Southeast Asian Workshop on Nuclear and Hadron Physics

Report of Contributions

https://indico.global/e/13949

Contribution ID: **1** Type: **not specified**

Vacuum stability of an extended standard model with U(1) symmetry

Thursday 21 August 2025 11:15 (25 minutes)

In this work, we study the vacuum structure of an extended standard model with \$U(1)_D\$ symmetry. The potential of the model consists of two scalar doublets and two scalar singlets. We theoretically analyze constraints, such as bounded-from-below, global minimum, and perturbativity up to the Planck scale. The experimental bounds from the Higgs invisible decay are also investigated.

Author: ADAM, Apriadi (Research Center for Physics, National Research and Innovation Agency (BRIN))

Co-authors: DIRGANTARA, Bayu; Mrs ANDRIANI, Yunita Kristanti (Graduate School of Science, University of Osaka)

Presenter: ADAM, Apriadi (Research Center for Physics, National Research and Innovation Agency (BRIN))

Session Classification: Researcher session

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

Quarkyonic matter with chiral symmetry restoration

Wednesday 20 August 2025 15:55 (25 minutes)

We present a novel unified approach to describe the dense symmetric nuclear matter by combining the quarkyonic matter framework with the parity doublet model. This integration allows for a consistent treatment of
the transition from hadronic to quark degrees of freedom while incorporating chiral symmetry restoration effects. Our model introduces a chiral invariant mass for both baryons and constituent quarks, enabling a smooth
crossover between hadronic and quark matter in symmetric nuclear matter. We derive the equation of state
(EOS) for this hybrid system and investigate its thermodynamic properties. The model predicts a gradual onset
of quark degrees of freedom at high densities while maintaining aspects of confinement.

Author: GAO, Bikai (Research Center for Nuclear Physics (RCNP), Osaka University,)

Presenter: GAO, Bikai (Research Center for Nuclear Physics (RCNP), Osaka University,)

Session Classification: Researcher session

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

Imprint of nuclear structure on identified particles in high energy heavy ion collisions

Tuesday 19 August 2025 17:15 (15 minutes)

The encoded nuclear structures related to flow fluctuations can be investigated at a fixed impact parameter in ultra-relativistic ion collisions through factorization breaking. This phenomenon is explored by analyzing momentum-dependent correlations among flow harmonics across distinct kinematic bins, specifically regarding transverse momentum (p_T) or pseudorapidity (η). The influence of various β deformations on these momentum-dependent coefficients has been observed previously. Our findings indicate a sensitivity to triaxiality for $pT > 1.5$ GeV in ultra-central U+U collisions. Notably, we find that the imprint of deformation is evident in the behavior of identified particles. We report a significant shift in the crossing point of observable ratios, specifically $\pi^{\pm}/p(\bar{p})$ and $\pi^{\pm}/K^{\pm}$. This new observable reveals that the crossing point occurs at higher p_T values for quadrupole-deformed nuclei and higher ratio values for triaxiality in U+U and Au+Au collisions, as determined using the TRENTO+VISH(2+1D) framework.

Authors: Mr SAHA, Abhisek (Peking University); MEHRABPOUR, Hadi (Peking Univresity)

Presenter: MEHRABPOUR, Hadi (Peking Univresity)

Session Classification: Young researcher session

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

Nuclear theories used in compact stars in some modified gravity theories

Tuesday 19 August 2025 10:20 (25 minutes)

In this talk, I will be presenting the most recent published work, emphasizing more on the nuclear aspect. Then, I will shift my focus to some points that I realize from this work and some of my past works. The main points will be twofold. First, according to the works that I had done so far, nuclear matter models give a significant shift to the maximum mass of compact stars. Second, although modified gravity models can also do the same, some of them do not give significant shift compared to the nuclear matter. However, the main drawback of nuclear matter models is that it is not enough to study ultracompact stars, which is a mimic to black holes, and the reason why one study exotic matter for astrophysical objects.

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Presenter: PRASETYO, Ilham (Sampoerna University)

Session Classification: Researcher session

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

Entanglement Suppression, Quantum Statistics and Symmetries in Spin-3/2 Baryon Scatterings

Wednesday 20 August 2025 13:00 (25 minutes)

We explore the interplay among entanglement suppression, quantum statistics and enhanced symmetries in the non-relativistic S-wave scattering involving the lowest-lying spin-3/2 baryons, which can be considered as four-dimensional qudits. These baryons form a ten-dimensional representation (decuplet) under the SU(3) light-flavor symmetry and, in this limit, are considered indistinguishable under strong interactions. Treating the S-matrix in the spin-3/2 baryon-baryon scattering as a quantum logic gate in the spin space, we study the consequence of entanglement suppression and compute the entanglement power of the S-matrix. When the entanglement power vanishes, the S-matrix is either an Identity or a SWAP gate and spin-flavor symmetries and/or non-relativistic conformal invariance emerge, as previously observed in spin-1/2 baryons. In the case of scattering identical particles, the entanglement power never vanishes due to constraints from spin statistics, which we interpret as projection-valued measurements onto symmetric or antisymmetric Hilbert space and define the entanglement power accordingly. When the entanglement power is non-vanishing but sits at a global or local minimum, enhanced symmetries still emerge and the S-matrix can be interpreted as an Identity or a SWAP gate acting on the restricted Hilbert space allowed by quantum statistics. In general, when scattering identical spin-s particles, we identify an enhanced SU(2s+1) spin symmetry for the Identity gate.

T.R. Hu, K. Sone, F. K. Guo, T. Hyodo and I. Low, arXiv:2506.08960 [hep-ph].

Authors: Mr HU, Tao-Ran; SONE, Katsuyoshi (Tokyo Metropolitan University); Prof. GUO, Feng-Kun (Insitute of Theoretical Physics, Chinese Academy of Sciences); HYODO, Tetsuo (Tokyo Metropolitan University); LOW, Ian

Presenter: HYODO, Tetsuo (Tokyo Metropolitan University)

Session Classification: Researcher session

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

Probing the Spectroscopy and Electromagnetic Structure of Heavy Meson within the Light-Front Quark Model

Tuesday 19 August 2025 14:05 (15 minutes)

The study of hadron by means of QCD is still unable to answer the unsolved puzzle; the hadron structures, especially those of heavy mesons. Hence, a comprehensive investigation of the 1S, 2S, and 3S states of heavy pseudoscalar (P) and vector (V) mesons for charmonia ($c\bar{c}$), bottomia ($b\bar{b}$), and charm-bottom ($c\bar{b}$) is strongly required. By employing the light-front quark model (LFQM) based on variational analysis, the harmonic oscillator (HO) basis as the trial wave function is used to study some properties of mesons. In this thesis, the QCD-motivated effective potential, i.e., the screening potential plus hyperfine interaction, is considered. First, the mass spectra of 1S, 2S, and 3S state P and V heavy mesons are computed and the suitable model parameters are obtained by using variational principle. Then, the corresponding decay constant and radiative M1 transition of the P and V mesons are also computed. Finally, the result of our calculation is compared with the available experimental data as well as other theoretical predictions.

Author: RIDWAN, Muhammad (Universitas Indonesia)

Presenter: RIDWAN, Muhammad (Universitas Indonesia)

Session Classification: Young researcher session

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

Bound states in a continuum in three-body systems of cold atoms

Tuesday 19 August 2025 13:25 (25 minutes)

We present a theoretical study of lifetimes of three-body resonances, focusing on the decay into a deep dimer and an unbound particle. By employing a two-channel model, we show that the width of resonances can vanish entirely by tuning of system parameters. A resonance with vanishing width can be interpreted as a stable bound state in the continuum, a phenomenon not yet observed in cold-atom systems. We illustrate this mechanism with two examples: a mass-imbalanced system in 1D, where an approximate analytical expression is derived, and a system of three identical bosons in 3D, closely related to the Efimov scenario. Most importantly, the latter system can exhibit bound states in a continuum by tuning an external magnetic field, a parameter well accessible in cold-atom experiments. Moreover, we provide some introduction and relation between systems of cold atoms and those in nuclear and hadron physics.

Author: HAPP, Lucas

Presenter: HAPP, Lucas

Session Classification: Researcher session

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

Large-Nc scalings in Chiral Effective Field Theory of the Contact Interactions for Octet and Decuplet baryons

Tuesday 19 August 2025 14:50 (15 minutes)

Starting from the relativistic manner, in this work, we construct the non-derivative four-point interactions for Octet and Decuplet baryons in the Chiral Effective Field Theory (ChEFT). The non-relativistic expansion of the baryon fields has been considered up to the Next-Leading Order (NLO) of the three-momentum. Using the $1/N_c$ operator product expansion up to $1/N_c^2$, we can reduce the free parameters (coupling constants) of the ChEFT from 28 down to 13. Moreover, we will discuss the implications of the large-Nc scalings in ΩΩ and ΩN scatterings from the Lattice QCD data.

Author: BUBPATATE, Chindanai (Khon Kaen University)

Co-authors: SAMART, Daris; Mr VASO, Dominador Jr. (Mindanao State University - Iligan Institute of Technology)

Presenter: BUBPATATE, Chindanai (Khon Kaen University)

Session Classification: Young researcher session

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

Internal structure of exotic hadrons with coupled channel potential in relation with scattering observables

Wednesday 20 August 2025 14:30 (15 minutes)

We study the internal structure of exotic hadrons, especially focusing on the relation between the compositeness and physical observables [1, 2]. Defined as the probability of finding hadronic molecular components in the wave function, compositeness serves as a quantitative measure of the internal structure of exotic hadrons. We utilize the coupled-channel potential model incorporating both quark and hadron degrees of freedom, which naturally generate the "bare state" responsible for the elementary component as the bound state in the quark channel. The behavior of the compositeness under the variation of the model parameters is investigated by using the $X(3872)$ as an example. In particular, we analyze the associated scattering phase shifts and the bound state wave functions to discuss the relation between the compositeness and the scattering observables for a shallow bound state.
Reference
[1] I. Terashima and T. Hyodo, Phys. Rev. C, 108, 035204 (2023).
[2] I. Terashima and T. Hyodo, arXiv:2505.17657 [hep-ph].

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Presenter: TERASHIMA, Ibuki (Tokyo Metropolitan University)

Session Classification: Young researcher session

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

Generalized parton distributions for the pion within the proper-time Nambu–Jona-Lasinio model

Tuesday 19 August 2025 14:35 (15 minutes)

The internal structure of the pion is investigated using generalized parton distribution (GPD) within the framework of the covariant Nambu–Jona-Lasinio (NJL) model. As an effective chiral symmetry-based theory of QCD, the NJL model provides valuable insight into non-perturbative aspects of pion structure. In the NJL model, to omit the divergence in the quark propagators, we apply a proper-time regularization scheme. We then evaluate the inhomogeneous Bethe–Salpeter equations and compute the corresponding GPD. This approach enables a consistent connection to pion form factors (FFs) and deepens our understanding of the underlying quark-gluon dynamics. Our preliminary results on tensor and vector pion GPDs are presented, and future work will be discussed.

Keywords: *Internal structure, generalized parton distribution, Nambu–Jona-Lasinio model, chiral symmetry, proper-time regularization scheme, electromagnetic form factors, quark dynamics.*

Authors: CHANDRA, Fernando (Universitas Indonesia); Dr HUTAURUK, Parada (PKNU); Prof. MART, Terry (Universitas Indonesia)

Presenter: CHANDRA, Fernando (Universitas Indonesia)

Session Classification: Young researcher session

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

The Reggeizations of the Odderon Spin-3 and Pomeron Spin-2 Exchanges in pp and ppbar Elastic Scattering

Tuesday 19 August 2025 16:30 (15 minutes)

In this study, we investigate the elastic scattering of proton-proton (pp) and proton-antiproton ($p\bar{p}$) systems in the Regge limit ($s >> |t|$), focusing on the contributions of spin-2 pomeron and spin-3 odderon exchanges to the scattering amplitude. Starting from effective Lagrangians describing these exchanges, we derive the corresponding amplitudes within the standard perturbative method in Quantum Field Theory (QFT). The calculation employs projection operators for higher-spin fields and applies Reggeization techniques to capture the appropriate high-energy behaviors of the odderon and pomeron.

To validate the model, we analyze its implications for the differential cross-section, with particular comparison to data from the TOTEM and DØ collaborations. Furthermore, we examine the effects of six distinct form factors at six center-of-mass energies: 1.80 TeV,1.96 TeV, 2.76 TeV, 7 TeV, 8 TeV, and 13 TeV, respectively. The results reveal the sensitivity of elastic scattering profiles to both spin structure and energy scale, all relevant parameters are also extracted from the data with a reliable statistical approach, as well as providing deeper insight into the role of charge-conjugation parity in hadronic interactions.

Keywords: Elastic Scattering, Pomeron, Odderon, Regge Limit, Quantum Field Theory (QFT), Differential Cross-Section

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Presenter: VASO, Dominador Jr. (Department of Physics, MSU-IIT, KKPaCT, Khon Kaen University)

Session Classification: Young researcher session

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

Uncertainties in the initial electromagnetic fields of heavy-ion collisions from Glauber modeling

Thursday 21 August 2025 08:30 (25 minutes)

Intense electromagnetic fields are formed in high-energy heavy ion collisions by the positively charged colliding ions. According to phenomenological models, charged observables produced in the collisions are affected by those electromagnetic fields [1]. However, the initial stages of the fields are not yet understood. We will discuss how the uncertainties in Glauber modeling of the colliding nucleons impact the initial EM fields. Those uncertainties are primarily from the Woods-Saxon (2-Fermi) parameterization from nuclear modeling. Quantifying the impact is important for interpreting experimental results using phenomenological models like magnetohydrodynamics.
[1] arXiv::2502.04611 [nuc-th]

Author: BENOIT, Nicholas (Hiroshima University)

Presenter: BENOIT, Nicholas (Hiroshima University)

Session Classification: Researcher session

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

Probing QCD matter from a little bang with spin transport

Wednesday 20 August 2025 15:30 (25 minutes)

In relativistic heavy ion collisions, the so-called little bang by analogy with the big bang in early universe can be realized in laboratories, where a deconfined phase of the quantum chromodynamic (QCD) matter at high temperature known as the quark gluon plasma (QGP) is produced. The QGP behaves as a nearly perfect fluid with the anisotropic flow that can be macroscopically described by relativistic hydrodynamics. Recent measurements of the spin polarization of Lambda hyperons further indicate the presence of strong vorticity of the rotating QGP and manifest the relativistic Barnett effect at the subatomic scale. Nevertheless, the related spin alignment phenomena of vector mesons cannot be simply explained by the vorticity. Microscopically, a considerable number of soft gluons in the QGP phase or even in the glasma phase as its precursor with overpopulated gluons in the color-glass-condensate effective theory may be delineated by fluctuating chromo-electromagnetic fields (or color fields for short). We will discuss how such color fields may potentially result in the spin alignment through the anisotropic spin correlation of the quark and antiquark forming a vector meson via quark coalescence and we may accordingly utilize the spin transport phenomena to probe the microscopic interaction of QCD matter in relativistic heavy ion collisions. Further studies on the local spin polarization from similar effects may also be mentioned.

Author: YANG, Di-Lun (Academia Sinica)

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Session Classification: Researcher session

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

Geometry of Non-Unitary Evolutions in Open Quantum Systems

Tuesday 19 August 2025 16:45 (15 minutes)

We introduce a geometric framework for non-unitary quantum processes, in line with the unitary SU(N) geometry. We propose a Finslerian metric for our goal, which modifies the original unitary geometry by applying the restrictions from Lindblad Master Equations from the perspective of Pontryagin's Maximum Principle (PMP). We illustrate the results of the Finslerian metrics for depolarising and amplitude-damping single-qubit cases with rotation around one axis. We discuss potential insights on connecting to circuit complexity and analysing the geometrical curvatures.

Authors: ACALAPATI MADANI, Muhammad Ezra (Laboratoire de la Physique de l'École Normale Supérieure (LPENS) / Sorbonne Université); Dr POLICASTRO, Giuseppe (Laboratoire de la Physique de l'École Normale Supérieure (LPENS)); Dr GHOSH, Kausik (Department of Mathematics, King's College London)

Presenter: ACALAPATI MADANI, Muhammad Ezra (Laboratoire de la Physique de l'École Normale Supérieure (LPENS) / Sorbonne Université)

Session Classification: Young researcher session

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

Quantum Numerical Integration Algorithm of a Polynomial Function for Nuclear Structure Application

Wednesday 20 August 2025 16:50 (15 minutes)

Quantum computers have also shown potential for efficient Hamiltonian simulation where computational resources scaling polynomially with system size. For instance, the Variational Quantum Eigensolver (VQE) has been adapted to evaluate ground state energy of nuclei [1] and the hardware specification needed [2], and to solve Bardeen-Cooper-Schrieffer (BCS) Hamiltonian [3]. In this project, we aim to
utilize the quantum computer to solve a nuclear structure related numerical integration problem. Quantum numerical integration algorithms (QNIA) have been shown to offer quadratic speedup over classical counterparts [4]. While QNIAs have found applications in finance and high-energy physics, these implementations used gate counts that exceed the capabilities of near-term quantum hardware [5]. Newer integration algorithms such as Fourier Quantum Monte Carlo Integration [6] and General Quantum Integration Algorithm (GQIA) [7] has been proposed. This presentation will discuss on the test outcomes of quantum integration on a simulated quantum computer using Qiskit provided by IBM.

[1] A. Perez-Obiol et al., Sci Rep 13 (2023).
[2] C. H. Wee, M. H. Koh, Y. S. Yap, 2024, arXiv: 2406.16165 [quant-ph].
[3] N. Sa, I. S. Oliveira, I. Roditi, Results in Physics 44, 106131 (2023).
[4] D. S. Abrams, C. P. Williams, 1999, arXiv: quant-ph/9908083 [quant-ph].
[5] I. Williams, M. Pellen, 2025, arXiv: 2502.14647 [quant-ph].
[6] S. Herbert, Quantum 6, 823 (2022).
[7] G. Shu, Z. Shan, J. Xu, J. Zhao, S. Wang, Sci Rep 14, 10432 (2024).

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Co-authors: Dr KOH, Meng Hock (Department of Physics, Faculty of Science, Universiti Teknologi Malaysia); Dr YAP, Yung Szen (Department of Physics, University of Technology Malaysia)

Presenter: TING LI, Teng (University of Technology Malaysia)

Session Classification: Young researcher session

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

Exploring Meson Structure through the Light-Front Quark Model

Wednesday 20 August 2025 11:05 (25 minutes)

The light-front quark model (LFQM) provides a powerful framework for investigating the internal structure of mesons in terms of their partonic degrees of freedom. Its manifest boost invariance and simple vacuum structure make it especially well suited for connecting nonperturbative hadron properties with experimentally measurable observables. In this talk, I present recent studies of meson structure using the LFQM, focusing on three central issues: (1) progress toward constructing realistic light-front wave functions that accurately capture hadron dynamics, (2) addressing covariance and current conservation challenges inherent in light-front approaches, and (3) understanding modifications of meson properties in extreme environments such as nuclear matter. These developments highlight the LFQM as an effective and versatile tool for deepening our understanding of mesons and their role in the nonperturbative regime of QCD.

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Presenter: ARIFI, Ahmad Jafar (JAEA)

Session Classification: Researcher session

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

Diquarks study from Lattice QCD

Wednesday 20 August 2025 14:45 (15 minutes)

In this work, we aim to calculate the diquark mass together with the quark-diquark potential in which we apply an extended HAL QCD potential method to a baryonic system made up from a static quark and a diquark. We consider various types of diquarks
(eg: scalar 0^+ diquark, axial-vector 1^+ diquark etc) to examine their mass differences.

Numerical calculations are performed by employing 2 + 1 flavor QCD gauge configurations generated by PACS-CS Collaborations on a L^3 \times T = $32^3 \times 64$ lattice with $m_\pi \sim 700$ MeV.

To improve the statistical noise in the static quark propagators, we also employ the HYP smearing on the gauge links.

Two-point correlators of quark-diquark baryonic system are then computed to obtain their ground-state energies and mass differences.

For the baryonic system made up from a scalar diquark and a static quark, we apply an extended HAL QCD method to study the scalar diquark mass and the quark-diquark potential where, in order to determine the diquark mass self-consistently in the HAL QCD method, we demand that the baryonic spectrum in the p-wave sector should be reproduced by the potential obtained from the baryonic system in the s-wave sector.

We obtain the scalar diquark mass of roughly (2/3) m_N, i.e., twice the naïve estimates of a constituent quark mass together with the quark-diquark potential of Cornell type (Coulomb + linear).

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Co-author: Dr ISHII, Noriyoshi (Research Center for Nuclear Physics, University of Osaka)

Presenter: KELVIN-LEE, Kai-Wen (Research Center for Nuclear Physics, University of Osaka)

Session Classification: Young researcher session

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

Estimation of pairing delta residual interaction strengths based on semi-classically averaged nuclear pairing properties

Tuesday 19 August 2025 11:10 (25 minutes)

Proper determination of pairing residual interaction strengths is crucial in any microscopic mean-field approaches. This has been traditionally performed by fitting the pairing strengths such that the experimental moment of inertia or the odd-even mass differences is reproduced. The equivalence of the two methods in the case of a constant matrix element has been investigated for nuclei in the rare earth region [1]. The recent work [2] proposed a new approach based on the Strutinsky averaging method to estimate the constant matrix element pairing strengths based on the underlying single-particle level densities with connection to some semi-classically averaged experimental data on odd-even mass difference. Using the estimated pairing strengths, it has been shown that the Hartree-Fock plus BCS calculated moment of inertia [2] and odd-even mass differences agree [3] well with data. Using the method developed in [2] as a starting point, we now propose a method to estimate the pairing strengths of a pairing interaction namely the volume delta pairing [4]. The appropriateness of the approach is assessed by comparison of moments of inertia calculated with the delta force with experimental data. Our approach is expected to be relevant in particular for extrapolations to nuclei or nuclear states where fitting to experimental data is impossible or inappropriate.

References:
[1] Nurhafiza M. Nor, Nor-Anita Rezle, Kai-Wen Kelvin-Lee, Meng-Hock Koh, L. Bonneau, and P. Quentin, Phys. Rev. C 99, 064306 (2019).
[2] Meng-Hock Koh and P. Quentin, Phys. Rev. C 110, 024311 (2024).
[3] T.V. Nhan Hao, N.N Bao Nguyen, D. Quang Tam, P. Quentin, Meng-Hock Koh and L. Bonneau, Chin. Phys. C 49 (3), 034101 (2025).
[4] Meng-Hock Koh, P. Quentin and L. Bonneau, (article under preparation).

Authors: KOH, Meng Hock (Department of Physics, Faculty of Science, Universiti Teknologi Malaysia); Dr BONNEAU, Ludovic (LP2i Bordeaux, UMR 5797, Université de Bordeaux, CNRS, F-33170 Gradignan, France); Prof. QUENTIN, Philippe (LP2i Bordeaux, UMR 5797, Université de Bordeaux, CNRS, F-33170 Gradignan, France)

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Session Classification: Researcher session

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

Impact of triaxial degree of freedom in superheavy region

Wednesday 20 August 2025 16:35 (15 minutes)

Currently, one of the most important and difficult areas of research in nuclear structure is the production of superheavy elements. All superheavy elements discovered so far are not stable against the two dominant decay modes, namely alpha decay and spontaneous fission. The decay modes and other essential properties of these nuclei have not been fully investigated experimentally due to their short life time. For example, the half-life of the latest synthesized element ^{294}Og is 0.58 ms \cite{brewer2018search}, and also shorter half-life than that around 60 ns reported for ^{252}Rf isotope \cite{khuyagbaatar2025stepping} . In order to overcome this challenge, and help the experimentalist to refine the next reactions, microscopic approaches are used to produce accurate information about them. The goal of this work is to investigate the impact of triaxial shape degrees of freedom on the dominant decay modes in some even-even isotopic chain of superheavy nuclei with $Z = 114 - 120$ and atomic mass A is ranging from 300 to 326.
The study was performed within a Hartree-Fock-plus-Bardeen-Cooper-Schrieffer (HF+BCS) approach using the SLy4 Skyrme parametrization. Seniority force was employed in the BCS framework to approximate the pairing interaction. The neutron and proton pairing strengths were fitted to reproduce the Madland pairing gaps. Some important ground state properties that have been investigated in both axial symmetric and triaxial calculations include binding energy, potential energy surface as a function of electric quadrupole deformation β_{20}, and triaxial electric quadrupole deformation β_{22}, alpha decay and spontaneous fission half lives. It was found that the ground state shapes of some isotopes with a non-rigid axially symmetric potential well appeared triaxial in the case of taking into account triaxiality. Furthermore, the fission barriers were reduced significantly for all considered isotopes in triaxial calculation, resulting the shorter half lives than the axial calculation. Finally, the impact of triaxiality on the dominant decay modes of superheavy nuclei was determined.

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Presenter: FAZLI, Fazle Rabi (UTM)

Session Classification: Young researcher session

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

GPE + GLE Calculations for Interaction Between Neutron Quantum Vortices and Proton Flux Tubes in the Outer Core of Neutron Stars

Tuesday 19 August 2025 15:50 (15 minutes)

Neutron stars exhibit sudden changes of its rotational velocity, known as “pulsar glitches”. It has been believed that glitches are mainly caused by superfluid neutron vortices in the inner crust of neutron stars. However, importance of contributions of the outer core has been recently discussed, and further microscopic investigations of quantum vortices and fluxtubes in the outer core of neutron stars are highly desired.
In this study, we investigate the interaction between quantum vortices of $^3P_2$ superfluid neutrons and fluxtubes of $^1S_0$ superconducting protons in the outer core of neutron stars, based on a successful bosonic theory of superfluid, the Gross-Pitaevskii equation (GPE). In this talk, we will discuss how the interaction of the $^3P_2$ superfluid vortices and the proton fluxtubes under a magnetic field in the outer core of neutron star affect the structure of the vortices in the neutron star.

Author: HATTORI, Tatsuhiro (Institute of Science Tokyo)

Co-author: Dr SEKIZAWA, Kazuyuki (Institute of Science Tokyo)

Presenter: HATTORI, Tatsuhiro (Institute of Science Tokyo)

Session Classification: Young researcher session

Contribution ID: **23** Type: **not specified**

Quark structure of the kaon from chiral effective models

Wednesday 20 August 2025 10:40 (25 minutes)

As a pseudo-Nambu-Goldstone boson, the kaon provides insights into how explicit chiral symmetry breaking influences the quark structure inside hadrons. In this talk, we explore the properties of the generalized quark distributions of the kaon within the nonlocal chiral quark model. We discuss how the explicit chiral symmetry breaking affects the (generalized) light and strange quark distributions in the kaon, compared to the pion case. We also discuss the kaon and pion gravitational form factors within chiral effective models. Finally, we review the current understanding of the parton structure of the kaon from experiments and discuss the possibility of exploring kaon parton structure through future collider experiments, such as EIC and EicC.

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Co-author: Dr HUTAURUK, Parada (PKNU)

Presenter: SON, Hyeon-Dong (Inha University)

Session Classification: Researcher session

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

Extraction of Proton Electric Form Factor and Radius from Low-Q^2 Data

Wednesday 20 August 2025 09:20 (25 minutes)

This study calculates the energy decay rates (r) for both up and down quarks and the electric form factors (G_E) of the proton using low four-momentum transfer (Q^2) data from the PRad and MaMi electron-proton scattering experiments. The extracted decay rates for u and d quarks were nearly identical with r 3.94, demonstrating a consistent exponential decay behavior across increasing Q^2. Moreover, analysis of the electric form factor confirmed that the calculated values closely match with PRad and MaMi data at low Q^2, validating the model in this region. However, increasing residuals and deviations from both MaMi data and the standard dipole form factor assumption at higher Q^2 indicate the model's limitations. The results underscore the sensitivity of both decay rates and G_E to the momentum transfer range and the need for a refined theoretical framework that incorporates higher-order QED corrections and spin-spin interactions. The extracted average proton charge radius is $0.8291 \pm 0.0019(stat) \pm 0.0004(std) fm$, aligns closely with PRad results, supporting evidence for a smaller proton radius.

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Session Classification: Researcher session

Contribution ID: **25** Type: **not specified**

Precision Calculations for the LHC

Thursday 21 August 2025 10:00 (25 minutes)

I will review the state-of-the-art high-precision theoretical predictions, which are mandatory components in interpreting the increasingly accurate LHC datasets. I will discuss recent developments in the aspects of higher-order calculations, mainly focusing on the scattering amplitude computation. I will showcase some of the recent high-precision phenomenological studies involving 2->3 scattering process at the LHC.

Author: HARTANTO, Heribertus Bayu (Asia Pacific Center for Theoretical Physics (APCTP), Pohang, South Korea)

Presenter: HARTANTO, Heribertus Bayu (Asia Pacific Center for Theoretical Physics (APCTP), Pohang, South Korea)

Session Classification: Researcher session

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

Quantum Chromodynamics and Hadron Structure

Wednesday 20 August 2025 08:55 (25 minutes)

It is widely believed that Quantum Chromodynamics (QCD)—a covariant non-abelian gauge theory—as an underlying theory of strong interaction at low energy. QCD was discovered 50 years ago, but our understanding of its properties, including color confinement, asymptotic freedom, and spontaneous chiral symmetry breaking, is still far from complete. This incomplete comprehension of QCD imply to limits our understanding of the internal structure of hadrons and the QCD phase diagram. In this talk, we will explore and discuss the recent developments of QCD and its properties, as well as the consequences for the internal structure of hadrons.

Author: HUTAURUK, Parada (PKNU)

Presenter: HUTAURUK, Parada (PKNU)

Session Classification: Researcher session

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

Electron Structure in Light Front QED Model

Wednesday 20 August 2025 10:15 (25 minutes)

In the present work, we discuss about the internal structure of the electron. The physical electron is considered as a composite system of a bare electron and photon. We mainly discuss about the Wigner distributions, gravitational form factors and mechanical properties of the electron. Results are obtained from the overlap of light-front wave functions in light-front QED model.

Author: KUMAR, Narinder (Doaba College)

Co-author: Dr MORE, Jai (INDIAN INSTITUTE OF TECHNOLOGY BOMBAY)

Presenter: KUMAR, Narinder (Doaba College)

Session Classification: Researcher session

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

Xi* productions with Regge contribution

Wednesday 20 August 2025 13:25 (25 minutes)

The production of the excited states of the Ξ^- hyperon from proton-kaon collision, $p + K^- \to \Xi^{*-} + K^+$, with the s- and u-channel processes has been studied. We employed the effective Lagrangian method to describe the production of Ξ^{*-} and utilized the Regge model for the u-channel process. To determine the couplings and the form factors for Ξ^{*-}, we also carry out the quark model calculation by using the baryon wave functions of the constituent quarks with the quark-diquark description. As a result, we predicted the production rates of $\Xi^-(1320)$, $\Xi^{*-}(1530)$, and some excited states of $l = 1$. The relation between the production rates of the final state Ξ^{*-} and the baryon structures of the Ξ^{*-} and the intermediate states such as Λ, Σ^0, and Σ^{*0} are discussed.

Author: SHIM, Sang-In (RCNP, Osaka University)

Co-author: HOSAKA, Atsushi

Presenter: SHIM, Sang-In (RCNP, Osaka University)

Session Classification: Researcher session

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

Internal structure of near-threshold states using compositeness

Tuesday 19 August 2025 13:00 (25 minutes)

Motivated by recent observations of exotic hadrons in the near-threshold energy region, the internal structure of near-threshold states has been intensively studied. To investigate their structure, we focus on a qualitative measure, called the compositeness X, defined as the probability of finding the clustering component in the wavefunction [1]. It is shown that in the limit where the eigenenergy goes to zero ($E \to 0$), the compositeness becomes unity as a consequence of the low-energy universality [2]. This indicates that the states exactly at the threshold commonly have a purely cluster structure, independently of the details of the system.

In this talk, we discuss the internal structure of near-threshold eigenstates that emerge slightly away from the $E \to 0$ limit, where $X = 1$ as a consequence of the low-energy universality. Using the compositeness, we show that shallow bound states below the threshold are typically composite dominant [3] and resonance above the threshold exhibit a different structure [4]. We further extend the analysis to near-threshold states in systems governed by both short-range and Coulomb interactions, where the low-energy universality does not hold due to the long-range interaction. However, we find that the remnants of the universality can appear depending on the competition between the interactions. We also address the internal structure of p-wave bound states near the threshold, by comparing to s-wave cases.

[1] T. Kinugawa, T. Hyodo, Eur. Phys. J. A 61, no.7, 154 (2025).
[2] T. Hyodo, Phys. Rev. C 90, 055208 (2014).
[3] T. Kinugawa and T. Hyodo, Phys. Rev. C 109, 045205 (2024).
[4] T. Kinugawa and T. Hyodo, arXiv:2403.12635 [hep-ph].

Author: KINUGAWA, Tomona (RIKEN)

Presenter: KINUGAWA, Tomona (RIKEN)

Session Classification: Researcher session

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

On the molecular structure effects of the photoproduction in the \bar D \Lambda_c final state

Wednesday 20 August 2025 14:05 (25 minutes)

We investigate the photoproduction of the D ¯Λ_c final state via intermediate hidden-charm pentaquark states P_c (4312),P_c (4440), and P_c (4457), focusing on the role of their underlying molecular structure. Using an effective Lagrangian approach and incorporating hadronic form factors, we construct the full amplitude for the reaction γp⟶P_c⟶D ¯Λ_c mediated by triangle loop diagrams involving intermediate meson and baryon exchanges. The P_c (4312) state, treated as a Jˆ P=1/2ˆ-, D ¯Σ_c molecule whereas the P_c (4440), and P_c (4457) are the (Dˆ*) ¯Σ_c molecule with Jˆ P=1/2ˆ-,3/2ˆ-, respectively that serves as a benchmark to analyze how the compositeness of the pentaquark influences the loop amplitude and the resulting cross sections. We calculate the full transition amplitude, including the loop integration with molecular vertex functions characterized by Gaussian regulators, and evaluate the invariant amplitude using both covariant and Euclidean techniques. The model emphasizes the importance of hadronic molecular interactions in shaping the observable distributions in meson photoproduction, particularly in terms of momentum dependence and angular structures. Our results provide theoretical predictions that can guide future experimental searches and analyses of hidden-charm molecular states through exclusive photoproduction channels.

Authors: Ms SUNTHARAWIRAT, Ratirat (Department of Physics, Faculty of Science, Khon Kaen University); Ms POLKHUHA, Nongnapat (Department of Physics, Faculty of Science, Khon Kaen University); Ms MONKATA, Nantana (Department of Physics, Faculty of Science, Khon Kaen University); Mr BUBPATATE, Chindanai (Department of Physics, Faculty of Science, Khon Kaen University); Mr VASO, Dominador JR. Francisco (Department of Physics, Mindanao State University - Iligan Institute of Technology and Department of Physics, Faculty of Science, Khon Kaen University); Dr THONGYOI, Nakorn (Department of Physics, Faculty of Science, Khon Kaen University); SAMART, Daris

Presenter: SAMART, Daris

Session Classification: Researcher session

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

Experimental studies on threshold cusps

Tuesday 19 August 2025 09:25 (25 minutes)

Near-threshold molecular-like state may appear as threshold cusp especially when the interaction is not strong enough so that a virtual state is formed instead of a bound state. In this talk, I will report experimental identification of a threshold cusp at Belle and some other related results. I will also discuss future plans and possibilities at Belle II and J-PARC.

Author: TANIDA, Kiyoshi (Japan Atomic Energy Agency)

Presenter: TANIDA, Kiyoshi (Japan Atomic Energy Agency)

Session Classification: Researcher session

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

Exploring cold and dense matter from two-color QCD: Numerical experiments and effective models

Thursday 21 August 2025 09:20 (25 minutes)

Two-color QCD is one of the useful testing grounds to explore cold and dense QCD medium, since the first-principles lattice numerical simulations are doable without suffering from the so-called sign problem. In this talk, I review recent progress of such numerical experiments. Then, I summarize what is unveiled by comparing with my effective model, the linear sigma model. Also I discuss possible extensions of effective models of two-color QCD to several directions.

Author: SUENAGA, Daiki (KMI, Nagoya University)

Presenter: SUENAGA, Daiki (KMI, Nagoya University)

Session Classification: Researcher session

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

Collision Parameter Probability Distribution Prediction in Heavy Ion Collision with Kolmogorov-Arnold Network

Tuesday 19 August 2025 15:35 (15 minutes)

Nuclear deformity has been known to introduce fluctuations in the initial geometry and multiplicity in heavy-ion collisions. As the centrality bin is often calculated based on the multiplicity, this fluctuation is propagated as a larger correlation uncertainty between collision parameters and experiment observables. The aim of this study is to establish a framework to construct the probability distribution function of the collision parameters based on the anisotropic flow and multiplicity. Since the effect of the collision parameter is more prominent for a deformed nucleus, we focus on Xe-Xe collision at 5.44 TeV.

We employ TRENTo which is based on the Glauber model to sample initial geometry. The degree of deformity is defined by β_2 coefficient which is fixed to 0.162 for Xe. We assume elliptical flow is linearly related to eccentricity as $\nu_2 = \kappa_2 \varepsilon_2$ with fixed $\kappa_2 = 0.18$. On top of the impact parameter, the initial geometry also depends on the collision orientation due to the nucleus deformity. The nucleus orientation is measured as the spin and tilt angle of the colliding nucleus with respect to the collision axis.

Finally, we feed the sampled collision events into Kolmogorov-Arnold Network (KAN) to construct the collision parameter probability distribution function in order to fit ν_2 measured from experiments. Although we see a limited success in reproducing experimental data, which is partly due to the limitation of our model that did not include hydrodynamic simulation, we have established a framework that can be further expanded by pairing it with a more realistic model to construct other collision parameters

Author: ABDI, Cendikia (Hiroshima University)

Co-author: NONAKA, Chiho

Presenter: ABDI, Cendikia (Hiroshima University)

Session Classification: Young researcher session

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

Constraining the proton transverse partonic distribution through coherent J/ψ production at HERA within a three-hotspot model

Tuesday 19 August 2025 14:20 (15 minutes)

We have investigated the transverse parton distribution of the proton through the momentum-transfer squared (t) distribution data of the differential cross section for coherent J/ψ production at HERA. Based on a Gaussian–hotspot model motivated by a three valence quark picture of a proton, we introduce three independent geometric degrees of freedom: (1) the overall impact–parameter size of each hotspot, (2) the radial displacement of constituent quarks from the proton center, and (3) an azimuthal rotation applied to the quark configuration. In our simplest implementation, the three quarks are arranged at equal radial distance. By fitting to HERA data, we demonstrate that variations in quark displacement strongly affect the $|t|$ slope, while the rotational degree of freedom affects only at high momentum transfer ($|t| > 0.6\ \mathrm{GeV}^2$).

Author: FADHEL, Muhammad Raihannafi (Universitas Gadjah Mada)

Co-author: SETYADI, Chalis (Universitas Gadjah Mada)

Presenter: FADHEL, Muhammad Raihannafi (Universitas Gadjah Mada)

Session Classification: Young researcher session

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

CosmiXs: Cosmic messenger spectra for indirect dark matter searches

Thursday 21 August 2025 10:25 (25 minutes)

The spectra of stable particles such as photons, positrons, antiprotons and neutrinos are one of the main ingredients to calculate the fluxes of cosmic rays and radiation searched for in indirect detection experiments. The modeling of the whole process is however very complicated since after dark matter annihilation or decay, a number of phenomena occur including resonance decays, parton showering, hadronization and hadron decays. Therefore the modeling itself cannot be performed from first principles. I will discuss some progress in this direction and present CosmiXs which uses VINCIA to properly model electroweak corrections, and handles the polarization information. I will then move to the modeling of antideuterons and discuss briefly the associated theoretical uncertainties.

Based on:
https://arxiv.org/abs/2411.04815
https://arxiv.org/abs/2312.01153

Author: JUEID, Adil (Institute for Basic Science)

Presenter: JUEID, Adil (Institute for Basic Science)

Session Classification: Researcher session

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

Generalized uncertainty principle effect in nuclear matter and slowly rotating neutron stars

Tuesday 19 August 2025 16:05 (15 minutes)

Recent observations of neutron stars indicate that there must be corrections to Einstein's theory of gravity. This research aims to study gravitational modifications in neutron stars. The GUP (Generalized Uncertainty Principle) effect is incorporated into the RG (Rainbow Gravity) metric in the slowly rotating case. GUP itself will affect the nuclear properties in neutron star matter, causes the modifications on neutron stars physical properties. According to these modified physical properties, such as the mass-radius profile, moment of inertia, and crust properties, neutron stars require a negative value for the GUP parameter β. This negative β preference also appears in the cases of white dwarf stars and black holes, although this means that the minimum position measurement uncertainty Δx_min=√β, which should emerge as a consequence of the existence of a minimal length, does not appear in this range.

Author: AL GHIFARI, Muhammad Hafizt (Universitas Indonesia)

Co-authors: Prof. SULAKSONO, Anto (Universitas Indonesia); Dr RAMADHAN, Handhika S. (Universitas Indonesia); Prof. ALATAS, Husin (IPB University)

Presenter: AL GHIFARI, Muhammad Hafizt (Universitas Indonesia)

Session Classification: Young researcher session

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

Primordial Helium In The Left-Right Symmetry Model With Extra Scalar Fields

Thursday 21 August 2025 10:50 (25 minutes)

Big Bang Nucleosynthesis (BBN) represents a crucial phase in the universe's evolution, occurring approximately one second after the Big Bang. The BBN theory predicts a primordial Helium-4 abundance of about 25%, offering key limits on the number of light particles present at BBN temperatures. The Left-Right Symmetry Model with an Extra Scalar Field is a development of the Standard Model with the addition of a massive scalar field, which has the opportunity to decay into relativistic particles. This research aims to determine the temperature ratio between the right and left sectors, the mass limit of the massive scalar field according to BBN constraints, and the primordial helium abundance. This research is theoretical. The research objectives can be achieved with various methods; the Yukawa Lagrangian and the Scalar Potential are depicted in a Feynman Diagram, which then calculates each sector's decay rate and temperature changes. The temperature ratio of the right and left sectors when the BBN took place in this model was 0.08-0.09. The mass limit of the corresponding massive scalar field BBN Constraint is . The abundance of primordial Helium-4 in the left sector is 25%, according to the Standard Model, while primordial Helium-4 in the right sector is 79%-87%. Thus, the Left-Right Symmetry Model with Extra Scalar mode satisfies the constraints of BBN words.

Author: ISTIKOMAH, Istikomah (Universitas Islam Negeri Walisongo Semarang)

Co-authors: EGA PRASHEYLIA, Amara (Universitas Islam Negeri Walisongo Semarang); HADI KUSUMA, Hamdan (Universitas Islam Negeri Walisongo Semarang)

Presenter: ISTIKOMAH, Istikomah (Universitas Islam Negeri Walisongo Semarang)

Session Classification: Researcher session

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

Recent results on the phi meson in dense matter from theory and experiment

Thursday 21 August 2025 08:55 (25 minutes)

The status of recent theoretical and experimental research related to the properties of the phi meson in nuclear matter is reviewed, focusing on observables that were/will be measured at the KEK E325, J-PARC E16 and J-PARC E88 experiments, including dilepton and Kˆ+Kˆ- decay modes and their angular distributions. The relation of these observables to fundamental properties of nuclear matter, such as chiral symmetry, its partial restauration in nuclear matter, in-medium Lorentz and charge symmetry violation and the resultant modification of hadronic dispersion relations, will also be discussed.

Author: GUBLER, Philipp

Presenter: GUBLER, Philipp

Session Classification: Researcher session

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

Decoding the Nucleon; Experimental Approaches to Its Internal Structure

Tuesday 19 August 2025 09:00 (25 minutes)

Understanding the internal structure of the nucleon is a crucial step toward unraveling the mysteries of visible matter, which constitutes just ˜ 5% of our universe. Despite significant progress in understanding atomic and subatomic particles, key properties of the nucleon, such as the origin of its mass, the "proton spin crisis," and the proton radius puzzle, remain unsolved. This talk will provide an overview of experimental approaches to probing nucleon structure, from the foundational scattering experiments to modern techniques exploring generalized parton distributions (GPDs) and transverse momentum distributions (TMDs). Key experiments at facilities like Jefferson Lab, Fermilab, and future explorations at the Electron-Ion Collider (EIC) will be discussed. By analyzing deep inelastic scattering, measuring spin asymmetries, and studying sea quark contributions, we aim to build a more unified and comprehensive picture of the nucleon. The insights gained from these approaches not only deepen our understanding of nucleon structure but also offer pathways to addressing broader questions about the fundamental composition of our universe.

Presenter: AKBAR, Zulkaida

Session Classification: Researcher session

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

Electro-Excitation Transition Form Factors of the Proton

Wednesday 20 August 2025 08:30 (25 minutes)

Just as the study of the hydrogen atom and its excited states deepened our understanding of electromagnetic interactions, investigating the internal structure of the proton and its electro-excitation transition form factors is essential for advancing our knowledge of the strong interaction. Can this be achieved directly from the fundamental equations of motion in terms of quarks and gluons? This talk presents an overview of recent progress in computing these form factors and highlights complementary experimental efforts at Jefferson Lab through the CLAS experiment. Where possible, comparisons are made with experimental data and predictions from alternative theoretical approaches.

Presenter: BASHIR, Adnan

Session Classification: Researcher session

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

From Core Burning to Collapse: Nuclear Physics Driving Nucleosynthesis and Neutrino Production in Massive Stars

Tuesday 19 August 2025 10:45 (25 minutes)

In this talk, I will highlight the critical role of nuclear reactions in massive and very massive stars and their significant impact on both nucleosynthesis and neutrino emission. As these stars evolve through successive burning stages such as carbon, neon, oxygen, and silicon burning, a complex network of nuclear processes governs the formation of intermediate and heavy elements. These reactions include alpha captures, neutron captures, proton captures, and photodisintegration, which together shape the elemental composition of the stellar core and contribute to the chemical enrichment of the universe. At the same time, weak interaction processes such as beta decay, electron capture, and thermal neutrino emission through pair production, photo processes, and plasma interactions become dominant sources of neutrinos. These neutrinos act as efficient carriers of energy, facilitating the cooling of stellar interiors and influencing the onset of core collapse. Accurate modeling of these phenomena depends on detailed nuclear physics inputs such as reaction rates, decay lifetimes, and cross sections. This presentation will examine how nuclear reaction networks in massive and very massive stars drive both nucleosynthetic yields and neutrino spectra, and how these processes connect to ongoing experimental efforts and future neutrino detection strategies.

Author: YUSOF, Norhasliza

Presenter: YUSOF, Norhasliza

Session Classification: Researcher session

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

Heavy-Quark Spin Symmetry Violation effects in Charmed Baryon Production

Tuesday 19 August 2025 17:00 (15 minutes)

In this work, we investigate an effective Lagrangian that describes the interactions between D mesons, charmed baryons (Y_c), and nucleons within the framework of Heavy-Quark Spin Symmetry (HQSS). Using the super-multiplet formalism, we systematically construct the three-point interaction terms. As a result, by considering the minimal sets of the effective Lagrangian in the HQSS construction, there are two effective Lagrangians that are invariant under HQSS whereas we find two minimum terms of the Lagrangian that violate the HQSS transformation. To reveal the phenomenological consequences of HQSS-breaking pattern, we compute the differential cross-sections for exclusive charmed baryon pair production in proton-antiproton collisions, $p\bar{p} \to Y_c \bar{Y}_c'$, with $Y_c, Y_c' \in \{\Lambda_c, \Sigma_c, \Sigma_c^*\}$. We demonstrate that the production rates of these channels can be used as a sensitive probe of the HQSS-violating dynamics. Our framework provides predictions for these observables, which are of crucial importance for the upcoming PANDA experiment at the Facility for Antiproton and Ion Research (FAIR).

Author: MONKATA, Nantana (Khon Kaen University)

Presenter: MONKATA, Nantana (Khon Kaen University)

Session Classification: Young researcher session

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

Two-pion emission decays of negative parity singly heavy baryons

Wednesday 20 August 2025 16:20 (15 minutes)

We investigate two-pion emission decays of singly charmed and bottom baryons, focusing on $\Lambda_Q^*(1P)$ and $\Xi_Q^*(1P)$ states with $J^P = 1/2^-$ and $3/2^-$, which belong to the flavor triplet $\bar{3}_F$. Our study includes both sequential decays through intermediate states in the flavor sextet 6_F and direct three-body decay, with coupling constants estimated using the chiral-quark model and chiral-partner scheme. Examining recent Belle measurements for $\Lambda_c(2625)^+$, we confirm its assignment as a λ-mode excitation with $J^P = 3/2^-$. We then give predictions for other cases, including the Ξ_Q^* decays. The observed asymmetry in the $\pi\pi$ mass distribution highlights the role of the direct process, reflecting the chiral-partner structure. However, the direct process is less significant in three-body decays unless S-wave resonances are suppressed.
Further experiments are needed to test our predictions and get more insights into the structure of heavy baryons.

Presenter: PONKHUHA, Nongnaphat (Khon Kaen University)

Session Classification: Young researcher session