel the mechanism behind the generation of v_2. We also study the anisotropic flow of nonprompt D^0 produced due to the decay of the bottom quarks. These studies provide further insights into the QGP interactions with heavy quarks like charm and bottom in heavy-ion collisions in different p_T regions ranging from 2–30 GeV/c, the widest ever performed with ESE, and centralities between 0–50\%.

Authors: CMS COLLABORATION; CHANDRA, Soumik (Purdue University)

Presenter: CHANDRA, Soumik (Purdue University)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **140** Type: **Oral Presentation**

Recent results on quarkonium suppression in pPb collisions at 8.16 TeV with CMS

Wednesday, March 25, 2026 11:35 AM (20 minutes)

Final-state effects such as interactions with co-moving particles or quark coalescence can influence the hadronization dynamics of heavy quarks in nuclear collisions. To investigate these phenomena, we present new multi-differential measurements of the $\Upsilon(nS)/\Upsilon(1S)$ production ratios as functions of rapidity, transverse momentum, and charged-particle multiplicity in proton-lead (pPb) collisions at $\sqrt{s_{\mathrm{NN}}} = 8.16\,\mathrm{TeV}$ with the CMS detector. These measurements probe higher multiplicities and achieve significantly improved precision compared to previous results at 5.02 TeV, and are further compared with the measurements in pp and PbPb collision systems. By comparing these relative bottomonium production ratios with recently measured $\psi(2S)/J/\psi$ ratios in the same system, we examine whether final-state effects manifest differently for charm and bottom quarks during the system's evolution. The results will provide new constraints on heavy-quark hadronization models in the nuclear collisions.

Authors: CMS COLLABORATION; NANDA, Shirsendu (Univ. of Illinois Chicago)

Presenter: NANDA, Shirsendu (Univ. of Illinois Chicago)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **141** Type: **Poster Presentation**

Probing the properties of the quark–gluon plasma through radial and anisotropic flow correlations across collision systems with CMS

Tuesday, March 24, 2026 6:57 PM (1 minute)

The study of collective phenomena in high-energy nuclear collisions provides crucial insights into the formation and evolution of the quark–gluon plasma (QGP). The transverse momentum–dependent isotropic flow observable, $v_0(p_T)$, probes radial flow fluctuations and their evolution from small to large systems, providing sensitivity to the medium's transport properties. Using data recorded with the CMS experiment at the LHC, the evolution of radial flow and its dependence on system size is measured and compared for the first time in pp, pPb, newly measured oxygen–oxygen (OO) and neon–neon (NeNe), and PbPb systems. Complementary measurements of the covariance between anisotropic flow coefficients and mean transverse momentum, cov(v_n, $[p_T]$), quantify correlations between geometric anisotropy and overall expansion strength. Also, elliptic (v_2) and triangular (v_3) flow harmonics are measured to characterize the anisotropic response to nuclear geometry in OO and NeNe systems. These results provide a unified picture of the QGP evolution across different collision systems and offer new constraints on initial-state fluctuations and nuclear deformation.

Authors: DATTAMUNSI, Aryaa (Indian Inst. of Tech. Madras); CMS COLLABORATION

Presenter: DATTAMUNSI, Aryaa (Indian Inst. of Tech. Madras)

Session Classification: Poster Session

Contribution ID: **142** Type: **Oral Presentation**

Probing Charm Quark Hadronisation with Strange and Baryonic Probes

Wednesday, March 25, 2026 9:25 AM (20 minutes)

The hadronisation of charm quarks within the strangeness-rich environment of the Quark-Gluon Plasma (QGP) offers a unique laboratory for studying non-perturbative QCD dynamics. We present new measurements from the CMS experiment utilising the high-statistics lead-lead (PbPb) collision datasets from Run 2 and Run 3. This work features a high-precision measurement of the elliptic (v_2) and triangular (v_3) flow of prompt $D_s^{\pm}$ mesons, which provides a unique handle on charm quark dynamics, as it is directly sensitive to the interplay between charm quarks and the strange-enhanced QGP environment. Concurrently, we present the first-ever measurement of the elliptic flow (v_2) of the prompt $\Lambda_c^{\pm}$ baryon, providing a definitive test of charm quark thermalisation and the degree to which it participates in the medium's anisotropic expansion. By comparing the flow of $D_s^{\pm}$ and $\Lambda_c^{\pm}$ to non-strange D^0 mesons, we can disentangle the effects of quark mass, strangeness content, and baryon-versus-meson formation on charm quark thermalisation and hadronisation. These flow measurements are contextualized by recent results for the $\Lambda_c^{\pm}$ nuclear modification factor (R_{AA}) and the $\Lambda_c^{\pm}/D^0$ yield ratio, which provide crucial information on charm quark energy loss and hadronization mechanisms. Collectively, these results serve as a crucial benchmark for theoretical models, offering unprecedented insight into the fundamental mechanisms of heavy quark interactions and hadronisation in the QGP.

Authors: CMS COLLABORATION; SAHA, Nihar Ranjan (Purdue University)

Presenter: SAHA, Nihar Ranjan (Purdue University)

Session Classification: Parallel III: Resonances

Contribution ID: **143** Type: **Oral Presentation**

Advances in Measuring Global Spin Density Matrix Elements of Vector Mesons in Heavy-Ion Collisions

Tuesday, March 24, 2026 3:35 PM (20 minutes)

The STAR Collaboration reported a significant ϕ-meson global spin alignment (ρ_{00}) signal in Au+Au collisions at $\sqrt{s_{NN}} \leq 62$ GeV by measuring the one dimensional (1D) polar angle distribution of ϕ-meson daughters with respect to the orbital angular momentum direction of the collision system [1].
This talk summarizes methodological developments from a recent paper on a two-dimensional (2D) method that considers the polar and azimuthal angle distributions, enabling simultaneous extraction of ρ_{00} and off-diagonal spin density matrix elements (SDMEs) for vector mesons in heavy-ion collisions [2].
This new method provides unique access to local quark-antiquark spin correlations and spin hydrodynamics in quark-gluon plasma, in addition to removing potential biases from non-zero off-diagonal SDMEs on ρ_{00} extracted with the 1D method [3-6].
Models invoking a strong meson force field or non-zero helicity frame ρ_{00} induced by the relative motion of $s\bar{s}$ pairs to the thermal background in heavy-ion collisions have been able to describe the 1D ρ_{00} results from [1]; however, these models assume off-diagonal SDMEs are zero [7-12]. A recently developed quark recombination model with quark-antiquark spin correlations is able to simultaneously explain ϕ-meson ρ_{00} measurements and lambda polarization (P_Λ) [3]. A distinctive feature of this model is the prediction of possible non-zero off-diagonal SDMEs. In this talk, a detailed procedure to correct for detector acceptance and resolution effects will be presented and validated using simulation studies, advancing experimental efforts towards measuring vector meson SDMEs and understanding their physical origin.

[1] STAR Collaboration., Nature \textbf{614}, 244–248 (2023)
[2] G. Wilks, X. Sun, and Z. Ye, arXiv:2510.18899 [nucl-ex] (2025).
[3] J.P. Lv et al., Physical Review D \textbf{109}, 114003 (2024).
[4] K.J. Gon\c{c}alves and G. Torrieri, Phys. Rev. C \textbf{105} 034913 (2022).
[5] P.H. De Moura, K.J. Gon\c{c}alves, and G. Torrieri, Phys. Rev. D \textbf{108} 034032 (2023).
[6] K.J. Gon\c{c}alves, G. Torrieri, and R. Ryblewski, Phys. Rev. C \textbf{112} 014901 (2025).
[7] X.L. Sheng et al., Physical Review D \textbf{101}, 096005 (2020).
[8] X.L. Sheng et al., Physical Review D \textbf{105}, 099903 (2022).
[9] X.L. Sheng et al., Physical Review D \textbf{102}, 056013 (2020).
[10] X.L. Sheng et al., Physical Review Letters \textbf{131}, 042304 (2023).
[11] X.L. Sheng et al., Physical Review C \textbf{108}, 054902 (2023).
[12] X.L. Sheng et al., Physical Review D \textbf{110}, 056047 (2024).

Authors: WILKS, Gavin (University of Illinois at Chicago); Dr SUN, Xu (The Institute of Modern Physics); YE, Zhenyu (LBNL)

Presenter: YE, Zhenyu (LBNL)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

Contribution ID: **144** Type: **Oral Presentation**

Exploring System-Size and Energy Dependence of J/ψ production with the STAR experiment

Wednesday, March 25, 2026 11:15 AM (20 minutes)

The suppression of quarkonium production in heavy-ion collisions has long been recognized as a key signature of QGP formation, reflecting the medium's temperature and color-screening properties. However, interpreting the observed nuclear modification factor (R_{AA}) remains challenging due to the interplay between hot-medium effects (dissociation and regeneration) and cold nuclear matter effects. Systematic measurements across different collision systems and energies are therefore essential to disentangle these contributions and deepen our understanding of QGP properties.

In this talk, we present new measurements of the J/ψ R_{AA} as a function of centrality and transverse momentum in O+O collisions at $\sqrt{s_{\rm NN}} = 200$ GeV, together with preliminary results from Au+Au collisions at $\sqrt{s_{\rm NN}}$ = 14.6–27 GeV collected during the RHIC BES-II program. The O+O data probe a unique regime in system size, bridging small (p+p, p+Au) and large (Au+Au, U+U) collisions, and are directly comparable to results from intermediate-size systems such as Cu+Cu and isobar (Ru+Ru, Zr+Zr) collisions. These measurements provide crucial insight into the onset of QGP formation and the nuclear properties across system size and energy. We further discuss the energy dependence of J/ψ R_{AA} from RHIC to LHC energies and compare the results with theoretical model calculations.

Authors: ZHANG, Aoke (South China Normal University); STAR COLLABORATION

Presenter: ZHANG, Aoke (South China Normal University)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **146** Type: **Oral Presentation**

Measurement of Charge Symmetry Breaking in A = 4 hypernuclei in $\sqrt{s_{NN}} = 3$ GeV Au+Au collisions at RHIC

Tuesday, March 24, 2026 4:25 PM (20 minutes)

The Λ binding energy difference between ^{4}H and ^{4}He, which is called the charge symmetry breaking in the ground states of a pair of A = 4 hypernuclei, was measured to be $\Delta B^4_\Lambda(0^+_{g.s.}) \approx 350$ keV in nuclear emulsion experiments in the 1970s. In the 2015 and 2016 experiments from J-PARC and A1 collaboration, the binding energy difference in excited states was found to be much smaller than that in the ground states. These results are difficult to reproduce in existing theoretical models. The full understanding of the charge symmetry breaking in A = 4 hypernuclei still remains an open question.

As a part of the STAR fixed target program, the STAR detector collected data in Au+Au collisions at $\sqrt{s_{NN}} = 3$ GeV. The high production yield of hypernuclei provides an opportunity to measure the Λ binding energies of both A = 4 hypernuclei in ground states in the same experiment to address this charge symmetry breaking puzzle. In 2022, STAR reported measurements of the Λ binding energies of ^{4}H and ^{4}He using 2018 data, finding $\Delta B^4_\Lambda(1^+_{exc}) = -\Delta B^4_\Lambda(0^+_{g.s.}) = -0.16 \pm 0.14(\mathrm{stat.}) \pm 0.12(\mathrm{syst.})$˜MeV, though with large statistical uncertainties. STAR collected about 2 billion Au+Au collision events at $\sqrt{s_{NN}} = 3$ GeV in the run 2021.

In this talk, we will present the improved measurement of the charge symmetry breaking in A = 4 hypernuclei in Au+Au collisions at $\sqrt{s_{NN}} = 3$ GeV with 2021 data. The signal reconstructions and binding energy measurements of ^{4}H and ^{4}He, including corrections and systematic uncertainty evaluations, will be discussed. The new results show about factor of 3 reduction in statistical uncertainties and confirm that the charge symmetry breaking in ground and excited states have similar magnitudes with opposite signs. These results will be compared to previous measurements and theoretical models.

Authors: STAR COLLABORATION; SHAO, Tianhao (Fudan University)

Presenter: SHAO, Tianhao (Fudan University)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **147** Type: **Poster Presentation**

Search for Exotic Particles in Multi-Prong Central Exclusive Production in pp Collisions at the STAR Experiment

Tuesday, March 24, 2026 7:13 PM (1 minute)

Central Exclusive Production (CEP) refers to a class of processes in which two protons interact through the exchange of colorless objects, such as photons or pomerons, resulting in the production of an isolated hadronic system in the central region, while both protons remain intact. In this analysis, CEP events are studied in proton–proton collisions at $\sqrt{s} = 510$ GeV recorded by the STAR experiment. Fiducial selections based on the Roman Pot acceptance are applied to ensure full kinematic containment and precise reconstruction of the scattered protons. Exotic hadrons are investigated in the exclusive $\pi^+\pi^-$, K^+K^-, and $\pi^+\pi^-\pi^+\pi^-$ final states through amplitude-based fits employing coherent and incoherent wave components that include spin and angular-momentum dependencies. Differential studies as a function of the transverse-momentum difference between the scattered protons - commonly referred to as \textit{glueball filtering} - are performed to probe the underlying production dynamics and explore kinematic regions that may favor gluon-rich resonance formation (glueball-like). Simulations using the GRANIITTI CEP event generator incorporate various exotic hadron resonances, providing a theoretical framework for interpreting the observed structures and validating the amplitude model.

Authors: GIRI, Aranya (Univ. of Houston); STAR COLLABORATION

Presenter: GIRI, Aranya (Univ. of Houston)

Session Classification: Poster Session

Contribution ID: **148** Type: **Oral Presentation**

Observation of a Strange Muonic Atom and Its Antimatter in Heavy-Ion Collisions at STAR

Tuesday, March 24, 2026 5:05 PM (20 minutes)

The discovery of exotic muonic atoms, including muonic antihydrogen and muonic kaon atoms, constitutes a milestone in our ability to make and study new forms of matter. The unique environment of relativistic heavy-ion collisions, characterized by the abundant production of muons alongside other charged particles, provides a promising platform for the formation and detection of these exotic atomic systems.

In this talk, we will report the observation of a new muonic atom composed of a muon bound to a kaon meson containing a strange quark. These strange muonic atoms and their antimatter counterparts are produced in isobar Ru+Ru and Zr+Zr collisions at $\sqrt{s_{\mathrm{NN}}}$ = 200 GeV and detected using the STAR detector at the Relativistic Heavy Ion Collider (RHIC). These measurements are used to directly determine the lepton production source size and to extract the yield of primordial low-p_T muons originating from the Quark Gluon Plasma (QGP) created in heavy-ion collisions.

Authors: STAR COLLABORATION; WANG, Xiaofeng (Shandong University)

Presenter: WANG, Xiaofeng (Shandong University)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **150** Type: **Oral Presentation**

Exploring Strangeness Production across Beam Energies in Au+Au Collisions at STAR

Tuesday, March 24, 2026 11:35 AM (20 minutes)

Strangeness production has been suggested as a sensitive probe of the early dynamics of the deconfined matter created in heavy-ion collisions. The measurements of the colliding energy dependence of (multi-)strange baryon-to-meson ratios can provide us with insights into the hadronization mechanism, which will contribute to the search for the energy threshold of the production of the Quark Gluon Plasma (QGP), one of the main goals of the Beam Energy Scan (BES) program at RHIC. The transverse momentum distribution of strange hadron production can be utilized to extract the features of the medium, such as the radial flow strength and the kinetic freeze-out temperature, which are also sensitive to QGP formation. Moreover, the rapidity density of (anti-)strange baryons may shed light on the baryon stopping mechanism. Recent datasets collected by STAR in Au+Au collisions at $\sqrt{s_{\rm NN}}$ = 7.7, 9.2, 11.5, 14.6, 17.3 and 19.6 GeV from the Beam Energy Scan II program provide us with an opportunity to carry out precise measurements of the observables mentioned above.

In this talk, we will present new measurements of strange hadron production in Au+Au collisions at $\sqrt{s_{\rm NN}}$ = 7.7, 9.2, 11.5, 14.6, 17.3, 19.6 GeV, including transverse-momentum spectra, rapidity spectra, nuclear modification factors, the averaged transverse momentum ($\langle p_T \rangle$) and mass ($\langle m_T \rangle - m_0$), antibaryon-to-baryon ratios and baryon-to-meson ratios. In particular, precise measurements of the energy and centrality dependence of Ω/ϕ ratios in Au+Au collisions at different energies will also be presented. These results will be compared with theoretical model calculations and the corresponding physics implications will be discussed.

Authors: STAR COLLABORATION; XU, Xiongxiong (Tsinghua University)

Presenter: XU, Xiongxiong (Tsinghua University)

Session Classification: Parallel I: Strangeness and HF

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

J/ψ production as a function of event activity in p+p collisions at $\sqrt{s} = 510$ GeV at STAR

Tuesday, March 24, 2026 7:00 PM (1 minute)

In this poster, we present measurements of J/ψ meson production in p+p collisions at $\sqrt{s} = 510$ GeV as a function of event activity. The J/ψ mesons are reconstructed via their dielectron decay channel at mid-rapidity ($|y| < 1$) for the transverse-momentum range $4 < p_T < 12$ GeV/c. We observe a faster-than-linear increase in J/ψ production with respect to the mid-rapidity charged-particle multiplicity density, with RHIC data seeming to follow a different trend than LHC measurements. These results will help improve our understanding of quarkonium production in p+p collisions and constrain theoretical models that incorporate such effects as multi-parton interactions and color-string percolation.

Author: SCHAEFER, Brennan (Lehigh University)

Presenter: SCHAEFER, Brennan (Lehigh University)

Session Classification: Poster Session

Contribution ID: **156** Type: **Oral Presentation**

A new 4D lattice QCD equation of state: extended density coverage from a generalized T'-expansion

Tuesday, March 24, 2026 3:35 PM (20 minutes)

Although calculations of QCD thermodynamics from first-principle lattice simulations are limited to zero net-density due to the fermion sign problem, it is possible to extend the equation of state (EoS) to finite values of the μ_B, μ_Q, μ_S chemical potentials via expansions around zero chemical potentials. Thanks to a new method based on a T'-expansion scheme, it was possible to extrapolate in the (T, μ_B) plane up to a baryo-chemical potential around $\mu_B/T = 3.5$, further than the range currently accessible by the Taylor expansion ($\mu_B/T < 2.5 \sim 3$) [1]. We present here a generalization of this scheme in which all three chemical potentials can be varied independently. We base our construction on continuum-estimated susceptibilities, obtained with the 4stout action on lattices with up to $N_\tau = 16$, 20 and 24 time slices, depending on the quantity considered [2]. As a result, we are able to offer a substantially larger coverage of the four dimensional QCD phase diagram compared to extrapolations based on the Taylor expansion, which we discuss based on stability and causality criteria.
[1] S. Borsanyi et al., Phys. Rev. Lett. 126 (2021) 23, 232001.
[2] A. Abuali et al., Phys.Rev.D 112 (2025) 5, 054502.

Author: MUSES COLLABORATION

Presenter: ABUALI, Ahmed (Univ. of Houston)

Session Classification: Parallel V: Phase Structure

Contribution ID: **157** Type: **Poster Presentation**

π/K/p/φ flow in O+O and d+Au collisions

Tuesday, March 24, 2026 6:58 PM (1 minute)

The collective expansion of Quark-Gluon Plasma (QGP) is characterized by distinct experimental signatures, such as mass ordering[1] of hadron anisotropic flow coefficients (v_n) and the Number of Constituent Quarks (NCQ) scaling[2]. This poster aims to investigate these key signatures in small collision systems by measuring the anisotropic flow (v_n) for identified particles (pions, kaons, protons, and ϕ-mesons) in O+O and d+Au collisions at $\sqrt{s_{NN}}$ =200 GeV, using data from the STAR experiment's 2021 run. By investigating mass ordering in flow coefficients at low p_T, we will be able to probe the potential development of radial flow, as expected from hydrodynamic expansion. At intermediate p_T, the v_n values of different hadron species will be tested for NCQ scaling, a signature that would indicate hadronization via the coalescence of constituent quarks from a collectively flowing partonic medium. The ϕ-meson, being largely insensitive to hadronic rescattering, would serve as a clean probe of the early partonic stage and behavior consistent with a common partonic flow. Furthermore, a comparison between d+Au and O+O collisions at similar multiplicities but different initial-state geometries, will be performed. This comparison will be essential in demonstrating if the magnitude of flow and the degree of scaling depend on system size and initial pressure gradients, hence providing crucial insights into the properties of the QGP created in small-system collisions.

References:
[1] C. Adler et al. Identified particle elliptic flow in au + au collisions at √sNN = 130GeV.Phys. Rev. Lett., 87:182301, Oct 2001.
[2] J. Adams et al. Azimuthal anisotropy in au+au collisions at √sNN = 200 GeV. Phys. Rev. C, 72:014904, Jul 2005.

Author: PAUL, Souvik (Stony Brook University)

Presenter: PAUL, Souvik (Stony Brook University)

Session Classification: Poster Session

Contribution ID: **159** Type: **Oral Presentation**

Extracting the Speed of Sound from Mean Transverse Momentum Measurements in Au+Au Collisions from RHIC Beam Energy Scan-II at STAR

Tuesday, March 24, 2026 10:05 AM (20 minutes)

The speed of sound c_s in strongly interacting matter encodes the stiffness of the nuclear equation of state (EOS). Recent theoretical work has argued that c_s^2 can be extracted experimentally from the logarithmic slope between the mean transverse momentum $\langle p_T \rangle$ and charged multiplicity $\langle dN/d\eta \rangle$ in ultra-central collisions. In ultra-central collisions, it is conjectured that the effective interaction volume becomes fixed, leading to a sensitivity of the $\langle p_T \rangle$ to the EOS that is otherwise diluted by volume variation in more peripheral regimes. The goal is to measure the speed of sound as a function of collision energy for the majority of data taken during the STAR Beam Energy Scan Phase II. We apply this framework initially to ultra-central Au+Au collisions at $\sqrt{s_{\rm NN}}$=200 GeV and determine the slope parameter $(dln\langle p_T \rangle)/dln\langle dN/d\eta \rangle)$ which serves as a potential experimental proxy for c_s^2. In addition, we compare our data to previous measurements at higher energy from ALICE and CMS.

Authors: BROODO, Caleb (Univ. of Houston); STAR COLLABORATION

Presenter: BROODO, Caleb (Univ. of Houston)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **160** Type: **Oral Presentation**

A 4D T'-expanded lattice QCD equation of state with a multi-dimensional critical contribution

Tuesday, March 24, 2026 5:25 PM (20 minutes)

Recently, a new equation of state based on the two-dimensional T'-expansion scheme with a parametrizable critical point from the 3D Ising model was released [1]. It allows to produce a family of equations of state which can be used to study the effect of the critical point on the QCD phase diagram, crucial to infer its existence and location from experimental results. Employing the newly developed 4D T'-expansion scheme equation of state from lattice QCD [2], we are now extending the critical point contribution from the (T, μ_B) plane to a critical surface at finite μ_B, μ_Q and μ_S. We present preliminary results of this generalization, where the critical surface at finite (μ_B, μ_Q, μ_S) can be parametrized using different functional forms.
[1] M. Kahangirwe, S. A. Bass, E. Bratkovskaya, J. Jahan, P. Moreau, P. Parotto, D. Price, C. Ratti, O. Soloveva, M. Stephanov, Phys.Rev.D 109 (2024) 9, 094046.
[2] A. Abuali et al., Phys.Rev.D 112 (2025) 5, 054502.

Authors: JAHAN, Johannes (Univ. of Houston); MUSES COLLABORATION

Presenter: JAHAN, Johannes (Univ. of Houston)

Session Classification: Parallel V: Phase Structure

Contribution ID: **161** Type: **Poster Presentation**

Measurement of the azimuthal correlation of D^0 mesons with charged particles in pp collisions at $\sqrt{s} = 13.6$ TeV with ALICE

Tuesday, March 24, 2026 6:56 PM (1 minute)

The analysis of the azimuthal-angle correlation between D^0 mesons and charged particles is important for studying charm-quark production, which occurs in the early stages of high-energy collisions via hard scattering. After their production, charm quarks undergo a fragmentation process which results in a spray of hadrons after hadronization, quite collinear to the charm quark at high momentum. The azimuthal-angle correlation is characterized by near- and away-side peaks, associated with the fragmentation of the charm quark and the recoil-parton topology, respectively. The measurement of the peak yield and width offers insights into the amount of particles produced from the charm fragmentation and their angular displacement with respect to the charm quark, respectively.

In this study, we present p_{T}-differential measurements of the azimuthal-angle correlation between D^0 mesons and charged particles in pp collisions at $\sqrt{s} = 13.6$ TeV, performed with the ALICE detector. Comparisons with previous studies at $\sqrt{s} = 5.02$ TeV, $\sqrt{s} = 7$ TeV, and $\sqrt{s} = 13$ TeV suggest that the PYTHIA8 and POWHEG+PYTHIA8 models provide the best description of the data. The new measurement, obtained from the analysis of pp collisions collected by ALICE during the LHC Run 3, extends in transverse-momentum p_{T} reach the previous ones, and allows to better characterize the charm fragmentation process by setting more stringent and p_{T}-differential constraints to its modelling in event generators. The results will also be compared with those for D^+ and D_s^+ mesons to evaluate the consistency of charm fragmentation across species and to investigate the role of strangeness in charm hadronization.

Author: KHADE, Swapnesh (IIT Indore India)

Presenter: KHADE, Swapnesh (IIT Indore India)

Session Classification: Poster Session

Contribution ID: **162** Type: **Oral Presentation**

Bayesian inference of holographic transport and energy loss for the hot and baryon dense QGP

Wednesday, March 25, 2026 9:45 AM (20 minutes)

We use the Einstein-Maxwell-Dilaton model, which is based on the gravity/gauge duality framework, supplemented by Bayesian inference to calculate key transport coefficients and energy loss of the quark-gluon plasma including baryon conductivity, baryon diffusion, bulk viscosity, shear viscosity, drag force, heavy quark diffusion coefficient and jet quenching parameter. Our model is calibrated to match the lattice QCD equation of state at zero chemical potential. The model, with updated parametrization, exhibits a line of first-order phase transition at high chemical potential, with a critical point located at T = 103.5 MeV and ⌧⌧= 597.5 MeV [1]. Here we focus on studying the transport coefficient and energy loss in a baryon-rich quark-gluon plasma, particularly along the line of first order phase transition and in the vicinity of the critical point.
[1] Hippert, M., Grefa, J., Manning, T. A., Noronha, J., Noronha-Hostler, J., Portillo Vazquez, I., Ratti, C., Rougemont, R., Trujillo, M., Phys.Rev.D 110 (2024) 9, 094006

Author: MUSES COLLABORATION

Presenter: KHAN, Musa Rahim (Univ. of Houston)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **163** Type: **Oral Presentation**

Merging multidimensional equations of state of strongly interacting matter via a statistical mixture

Tuesday, March 24, 2026 5:45 PM (20 minutes)

We introduce a model-independent mechanism to merge two (or more) equations of state (EoS) by treating them as a two-fluid statistical mixture in the Grand Canonical Ensemble. The merged grand-potential density $\omega(T, \mu_B)$ is built directly from the input EoS, and the fluid fraction is fixed by minimizing ω at fixed (T, μ_B). Thermodynamic consistency is enforced across all observables. This construction satisfies the Maxwell relations and enforces convexity of the pressure $P(T, \mu_B)$. All quantities are derived from a single merged grand potential Ω as a function of T and μ_B. This yields smooth, differentiable fields over the T–μ_B plane. The method can be modified to accommodate a first-order phase transition and critical point on the phase diagram. Implementing this mechanism, we merge a van der Waals hadron resonance gas EoS with a holographic Einstein Maxwell Dilaton EoS. The result is a single EoS, spanning hadronic to deconfined matter over a broad range in (T, μ_B). It has immediate applications to heavy-ion hydrodynamics simulations. This construction may be generalized to more than two input EoSs.

Authors: MUSES COLLABORATION; GARELLA, Prachi (Univ. of Houston)

Presenter: GARELLA, Prachi (Univ. of Houston)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **165** Type: **Oral Presentation**

Parameters sensitivity analysis of the Chiral Mean Field Model from Neutron Star Observables

Tuesday, March 24, 2026 10:55 AM (20 minutes)

We present a Fisher–information–based sensitivity analysis of the Chiral Mean Field (CMF) model parameters using neutron star observables as macroscopic probes of dense QCD matter. Building upon the MUSES framework, we developed a workflow that integrates the CMF, Lepton, and QLIMR modules to generate cold, β-equilibrated equations of state by smoothly merging a CMF core with the SLy crust, and to produce the corresponding stellar sequences. From these, we extract masses, radii, compactnesses, and tidal deformabilities, whose logarithmic derivatives with respect to each CMF parameter and the central energy define a dimensionless, Fisher-inspired sensitivity matrix. A principal-component analysis (PCA) of this matrix identifies the effective combinations of microscopic parameters that most strongly govern neutron-star structure. This framework establishes a reproducible, data-driven approach to quantify parameter sensitivities in dense-matter models and to guide future Bayesian inference of nuclear information from multi-messenger astrophysical observations.

Author: MUSES COLLABORATION

Presenter: CAMACHO, Nikolas Cruz (University of Illinois Urbana Champaign)

Session Classification: Parallel VII: EoS and Astrophysics

Contribution ID: **167** Type: **Oral Presentation**

How strange: Phase diagrams with 3 critical points

Wednesday, March 25, 2026 8:45 AM (20 minutes)

We find that chiral mean-field models can produce a phase diagram with 3 critical points: the usual liquid-gas transition, deconfinement, and also a new critical point that arises from a transition from the baryon octet phase into a phase dominated by strange and resonance baryons. At the onset of this phase we find a drastic increase in strangeness since cascade baryons tend to dominate. We discuss possible signatures within heavy-ion collisions and neutron star mergers.

Authors: Prof. NORONHA-HOSTLER, Jacquelyn (University of Illinois Urbana Champaign); MUSES COLLABORATION

Presenter: Prof. NORONHA-HOSTLER, Jacquelyn (University of Illinois Urbana Champaign)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **168** Type: **Oral Presentation**

Connecting heavy-ion collisions to strange dense matter in neutron stars

Wednesday, March 25, 2026 12:15 PM (20 minutes)

Connecting neutron stars to heavy-ion collisions is essential for constraining the neutron star Equation of State and its interior structure. One such phenomenological tool is the symmetry energy expansion, which characterizes the energy difference between symmetric nuclear matter and pure neutron matter [1]. However, the usual expansion is ill-defined when strangeness is present [2]. We generalize the symmetry energy expansion to include strangeness by redefining the isospin asymmetry parameter. The current work extends [2] to cover regimes where strangeness content is out of equilibrium, which accurately predicts the beta equilibrium state of the chiral mean field model [3]. With the new expansion, we can finally connect strange dense matter with heavy ion collisions. The expansion also provides a fast surrogate for input to calculate transport coefficients (e.g., bulk viscosity), reducing costly numerical evaluations.

[1] B.-A. Li, C. M. Ko, and W. Bauer, "Isospin Physics in Heavy-Ion Collisions at Intermediate Energies", Int. J. Mod. Phys. E 7, 147 (1998).
[2] Y. Yang, N. C. Camacho, M. Hippert, and J. Noronha-Hostler, "Symmetry Energy Expansion with Strange Dense Matter", 2504.18764.
[3] V. Dexheimer and S. Schramm, "Proto-Neutron and Neutron Stars in a Chiral SU(3) Model", Astrophys. J. 683, 943, (2008).

Author: RATTI FOR THE MUSES COLLABORATION, Claudia

Presenter: YANG, Yumu (University of Illinois Urbana Champaign)

Session Classification: Parallel VII: EoS and Astrophysics

Contribution ID: **169** Type: **Poster Presentation**

Finite-Temperature CMF-HRG Equation of State within MUSES

Tuesday, March 24, 2026 7:15 PM (1 minute)

Using the finite-temperature Chiral Mean Field (CMF) model within the MUSES framework—where the baryon octet and decuplet, including strange baryons, interact via meson fields and are treated at finite □ through Fermi integrals—we extend the particle content by adding species not included in CMF as a non-interacting ideal gas of PDG-listed hadrons and resonances, explicitly incorporating strange mesons and resonances. The resulting, thermodynamically consistent equation of state spans a wide range of temperatures and densities, enabling direct comparison with continuum-extrapolated lattice-QCD thermodynamics near □□=□□=□□=0 while remaining suitable for neutron-star and merger applications at high density. We outline calibration and validation targets against lattice and hadronic benchmarks and discuss implications for astrophysical modeling.

Kumar, Rajesh, Joaquin Grefa, Konstantin Maslov, Yuhan Wang, Arvind Kumar, Ralf Rapp, Claudia Ratti, and Veronica Dexheimer, Physical Review D 111, no. 7 (2025): 074029.

Cruz-Camacho, Nikolas, Rajesh Kumar, Mateus Reinke Pelicer, Jeff Peterson, T. Andrew Manning, Roland Haas, Veronica Dexheimer, Jaquelyn Noronha-Hostler, and (MUSES Collaboration), Physical Review D 111, no. 9 (2025): 094030.

Authors: GREFA, Joaquin (Kent State University); MUSES COLLABORATION

Presenter: GREFA, Joaquin (Kent State University)

Session Classification: Poster Session

Contribution ID: **170** Type: **Oral Presentation**

Momentum Anisotropy from Resistive Magnetohydrodynamics

Tuesday, March 24, 2026 11:35 AM (20 minutes)

We develop a relativistic framework for resistive magnetohydrodynamics for a two-component plasma composed of oppositely charged massless particles. Starting from the Boltzmann–Vlasov equation, the 14-moment method is used to derive coupled evolution equations for the charge–diffusion current and the shear–stress tensor. The formulation captures nonlinear feedback between electromagnetic fields and dissipative quantities and shows that even an electric field alone can generate shear stress in the fluid. In the homogeneous limit, the equations reproduce the expected Ohmic behavior at late times, while nonlinear effects modify the transient relaxation and lead to oscillatory, Hall-like responses in the presence of magnetic fields.
During Bjorken expansion, the electric field continues to act as the primary driver of shear, while the expansion rate modulates its evolution, enhancing the lifetime of the anisotropy and amplifying the coupling between diffusion and shear. The present formulation also provides a consistent basis to incorporate effects related to chirality. In particular, the inclusion of Berry-curvature terms in the kinetic description is expected to introduce parity-odd transport contributions, offering a natural way to study the connection between electromagnetic response and chiral dynamics in relativistic plasmas.

References:

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Co-author: Prof. DENICOL, Gabriel (Universidade Federal Fluminense, UFF, Niteroi, RJ, Brazil)

Presenter: KUSHWAH, Khwahish (Universidade Federal Fluminense (UFF), Rio de Janeiro, Brazil)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

Contribution ID: **172** Type: **Oral Presentation**

Monte Carlo EKRT event generator for initializing 3+1 D fluid dynamics in high energy nuclear collisions

Wednesday, March 25, 2026 10:05 AM (20 minutes)

We present a novel Monte-Carlo implementation of the EKRT model, MC-EKRT, for computing partonic initial states in high-energy nuclear collisions [1]. Our new MC-EKRT event generator is based on collinearly factorized, dynamically fluctuating pQCD minijet production, supplemented with a saturation conjecture that controls the low-p_T particle production. Previously, the EKRT model has been very successful in describing low-p_T observables at mid-rapidity in heavy-ion collisions at the LHC and RHIC energies [2,3]. As novel features, our new MC implementation gives a full 3-dimensional initial state event-by-event, includes dynamical minijet-multiplicity fluctuations in the saturation and particle production, introduces a new type of spatially dependent fluctuating nuclear parton distribution functions, and accounts for the conservation of energy/momentum and valence-quark number. We show, by averaging a large set of event-by-event MC-EKRT initial conditions for 3+1 dimensional hydrodynamical evolution, that we obtain a good agreement with the rapidity-dependent multiplicity and elliptic flow data for LHC Pb+Pb and RHIC 200 GeV Au+Au collisions. This suggests that the same saturation mechanism that has successfully explained the mid-rapidity observables, works well also at larger rapidities. As a further application of MC-EKRT, we also study event-by-event fluctuations and decorrelations of initial eccentricities.

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[2] H. Niemi, K. J. Eskola and R. Paatelainen, Phys. Rev. C 93, no.2, 024907 (2016)
[3] H. Hirvonen, K. J. Eskola and H. Niemi, Phys. Rev. C 106, no.4, 044913 (2022)

Authors: NIEMI, Harri (University of Jyväskylä); HIRVONEN , Henry (Vanderbilt University); Dr AUVINEN, Jussi (University of Jyväskylä); Prof. ESKOLA, Kari J. (University of Jyväskylä (FI)); KUHA, Mikko; KANAKUBO, Yuuka (RIKEN iTHEMS)

Presenter: HIRVONEN , Henry (Vanderbilt University)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **173** Type: **Oral Presentation**

Equation of State differentials in the QCD phase diagram mapped by heavy-ion isobar collisions and theory

Tuesday, March 24, 2026 2:55 PM (20 minutes)

Baryon (μ_B), electric charge (μ_Q) and strange quark (μ_S) chemical potentials, and temperature (T) are fundamental thermodynamic parameters characterizing QCD matter under extreme conditions. Their differentials ($\Delta\mu_B/\Delta\mu_Q$, $\Delta\mu_S/\Delta\mu_Q$) provide insight into the system's constituent correlation, response, and trajectory in the multidimensional (4D) QCD phase diagram. In this work, we report those differentials obtained from Bayesian analyses of experimental data in two isobar heavy-ion collisions ($Zr + Zr$ and $Ru + Ru$) and confront it with theory predictions for allowed trajectories in the QCD phase diagram. The chemical potentials and their differentials are derived from lattice QCD (expanded to finite net baryon chemical potential) and the Chiral Mean Field (CMF) model under the same conditions as the experiments. We find good agreement between experiment and theory, offering strong support for the theoretical modeling of QCD matter in 4D, while also identifying areas for further refinement.

Authors: Dr TSANG, Chun Yuen (Kent State University); RATTI, Claudia; GREFA, Joaquin (Kent State University / University of Houston); KUMAR, Rajesh; Prof. DEXHEIMER, Veronica (Kent State University); XU, Zhangbu (Kent State University)

Presenter: GREFA, Joaquin (Kent State University / University of Houston)

Session Classification: Parallel V: Phase Structure

Contribution ID: **176** Type: **Poster Presentation**

Measurement of thermal radiations in Au+Au collisions at 200 GeV by PHENIX

Tuesday, March 24, 2026 7:03 PM (1 minute)

Dileptons, being electromagnetically decoupled from the strongly interacting medium, are key probes of the thermal and chemical evolution of the Quark-Gluon Plasma (QGP) and the hadronic matter. In the intermediate mass range ($m_\phi < m_{ee} < m_{J/\psi}$), they primarily originate from the thermal radiation of the QGP and semi-leptonic decays of heavy flavor mesons. Disentangling these sources in the dilepton mass spectrum is essential for understanding the dynamics of thermal radiation and constraining theoretical models of QCD matter. In this talk, using the Silicon Vertex Detector and high-statistics Au+Au data at 200 GeV from 2014, PHENIX presents the first measurements of the dielectron mass spectrum at mid-rapidity, as well as an empirical approach to separate the thermal and heavy-flavor components via the distance-of-closest-approach. A good signal-to-background ratio is achieved using a boosted decision tree classifier for electron/hadron separation, along with precise hit-to-track matching and photon conversion rejection. The measured invariant mass spectrum agrees with expectations from hadronic decays based on previous PHENIX results and shows excess contributions consistent with expectations from heavy-flavor decays and thermal production. The achieved resolution in pair transverse distance-of-closest-approach, which reflects the spatial separation between electron and positron tracks, allows statistically separating prompt thermal radiation from heavy-flavor decay sources.

Author: MITRANKOVA, Mariia (Stony Brook University)

Presenter: MITRANKOVA, Mariia (Stony Brook University)

Session Classification: Poster Session

Contribution ID: **177** Type: **Oral Presentation**

Open heavy flavor in flowing QCD matter

Tuesday, March 24, 2026 5:45 PM (20 minutes)

We derive the leading modifications to transverse momentum broadening and medium-induced gluon spectrum in flowing matter for the case of a heavy flavor quark. We show that the broadening and radiation patterns acquire a new directional dependence arising from the interplay between the quark mass and the medium flow —an effect absent in the massless case. Consequently, the dead-cone effect is modified by the medium evolution, influencing the filling of the vacuum-vetoed region by medium-induced radiation. These results advance our understanding of how to construct heavy-flavor observables sensitive to the medium's evolution, representing a key step towards imaging studies of the quark–gluon plasma in heavy-ion collisions using hard probes.

Authors: Dr SADOFYEV, Andrey (LIP, Lisbon); SALGADO LOPEZ, Carlos Albert (Universidade de Santiago de Compostela (ES)); LOURENCO HENRIQUES BARATA, Joao; MAYO LOPEZ, Xoan (Massachusetts Institute of Technology)

Presenter: MAYO LOPEZ, Xoan (Massachusetts Institute of Technology)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **179** Type: **Poster Presentation**

Accessing the shape of cluster pattern in ^{16}O+^{16}O and d+Au collisions from STAR experiment

Tuesday, March 24, 2026 7:05 PM (1 minute)

Collectivity in small collision systems at both RHIC and the LHC have attracted considerable attention regarding the origin of azimuthal anisotropy and the light nuclei structure. Recent measurements have established a geometry-driven picture through the comparison of $v_2\{2\}$ and $v_2\{4\}$ in d+Au and ^{16}O+^{16}O collisions at $\sqrt{s_{\rm NN}} = 200$ GeV at STAR, underscoring the important role of the initial-state geometry [1]. As this geometry is directly shaped by the underlying nuclear structure, ab-initio models have investigated several observables and suggest that the v_n–$[p_{\rm T}]$ correlations and $[p_{\rm T}]$ fluctuations are particularly sensitive to the intrinsic structure of ^{16}O, in particular, its possible α-clustering configurations [2,3].

With data from STAR, we present systematic measurements of the v_n–$[p_{\rm T}]$ correlations and $[p_{\rm T}]$ fluctuations in both d+Au and ^{16}O+^{16}O collisions at $\sqrt{s_{\rm NN}} = 200$ GeV. The results are compared with theoretical predictions incorporating different ab-initio nuclear structure inputs, including configurations with and without α clustering. These comparisons offer new insight into the cluster patterns of light nuclei across energy scales and shed light on initial conditions of quark-gluon plasma and collective dynamics in small relativistic collision systems.

[1] STAR Collaboration, "Engineering the shapes of quark-gluon plasma droplets by comparing anisotropic flow in small symmetric and asymmetric collision systems", arXiv: 2510.19645

[2] C. Zhang, J. Chen, G. Giacalone, S. Huang, J. Jia, Y.-G. Ma, Physics Letters B 862, 139322 (2025)

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Authors: STAR COLLABORATION; WANG, Zaining (Fudan University)

Presenter: WANG, Zaining (Fudan University)

Session Classification: Poster Session

Contribution ID: **181** Type: **Poster Presentation**

Anisotropic Flow of Identified Hadrons in O+O Collisions at $\sqrt{s_{\rm NN}} = 200$ GeV

Tuesday, March 24, 2026 7:06 PM (1 minute)

Recent measurements of charged hadron azimuthal anisotropies in both asymmetric and symmetric small collision systems have far-reaching implications for the origins of final state momentum anisotropy driven by nucleonic as well as sub-nucleonic fluctuations present during the initial state. The creation of Quark-Gluon Plasma (QGP) in small collision systems is a topic of active research, given their extremely short lifetime and the question of formation of a thermalized medium in such collisions. During the data taking in 2021, STAR recorded a large statistics of minimum bias and high multiplicity events of O+O collisions at $\sqrt{s_{\rm NN}} = 200$ GeV. We present the anisotropic flow (v_n) of the identified hadrons, $\pi^{\pm}$, $K^{\pm}$, and $p(\overline{p})$, as well as the strange hadrons, $K^0_{\rm S}$, $\Lambda(\overline{\Lambda})$, and ϕ in O+O collisions using the sub-event Q-cumulant method. In particular, we study the transverse momentum ($p_{\rm T}$) dependence of elliptic (v_2) and triangular (v_3) flow coefficients in order to test the number-of-constituent-quark (NCQ) scaling hypothesis in central O+O collisions. This will provide valuable insights regarding the influence of partonic phase on the origins of collectivity in such a small collision system. The system size dependence of $v_2(p_{\rm T})$ and $v_3(p_{\rm T})$ is also shown by comparing with existing measurements in relatively larger systems (e.g., Cu+Cu, Au+Au, and U+U) at similar collision energies. This is expected to help in understanding the effect of initial state spatial anisotropies, characterized by the eccentricities (ε_n), on the final state momentum anisotropies.

Authors: STAR COLLABORATION; Mr PRODHAN, Santanu (IISER Tirupati)

Presenter: Mr PRODHAN, Santanu (IISER Tirupati)

Session Classification: Poster Session

Contribution ID: **183** Type: **Poster Presentation**

Measurements of inclusive charmonium production at midrapidity in pp collisions at $\sqrt{s}$ = 13.6 TeV with ALICE

Tuesday, March 24, 2026 6:54 PM (1 minute)

Charmonium is a bound state of a charm and an anti-charm quark and its production process can be factorized into two stages: the heavy quark production and the formation of the bound state. The former happens within initial hard parton-parton scatterings with large momentum transfers, and can be well described by perturbative quantum chromodynamics (QCD). The second one, which involves long distances and soft momentum scales, is a typical non-perturbative process. Measurements of J/ψ and ψ(2S) cross section in pp collisions are crucial for studying charmonium production mechanisms and testing different QCD-based model calculations. They can also provide a reference for investigating the quark-gluon plasma formed in nucleus-nucleus collisions and the cold nuclear matter effects in proton-nucleus collisions.

In this poster, the results of inclusive J/ψ production cross section as well as the ψ(2S)-to-J/ψ ratios as functions of p_{T} and rapidity at midrapidity ($|y| < 0.9$) in pp collisions at the center-of-mass energy of $\sqrt{s}$ = 13.6 TeV will be shown. The analysis is based on the data collected by the upgraded ALICE detector during LHC Run 3, which offers a significantly larger data sample compared to Run 1 and 2.

Author: ZHANG, Yuan (University of Science and Technology of China (CN))

Presenter: ZHANG, Yuan (University of Science and Technology of China (CN))

Session Classification: Poster Session

Contribution ID: **184** Type: **Oral Presentation**

Production of Unstable Light Nuclei in Au+Au Collisions at $\sqrt{s_{NN}} = 3$ GeV with the STAR Detector

Tuesday, March 24, 2026 5:25 PM (20 minutes)

In relativistic heavy-ion collisions, a large number of light nuclei can be produced. Studying the production mechanism of light nuclei can help us understand the evolution process of relativistic heavy-ion collisions. There have been quite a lot of studies on stable light nuclei, while research on unstable light nuclei is still relatively lacking. Unstable light nuclei are fragile resonance state, and it will be provide different perspectives for understanding the dynamical evolution of heavy-ion collisions.

In this presentation, we propose a new method to extract the signals of unstable light nuclei in relativistic heavy-ion collision experiments, specifically ^{4}Li and ^{5}Li. This method is based on the phase-shift analysis data from low-energy nuclear scattering experiments as well as the Lednicky-Lyuboshitz model, and partial wave analysis of the nuclear-nuclear final state interactions in heavy-ion collisions will be implemented. We will present the centrality, rapidity dependence of the yield (dN/dy), transverse momentum (p_T) spectra, and mean transverse momentum ($\langle p_T \rangle$) of ^{4}Li and ^{5}Li in Au+Au collisions at $\sqrt{s_{NN}} = 3$ GeV.

Authors: WU, Junlin (Univ. of Chinese Academy of Sciences); STAR COLLABORATION

Presenter: WU, Junlin (Univ. of Chinese Academy of Sciences)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **185** Type: **Poster Presentation**

Search for dark photons in π^0/η Dalitz decays with the STAR detector

Tuesday, March 24, 2026 6:50 PM (1 minute)

As one of the potential candidates for dark matter, the dark photon ($A^{'}$) could act as a mediator between dark matter particles, analogous to the photon (γ) in the Standard Model, which mediates electromagnetic interactions. The dark photon could be detected through its kinetic mixing with the QED photon, with the strength of this coupling suppressed by a factor labeled ϵ. This allows dark photons to be produced in laboratory environments via processes that generate ordinary photons, which can then decay into visible Standard Model final states.

In this presentation, we will present the search for prompt-like massive dark photons produced in Ru+Ru and Zr+Zr collisions at $\sqrt{s_{\rm NN}}$ = 200 GeV, using the STAR detector through the dielectron decay channel. The search focuses on invariant mass range up to 100 MeV/c^2. The dark photon search is crucial for extending our understanding of new physics beyond the Standard Model.

Authors: SHEN, Kaifeng (Univ. of Science and Technology of China); STAR COLLABORATION

Presenter: SHEN, Kaifeng (Univ. of Science and Technology of China)

Session Classification: Poster Session

Contribution ID: **186** Type: **Oral Presentation**

Measurement of thermal dielectron production in O+O collisions at $\sqrt{s_{\rm NN}} = 200$ GeV with the STAR experiment

Tuesday, March 24, 2026 9:45 AM (20 minutes)

Thermal dielectrons serve as an ideal thermometer to probe the average temperature of the hot and dense QCD medium created in heavy-ion collisions. Previous measurements over a wide range of collision energies and collision systems exhibit consistent temperature trends, indicating significant contributions from the quark-gluon plasma (QGP). Oxygen-oxygen (O+O) collisions, with an effective system size comparable to that of d+Au collisions, could bridge the understanding between small and large collision systems, and provide a new opportunity to investigate the existence and properties of QGP matter in small collision systems.

In this talk, we will present the first measurement of thermal dielectron production in O+O collisions at $\sqrt{s_{\rm NN}} = 200$ GeV with the STAR experiment. The results will include the invariant mass spectra, excess yields, and the extracted average temperature. Comparisons with results from other collision energies and systems will be shown, and the physics implications will also be discussed.

Authors: STAR COLLABORATION; LIU, Zihan (Univ. of Science and Technology of China)

Presenter: LIU, Zihan (Univ. of Science and Technology of China)

Session Classification: Parallel III: Resonances

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

Study of charge and baryon transport in O+O and Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV with STAR experiment

Tuesday, March 24, 2026 7:07 PM (1 minute)

Baryon number is one of the most rigorously tested conserved quantities in physics. Traditionally, it is thought to be carried by valence quarks, but this view lacks experimental confirmation and is not derived from Quantum Chromodynamics. In the 1970s, an alternative theory was proposed, suggesting the existence of a non-perturbative Y-shaped structure in the gluon field of baryons, known as the baryon junction, which serves as the carrier of baryon number. Due to the significant mass difference between neutral gluons and charged quarks, they tend to stop at mid-rapidity and far from mid-rapidity, respectively. Thus, the correlation of baryon and charge stopping provides a means to explore the carrier of baryon number.

STAR has measured the ratio of mean net-baryon yields to the difference of net-charge yields ($\langle B \rangle / \Delta Q$) at mid-rapidity in Ru+Ru and Zr+Zr collisions, and found the ratio is larger than A to ΔZ ratio, disfavoring the scenario of valence quark stopping at mid-rapidity. While the difference in Z/A between Ru+Ru and Zr+Zr collisions is only about 10\%, it reaches roughly 25\% for O+O and Au+Au collisions. The measurements of the correlation of charge and baryon stopping in O+O and Au+Au collisions are expected to yield a stronger signal and provide new insight into the baryon junction mechanism.

In this presentation, we will show results from O+O and Au+Au collisions at $\sqrt{s_{NN}} = 200GeV$. Using the STAR detector, we measure the transverse momentum spectra of $\pi^{\pm}$, $K^{\pm}$, protons, and antiprotons at mid-rapidity. These results are used to calculate the net-charge and net-baryon stopping at mid-rapidity, thereby investigating the carrier of baryon number. This work will contribute to exploring baryon structure and understanding the baryon transport process in high-energy heavy-ion collisions.

Authors: STAR COLLABORATION; LU, Wendi (Univ. of Science and Technology of China)

Presenter: LU, Wendi (Univ. of Science and Technology of China)

Session Classification: Poster Session

Contribution ID: **189** Type: **Oral Presentation**

Strange hadron production in different collision systems at $\sqrt{s_{\mathrm{NN}}}$ = 200 GeV at STAR

Tuesday, March 24, 2026 9:05 AM (20 minutes)

The study of high-energy collisions of small systems has generated significant discussions about the initial conditions, including the size of the system, needed to generate the Quark-Gluon Plasma (QGP). Results from asymmetric small systems, such as p+Au and p+Pb, exhibit some QGP-like signatures (e.g., flow and enhancement of strangeness production) but not others (e.g., jet quenching). However, recent results from RHIC and LHC provide strong indications of jet quenching in O+O collisions, suggesting a long-lived QGP may be created in these collisions. Therefore, new studies on strangeness production in O+O collisions are essential to explore additional potential QGP signatures in this system.

A key question for strangeness production is the dependence of the collision system at a fixed energy. This dependence can be studied with STAR because RHIC has an extensive and diverse existing data collection with different collision systems and energies. For example, the Ω/ϕ ratio and the (multi) strange-hadron-to-pion yield ratios as a function of multiplicity in different collision systems can help us investigate and possibly identify the threshold for QGP production.

In this talk, we will present new STAR measurements of strange hadron production in d+Au, O+O, Zr+Zr, and Ru+Ru collisions at $\sqrt{s_{\mathrm{NN}}}$ = 200 GeV, including their transverse momenta spectra, yields and their rapidity dependence, nuclear modification factors, antibaryon-to-baryon ratios, and baryon-to-meson ratios. We will compare these results with existing p+p, p+Au, and other larger symmetric systems used at RHIC (Au+Au, Cu+Cu), as well as with predictions from theoretical model calculations.

Authors: PONCE, Iris (Yale University); STAR COLLABORATION

Presenter: PONCE, Iris (Yale University)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **190** Type: **Poster Presentation**

Measurement of coherent K^+K^- photoproduction in Au+Au ultra-peripheral collisions at $\sqrt{s_{\rm NN}} = 200$ GeV with the STAR detector

Tuesday, March 24, 2026 7:08 PM (1 minute)

The nature of the high invariant mass region ($M_{K^+K^-} > 1.1$ GeV/c^2) in coherent K^+K^- photoproduction in ultra-peripheral heavy-ion collisions (UPCs) has remained an unresolved question in physics. Previous ALICE measurements have shown nontrivial structures in this region, but the underlying production mechanisms are stil under debate. The relative contributions from photon–nucleus (γA) processes - including coherent ϕ-meson decay and non-resonant Drell-Soding interference - and from the diphoton fusion ($\gamma\gamma$) are not yet unambiguously determined.

To shed light on these open issues, we present a new measurement of coherent K^+K^- photoproduction in Au+Au ultra-peripheral collisions at $\sqrt{s_{\rm NN}} = 200$ GeV with the STAR detector at RHIC. The K^+K^- pairs are identified using the TPC and TOF detectors, and a clear coherent signal is observed at low transverse momentum. The invariant mass distribution and differential cross sections are studied to explore the relative roles of resonant, non-resonant, and two-photon processes. This measurement provides new constraints on strangeness photoproduction and on the dynamics of photon-nucleus and two-photon processes in heavy-ion UPCs.

Authors: WANG, Luobing (Univ. of Science and Technology of China); STAR COLLABORATION

Presenter: WANG, Luobing (Univ. of Science and Technology of China)

Session Classification: Poster Session

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

Bulk Properties of the medium in Ru+Ru and Zr+Zr Collisions at $\sqrt{s_{NN}} = 200$ GeV with STAR detector

Tuesday, March 24, 2026 6:51 PM (1 minute)

Understanding the bulk properties of matter produced in heavy-ion collisions is crucial for probing the dynamics and phase transitions of Quark-Gluon Plasma. We present measurements of $\pi^{\pm}$, $K^{\pm}$, p, $\bar{p}$, Λ, $\bar{\Lambda}$, Ξ and $\bar{\Xi}$ production in Ru+Ru and Zr+Zr collisions at $\sqrt{s_{NN}} = 200$ GeV using the STAR detector. Transverse momentum (p_T) spectra are analyzed to extract particle yields (dN/dy), yield ratios, and mean transverse momentum ($\langle p_T \rangle$) at mid-rapidity, probing the properties of the produced medium. The p_T distributions are fitted with a blast-wave function to extract kinetic freeze-out parameters and to study the possible effects of incomplete thermal equilibrium. Chemical freeze-out conditions are extracted using the THERMUS thermal model. Key parameters are compared across different collision systems using published data. These results enhance our understanding of bulk matter properties in heavy-ion collisions.

Authors: TSANG, Chun Yuen (Kent State University); STAR COLLABORATION

Presenter: TSANG, Chun Yuen (Kent State University)

Session Classification: Poster Session

Contribution ID: **192** Type: **Oral Presentation**

Light hadron production measurements with Au+Au Collisions from $\sqrt{s_{\rm NN}} = 3.2 - 4.5$ GeV with STAR

Tuesday, March 24, 2026 8:45 AM (20 minutes)

One of the main physics goals of the Beam Energy Scan (BES) program at RHIC is to study the QCD phase diagram, especially around the phase transition between the quark-gluon plasma (QGP) and hadronic matter. BES Phase-I studied Au+Au collisions from center-of-mass energy ($\sqrt{s_{\rm NN}}$) of 7.7 to 62.4 GeV. BES Phase-II extended these measurements in several important ways, one of which was the addition of a fixed-target program that pushed the collision energy down to 3.0 GeV (or baryon chemical potential, $\mu_{\rm B}$, up to 720 MeV). Fixed-target collisions at STAR allow for a more extensive scanning of the QCD phase diagram to an important region where the QCD critical point may lie, and to a region dominated by dense baryonic matter. One key measurement in the fixed-target program is the spectrum of the lightest hadrons [$\pi^{\pm}$, $\rm K^{\pm}$, p(p)] as a function of transverse momentum, rapidity, and collision centrality. Such measurements enable the empirical determination of the colliding system's location on the phase diagram at chemical freeze-out. This talk details the latest status of the light hadron production measurements at STAR, and dN/dy measurements are shown from $\sqrt{s_{\rm NN}} = 3.2 - 4.5$ GeV.

Authors: LABONTE, Mathias (Univ. of California Davis); STAR COLLABORATION

Presenter: LABONTE, Mathias (Univ. of California Davis)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **194** Type: **Oral Presentation**

Nonperturbative Heavy-Flavor Transport Approach for Hot QCD Matter

Tuesday, March 24, 2026 4:45 PM (20 minutes)

Heavy quarks serve as pristine probes of the transport properties and hadronization dynamics of the quark–gluon plasma (QGP) created in high-energy nuclear collisions. A key challenge in this context is to embed the interactions of heavy quarks in the expanding medium compatible with the strong-coupling nature of the QGP, and thus to unravel the underlying microscopic mechanisms. Toward this end, we present a comprehensive framework that employs state-of-the-art treatments of these components.
The transport of heavy quarks in the QGP medium is described by a Langevin-based transport model that has been augmented to incorporate medium-induced radiation. This transport model is coupled to a bulk evolution model based on 2+1D relativistic viscous fluid dynamics. The heavy quark transport coefficients are derived from nonperturbative T-matrix calculations, which account for resonant correlations near the QGP transition temperature. Hadronization of heavy quarks is described by a fragmentation-plus-recombination model. We utilize the resonance recombination model that satisfies 4-momentum conservation and provides an equilibrium mapping between quark and meson distributions. The recombination probabilities are derived from resonant heavy-quark scattering rates.
We report key observables in open heavy flavor physics, including the nuclear modification factor, elliptic flow, baryon-to-meson ratio, as well as D-Dbar angular correlations, and compare our results with experimental data from the RHIC and LHC.

Reference:arXiv:2509.13881

Author: FU, Yu (Duke University)

Co-authors: RAPP, Ralf (TAMU); BASS, Steffen (Duke); KRISHNA, Tharun (TAMU); KE, Weiyao (CCNU)

Presenter: FU, Yu (Duke University)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **195** Type: **Poster Presentation**

Study of multiplicity-dependent $\rho(770)^0$ production in pp collisions at 13.6 TeV with ALICE

Tuesday, March 24, 2026 6:52 PM (1 minute)

Short-lived resonances provide valuable insight into the dynamics and properties of the hadron gas phase that forms after hadronization. Since the resonance lifetime is comparable to that of the hadron gas phase, their measured yields are affected by the competing rescattering and regeneration effects. These can be studied experimentally by measuring the yield ratios of resonances to their corresponding ground-state hadron as a function of the charged-particle multiplicity, which serves as a proxy for the system size. In this context, the $\rho(770)^0$ resonance is particularly interesting due to its very short lifetime of about 1.3 fm/c for the study in small collision systems, corresponding to a very short duration of the hadron gas phase. This study serves as a reference for measurements in heavy-ion collisions. This contribution presents the study of the $\rho(770)^0$ production in pp collisions at 13.6 TeV with the ALICE detector as a function of multiplicity. The results are compared with existing measurements from other collision energies and discussed within the framework of state-of-the-art phenomenological models describing particle production at LHC energies.

Author: LIM, Hyunji (Pusan National University (KR))

Presenter: LIM, Hyunji (Pusan National University (KR))

Session Classification: Poster Session

Contribution ID: **196** Type: **Oral Presentation**

Deterministic AI Surrogate Modeling for Fast Hydrodynamic Evolution of the Quark Gluon Plasma

Wednesday, March 25, 2026 9:25 AM (20 minutes)

Accurate modeling of the space–time evolution of the quark–gluon plasma (QGP) through relativistic hydrodynamics is essential for connecting initial-state fluctuations to final-state observables and for understanding interactions between hard probes and the evolving QGP in heavy-ion collisions. However, full hydrodynamic simulations are computationally intensive, posing major challenges for large-scale parameter scans and event-by-event analyses. A typical 2+1D simulation requires about an hour per event on CPU, while a 3+1D evolution for central Pb+Pb collisions can take up to ten hours per event, making comprehensive studies prohibitively expensive. We introduce a deterministic AI–based surrogate model that emulates the full QGP hydrodynamic evolution with unprecedented speed. Trained on viscous hydrodynamic solutions from MUSIC, the model achieves orders-of-magnitude faster inference while maintaining high fidelity to the underlying dynamics. This dramatic reduction in computational cost transforms the feasibility of QGP evolution studies, enabling fast and accurate access to full time-dependent information and paving the way for precision, high-statistics analyses.

Authors: Dr GO, Yeonju (Brookhaven National Laboratory); Dr CHAMIZO LLATAS, Maria (Brookhaven National Laboratory); Dr SCHENKE, Bjoern (Brookhaven National Laboratory); Dr HUANG, Jin (Brookhaven National Laboratory); Dr YIHUI, Ren (Brookhaven National Laboratory); Dr LEE, Seungjun (Brookhaven National Laboratory); Dr TORBUNOV, Dmitrii (Brookhaven National Laboratory)

Presenter: Dr GO, Yeonju (Brookhaven National Laboratory)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **197** Type: **Poster Presentation**

From collective flow to hadronization dynamics: Tracing soft–to–hard interplay with the radial-flow fluctuations $v_0(p_T)$

Tuesday, March 24, 2026 7:16 PM (1 minute)

We present a comprehensive study of the momentum-differential radial-flow fluctuations $v_0(p_T)$, which quantifies event-by-event correlations between the mean transverse momentum and the spectral shape, over the full measured range up to 10 GeV/c. Using a Bayesian-calibrated multi-stage hydrodynamic framework, we identify a universal scaling of $v_0(p_T)$ at low p_T, revealing a robust collective expansion that remains remarkably insensitive to model variations across RHIC and LHC energies [L. Du, arXiv: 2508.07184]. The study establishes $v_0(p_T)$ at low p_T as a clean probe of the bulk medium's collective response and provides quantitative constraints on QGP transport coefficients and initial-state granularity. Interestingly, the model-data comparison shows a noticeably larger deviation for kaons than for pions or protons, suggesting a possible strangeness-related sensitivity in the underlying dynamics.

Building on this foundation, we extend the analysis into the intermediate- and high-p_T regions, where quark coalescence and partonic energy loss become important, and investigate how $v_0(p_T)$ encodes the evolving correlations among these momentum regimes [L. Du and P. Jacobs, in preparation]. The observed pattern, a linear rise at low p_T, followed by a flattening or mild decrease at higher momenta, reveals a continuous transition of the dominant production mechanisms. We establish $v_0(p_T)$ as a differential probe of the interplay between hydrodynamic flow, quark recombination, and hard fragmentation. Its species dependence, including strange hadrons, provides a novel handle on hadronization dynamics and the coupling between the collective bulk and emerging partonic degrees of freedom. These results position $v_0(p_T)$ as a sensitive and complementary observable for constraining the dynamical evolution and hadronization of QCD matter from the soft thermal regime to the semi-hard transition region.

Author: DU, Lipei (University of California Berkeley/LBNL)

Presenter: DU, Lipei (University of California Berkeley/LBNL)

Session Classification: Poster Session

Contribution ID: **198** Type: **Oral Presentation**

Demonstrating CBM Capabilities through Λ Baryon Reconstruction in Ni+Ni Collisions with the mCBM Experiment at SIS18 of GSI/FAIR

Wednesday, March 25, 2026 11:15 AM (20 minutes)

The Compressed Baryonic Matter (CBM) experiment at the upcoming Facility for Antiproton and Ion Research (FAIR) is a high-rate fixed-target experiment designed to investigate nuclear matter at extreme baryon densities in relativistic nucleus-nucleus collisions. To enable high-statistics measurements of rare probes, CBM is designed to operate at event rates up to 10 MHz. This necessitates the development of fast and radiation-tolerant detectors, self-triggered front-end electronics, a free-streaming data acquisition architecture, and real-time event reconstruction capabilities. Prototype versions and pre-series productions of the CBM detector systems have been deployed in the mini-CBM demonstrator setup mCBM —an experimental precursor comprising sub-components of all major CBM systems, installed at the SIS18 facility of GSI/FAIR within the FAIR Phase-0 program.

In 2024, Ni˜+˜Ni collisions at a kinetic beam energy of 1.93 AGeV and an average interaction rate of about 500 kHz were successfully recorded. This dataset enables a detailed evaluation of the operational performance of the detector systems as well as the complete CBM data chain, while the reconstruction of rare Λ baryons serves as a natural benchmark. This paper presents the first results on Λ baryon reconstruction with the mCBM experiment, demonstrating the readiness of the detector technologies and the data chain for the upcoming full-scale CBM experiment.

Author: LEUNG, Yue Hang (Univ. of Heidelberg)

Presenter: LEUNG, Yue Hang (Univ. of Heidelberg)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **199** Type: **Poster Presentation**

Measurements of elliptic flow and local polarization of Λ hyperons with event shape engineering in 19.6 GeV Au+Au collisions at RHIC-STAR

Tuesday, March 24, 2026 7:09 PM (1 minute)

Anisotropic flow is expected to generate local vorticities along the beam direction, which in turn leads to local polarization. While local polarization of hyperons has been observed at RHIC and the LHC, current theoretical models cannot completely explain data observed in experiments. Some theoretical calculations suggest that the local polarization of hyperons can be from mechanisms other than anisotropic-flow induced vorticities, highlighting the need for more detailed experimental measurements to resolve this puzzle.

To address this, we employ Event Shape Engineering (ESE), which selects events with different magnitudes of the final-state flow vector within a narrow centrality range. By selecting events with different elliptic flow magnitudes, we can more precisely investigate the contribution of flow-related effects to local polarization. In this talk, we report on the experimental measurements of elliptic flow and local polarization of Λ and $\bar{\Lambda}$ using ESE method at $\sqrt{s_{\rm NN}} = 19.6$ GeV Au+Au collisions from the STAR experiment. We will discuss the relation among the initial geometry, elliptic flow, and local polarization.

Authors: STAR COLLABORATION; KONDO, Taiti (University of Tsukuba)

Presenter: KONDO, Taiti (University of Tsukuba)

Session Classification: Poster Session

Contribution ID: **200** Type: **Oral Presentation**

Fluctuations and Correlations of Conserved Charges in Isobar Collisions at $\sqrt{s_{NN}}$ = 200 GeV with STAR Detector

Wednesday, March 25, 2026 10:05 AM (20 minutes)

Fluctuations and correlations of conserved charges, such as net-charge (Q), net-baryon (B), and net-strangeness (S), are sensitive to the quantum chromodynamics (QCD) phase transition and the QCD critical point. To achieve this goal, previous studies have focused on the fluctuations of conserved charges, while the correlations of conserved charges also hold significant physical significance. The baryon-strangeness number correlations can provide an important experimental criterion for the degrees of freedom in the quark-gluon plasma (QGP) [1]. Further, baryon-charge number (BQ) correlations are highly sensitive to magnetic fields and can be used to infer the magnetic field strength within the collision system [2].

In this talk, we report the centrality dependence of the second order conserved charges correlations (B-Q, Q-S, B-S) in isobar collision systems (Ru+Ru and Zr+Zr) at $\sqrt{s_{NN}}$ = 200 GeV with STAR. The measurements are performed by including various particles p, k, π, Λ, and Ξ as proxies for conserved charges. The results from the two system will be compared and the physics implications will be discussed.

[1] V. Koch, A. Majumder, and J. Randrup, Baryon-Strangeness Correlations: A Diagnostic of Strongly Interacting Matter, Phys. Rev. Lett. \textbf{95}, 182301 (2005).

[2] H.-T. Ding, J.-B. Gu, A. Kumar, and S.-T. Li, Second order fluctuations of conserved charges in external magnetic fields, Phys. Rev. D \textbf{111}, 114522 (2025).

Authors: LI, Changfeng (Central China Normal University); STAR COLLABORATION

Presenter: LI, Changfeng (Central China Normal University)

Session Classification: Parallel VI: Correlations

Contribution ID: **201** Type: **Oral Presentation**

Radial Flow of Strange and Multi-strange Hadrons in Heavy-Ion Collisions at RHIC–STAR

Tuesday, March 24, 2026 3:15 PM (20 minutes)

We present recent STAR measurements of the newly proposed radial flow fluctuation coefficient, $v_0(p_T)$, for strange and multi-strange hadrons in heavy-ion collisions at RHIC. The $v_0(p_T)$ of strange and multi-strange hadrons is of great interest because these particles are less affected by late-stage hadronic interactions, making them good probes of the early partonic stage. The analysis covers both the top RHIC energy and the Beam Energy Scan (BES) program, spanning $\sqrt{s_{NN}} = 11.5$–200 GeV.

As a measure of the isotropic component of collective expansion, $v_0(p_T)$ provides direct sensitivity to the strength and fluctuations of radial flow. We investigate its behavior in hadrons of different masses, such as Λ, $\bar{\Lambda}$, K^0_S, Ξ^-, $\bar{\Xi}^+$ and ϕ mesons. In addition, we explore the Number-of-Constituent-Quark (NCQ) scaling of $v_0(p_T)$ to examine whether the radial flow originates from partonic collectivity, as has been established for elliptic flow. The energy dependence of $v_0(p_T)$ is further examined to trace the evolution of collective expansion across the collision energies. The observed patterns, together with comparisons to transport and hydrodynamic model calculations, provide new insights into the development of radial flow and its event-by-event fluctuations across the QCD phase diagram.

Authors: STAR COLLABORATION; KONG, Yuli (Central China Normal University)

Presenter: KONG, Yuli (Central China Normal University)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **202** Type: **Oral Presentation**

Testing the compatibility of lQCD spatial diffusion coefficient by mean of experimental open heavy flavor observables: R_{AA}, v_2, and v_3

Wednesday, March 25, 2026 10:55 AM (20 minutes)

Heavy-flavour production represents a crucial probe for studying transport properties of the Quark-Gluon Plasma (QGP), with the spatial diffusion coefficient $D_s(T)$ encoding the interaction strength between heavy quarks (HQs) and the medium. Recent lattice QCD (lQCD) results with dynamical fermions show very low values, $2\pi TD_s \approx 1$ for charm quarks at $T = T_c$, much lower than quenched QCD and most phenomenological models ($2\pi TD_s \approx 3.5$–5). These values imply short thermalization times ($\tau_{th} \approx 1$–$1.5 fm/c$) for HQs, raising questions about their compatibility with experimental data such as the nuclear modification factor R_{AA}, and flow coefficients v_2, v_3 of D mesons and Λ_c baryons; both in close agreement to the recent experimental data of ALICE and CMS. We study this aspect using an event-by-event Langevin transport model. In particular, we test different scenarios and show that low D_s ($p \to 0$) values can match experimental data only if the thermalization time $\tau_{th}(p) = 1/A(p)$ depends strongly on momentum, as predicted by T-matrix approaches and the extended Quasi-Particle Model (QPMp). In contrast, assuming a constant $\tau_{th} = M_c D_s^{lQCD}/T$ does not reproduce the observed experimental trends. We also study the implications of a small thermalization time for both charm and bottom quarks. Moreover, fast thermalization makes final-state observables largely insensitive to the initial charm-quark momentum distribution up to $p_T \approx M_c$, suggesting a universal behavior driven by a dynamical attractor.

[1] M.L.Sambataro, V. Minissale, S. Plumari and V. Greco, Phys.Lett.B 849 (2024) 138480.
[2] M. L. Sambataro, V. Greco, G. Parisi and S. Plumari, Eur.Phys.J.C 84 (2024) 9, 881.
[3] M. L. Sambataro, V. Minissale, S. Plumari and V. Greco, e-print:2508.01024 (accepted by PLB).

Authors: SAMBATARO, Maria Lucia (Università di Catania - LNS (INFN)); Dr MINISSALE, Vincenzo (Università di Catania, INFN (sezione di Catania)); Prof. PLUMARI, Salvatore (Università di Catania - LNS (INFN)); Prof. GRECO, Vincenzo (Università di Catania - LNS (INFN))

Presenter: SAMBATARO, Maria Lucia (Università di Catania - LNS (INFN))

Session Classification: Parallel II: Bulk Properties

Contribution ID: **203** Type: **Oral Presentation**

Anisotropic flow of strange hadrons emitted from Ag+Ag collisions at beam energy of 1.6\textit{A} GeV measured with HADES

Tuesday, March 24, 2026 9:45 AM (20 minutes)

The High Acceptance Di-Electron Spectrometer (HADES) [1] installed at the SIS18 accelerator in GSI Darmstadt registers products of heavy-ion collisions (as well as of elementary interactions) at energies of a few GeV per nucleon. The nuclear matter produced in such collisions reaches extreme densities and temperatures [2, 3, 4], comparable to those expected in neutron star mergers [5].

Particles containing (anti)strange quarks are of particular interest, as they are produced sparsely in this energy regime and the study of their interaction with the medium is of high relevance. For charged kaons it is predicted that, due to their interaction with nuclear matter, their effective mass and decay constant should change [6]. This phenomenon was investigated by other experiments, but so far without a definitive conclusion [7]. Another interesting particle species is the Λ baryon, due to its role in the so-called hyperon puzzle [8], where its interaction potential with nuclear matter is an important piece of the "puzzle".

It is predicted that the anisotropic flow of strange hadrons should be sensitive to their interaction with the surrounding nuclear medium [7, 9]. This contribution will contain preliminary distributions of anisotropic flow coefficients $v_n(p_t, y_0)$ of the 1st and 2nd order of strange hadrons – $K^{\pm}$ mesons and Λ baryons – emitted from Ag+Ag collisions at a beam energy of 1.6 GeV/nucleon. The distributions were measured in a broad centrality class of 10-40% most central collisions and cover a large area of the momentum phase space with $-0.9 < y_0 < 0.7$ and $100 < p_t[\mathrm{MeV/c}] < 1500$. The measurement of the anisotropic flow of Λ baryons would be the lowest energy at which such a measurement was carried out.

HADES allows the direct measurement of charged kaon four-momenta, while the Λ baryon must be reconstructed via its primary decay channel: $\Lambda \rightarrow p\pi^-$. The background is then subtracted using a mixed event technique. The applicability of neural networks for the optimization of the Λ reconstruction will be discussed. All of the flow results are corrected for the resolution of the event-plane measurement and possible inefficiencies due to high detector occupancies will be discussed.

[1] G. Agakichiev et al., Eur. Phys. J. A 41, 243 (2009)
[2] C. Hartnack et al., Phys. Rept. 510, 119 (2012)
[3] P. Danielewicz et al., Science 298, 1592 (2002)
[4] W. Reisdorf et al., Nucl. Phys. A 848, 366 (2010)
[5] E. R. Most et al., Phys. Rev. D 107, 043034 (2023)
[6] T. Song et al., Phys. Rev. C 103, 044901 (2021)
[7] V. Zinyuk et al., Phys. Rev. C 90, 025210 (2014)
[8] A. Ohnishi et al., EPJ Web of Conferences 271, 08006 (2022)
[9] Y. Nara et al., Phys. Rev. C 106, 044902 (2022)

Authors: HADES COLLABORATION; ORLINSKI, Jan (Faculty of Physics, University of Warsaw)

Presenter: ORLINSKI, Jan (Faculty of Physics, University of Warsaw)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **204** Type: **Oral Presentation**

Probing collective behaviour of Heavy Quarks through p_T–differential radial flow $v_0(p_T)$

Tuesday, March 24, 2026 2:55 PM (20 minutes)

We present, for the first time, the charmed hadron p_T–differential radial flow $v_0(p_T)$, within a Langevin transport framework that incorporates event-by-event fluctuations. We propose $v_0(p_T)$ of heavy quarks as a novel and sensitive observable for probing the properties of the Quark–Gluon Plasma (QGP). This observable exhibits a pronounced sensitivity to the interaction strength between heavy quarks and the medium. When evaluated across three transport scenarios, ranging from weak to strong coupling, $v_0(p_T)$ increases by nearly a factor of five at intermediate p_T, offering a powerful tool to constrain the heavy-quark transport coefficients, a long-standing objective in heavy-ion physics. At low p_T, $v_0(p_T)$ is also highly sensitive to the hadronization mechanism: coalescence plus fragmentation leads to a larger $v_0(p_T)$ for Λ_c baryons compared to D mesons, while pure fragmentation yields similar values. Our results indicate that heavy quarks participate in the collective expansion of the QGP, with a radial flow magnitude comparable to that observed for light hadrons in recent ALICE and ATLAS measurements. These features make $v_0(p_T)$ a powerful tool to investigate both transport and hadronization dynamics and open new directions for future studies in small systems such as p+A and O+O collisions, relevant to the HI-LHC program.

[1] M. L. Sambataro, S. Plumari, S. K. Das and V. Greco, e-print: 2510.19448 (submitted to PRL).
[2] S. Plumari et al., PLB 805 (2020) 135460.

Authors: Prof. PLUMARI, Salvatore (University of Catania, LNS-INFN); SAMBATARO, Maria Lucia (Università di Catania - LNS (INFN)); DAS, Santosh K. (School of Physical Sciences, Indian Institute of Technology Goa); GRECO, Vincenzo (University of Catania, LNS-INFN)

Presenter: Prof. PLUMARI, Salvatore (University of Catania, LNS-INFN)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **205** Type: **Oral Presentation**

Heavy Quark Recombination Across Collision Systems: Meson and Baryon production

Wednesday, March 25, 2026 8:45 AM (20 minutes)

Measurements of heavy baryon production in pp, pA and AA collisions from RHIC to top LHC energies have recently attracted more and more attention, currently representing a challenge for the heavy-quark hadronization theoretical understanding. In such experiments there have been many indications of the formation of a deconfined phase of quarks and gluons called the quark-gluon-plasma (QGP).
The large baryon over meson ratio $\Lambda_c/D^0 \sim O(1)$ observed in both AA collisions at RHIC and LHC [1] as well as in pp collisions at 5.02 and 13 TeV has been well described by an hadronization approach based on the recombination of heavy quarks combined with fragmentation. The obtained ratio is, in general, quite larger than the one measured and expected in e^+e^-, ep collisions.
The same approach also predicts a quite large $\Xi_c/D^0 \sim 0.15$ and $\Omega_c/D^0 \sim 0.05$ in pp collisions, in quite good agreement with experimental measurements [2].
Given such successful predictions, we present here a critical assessment of the elements of the hadronization modeling that are mainly driving heavy baryon enhancement.
In addition, we discuss the extensions of the approach applied in order to supply the prediction for the multi-charmed baryon production, i.e. Ξ_{cc}, Ω_{cc} and Ω_{ccc}, over a wide system size scan from $PbPb$ to $KrKr$, $ArAr$ and OO [3], and the bottomed hadron production in pp and $PbPb$ collisions [4][5].
We can compare the coalescence prediction with the one coming from a statistical hadronization approach, investigating further the impact on the production coming from non-equilibrium features in the heavy-quark distribution that comes from the solution of relativistic Boltzmann or Langevin equation that describes the QGP evolution.

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[2] V. Minissale, S. Plumari and V. Greco, Physics Letters B 821 (2021) 136622.
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[4] M.L. Sambataro, V. Minissale, S. Plumari and V. Greco,Phys.Lett.B 849 (2024) 138480
[5] V. Minissale, V. Greco and S. Plumari, Phys.Lett.B 860 (2025) 139190

Authors: MINISSALE, Vincenzo (Università degli Studi di Catania - INFN Catania); Prof. PLUMARI, Salvatore (University of Catania, LNS-INFN); SAMBATARO, Maria Lucia (Università di Catania - LNS (INFN)); GRECO, Vincenzo

Presenter: MINISSALE, Vincenzo (Università degli Studi di Catania - INFN Catania)

Session Classification: Parallel III: Resonances

Contribution ID: **206** Type: **Poster Presentation**

Unlocking the Thermal Secrets of High-Energy Collisions with Non-Extensive Thermodynamics

Tuesday, March 24, 2026 7:17 PM (1 minute)

I present a comprehensive investigation of hadron production dynamics in high-energy collisions, ranging from proton-proton to lead-lead, utilizing a non-extensive statistical framework and data from the ALICE experiment at the LHC. Analyzing identified hadron spectra –including light and charmed species –we demonstrate the power of the Tsallis thermometer to map out the thermal characteristics of collision systems [1,2]. Our findings reveal a striking connection between hadron mass and effective temperature, hinting at a common timescale for spectrum formation. Furthermore, we observe a distinct sensitivity of non-extensivity to event shape and constrain the heat capacity of the evolving hot system [3]. This work highlights the ability of non-extensive thermodynamics to connect soft and hard processes, providing new insights into the thermal properties and complex dynamics of high-energy collisions.

Refs:
[1] L. Gyulai, G. Bíró, R. Vértesi, G.G. Barnaföldi: Int.J.Mod.Phys.A 40 (2025) 09, 2444010
[2] L. Gyulai, G. Bíró, R. Vértesi, G.G. Barnaföldi: J. Phys. G: Nucl. Part. Phys. 51 085103 (2024)
[3] L. Gyulai, G. Bíró, R. Vértesi, G.G. Barnaföldi: Effect of event classification on the Tsallis-thermometer (in preparation)

Authors: BIRO, Gabor (HUN-REN Wigner Research Centre for Physics (HU)); BARNAFOLDI, Gergely (Hungarian Academy of Sciences (HU)); GYULAI, Laszlo (HUN-REN Wigner Research Centre for Physics (HU)); VERTESI, Robert (HUN-REN Wigner Research Centre for Physics (HU))

Presenter: BARNAFOLDI, Gergely (Hungarian Academy of Sciences (HU))

Session Classification: Poster Session

Contribution ID: **207** Type: **Poster Presentation**

Unveiling the Secrets of Nuclear Structure: Alpha-Clustering and Collective Flow in Collisions of Small systems at LHC Energies

Tuesday, March 24, 2026 7:18 PM (1 minute)

The search for quark-gluon plasma in small collision systems has led to renewed interest in the internal structure of nuclei. This study explores the impact of alpha-clustering –the formation of ^{4}He nuclei within larger nuclei –on collective flow in oxygen-oxygen (O-O) collisions at the Large Hadron Collider. Utilizing a sophisticated hybrid hydrodynamic model, we demonstrate that alpha-clustering significantly modifies anisotropic flow coefficients (v_2 and v_3), particularly at low multiplicities, leading to enhanced collective behavior. Furthermore, we observe unique fluctuations in v_2 that are sensitive to both final-state multiplicity and the underlying nuclear density profile. These findings provide compelling evidence for the importance of internal nuclear structure in shaping the dynamics of heavy-ion collisions and offer a novel pathway for validating advanced theoretical models. This work opens new avenues for probing the interplay between nuclear structure and the emergence of collective phenomena in extreme environments.

Refs:
[1] S. Prasad, N. Mallick, R. Sahoo, G.G. Barnaföldi: Phys. Lett. B 860 (2025) 139145
[2] A.M. Kavumpadikkal Radhakrishnan, S. Prasad, N. Mallick, R. Sahoo, G.G. Barnaföldi: Physics Letters B 870 (2025) 139941

Authors: MENON K R, Aswathy (Indian Institute of Technology Indore (IN)); BARNAFOLDI, Gergely (Hungarian Academy of Sciences (HU)); MALLICK, Neelkamal (University of Jyväskylä); SAHOO, Raghunath (Indian Institute of Technology Indore (IN)); Mr PRASAD, Suraj (Indian Institute of Technology Indore (IN))

Presenter: BARNAFOLDI, Gergely (Hungarian Academy of Sciences (HU))

Session Classification: Poster Session

Contribution ID: **208** Type: **Oral Presentation**

Flow of electromagnetic probes as a magnetometer in high-energy heavy-ion collisions

Tuesday, March 24, 2026 10:55 AM (20 minutes)

We have developed a relativistic resistive magnetohydrodynamic (RRMHD) model to tackle an important problem of heavy-ion physics: understanding the impact of the strong electromagnetic (EM) fields on the quark-gluon plasma (QGP) medium. Our model simulates the evolution and interaction between charges in the QGP and EM fields. This leads to modifications of electrically charged observables. In this presentation, we will report on the initial results of EM probes with corrections from EM fields using an MHD model.

We have calculated the leading order photon and dilepton rates with perturbative corrections from the EM fields. Our RRMHD provides the dynamic fluid and EM field necessary for a complete description of the EM field modifications. Because of the directional dependence of the EM fields produced by the collision spectators, we find significant modifications to the flow of EM probes. Additionally, the modifications depend on the centrality of the collision and event-by-event positions of the initial protons. This suggests EM probes could be used as a magnetometer for high-energy heavy-ion collisions.

Author: BENOIT, Nicholas J. (Hiroshima University)

Co-authors: NONAKA, Chiho (Hiroshima University); TAKAHASHI, Hiroyuki (Komazawa Univ.); MIYOSHI, Takahiro (Hiroshima Univ.)

Presenter: BENOIT, Nicholas J. (Hiroshima University)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

Contribution ID: **209** Type: **Poster Presentation**

Observation of the $\Omega(2012)$ baryon at ALICE

Tuesday, March 24, 2026 6:53 PM (1 minute)

The ALICE Collaboration has observed the $\Omega(2012)$ baryon via its decays to $\Xi^- K^0_S$ in high-multiplicity proton-proton collision at $\sqrt{s} = 13$ TeV. This observation, which has a significance of 15 sigma, corroborates the discovery of this particle by Belle in 2018. The measured mass and width values are consistent with those reported by Belle, confirming that the Omega(2012) has a rather narrow width for a particle that decays strongly. The first measurement of a p_{T} spectrum and yield for the $\Omega(2012)$ is also reported. In combination with thermal model calculations, these results can be used to obtain absolute branching ratios for two-body decays of the $\Omega(2012)$. The width and branching-ratio measurements provide further support for the hypothesis that the $\Omega(2012)$ baryon has spin 3/2. This presentation will describe the analysis technique and discuss the results in comparison to previous measurements and theoretical models.

Authors: KNOSPE, Anders (Lehigh University); BELLWIED, Rene (Univ. of Houston)

Presenter: BELLWIED, Rene (Univ. of Houston)

Session Classification: Poster Session

Contribution ID: **210** Type: **Oral Presentation**

Searching for CME with Transformers

Tuesday, March 24, 2026 2:35 PM (20 minutes)

The Chiral Magnetic Effect (CME)—a QCD-anomaly–driven charge separation in the strong magnetic fields of non-central heavy-ion collisions—remains extremely difficult to isolate because flow-related backgrounds, especially from resonance decays, can mimic CME-like correlations. To address this weak-signal in a complicated background problem, we explore Transformer-based Artificial Intelligence models, originally developed for natural language processing, to study the CME in relativistic heavy-ion collisions. Unlike conventional neural networks that treat particle features more independently, Transformers use self-attention to model interactions among all particles in an event, aligning naturally with the system's collective dynamics. We train on controlled synthetic datasets with known CME strength and use the learned event representation to regress a CME-sensitive proxy. We will show that the principle works: the model exhibits an approximately linear response to increasing CME strength in the presence of typical resonance-flow backgrounds, indicating complementary sensitivity beyond traditional observables.

Author: TANG, Aihong (BNL)

Presenter: TANG, Aihong (BNL)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

Contribution ID: **211** Type: **Oral Presentation**

Probing the structure of $f_0(980)$ from the elliptic flow in p-Pb collisions at the LHC

Tuesday, March 24, 2026 8:45 AM (20 minutes)

The study of exotic hadrons has long been a topic of great interest for the understanding of Quantum Chromodynamics (QCD). As one of the light exotic hadrons, the structure and constituent quark content of $f_0(980)$ have been debated for decades, with theories suggesting it could be a tetraquark state ($s\bar{s}q\bar{q}$) or a hadronic molecule ($K\bar{K}$). Assuming that the $f_0(980)$ is a $K\bar{K}$ molecule that can only survive at the kinetic freeze-out of the evolving bulk matter, we implement the coalescence model to study its transverse momentum (p_T) spectra and elliptic flow $v_2(p_T)$ in high-multiplicity p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV. Using the well-tuned kaon phase-space distributions from the Hydro-Coal-Frag model, our $K\bar{K}$ coalescence calculations for the $f_0(980)$ successfully reproduce the elliptic flow measured by CMS over the range $0 < p_T < 12$ GeV and are also agree with the p_T-spectra from ALICE with a reasonable range of values for the $f_0(980)$ radius. These results in heavy ion collisions are consistent with the $K\bar{K}$ molecular picture of the $f_0(980)$. We also find that the number-of-constituent scaling of v_2 for the $f_0(980)$ is violated in p-Pb collisions at the LHC, due to a large proportion of the coalescing kaons having different momenta. This demonstrates the necessity of realistic coalescence model calculations and also explains why the CMS interpretation of the $f_0(980)$ as an ordinary $q\bar{q}$ meson is no longer reliable, since the measured v_2 was analyzed by applying a simple scaling formula based on the assumption of equal momentum coalescence. Our investigation provides a novel way to explore the internal structure of light exotic hadrons that are abundantly produced in relativistic heavy and/or light ion collisions.

References

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Author: WANG, Yili (Peking University)

Co-authors: Prof. KO, Che-Ming; Prof. GUO, Feng-Kun (Insitute of Theoretical Physics, Chinese Academy of Sciences); SONG, Huichao; Dr XIE, Ju-Jun (Institute of Modern Physics, Chinese Academy of Sciences); ZHAO, Wenbin (Wayne State University)

Presenter: WANG, Yili (Peking University)

Session Classification: Parallel III: Resonances

Contribution ID: **214** Type: **Oral Presentation**

sPHENIX new measurements of heavy flavor hadronization in p+p collisions at RHIC

Wednesday, March 25, 2026 10:05 AM (20 minutes)

sPHENIX is a next-generation experiment at RHIC for jet and heavy-flavor physics which was fully commissioned in 2024. Using its novel streaming-readout-capable, precision tracking system, sPHENIX collected 100 billion unbiased p+p collisions, and a further sample of minimum-bias Au-Au collisions, in Run-24. A key measurement of the sPHENIX heavy flavor physics program are measurements of the ratios of heavy flavor hadron yields, in both Au+Au and p+p collisions. These measurements, which include comparisons of Λ_c to D^0 and the D_s^+ to D^+ differential yields, probe questions related to the hadronization of heavy-flavor baryons compared to mesons and of strangeness enhancement in the charm sector, both in the Quark-Gluon Plasma medium and in vacuum. For example, there are no previous measurements of the Λ_c/D^0 and D_s^+/D^+ baselines in p+p collisions at RHIC energies, modern Monte Carlo event generators give widely different predictions, and the ratios in Au+Au at RHIC are only poorly known. This talk presents the progress towards a new measurement from sPHENIX of the first Λ_c/D^0 and D_s^+/D^+ ratios in p+p collisions at RHIC.

Authors: HUGHES, Charles (Lehigh University); SPHENIX COLLABORATION

Presenter: HUGHES, Charles (Lehigh University)

Session Classification: Parallel III: Resonances

Contribution ID: **215** Type: **Poster Presentation**

sPHENIX measurements of bulk properties of Au+Au collisions

Tuesday, March 24, 2026 7:02 PM (1 minute)

The sPHENIX experiment at RHIC is designed to explore the properties of strongly interacting matter through precision measurements of global observables in relativistic ion collisions, using full-azimuth calorimetry and high-resolution silicon tracking. This talk presents final results for measurements of the transverse-energy density ($dE_T/d\eta$) and charged-hadron multiplicity density ($dN_{ch}/d\eta$) in Au+Au collisions at 200 GeV, recently published as JHEP08(2025)075 and PRC112(2025)024908. The dEt/dη measurement, performed with the electromagnetic and hadronic calorimeters over $|\eta| < 1.1$, represents the first RHIC result using a hadronic calorimeter, providing improved precision and η-granularity compared to the state of the art. The $dN_{ch}/d\eta$ analysis, based on tracklets in the intermediate silicon tracker, achieves full-azimuth coverage and excellent agreement with previous RHIC measurements. Together, these new measurements provide important input for constraining theoretical descriptions of particle production and the initial conditions of heavy-ion collisions, and they are benchmarked against compilations of the latest predictions from modern Monte Carlo event generators. In addition, the status of the next steps of bulk property and collective flow measurements in Au+Au collisions will be discussed.

Author: SPHENIX COLLABORATION

Presenter: SPHENIX COLLABORATION

Session Classification: Poster Session

Contribution ID: **216** Type: **Oral Presentation**

sPHENIX measurements of long-range correlations in p+p collisions at RHIC

Wednesday, March 25, 2026 12:15 PM (20 minutes)

Energetic collisions of heavy nuclei have long been known to create a hot and dense state of matter known as the quark-gluon plasma (QGP). The QGP may also be created in collisions of heavy-on-light and even light-on-light nuclear collisions. One key signature of QGP formation is the development of long-range angular correlations, which indicate the propagation of early-time position-space correlations into late-time momentum-space correlations. Such signatures have been observed in p+p collisions at the LHC, and in p/d/h+A collisions at RHIC, but not yet in p+p collisions at RHIC energies. The sPHENIX detector has a variety of sub-systems which cover a large pseudorapidity acceptance, as well as a uniquely high-rate data acquisition system which collected a very large data sample in Run-24 p+p running. These capabilities make it an ideal detector to potentially observe long-range collective behavior in high-multiplicity p+p collisions for the first time at these energies. In this talk, we present the latest sPHENIX results on long-range correlations in p+p collisions at 200 GeV and the broader implications for understanding the origin of such effects across collision systems and energies.

Authors: ENOKIZONO, Akitomo (RIKEN); SPHENIX COLLABORATION

Presenter: ENOKIZONO, Akitomo (RIKEN)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **217** Type: **Oral Presentation**

sPHENIX novel use of generative AI for physics measurements

Tuesday, March 24, 2026 5:25 PM (20 minutes)

Generative artificial intelligence (AI) has been transforming industry and science. sPHENIX, a new experiment at RHIC, has been at the cutting edge in adopting innovative generative AI to accelerate simulation, reconstruction, and analysis in a robust manner. In this talk we will highlight three recent works on (1) diffusion model based full detector full event heavy ion collision simulation [DOI: 10.1103/PhysRevC.110.034912], (2) heavy ion background subtraction on calorimeter jets using unsupervised generative learning [arXiv:2510.23717], and (3) a scalable and generalizable foundation model for tracking reconstruction [arXiv:2508.14087]. The implications of these new technologies for the physics of heavy flavor and strange probes of the QGP will be highlighted.

Authors: LI, Shuhang (Columbia University); SPHENIX COLLABORATION

Presenter: LI, Shuhang (Columbia University)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **218** Type: **Oral Presentation**

Probing the glasma with heavy quark azimuthal correlations

Tuesday, March 24, 2026 2:35 PM (20 minutes)

The Glasma is produced in the pre-equilibrium stage of high-energy heavy-ion collisions within the Color Glass Condensate framework. These strong, classical, out-of-equilibrium gluon fields significantly influence the dynamics of heavy quarks, which are created early in the collision. Our study shows that the azimuthal correlations of $c\overline{c}$ and $b\overline{b}$ pairs are strongly modified by the Glasma, with the magnitude of this effect being comparable to that observed in the Quark Gluon Plasma phase [1].

To investigate this, we solve numerically the Glasma classical Yang-Mills equations together with the collisionless Boltzmann-Vlasov transport equations for heavy quarks [2]. We simulate the evolution of $Q\overline{Q}$ pairs produced back-to-back in Glasma fields and extract their two-particle correlation function $\mathcal{C}(\Delta\phi, \Delta\eta)$. Focusing on the azimuthal $\mathcal{C}(\Delta\phi)$, we determine the correlation width $\sigma_{\Delta\phi}$ as a function of the initial quark transverse momentum p_T and the Glasma saturation scale Q_s. We find that for pairs with moderate p_T in a Glasma characterized by sufficiently large Q_s, a pronounced decorrelation develops already within the first $\tau = 0.3\,\mathrm{fm/c}$.

[1] D. Avramescu, V. Greco, T. Lappi, H. Mäntysaari, D. Müller - Phys. Rev. Lett. 134 (2025) 17, 172301 and Phys. Rev. D 111 (2025) 7, 074036

[2] D. Avramescu, V. Băran, V. Greco, A. Ipp, D. Müller, M. Ruggieri - Phys. Rev. D 107, 114021

Authors: AVRAMESCU, Dana (University of Jyväskylä); GRECO, Vincenzo; LAPPI, Tuomas; Dr MÄNTYSAARI, Heikki (University of Jyväskylä); Dr MUELLER, David (TU Wien)

Presenter: AVRAMESCU, Dana (University of Jyväskylä)

Session Classification: Parallel VI: Correlations

Contribution ID: **221** Type: **Poster Presentation**

Canonical statistical hadronization with local charge conservation

Tuesday, March 24, 2026 7:22 PM (1 minute)

We present a framework to study (cross-)cumulants and balance functions of identified hadrons in heavy-ion and hadronic collisions using two-point correlation function with local charge conservation. We discuss the effects of multiple conserved charges (in particular strangeness), as well as correlations due to hadronic interactions, resonance decays, baryon annihilation, and light nuclei formation. We analyze the behavior of various observables accessible to experiments at LHC and RHIC, with a particular focus on strangeness fluctuations, and discuss how these can be shed light on the hadronization mechanism as well criticality.

Authors: KUZNIETSOV, Volodymyr (University of Houston); Prof. VOVCHENKO, Volodymyr (University of Houston)

Presenter: KUZNIETSOV, Volodymyr (University of Houston)

Session Classification: Poster Session

Contribution ID: **223** Type: **Oral Presentation**

Strange Quark Matter as Dark Matter

Wednesday, March 25, 2026 11:15 AM (20 minutes)

Forty years ago, Witten suggested that dark matter might consist of macroscopic droplets of strange quark matter, formed during a cosmological first-order phase transition. Although lattice QCD at small baryon chemical potential points to a smooth crossover, scenarios in which the early Universe still encounters first-order dynamics remain plausible. We revisit the conditions under which strangelets could form and survive to the present day, considering both first-order and non–first-order cosmological cooling scenarios. We describe the main physical processes that can lead to their formation, stabilization, and partial evaporation, and we estimate the resulting mass distributions in light of current observational constraints. We also show that strangelets could exist with masses <10¹⁷ g, a range in which primordial black holes are excluded, making it possible to distinguish between these two dark-matter candidates.

Authors: DRAGO, Alessandro; RATTI, Claudia; DI CLEMENTE, Francesco (University of Houston); FORMAGGIO, Lorenzo (University of Houston); Prof. CASOLINO, Marco (University of Roma "Tor Vergata"); LATTANZI, Massimiliano

Presenter: DI CLEMENTE, Francesco (University of Houston)

Session Classification: Parallel VII: EoS and Astrophysics

Contribution ID: **226** Type: **Oral Presentation**

Probing Baryon Number Transport and Strangeness Production Dynamics with Hyperon-kaon Correlations

Wednesday, March 25, 2026 9:45 AM (20 minutes)

The baryon number transport from beam rapidity to mid-rapidity has been observed from the detection of an excess of hyperons over anti-hyperons numbers around mid-rapidity in nuclear collisions at RHIC energies. To understand the dynamics of the baryon number transport over a large rapidity gap, the gluon junction model, which suggest the Y-shaped gluonic junction in proton and neutron may carry the baryon number, has recently drawn considerable attention as a potential explanation. Since the Hyperons will be produced with Kaons simultaneously due to the strangness conservation, their correlation provide a particularly sensitive observable for probing the underlying dynamics. In this work, we analyze hyperon–kaon correlation patterns in p+Au collisions at 39 and 62 GeV using the AMPT and UrQMD transport models. The effects of strangeness conservation and baryon number transport are examined in detail, and the resulting model predictions are proposed as a reference baseline for forthcoming experimental investigations

Author: PING, Siyuan (Fudan University)

Co-authors: WANG, Gang (UCLA); Dr MA, Long (Fudan University); YU, Xiaozhou; WU, Xiatong (UCLA); HUANG, huan

Presenter: PING, Siyuan (Fudan University)

Session Classification: Parallel VI: Correlations

Contribution ID: **228** Type: **Poster Presentation**

Multi-fluid dynamics at RHIC BES energies with MUFFIN-2.0: baryon stopping to baryon transparency, flow and first conclusions from the modelling

Tuesday, March 24, 2026 7:27 PM (1 minute)

Understanding the transition from baryon stopping to transparency provides crucial insights into QCD matter properties at finite baryon density - a key goal of the RHIC Beam Energy Scan program. We present a generalized and improved multi-fluid dynamic approach to model heavy-ion collisions at RHIC Beam Energy Scan energies. The extensions touch two key aspects of the modelling.

The first aspect is the friction terms that represent stopping of the original baryon-rich fluids and production of new ''fireball" fluid (which vaguely corresponds to produced particles). The friction terms are generalized for partial transfer of both energy-momentum and conserved charges (baryon and electric) to the fireball fluid, different from fixed limiting cases used in the original model. Next, the procedure of numerical integration of the friction terms is more precise, which is important as the formation of the fireball fluid happens very fast at relatively large collision energies.

Second aspect is the procedure of fluid unification, which corresponds to the feature of different fluids becoming indistinguishable in a given cell once their velocities are close enough. We improve over the original unification criterion to make it more consistent physics-wise. Lastly, finite shear viscosity is introduced in the evolutions of the fluids.

We demonstrate how different settings of the friction terms translate into the basic resulting observables such as net proton and all charged hadron distributions, as well as transverse momentum spectra (radial flow) and elliptic flow, and what the agreement with the data can tell us about the properties of the underlying system.

Authors: Dr WERTHMANN, Clemens (Ghent University); Dr KARPENKO, Iurii (FNSPE CTU in Prague); HUOVINEN, Pasi (University of Wroclaw)

Presenter: Dr KARPENKO, Iurii (FNSPE CTU in Prague)

Session Classification: Poster Session

Contribution ID: **229** Type: **Oral Presentation**

Unshadowing NCQ scaling of elliptic flow at RHIC-FXT and FAIR energies

Tuesday, March 24, 2026 9:05 AM (20 minutes)

Constituent quark number scaling has been proposed as one of the key signatures of a QGP phase. The flow scaling arises from a quark coalescence picture relevant at intermediate transverse momenta. While at collision energies above 7.7 GeV the NCQ scaled elliptic flow of baryons and mesons aligns very well, the scaling breaks between 4.5 and 3.0 GeV as evidenced by recent STAR measurements. At these energies the shadowing effect induced by the bypassing spectator leads to tremendous absorption and thus one cannot distinguish between quark coalescence from the QGP with shadowing from a purely hadronic phase with shadowing. Here I develop a new method to disentangle the shadowing effect of different hadron species and reconstruct the anisotropy of the emission source. The method is shown to reliably reconstruct the emission anisotropy in UrQMD calculations of the elliptic flow of baryons, mesons as well as light nuclei and hypernuclei. This will allow the STAR, HADES and the upcoming CBM experiment to unshadow their flow measurements and decipher whether NCQ scaling is present in this energy regime, thus making it relevant for the critical point search.

Author: REICHERT, Tom (CERN)

Presenter: REICHERT, Tom (CERN)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **230** Type: **Oral Presentation**

Hadron resonance gas with density-dependent interactions for neutron stars and heavy-ion collisions

Tuesday, March 24, 2026 11:55 AM (20 minutes)

We formulate a hadron resonance gas model with density-dependent mean field interactions and a generalized excluded volume prescription. The framework, implemented within the open-source Thermal-FIST package, provides a unified description of the hadronic phase in heavy-ion collisions and neutron star matter. We also discuss the interplay of constraints from lattice QCD susceptibilities, nuclear matter, and neutron star observations on the mean field parameters, with a focus on the strangeness dependence of hadronic interactions.

Author: VOVCHENKO, Volodymyr (University of Houston)

Presenter: VOVCHENKO, Volodymyr (University of Houston)

Session Classification: Parallel VII: EoS and Astrophysics

Contribution ID: **232** Type: **Oral Presentation**

Heavy-flavor jets and hard-process correlations in HI collisions with ATLAS

Tuesday, March 24, 2026 3:15 PM (20 minutes)

This talk presents new ATLAS results that probe the mass and system-size dependence of parton-medium interactions using heavy-flavor jets in Pb+Pb collisions and hard-process correlations in O+O collisions. The first part reports measurements of b-tagged jets and events with multiple jets recoiling against a photon in Pb+Pb collisions. These measurements place strong constraints on the color-charge and mass dependence of parton energy loss. The second part uses the unique system size of O+O collisions to investigate hard probes in a small collision environment. We present measurements of dijet momentum balance and γ–hadron correlations, which test the onset—or potential absence—of final-state energy loss as the system size decreases. Together, the Pb+Pb b-jet results and O+O hard-process observables offer a coherent picture of energy-loss mechanisms across parton flavor and system size, providing new constraints for theoretical models and insights into the emergence of medium effects in small collision systems.

Authors: ATLAS COLLABORATION; PEREPELITSA, Dennis (Univ. of Colorado Boulder)

Presenter: PEREPELITSA, Dennis (Univ. of Colorado Boulder)

Session Classification: Parallel VI: Correlations

Contribution ID: **233** Type: **Poster Presentation**

Probing strongly-interacting nuclear matter in ultra-peripheral Pb+Pb collisions with ATLAS

Tuesday, March 24, 2026 7:21 PM (1 minute)

In ultra-relativistic heavy-ion collisions, large rates of γγ processes occur through the interaction of the large electromagnetic fields of the nuclei. In ultra-peripheral collisions (UPCs), characterized by a large impact parameter between the nuclei, the outgoing particles exhibit back-to-back production in the transverse plane, which provides precise and efficient identification. This talk presents an overview of recent ATLAS measurements potentially sensitive to the structure of strongly interacting matter, including the production of J/ψ mesons, coincident UPC processes, and photonuclear jet production. Measurements of J/ψ production use new low-multiplicity track triggering capabilities of the ATLAS detector in Run 3 to constrain the spatial and momentum structure of partons within the nucleus. Measurements of coincident UPC processes are complementary to these studies, providing insights into the importance of exclusivity requirements and constraining the nuclear charge form factors through studies of simultaneous $\gamma\gamma \to \mu^+\mu^-$ and diffractive photonuclear ρ production. Finally, measurements of photonuclear jet production in inclusive UPCs provide a novel method of constraining the nuclear parton distributions with high-precision data in a kinematic region with little existing constraint.

Authors: ATLAS COLLABORATION; MOHAPATRA, Soumya (Columbia University)

Presenter: MOHAPATRA, Soumya (Columbia University)

Session Classification: Poster Session

Contribution ID: **234** Type: **Oral Presentation**

Freeze-out of charge fluctuations in the QGP: D-measure at the LHC

Tuesday, March 24, 2026 9:05 AM (20 minutes)

The D-measure of net-charge fluctuations quantifies the variance of net charge in strongly interacting matter. It was introduced over 20 years ago as a potential signal of quark-gluon plasma (QGP) in heavy-ion collisions, where it is expected to be suppressed due to the fractional electric charges of quarks. Measurements have been performed at RHIC and LHC, but the conclusion has been elusive in the absence of quantitative calculations for both scenarios.

We address this issue by employing a recently developed formalism of density correlations and incorporate resonance decays, local charge conservation, and experimental kinematic cuts. We find that the hadron gas scenario is in fair agreement with the ALICE data for $\sqrt{s_{NN}}$ = 2.76 TeV Pb–Pb collisions only when a very short rapidity range of local charge conservation is enforced, while the QGP scenario is in excellent agreement with experimental data and largely insensitive to the range of local charge conservation. A Bayesian analysis of the data utilizing different priors yields moderate evidence for the freeze-out of charge fluctuations in the QGP phase relative to hadron gas. The upcoming high-fidelity measurements from LHC Run 2 will serve as a precision test of the two scenarios.

Authors: RATTI, Claudia; Mr PARRA, Jonathan (University of Houston); POBEREZHNIUK, Roman (University of Houston); KOCH, Volker; VOVCHENKO, Volodymyr (University of Houston)

Presenter: POBEREZHNIUK, Roman (University of Houston)

Session Classification: Parallel III: Resonances

Contribution ID: **235** Type: **Oral Presentation**

Measurements of radial and anisotropic flow in Pb+Pb collisions with the ATLAS detector

Tuesday, March 24, 2026 2:15 PM (20 minutes)

Radial and anisotropic flow are key observables for probing the expansion dynamics of the quark-gluon plasma (QGP). The first measurement of transverse momentum–dependent radial flow fluctuations, v0(pT), in Pb+Pb collisions is presented. The $v_0(p_T)$ observable exhibits three key features: (i) long-range correlations in pseudorapidity, (ii) factorization in p_T, and (iii) a centrality-independent shape. Observations of these features provide compelling evidence that radial flow originates from collective expansion. Comparisons with hydrodynamic models show strong sensitivity to bulk viscosity, highlighting $v_0(p_T)$ as a powerful new probe of QGP transport properties. The first measurement of directed flow, v_1, relative to the spectator plane with the ATLAS detector at the LHC is also reported. The measurement leverages experimental capabilities enabled by the installation of a new Reaction Plane Detector within the ATLAS Zero Degree Calorimeter. The results will inform modeling of the initial-state conditions and the electromagnetic fields generated by spectator nuclei in heavy-ion collisions.

Authors: ATLAS COLLABORATION; DIMRI, Aman (Stony Brook University)

Presenter: DIMRI, Aman (Stony Brook University)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **242** Type: **Poster Presentation**

J/\psi azimuthal anisotropy measurement in pp collisions at $\sqrt{s} = 13.6$ TeV with ALICE

Tuesday, March 24, 2026 7:01 PM (1 minute)

The long-range near-side correlation and collective motion have been observed in proton-proton (pp) collisions, suggesting that a hot and dense medium could be produced even in small systems such as pp and p–Pb collisions. One of the common observables used to quantify collective motion is the second-order flow coefficient, v_2, which has been observed in both the light-flavor and open heavy-flavor sectors. A significant D^0 v_2 indicates that charm quarks participate in the strong collective motion in pp collisions. Charm bound states, such as J/ψ (composed of a charm and an anti-charm quark), might also follow this collective motion. Thanks to significant detector upgrades during the LHC Long Shutdown, approximately 150 pb^{-1} of minimum-bias events have been collected in pp collisions during Run˜3 data taking, enabling the measurement of J/ψ v_2 in pp collisions.

In this poster, we will present preliminary results on the inclusive J/ψ v_2 as a function of transverse momentum (p_{T}) at mid rapidity ($|y| < 0.9$) in pp collisions at $\sqrt{s}$ = 13 TeV. These new results will be compared with existing measurements at forward rapidity ($2.5 < y < 4$) in pp collisions at $\sqrt{s}$ = 13 TeV, as well as with similar measurements in heavy-ion collisions.

Author: ZHU, Senjie (University of Science and Technology of China)

Presenter: ZHU, Senjie (University of Science and Technology of China)

Session Classification: Poster Session

Contribution ID: **243** Type: **Oral Presentation**

Multiplicity Dependence of the K/π Ratio in e^+e^- Collisions with Archived DELPHI Data

Tuesday, March 24, 2026 10:05 AM (20 minutes)

Strangeness enhancement has emerged as a system-spanning trend in pp, pPb, and PbPb collisions. Whether a similar behavior is present in elementary e^+e^- collisions, where the initial state is clean and final-state interactions are minimal, is a key question for disentangling hadronization dynamics from hot-QCD effects. We present a measurement of the kaon-to-pion yield ratio, $K^{\pm}/\pi^{\pm}$, as a function of the event charged-particle multiplicity using archived DELPHI data collected at LEP. Events are binned in the reconstructed track multiplicity $N_{\mathrm{trk}}^{\mathrm{offline}}$, and inclusive $K^{\pm}$ and $\pi^{\pm}$ yields are extracted using DELPHI's particle-identification capabilities, with corrections applied for detector acceptance and efficiency. The resulting K/π vs.\ $N_{\mathrm{trk}}^{\mathrm{offline}}$ dependence is compared to event generators such as PYTHIA6, PYTHIA8, HERWIG, and SHERPA. This measurement sheds new light on the emergence of strangeness enhancement in small collision systems.

Authors: Ms CHEN, Yi (Luna) (Vanderbilt University); E+E- ALLIANCE

Presenter: Ms CHEN, Yi (Luna) (Vanderbilt University)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **244** Type: **Oral Presentation**

Superfluid dynamics of the QCD chiral phase transition

Wednesday, March 25, 2026 9:05 AM (20 minutes)

High-energy heavy-ion collisions create a quark–gluon plasma (QGP) with approximately restored chiral symmetry. Lattice QCD determines the chiral crossover temperature to be $T_c = (156.5 \pm 1.5)\,\mathrm{MeV}$, below which chiral symmetry is spontaneously broken and pions emerge as pseudo–Goldstone bosons. Yet, this chiral transition—second order in the chiral limit—is absent from current hydrodynamic models. We present numerical studies of Model G, the dynamical universality class governing the QCD chiral phase transition. Using scaling arguments and stochastic simulations, we demonstrate a parametric enhancement of long-wavelength Goldstone modes after a quench into the broken phase. The ensuing out-of-equilibrium evolution is effectively captured by a non-abelian pion superfluid description, from which we compute the nonequilibrium pion spectrum. Even with explicit chiral symmetry breaking, soft pion yields remain enhanced over parametrically long times. Coupling this superfluid dynamics to QGP hydrodynamics enables quantitative predictions for signatures of the chiral transition, most notably, enhanced soft pion production in heavy-ion collisions.

Authors: MAZELIAUSKAS, Aleksas (Heidelberg University); TEANEY, Derek (Stony Brook University); GEBHARD, Jannis (Heidelberg University)

Presenter: GEBHARD, Jannis (Heidelberg University)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **245** Type: **Oral Presentation**

News on charged and neutral hadron production from NA61/SHINE

Tuesday, March 24, 2026 12:15 PM (20 minutes)

The NA61/SHINE experiment at the CERN SPS performs a systematic scan in collision energy and system size to study the onset of deconfinement and the mechanisms of strangeness production in strongly interacting matter. This contribution presents recent results on both charged and neutral hadron production in nucleus–nucleus collisions.
Hadron production results, including the K^+/π^+ ratio in central Pb+Pb collisions at $\sqrt{s_{\rm NN}} = 7.6$ GeV, are presented, confirming the "horn" structure previously observed by NA49. This is extended with the new preliminary results on the $\pi/N_{\rm W}$ ("kink") ratio from the Xe+La energy scan, which demonstrate a behavior similar to that seen in Pb+Pb. Complementary results on Λ baryon production in the 10% most central Ar+Sc collisions at $\sqrt{s_{\rm NN}} = 5.1$–16.8 GeV) are also reported. The energy dependence of the Λ/π and strangeness-to-pion ratios is compared with existing proton-proton and nucleus-nucleus data, as well as model predictions. These new results are investigated in the context of the onset of deconfinement and of various hadron production mechanisms relevant at the SPS energy range.
Finally, new preliminary results on the excess of charged over neutral kaons in Ar+Sc collisions at $\sqrt{s_{\rm NN}} = 8.8$ GeV will be discussed as further confirmation of the significant isospin violation previously observed by NA61/SHINE at $\sqrt{s_{\rm NN}} = 11.9$ GeV.

Authors: LEWICKI, Maciej (The Henryk Niewodniczański Institute of Nuclear Physics Polish Academy of Sciences); BALKOVA, Yuliia (National Centre for Nuclear Research, Warsaw)

Presenter: LEWICKI, Maciej (The Henryk Niewodniczański Institute of Nuclear Physics Polish Academy of Sciences)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **246** Type: **Oral Presentation**

Nuclear modification factor of inclusive and strange hadrons in OO collisions at \sqrt{s_{NN}=5.36 TeV with CMS

Tuesday, March 24, 2026 11:15 AM (20 minutes)

High-momentum charged particles originate from the fragmentation and hadronization of partons that undergo hard scattering, and their yields are consequently sensitive to parton energy loss in the QGP. The CMS experiment has recently reported a significant suppression of charged-particle production in oxygen–oxygen (OO) collisions at \sqrt{s_{NN}} = 5.36 TeV, providing a first indication of parton energy loss even in intermediate-size systems.
In this talk, we discuss the CMS measurement of charged particle differential cross sections and the nuclear modification factor R_{AA} in oxygen-oxygen (OO) collisions as a function of $p_{T}. We present a comparison with models that incorporate parton energy-loss mechanisms. In addition, we also examine charged particle production in pO collisions.
To further probe this phenomenon, we study identified-strange hadrons, Kˆ0_S and Lambda, which are particularly sensitive to hadronization dynamics. In the intermediate transverse momentum region, (2 < pT < 5 GeV), when the dominant particle production mechanism transitions from soft processes to hard scattering, effects from radial flow and quark coalescence become important. Radial flow boosts heavier particles to higher pT, while quark coalescence enhances baryon production relative to mesons in this region, leading to a modified nuclear modification factor for strange hadrons. We present the first measurement of the nuclear modification factor of identified strange hadrons, Kˆ0_S and Lambda, in OO collisions at \sqrt{s_{NN}} = 5.36 TeV, providing new insights into the flavor dependence of parton energy loss and the role of strangeness in the QGP medium.

Authors: CMS COLLABORATION; PANT, Vipul (Univ. of Illinois Chicago)

Presenter: PANT, Vipul (Univ. of Illinois Chicago)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **247** Type: **Oral Presentation**

Open-heavy flavour and strangeness production in nuclear collisions at the LHCb experiment

Wednesday, March 25, 2026 8:45 AM (20 minutes)

Open heavy-flavor production studies at LHCb provide precise probes of hadronization in collision systems ranging from γPb interactions to semi-central PbPb collisions. Studies of heavy baryons and mesons containing two different heavy or strange valence quarks probe the interplay of statistical hadronization, coalescence, and multi-parton interactions. From another point of view, the production of strange hadrons in high-energy collisions provides insight into hadronization, parton fragmentation, and nuclear effects. While strangeness enhancement has been linked to quark-gluon plasma formation in heavy-ion collisions, recent observations in small systems challenge conventional hadronization models. In this talk, recent results on open heavy-flavor and strangeness production from the LHCb experiment will be presented, providing new constraints on hadronization dynamics and nuclear effects in small systems.

Authors: LHCB COLLABORATION; KOT, Oleksandr (Kyiv-KINR)

Presenter: KOT, Oleksandr (Kyiv-KINR)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **248** Type: **Oral Presentation**

Flow measurements at LHCb

Tuesday, March 24, 2026 3:35 PM (20 minutes)

In heavy-ion collisions, azimuthal correlations probe collective phenomena in the hot and dense medium formed, known as the Quark–Gluon Plasma (QGP). In small collision systems, similar correlations may arise from final-state effects or from initial-state parton correlations. The LHCb experiment has a unique capability to study particle correlations in high-energy hadron collisions at forward rapidity, accessing a kinematic region distinct from other LHC detectors, where longitudinal dynamics play a larger role. By comparing results at forward and backward pseudorapidity, LHCb is also sensitive to possible initial state effects. In addition, thanks to the diverse fixed-target data samples collected by the LHCb experiment, it is possible to study the influence of nuclear geometry on final-state particle correlations by comparing targets with different shapes. This contribution presents recent results on collective flow measurements from the LHCb experiment.

Authors: DA SILVA, Cesar Luiz (Los Alamos National Laboratory); LHCB COLLABORATION

Presenter: DA SILVA, Cesar Luiz (Los Alamos National Laboratory)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **249** Type: **Oral Presentation**

Charm and quarkonium production in collider and fixed-target mode at LHCb

Wednesday, March 25, 2026 9:45 AM (20 minutes)

Quarkonium production in hadronic collisions is a key observable for studying the interaction of heavy quarks with the nuclear medium. While quarkonium states can dissociate and recombine in nucleus-nucleus collisions, their production in smaller systems may be influenced by a combination of initial- and final-state effects such as shadowing and co-mover breakup. Thanks to excellent vertexing performance that allows separation of prompt and b-hadron decay components, the LHCb collaboration has performed precise measurements of J/ψ, ψ(2S), Υ(nS), and χ_c production. LHCb can explore a wide range of environments: apart from high-statistics pp and pPb datasets at the TeV energy range, the new gas injection system has permitted to acquire a variety of proton-nucleus and nucleus-nucleus systems in fixed-target configuration at energy scale of ~ 100. Also, with the upgraded LHCb detector for LHC Run 3, more central PbPb collisions can be studied compared to Run 2, enabling studies in regions where the influence of the hot nuclear medium is significantly stronger. This talk will present recent studies of quarkonium production with the LHCb detector.

Authors: ARATA, Carolina (SPhN); LHCB COLLABORATION

Presenter: ARATA, Carolina (SPhN)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **250** Type: **Oral Presentation**

Overview of the NA60+/DiCE experiment at the CERN SPS

Wednesday, March 25, 2026 11:35 AM (20 minutes)

NA60+/DiCE is a new experiment, proposed for data taking in the coming years, which aims to explore the high baryochemical potential region of the QCD phase diagram. NA60+/DiCE will perform a beam-energy scan with Pb–Pb and p–A collisions in the range 6 < \sqrt{s_{NN}} < 17, taking advantage of the high-intensity beams available at the CERN SPS.

The experimental apparatus comprises a vertex spectrometer and a large-acceptance muon spectrometer., A vertex telescope with ultra-thin, large-area Monolithic Active Pixel Sensors (MAPS) is positioned close to the target and operates within a dipole magnetic field. Downstream, the set-up includes a muon spectrometer based on large-area gaseous detectors and a second dipole magnet. A high-intensity beam grants access to rare observables that have been scarcely explored such as hidden and open charm.

Open charm hadrons will be reconstructed via their decays into charged hadrons, tracked by the silicon detectors of the vertex spectrometer. High-precision measurements of the yields of Dˆ0, Dˆ+, D_sˆ+ mesons, and \Lambda_cˆ+ baryons will provide valuable constraints on the transport properties of the QGP and on charm-quark hadronization.

Charmonium states will be studied through their dimuon decay channels, reconstructed by matching muon tracks between the vertex spectrometer and the muon spectrometer. Measurements of J/\psi and \psi(2S) at different collision energies will enable the identification of the onset of charmonium suppression in a deconfined medium, which can be correlated with the system's temperature, also determined via thermal dimuons measured by NA60+/DiCE.

Additionally, NA60+/DiCE will investigate hadronic decays of strange hadrons and hypernuclei production; the corresponding performance studies will be presented.

This talk will cover the technical aspects of the experimental apparatus, the R&D progress, and the physics program and its potential impact alongside other experiments.

Author: USAI, Gianluca (University of Cagliari)

Presenter: USAI, Gianluca (University of Cagliari)

Session Classification: Parallel VIII: Open Questions and Future

Contribution ID: **251** Type: **Oral Presentation**

PHENIX Measurements of Identified Charged Hadrons and Forward ϕ-meson in Small and Large Systems

Tuesday, March 24, 2026 9:25 AM (20 minutes)

Measurements of light hadron production provide essential insight into final-state effects in ultra-relativistic nuclear collisions. These effects include collective flow in both small and large systems, hadronization via recombination, strangeness enhancement, and modifications arising from cold nuclear matter. Studies of system-size and centrality dependence further constrain the role of initial conditions, such as nuclear overlap geometry and nuclear modification of parton distribution functions.

In this talk, we present recently finalized PHENIX measurements of identified charged hadrons ($\pi/K/p$) and vector mesons, including ω, ρ, K^* and ϕ, in p+p, p+Al, p/d/^{3}He/Cu+Au, Au+Au, and U+U collisions at $\sqrt{s_{NN}}$ = 193–200 GeV. Particular emphasis is placed on the ϕ meson, a pure $s\bar{s}$ state, which serves as a sensitive probe of strangeness production, parton energy loss, and recombination mechanisms in the quark–gluon plasma (QGP). Using the $\phi \to \mu\mu$ decay channel, we report the first measurements of low-mass vector mesons at forward rapidity ($1.2 < |y| < 2.2$) as a function of transverse momentum and the average number of participating nucleons.

While the ω and ρ mesons exhibit strong suppression across all p_T and centralities, the ϕ meson shows distinct behavior, with suppression at high p_T and enhancement at intermediate p_T in central collisions. Comparisons to empirical scaling trends, previous measurements, and theoretical model calculations are discussed, providing new constraints on the flavor dependence of particle production and the interplay of cold and hot nuclear matter effects in heavy-ion collisions.

Authors: PRASAD, Chaitanya (Stony Brook University); PHENIX COLLABORATION

Presenter: PRASAD, Chaitanya (Stony Brook University)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **252** Type: **Oral Presentation**

sPHENIX measurements of strange and heavy-flavor hadron production in p+p collisions

Tuesday, March 24, 2026 11:55 AM (20 minutes)

The new sPHENIX collider detector experiment features a unique tracking system capable of streaming readout, enabling the collection of very large, unbiased p+p datasets previously not available at RHIC. In RHIC Run-24, sPHENIX recorded over 100 billion p+p collisions at 200 GeV in this readout scheme, and is collecting additional p+p data at the end of Run-25 with an even higher fraction of the luminosity in this mode. Using these datasets, qualitatively new measurements in both the strange and heavy-flavor (charm, bottom) sectors are feasible for the first time. For example, the transverse-momentum and multiplicity dependence of strange light hadrons can yield key insights about the onset of QGP formation. As the strange quark mass is below the critical temperature, they can be thermally produced inside the QGP. By measuring the relative production of Λ0 baryons to K0S mesons in p+p collisions, a key baseline measurement is performed, that when compared to later open heavy flavor measurements in various collision systems will enable sPHENIX to make quantitative statements on hadronization mechanisms such as comover effects and color reconnection. This talk will also report the progress of the first sPHENIX measurements in the open charm and bottom sectors in the Run-24 and Run-25 p+p collision datasets, which are ultimately expected to include reference cross-sections, ratios of identified yields for heavy flavor hadronization studies, and the multiplicity dependence of charm production.

Authors: MITRANKOVA, Mariia (Stony Brook University); SPHENIX COLLABORATION

Presenter: MITRANKOVA, Mariia (Stony Brook University)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **253** Type: **Oral Presentation**

Study heavy quark production mechanisms and hadronization in p+p and p+Au collisions in PHENIX

Wednesday, March 25, 2026 9:25 AM (20 minutes)

Heavy quarks are produced predominantly in the initial hard scatterings of high-energy hadronic collisions and therefore provide sensitive probes of heavy-flavor production mechanisms and hadronization in small collision systems. Recent measurements at RHIC and the LHC have shown a strong correlation between heavy-flavor yields and event charged-particle multiplicity in p+p and p+A collisions, suggesting contributions from multi-parton interactions and possible final-state effects. In this talk, the PHENIX experiment presents latest studies of J/ψ production as a function of event multiplicity in p+p and p+Au collisions. The charmonium yield and event activity are measured in separated rapidity regions, reducing auto-correlation effects and enabling studies of nuclear medium effects on J/ψ production and hadronization over different Bjorken-x regimes.

In addition, a precise baseline measurement of the beauty contribution to inclusive J/ψ production in p+p collisions at $\sqrt{s} = 200$ and 510 GeV is reported. J/ψ mesons from B-meson decays are statistically separated from prompt J/ψ using displaced decay vertices. The fraction of $B \to J/\psi$ is measured over wide transverse momentum and rapidity ranges and compared with results from other experiments and theoretical calculations based on FONLL combined with the color evaporation model. Together, these studies establish a comprehensive framework for understanding heavy-quark production and hadronization in heavy ion collisions.

Authors: LIU, Ming (Los Alamos National Laboratory); PHENIX COLLABORATION

Presenter: LIU, Ming (Los Alamos National Laboratory)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **254** Type: **Oral Presentation**

Third-body-corrected Two-Pion Femtoscopic Correlations in Au+Au Collisions at high baryon density

Tuesday, March 24, 2026 5:45 PM (20 minutes)

Measurements of identical pion femtoscopy offer insights into collision dynamics, such as collective expansion, geometry of the collision zone at freeze-out, final state interactions, etc. In addition to the quantum interference and Coulomb interactions among the pion pairs, Coulomb interactions between the pair and the net positive charge in the emitting source affect the final correlation measurements as well. Furthermore, due to the imbalance of protons and neutrons inside the colliding nuclei, initial isospin, which could play an important role in determining the Equation of State (EoS) of the produced medium, also can affect the correlation functions at high baryon density.

In this talk, we present the results of the identical charged pion correlations from $\sqrt{s_{\rm NN}}$ = 3.0, 3.2, 3.5, 3.9, 4.5, 7.7 GeV Au+Au collisions collected by the STAR experiment. A new procedure has been developed to remove the residual effect from the 3rd-body Coulomb force. The correlation strength (λ) and HBT radii ($R_{\rm out}, R_{\rm side}, R_{\rm long}, R^2_{\rm out-long}$) extracted from the positive and negative charged pion correlation functions, before and after removing the 3rd-body Coulomb effect, will be presented as a function of collision energy, centrality, pair transverse momentum($k_{\rm T}$) and pair rapidity ($y^{\pi\pi}_{\rm c.m.}$). Transport model UrQMD calculations with realistic experimental cuts will be used to aid the discussions.

Authors: STAR COLLABORATION; QI, Youquan (Central China Normal University)

Presenter: QI, Youquan (Central China Normal University)

Session Classification: Parallel V: Phase Structure

Contribution ID: **255** Type: **Oral Presentation**

Measurement of coherent J/Ψ and K^+K^- photoproduction in UPCs at $\sqrt{s_{\rm NN}}$ = 200 GeV with the STAR experiment

Wednesday, March 25, 2026 12:15 PM (20 minutes)

In ultra-peripheral collisions (UPCs), photon-induced production mechanisms include resonant vector-meson photoproduction, the non-resonant Drell-Soding process, and $\gamma\gamma$ processes. Coherent vector meson photoproduction provides a sensitive probe of the gluonic structure of heavy nuclei; vector mesons of different mass (e.g. ϕ and J/Ψ) offer insights into different x regions corresponding to different QCD scales. Moreover, hadron antihadron photoproduction via the non-resonant Drell-Soding and $\gamma\gamma$ processes, require further measurements to be better understood. Measurements of the differential cross-sections for coherent vector-meson (ϕ and J/Ψ) and K^+K^- photoproduction offer a direct probe of nuclear gluon structure and help clarify the roles of the Drell-Soding and $\gamma\gamma$ processes.

In this presentation, we present the first measurement of coherent J/ψ photoproduction cross section in isobaric (Ru+Ru/Zr+Zr) UPCs at $\sqrt{s_{\rm NN}}$ = 200 GeV. The differential cross-sections are reported as functions of rapidity and forward neutron multiplicity. Photon flux-corrected cross sections at a photon–nucleon center-of-mass energy of 25 GeV are compared with Au+Au results and shown as a function of the nuclear mass number A to investigate colliding system size dependencies. We also report measurements of coherent ϕ and K^+K^- photoproduction in Au+Au UPCs at $\sqrt{s_{\rm NN}}$ = 200 GeV. The differential cross sections are studied to explore the relative roles of resonant, non-resonant, and $\gamma\gamma$ processes and their interference term. Our results offer novel insights into both the gluon structure and new constraints on dynamics of Drell-Soding and $\gamma\gamma$ processes in heavy-ion UPCs.

Authors: STAR COLLABORATION; LI, Zengzhi (South China Normal University)

Presenter: LI, Zengzhi (South China Normal University)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **256** Type: **Oral Presentation**

Hyperon Spin Observables in Au+Au Collisions at RHIC BES-II: Global and Local Polarization, Spin Correlations

Tuesday, March 24, 2026 9:25 AM (20 minutes)

The observation of hyperon polarization in heavy-ion collisions has established spin phenomena as powerful probes of the properties of the quark-gluon plasma (QGP) and the dynamics of strongly interacting matter. Global polarization reflects the medium's overall vorticity, while local polarization is expected to arise from anisotropic flow–induced vorticities, although current theoretical descriptions remain incomplete.

In this talk, we present recent STAR results on hyperon spin observables in Au+Au collisions from the RHIC Beam Energy Scan Phase II (BES-II) program. Global polarization measurements of Λ, Ξ, and Ω hyperons at $\sqrt{s_{NN}} = 7.7$–27 GeV provide new insights into the polarization mechanism, including possible magnetic-field–driven effects through the comparison between Λ and $\bar{\Lambda}$ polarizations. In addition, we report the status of spin correlation measurements of Λ–(anti)–Λ hyperon pairs, which probe the local structure and dynamics of spin polarization in the QGP.

Furthermore, we employ Event Shape Engineering to study the contribution of elliptic flow related effects to local polarization of Λ and $\bar{\Lambda}$ hyperons in Au+Au collisions at $\sqrt{s_{NN}} = 19.6$ GeV. These measurements allow to investigate the relation among the initial geometry, elliptic flow, and local polarization.

Authors: STAR COLLABORATION; FU, Tong (Shandong University)

Presenter: FU, Tong (Shandong University)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

Contribution ID: **257** Type: **Oral Presentation**

Collision Energy and System Size Dependent Radial Flow Fluctuations at RHIC

Tuesday, March 24, 2026 2:35 PM (20 minutes)

Understanding the expansion dynamics and transport properties of the quark–gluon plasma (QGP) is one of the central goals of heavy-ion collision experiments. The newly proposed observable $v_0(p_T)$ [1], which is directly sensitive to p_T-differential fluctuations of radial flow, has been measured by the LHC experiments [2,3] and has been suggested as a sensitive probe of the medium's bulk viscosity 4. Extending these measurements to RHIC energies provides a unique opportunity to study the evolution of radial expansion dynamics and transport properties over a broad range of collision energies and system sizes.

In this work, we present measurements of $v_0(p_T)$ for charged hadrons and identified pions, kaons, and protons in Au+Au collisions at $\sqrt{s_{NN}}$ = 7.7, 9.2, 11.5, 14.6, 19.6, 27, 54.4, and 200˜GeV, as well as in O+O collisions at $\sqrt{s_{NN}} = 200$˜GeV at STAR-RHIC. The characteristic mass ordering of $v_0(p_T)$ among identified hadrons at low p_T is studied for different collision energies and system sizes, and the analysis is extended to high p_T to investigate possible effects from jet quenching.

We also discuss the energy dependence of the p_T slope of $v_0(p_T)$ and the p_T value at which $v_0(p_T)$ changes sign, as they reflect the strength and fluctuations of the radial flow 5. Particle and antiparticle results are compared across energies, highlighting the increasing role of baryon transport at lower energies. The results are compared with Pb+Pb data at $\sqrt{s_{NN}} = 5.02$˜TeV from the LHC to study the energy evolution of radial flow fluctuations from RHIC to LHC.

Finally, comparisons with state-of-the-art hydrodynamic calculations allow us to assess the sensitivity of $v_0(p_T)$ to key transport properties of the medium, including bulk viscosity, the speed of sound, and jet energy loss. These measurements provide new constraints on initial conditions and transport coefficients, and offer unique insights into the nature of radial flow fluctuations across a wide range of collision energies and system sizes.

Authors: STAR COLLABORATION; WANG, Zaining (Fudan University)

Presenter: WANG, Zaining (Fudan University)

Session Classification: Parallel II: Bulk Properties

Contribution ID: **258** Type: **Oral Presentation**

Charged-particle multiplicities, pseudorapidity and transverse-momentum distributions, and two- and four-particle correlations in O+O, Ne+Ne, and p+O collisions with the ATLAS detector

Wednesday, March 25, 2026 9:05 AM (20 minutes)

This presentation reports new ATLAS measurements of soft-particle production and collective flow in light-ion collisions at the LHC. Charged-particle pseudorapidity densities ($dn/d\eta$) and average transverse momenta ($\langle p_T \rangle$) are measured in O+O and Ne+Ne collisions at $\sqrt{s_{NN}} = 5.36$ TeV over the fiducial range $|\eta| < 2.5$ and $0.27 < p_T < 5$ GeV. Fits to the measured transverse-momentum spectra are employed to extrapolate these observables to $p_T = 0$ GeV. Results for $dn/d\eta$ and $\langle p_T \rangle$ are presented as functions of pseudorapidity and collision centrality for both fiducial and fully extrapolated p_T intervals. Ratios of Ne+Ne to O+O $dn/d\eta$ and differences in $\langle p_T \rangle$, which significantly reduce correlated systematic uncertainties, are also reported. These measurements are compared with hydrodynamic calculations incorporating different initial-state models to assess the role of nuclear geometry in particle-production dynamics.

Complementary measurements of collective flow further probe the initial-state structure of these light-ion systems. Using charged-particle tracks, ATLAS extracts azimuthal anisotropy coefficients v_n2 and v_n4 in O+O and Ne+Ne collisions, revealing clear signatures of collectivity and demonstrating that the elongated nuclear structure of neon enhances v_2k in the most central events relative to oxygen. In addition, measurements of v_n2 for $n = 2$–4 in p+O collisions, compared with corresponding p+Pb results, provide stringent constraints on the geometry and initial-state conditions of highly asymmetric systems. Together, these new light-ion measurements deliver a high-precision dataset that advances the understanding of collective dynamics, particle production, and initial-state effects in small collision systems.

Authors: ATLAS COLLABORATION; MOHAPATRA, Soumya (Columbia University)

Presenter: MOHAPATRA, Soumya (Columbia University)

Session Classification: Parallel VI: Correlations

Contribution ID: **259** Type: **Oral Presentation**

Global Polarization and Vector Meson Production with ALICE

Tuesday, March 24, 2026 3:15 PM (20 minutes)

Ultra-relativistic heavy-ion collisions create a unique environment for studying the quark–gluon plasma (QGP). In non-central collisions, the large initial orbital angular momentum can be transferred to the medium as vorticity, inducing a global polarization of produced particles. Furthermore, the strong initial magnetic field generated in heavy-ion collisions can contribute to the global polarization, leading to competing effects to particle and anti-particle based on their electric charge.

This talk presents new results from the ALICE experiment using high-statistics data from LHC Run 3. We report the first observation of global Λ hyperon polarization in Pb–Pb collisions at $\sqrt{s_{NN}}$ = 5.36 TeV. These measurements offer a direct probe into the vortical dynamics of the medium and into the interplay between spin and orbital angular momentum in strongly interacting matter.

Complementing the hyperon studies, we investigate the production and polarization of vector mesons, which are essential for understanding particle production mechanisms and hadronization from polarized quarks. We present preliminary ϕ meson p_T spectra across various centrality classes in Pb–Pb collisions at $\sqrt{s_{NN}}$ = 5.36 TeV, alongside results from pp collisions at $\sqrt{s_{NN}}$ = 13.6 TeV. The ϕ meson is reconstructed via the dimuon channel at forward rapidity, with the pp data providing a vital reference for interpreting polarization effects. Finally, these results are compared with previous measurements and theoretical predictions from various Monte Carlo models to further constrain our understanding of strongly interacting matter.

Authors: ALICE COLLABORATION; DAS, Prottay (CERN)

Presenter: DAS, Prottay (CERN)

Session Classification: Parallel IV: Chirality, Vorticity and Polarization

Contribution ID: **260** Type: **Oral Presentation**

The role of strangeness and baryon enhancement in heavy-quark hadronization from pp to Pb–Pb collisions with ALICE

Wednesday, March 25, 2026 9:45 AM (20 minutes)

Understanding charm-quark hadronization is key to characterizing the quark–gluon plasma formed in heavy-ion collisions. Measurements of strange and non-strange charm hadrons across collision systems probe hadronization mechanisms, particularly in Pb–Pb collisions where abundant strangeness is expected to enhance recombination effects and provide stringent tests of statistical-hadronization models. In addition, the observed enhancement of charm-baryon production relative to mesons compared with e^+e^- collisions challenges fragmentation-based descriptions and motivates models incorporating modified hadronization mechanisms. A consistent description of both strange and non-strange charm baryons remains an open question, calling for precise experimental constraints.

In this contribution, we present a combined study of charm-meson and charm-baryon production with ALICE. We report measurements of the $\mathrm{D_s^+/D^+}$ production ratio from low-multiplicity pp collisions at $\sqrt{s} = 13.6$ TeV to Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.36$ TeV. We also present the first $\mathrm{p_T}$-differential cross sections of the orbitally excited $\mathrm{D_{s1}}(2536)^+$ and $\mathrm{D_{s2}}(2573)^{*+}$ mesons in pp collisions at $\sqrt{s} = 13.6$ TeV, including their yield ratios to the $\mathrm{D_s^+}$ ground state. Furthermore, we discuss measurements of non-strange (Λ_c^+, $\Sigma_\mathrm{c}^{0,++}$) and strange ($\Xi_\mathrm{c}^{0,+}$) charm baryons in pp collisions at $\sqrt{s} = 13.6$ TeV from LHC Run 3, and compare them with model predictions. Finally, we highlight baryon-to-meson ratios as functions of event multiplicity, including the latest $\Lambda_\mathrm{c}^+/\mathrm{D}^0$ results.

Authors: ALICE COLLABORATION; CHINU, Fabrizio (Univ. of Torino)

Presenter: CHINU, Fabrizio (Univ. of Torino)

Session Classification: Parallel III: Resonances

Contribution ID: **261** Type: **Oral Presentation**

Heavy-flavour production and correlations in pp collisions: precision tests of pQCD and hadronization with ALICE

Tuesday, March 24, 2026 3:35 PM (20 minutes)

Heavy quarks (charm and beauty) are produced in hard partonic scatterings, making their cross sections in proton–proton (pp) collisions calculable in perturbative quantum chromodynamics (pQCD) and thus providing stringent tests of theory. Furthermore, the associated production of two charm hadrons in a single collision probes the dynamics of multiparton interactions, distinguishing between single (SPS) and double parton scattering (DPS) processes.

In this contribution, we report measurements of prompt D-meson production, as well as non-prompt/prompt production cross-section ratios. The final result of the measurement of the transverse-momentum (p_{T}) production cross section of B^0 mesons down to $p_{\mathrm{T}} = 1$ GeV/c at midrapidity is presented. The rapidity dependence of B-meson production is discussed by computing the ratio with respect to LHCb measurements at forward rapidity. The associated production of D^0 and J/ψ pairs in pp collisions at 13.6 TeV is presented as well, where D^0 mesons are reconstructed at midrapidity, while J/ψ candidates are measured at both forward and midrapidity. The production of J/ψ pairs at forward rapidity in pp collisions at 13 TeV is also reported. These comprehensive measurements are compared to pQCD calculations and phenomenological models, providing crucial constraints on heavy-quark production, hadronisation, and multiparton interaction dynamics.

Authors: ALICE COLLABORATION; SHARMA, Deependra (IIT Mumbai)

Presenter: SHARMA, Deependra (IIT Mumbai)

Session Classification: Parallel VI: Correlations

Contribution ID: **262** Type: **Oral Presentation**

Quarkonia production and polarization in pp and Pb–Pb collisions with ALICE

Wednesday, March 25, 2026 10:05 AM (20 minutes)

The production of heavy quarkonium —bound states of a heavy quark (charm or beauty) and its corresponding antiquark —is widely used to probe both the properties of quantum chromodynamics (QCD) in high-energy proton–proton (pp) collisions and deconfinement in heavy-ion collisions. In pp collisions, precise measurements of quarkonium production cross sections, polarization, and correlations with event activity are essential for constraining theoretical models and improving the understanding of charmonium production mechanisms. In heavy-ion collisions, quarkonium production and polarization serve as a rich testing ground to study quarkonium formation and in-medium dynamics.

In this contribution, we present new measurements of charmonium and Υ(1S) production in pp collisions, together with J/ψ polarization at mid and forward rapidity. Results on J/ψ production as a function of event multiplicity are also reported. In addition, measurements of J/ψ and ψ(2S) production and J/ψ spin alignment as functions of centrality and transverse momentum in Pb–Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV will be presented. New preliminary results on the J/ψ-to-ψ(2S) production ratio at $\sqrt{s_{NN}}$ = 5.36 TeV, obtained with the upgraded ALICE Run 3 detector, are also shown. All results are compared with model calculations and their physics implications are discussed.

Authors: ALICE COLLABORATION; LEE, Hyungjun (Sungkyunkwan University)

Presenter: LEE, Hyungjun (Sungkyunkwan University)

Session Classification: Parallel I: Strangeness and HF

Contribution ID: **263** Type: **not specified**

Opening Ceremony

Monday, March 23, 2026 8:45 AM (15 minutes)

Session Classification: Plenary

Contribution ID: **264** Type: **not specified**

Overview of Strangeness and Heavy Flavor in High Energy Nuclear Collisions

Monday, March 23, 2026 9:00 AM (40 minutes)

Presenter: MUELLER, Berndt (Duke University)

Session Classification: Plenary

Contribution ID: **265** Type: **not specified**

ALICE Highlight I - Recent Results from Light Flavor

Monday, March 23, 2026 10:05 AM (25 minutes)

Presenter: PINTO, Chiara (CERN/TU Munich)

Session Classification: Plenary

Contribution ID: **266** Type: **not specified**

STAR Highlight I - Recent Results from Beam Energy Scan II

Monday, March 23, 2026 9:40 AM (25 minutes)

Presenter: PANDAV, Ashish (LBNL)

Session Classification: Plenary

Contribution ID: **267** Type: **not specified**

sPHENIX Highlights

Monday, March 23, 2026 11:00 AM (25 minutes)

Presenter: OTTINO, Gregory (LBNL)

Session Classification: Plenary

Contribution ID: **268** Type: **not specified**

CMS Highlights

Monday, March 23, 2026 11:25 AM (25 minutes)

Presenter: PRADHAN, Raghunath (Univ. of Illinois Chicago)

Session Classification: Plenary

Contribution ID: **269** Type: **not specified**

ATLAS Highlights

Monday, March 23, 2026 11:50 AM (25 minutes)

Presenter: GILBERT, Benjamin Jacob (Lawrence Livermore National Laboratory)

Session Classification: Plenary

Contribution ID: **270** Type: **not specified**

LHCb Highlights

Monday, March 23, 2026 12:15 PM (25 minutes)

Presenter: BOETTCHER, Thomas (Indiana University)

Session Classification: Plenary

Contribution ID: **271** Type: **not specified**

ALICE Highlight II - Recent Results from Heavy Flavor

Monday, March 23, 2026 2:15 PM (25 minutes)

Presenter: CATALANO, Fabio (Univ. of Houston)

Session Classification: Plenary

Contribution ID: **272** Type: **not specified**

PHENIX Highlights

Monday, March 23, 2026 2:40 PM (20 minutes)

Presenter: MITRANKOV, Iurii (Stony Brook University)

Session Classification: Plenary

Contribution ID: **273** Type: **not specified**

NA61/SHINE Highlights

Monday, March 23, 2026 3:00 PM (20 minutes)

Presenter: MARCINEK, Antoni (Institute of Nuclear Physics, Krakow)

Session Classification: Plenary

Contribution ID: **274** Type: **not specified**

HADES Highlights

Monday, March 23, 2026 3:20 PM (20 minutes)

Presenter: RUSTAMOV, Anar (GSI)

Session Classification: Plenary

Contribution ID: **275** Type: **not specified**

STAR Highlight II: Study of Small Systems and the Search for New, Exotic Physics

Monday, March 23, 2026 3:40 PM (25 minutes)

Presenter: JIA, Jiangyong (Stony Brook University)

Session Classification: Plenary

Contribution ID: **276** Type: **not specified**

Theory Overview: QCD Phase Structure at High Density Region

Monday, March 23, 2026 4:35 PM (30 minutes)

Presenter: SORENSEN, Agnieszka (FRIB)

Session Classification: Plenary

Contribution ID: **277** Type: **not specified**

Theory Overview: Chirality, Polarization and Spin Alignment in Heavy-Ion Collisions

Monday, March 23, 2026 5:05 PM (30 minutes)

Presenter: SHI, Shuzhe (Tsinghua University)

Session Classification: Plenary

Contribution ID: **278** Type: **not specified**

Theory Overview: Dynamics Model Simulations for Heavy-Ion Collisions

Monday, March 23, 2026 5:35 PM (30 minutes)

Presenter: DU, Lipei (UC Berkeley/LBNL)

Session Classification: Plenary

Contribution ID: **279** Type: **not specified**

Experimental Review on Bulk Properties and Light/Strange Hadron Production in Heavy-Ion Collisions

Thursday, March 26, 2026 8:45 AM (25 minutes)

Presenter: SHI, Shusu (Central China Normal University)

Session Classification: Plenary

Contribution ID: **280** Type: **not specified**

Theoretical Review on Bulk Properties and Light/Strange Hadron Production in Heavy-Ion Collisions

Thursday, March 26, 2026 9:10 AM (25 minutes)

Presenter: KANAKUBO, Yuuka (RIKEN iTHEMS)

Session Classification: Plenary

Contribution ID: **281** Type: **not specified**

Femtoscopy, Final State Interactions and Exotic Particle Search

Thursday, March 26, 2026 9:35 AM (25 minutes)

Presenter: SERKSNYTE, Laura (CERN)

Session Classification: Plenary

Contribution ID: **282** Type: **not specified**

Nuclei and Hypernuclei Production in Heavy-Ion Collisions

Thursday, March 26, 2026 10:00 AM (25 minutes)

Presenter: XIE, Guannan (Univ. of Chinese Academy of Sciences)

Session Classification: Plenary

Contribution ID: **283** Type: **not specified**

Experimental Review on QCD Critical Point Search

Thursday, March 26, 2026 10:55 AM (25 minutes)

Presenter: LUO, Xiaofeng (Central China Normal University)

Session Classification: Plenary

Contribution ID: **284** Type: **not specified**

Theoretical Review on QCD Critical Point Predictions

Thursday, March 26, 2026 11:20 AM (25 minutes)

Presenter: PRADEEP, Maneesha (IlSc, India)

Session Classification: Plenary

Contribution ID: **285** Type: **not specified**

Recent Developments in Lattice QCD

Thursday, March 26, 2026 11:45 AM (25 minutes)

Presenter: DING, Heng-Tong (Central China Normal University)

Session Classification: Plenary

Contribution ID: **286** Type: **not specified**

Experimental Review on Global Polarization and Spin Alignment in Heavy-Ion Collisions

Thursday, March 26, 2026 12:10 PM (25 minutes)

Presenter: NIIDA, Takafumi (University of Tsukuba)

Session Classification: Plenary

Contribution ID: **287** Type: **not specified**

Experimental Review on Open Heavy Flavor Measurements

Thursday, March 26, 2026 2:15 PM (25 minutes)

Presenter: FAGGIN, Mattia (INFN Padova)

Session Classification: Plenary

Contribution ID: **288** Type: **not specified**

Theoretical Review on Open Heavy Flavor in Medium

Thursday, March 26, 2026 2:40 PM (25 minutes)

Presenter: XING, Hongxi (South China Normal University)

Session Classification: Plenary

Contribution ID: **289** Type: **not specified**

Experimental Review on Quarkonia Measurements

Thursday, March 26, 2026 3:05 PM (25 minutes)

Presenter: MICHELETTI, Luca (INFN Torino)

Session Classification: Plenary

Contribution ID: **290** Type: **not specified**

Theoretical Review on Quarkonia in Medium

Thursday, March 26, 2026 3:30 PM (25 minutes)

Presenter: PETRECZK, Peter (BNL)

Session Classification: Plenary

Contribution ID: **291** Type: **not specified**

Strangeness and Heavy Flavor Production in Small Systems

Friday, March 27, 2026 8:45 AM (25 minutes)

Presenter: DAS, Sruthy (Univ. of Illinois Chicago)

Session Classification: Plenary

Contribution ID: **292** Type: **not specified**

Baryon Transport from Light to Strange Quarks

Friday, March 27, 2026 9:10 AM (25 minutes)

Presenter: TSANG, Chun Yuen (Kent State University)

Session Classification: Plenary

Contribution ID: **293** Type: **not specified**

Open Quantum System Approaches for Heavy-Ion Collisions

Friday, March 27, 2026 9:35 AM (25 minutes)

Presenter: ROTHKOPF, Alexander (Korea University)

Session Classification: Plenary

Contribution ID: **294** Type: **not specified**

Nuclear Matter Equation-of-State and Astrophysics

Friday, March 27, 2026 10:00 AM (25 minutes)

Presenter: PELICER, Mateus (Univ. of Illinois Urbana-Champaign)

Session Classification: Plenary

Contribution ID: **295** Type: **not specified**

LHC Upgrades and Future Physics Programs

Friday, March 27, 2026 10:55 AM (25 minutes)

Presenter: CHINELLATO, David (Marietta Blau Institute Vienna)

Session Classification: Plenary

Contribution ID: **296** Type: **not specified**

Future Fixed Target Program @SPS

Friday, March 27, 2026 11:20 AM (20 minutes)

Presenter: SCOMPARIN, Enrico (INFN Torino)

Session Classification: Plenary

Contribution ID: **297** Type: **not specified**

CBM @FAIR

Friday, March 27, 2026 11:40 AM (20 minutes)

Presenter: LINZ, Frederic (GSI/FAIR)

Session Classification: Plenary

Contribution ID: **298** Type: **not specified**

Strange and Heavy Flavor Physics at EIC and ePIC status

Friday, March 27, 2026 12:00 PM (20 minutes)

Presenter: MA, Rongrong (BNL)

Session Classification: Plenary

Contribution ID: **299** Type: **not specified**

Conference Summary

Friday, March 27, 2026 2:00 PM (45 minutes)

Presenter: CAINES, Helen (Yale University)

Session Classification: Plenary

Contribution ID: **300** Type: **not specified**

Flash Talks

Friday, March 27, 2026 2:45 PM (45 minutes)

Session Classification: Plenary

Contribution ID: **301** Type: **not specified**

Andre Mischke's Award

Friday, March 27, 2026 4:00 PM (10 minutes)

Session Classification: Plenary

Contribution ID: **302** Type: **not specified**

JSPC Journal's Award

Friday, March 27, 2026 4:10 PM (20 minutes)

Session Classification: Plenary

Contribution ID: **303** Type: **not specified**

SQM 2027/2028

Friday, March 27, 2026 4:30 PM (15 minutes)

Session Classification: Plenary

Contribution ID: **304** Type: **not specified**

Closing

Friday, March 27, 2026 4:45 PM (15 minutes)

Session Classification: Plenary

Contribution ID: **305** Type: **not specified**

Lecture 1: Heavy Quarks and Quarkonia

Sunday, March 22, 2026 9:00 AM (1h 30m)

Presenter: VITEV, Ivan (Los Alamos National Laboratory)

Session Classification: Student Day

Contribution ID: **306** Type: **not specified**

Lecture 2: Bulk Physics

Sunday, March 22, 2026 11:00 AM (1h 30m)

Presenter: SHEN, Chun (Wayne State University)

Session Classification: Student Day

Contribution ID: **307** Type: **not specified**

Lecture 3: Chiral Effects in QCD

Sunday, March 22, 2026 2:00 PM (1h 30m)

Presenter: LIAO, Jinfeng (Indiana University)

Session Classification: Student Day

Contribution ID: **308** Type: **not specified**

Activity 4 (TBA)

Sunday, March 22, 2026 4:00 PM (1h 30m)

Session Classification: Student Day

Contribution ID: **309** Type: **Poster Presentation**

Imaging Freeze-Out Sources and Extracting Strong Interaction Parameters in Relativistic Heavy-Ion Collisions

Tuesday, March 24, 2026 7:23 PM (1 minute)

By combining femtoscopic interferometry with an optical deblurring algorithm, we present a novel method to image the source in heavy-ion collisions while simultaneously extracting the interaction strength between particle pairs. We apply this method to the published STAR data on Au+Au collisions at $\sqrt{s_{\rm NN}} = 200$ GeV, obtaining new fits for both the spatial distribution of the emission source and the strong interaction parameters for protons (p) and antiprotons ($\bar{p}$) from the respective pp and $\bar{p}\bar{p}$ correlation functions. Within uncertainties, p and $\bar{p}$ share the same freeze-out distribution, deviating from the widely assumed Gaussian shape. These results provide evidence for matter–antimatter symmetry at freeze-out, prior to full randomization of nucleons in the collision process.

Authors: XU, Junhuai (Tsinghua University); XIAO, Zhigang (Tsinghua University)

Presenter: XU, Junhuai (Tsinghua University)

Session Classification: Poster Session

Contribution ID: **310** Type: **Poster Presentation**

Eigen-microstate Signatures of Criticality in Relativistic Heavy-Ion Collisions

Tuesday, March 24, 2026 7:28 PM (1 minute)

We develop the eigen-microstate framework as a new approach to identify criticality in relativistic heavy-ion collisions. We construct the original microstate, defined as the final-state particle fluctuations of a single event. By examining ensembles of such original microstates with and without critical signals, we demonstrate that the corresponding eigen-microstate can extract and reveal the dominant critical mode, with the largest eigenvalue serving as a robust order parameter. This framework avoids equilibrium assumptions and the approach is directly applicable to RHIC Beam Energy Scan data, offering a powerful new tool in the search for the QCD critical point.

We also present a comprehensive model study of the eigen-microstate approach (EMA) for identifying critical fluctuations in relativistic heavy-ion collisions. Using UrQMD and two stochastic baseline models, we demonstrate that EMA is insensitive to conventional short-range correlations and effectively filters out non-critical backgrounds. Critical fluctuations embedded via event-level or particle-level replacement with critical Monte-Carlo (CMC) events generate characteristic cluster-like eigen-microstate patterns and enhanced leading eigenvalues, with event-level criticality producing stronger responses. The eigen microstates exhibit the same pattern across different scales, demonstrating that the fractal nature of critical fluctuations is captured by the eigen microstates. Finite-size scaling of eigenvalue ratios exhibits fixed-point behavior, confirming the largest eigenvalue as an effective order-parameter-like quantity. These results demonstrate that EMA offers a robust and background-independent method for critical-point searches in current and future heavy-ion experiments.

Author: WU, Yuanfang (Central China Normal University)

Presenter: WU, Yuanfang (Central China Normal University)

Session Classification: Poster Session