TOPTIER CNS Summer School 2025

Report of Contributions

Contribution ID: **1** Type: **poster presentation**

Quarkyonic matter with chiral symmetry restoration

Wednesday 27 August 2025 17:30 (12 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.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: GAO, Bikai (RCNP, Osaka University)

Presenter: GAO, Bikai (RCNP, Osaka University)

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **4** Type: **oral presentation**

Progress on AMS Measurement of 60Fe in the Chang'E-5 lunar soil sample

Monday 25 August 2025 15:40 (12 minutes)

The Moon provides a unique environment for investigating nearby astrophysical events such as supernovae. Lunar samples retain valuable information from these events, via detectable long-lived "fingerprint" radionuclides such as ^{60}Fe. We are developing the accelerator mass spectrometry (AMS) method for detecting ^{60}Fe using the HI-13 tandem accelerator at the China Institute of Atomic Energy. For our experiments, We have been allocated 200 mg of Chang'E-5 lunar soil samples by the China National Space Administration.

The identification of ^{60}Fe with AMS is highly challenging due to strong isobaric interferences. Such interferences could not be sufficiently suppressed by the existing magnetic systems of the HI-13 tandem accelerator and the following Q3D magnetic spectrograph. To lower the detection background for the low abundance nuclide, a Wien filter was installed after the accelerator magnetic systems. A 1 μm thick Si_3N_4 foil was installed in front of the Q3D as an energy degrader. For particle detection, a multi-anode gas ionization chamber was mounted at the center of the focal plane of the spectrograph. An ^{60}Fe standard sample with an abundance of 1.125×10^{-10} was used to test the new AMS system. These results indicate that ^{60}Fe can be clearly distinguished from its isobar. In this presentation, we will report the current status of this experiment.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: YANG, zhang

Presenter: YANG, zhang

Session Classification: Young Scientist Session 2

Contribution ID: **5** Type: **poster presentation**

A new Hamiltonian for jj4_45 model space and corresponding spectroscopic study

Wednesday 27 August 2025 18:30 (12 minutes)

This study advances the nuclear shell model by systematically investigating effective interactions in the f5pgd5 shell region (mass numbers 40 < A < 100).
Building on existing interactions(JUN45 and jj45pna), we refine central, spin-orbit, and tensor force parameters, incorporating universal monopole corrections to develop the first dedicated effective interaction for the f5pgd5 region. Validation near the N=50 shell closure demonstrates excellent agreement with experimental data and superior performance over existing models, confirming its applicability across this region and beyond.
Leveraging the optimized interaction, we generate a high-precision theoretical database for nuclides in this mass range, encompassing binding energies, excitation spectra, level densities, β-decay properties, and spectroscopic factors. Our work provides a foundational tool for future studies in nuclear structure and reaction physics, bridging theory and experiment in medium-mass nuclei.

Research field of your presentation

Theoretical Low-energy nuclear physics

Authors: Prof. 袁, 岑溪 (中山大学); 张, 润泽 (中山大学)

Presenter: 张, 润泽 (中山大学)

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **6** Type: **poster presentation**

Development of ¹²C-enriched irradiation-resistant diamond targets for astrophysical ¹²C(α, γ)¹⁶O reaction measurements

Wednesday 27 August 2025 18:54 (12 minutes)

The ¹²C(α, γ)¹⁶O reaction plays a pivotal role in nuclear astrophysics research. The direct measurement of this reaction remains particularly challenging due to its extremely low cross section (approximately 10⁻¹⁷ barn at 300 keV) within the Gamow window. This study addresses the critical need for irradiation-resistant ¹²C-enriched targets to enable accurate measurements. We successfully fabricated a ¹²C-enriched diamond target on molybdenum substrate through Microwave Plasma Chemical Vapor Deposition (MPCVD), demonstrating remarkable stability under high-intensity proton beam irradiation. Experimental results revealed only a 1.8% decrease in the ¹²C(p, γ)¹³N reaction yield in the ¹²C layer following proton bombardment at 270 keV with 2 mA beam current and a total accumulated charge of 124.2 C, indicating a significant improvement compared to conventional carbon targets. Isotopic analysis confirmed a ¹³C/¹²C ratio of (9.7 ± 1.3) × 10⁻⁵, verifying the absence of contamination during MPCVD processing. Additionally, we developed a novel nuclear-reactionbased methodology for quantifying hydrogen content in thin films, establishing an upper limit of 0.058% (95% confidence level) for hydrogen concentration in the diamond target. The combined irradiation resistance and isotopic purity of this target meet the stringent requirements for direct ¹²C(α, γ)¹⁶O reaction measurements in astrophysical environments.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: DONG, Jing-Yu (China Institute of Atomic Energy)

Presenter: DONG, Jing-Yu (China Institute of Atomic Energy)

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **7** Type: **oral presentation**

Revised reaction rate for the astrophysical reaction 18O(p, α)15N via a global R-matrix analysis

Saturday 23 August 2025 15:40 (12 minutes)

The $^{18}\mathrm{O}(p,\alpha)^{15}\mathrm{N}$ reaction plays a crucial role in influencing the abundances of key isotopes such as $^{19}\mathrm{F}$, $^{18}\mathrm{O}$, and $^{15}\mathrm{N}$ in asymptotic giant branch (AGB) stars. This reaction may offer a potential mechanism to explain the discrepancies between observational data and theoretical model predictions.
A comprehensive R-matrix analysis of the $^{18}\mathrm{O}(p,\alpha)^{15}\mathrm{N}$ reaction has been conducted, incorporating supplementary constraints from other reaction channels, especially, the $^{15}\mathrm{N}+\alpha$ scattering data were involved in the analysis for the first time. All available experimental data have been systematically compiled and used in the R-matrix analysis.
A revised determination of reaction rate has been extracted relying on the present fitting parameters. The uncertainties on the corresponding reaction rates were then obtained by a Monte Carlo analysis. The currently determined reaction rates are systematically lower than those measured by Bruno *et al.* (2019), resulting in reduced depletion efficiency of $^{18}\mathrm{O}$ that consequently enhances its surface abundance in AGB stars. Therefore, this enables scientists to reduce reliance on dilution assumptions when interpreting observational data through theoretical models.
This work has been published in the Astrophysical Journal 973:93 (2024).

Research field of your presentation

Experimental Low-energy nuclear physics

Authors: Mr LI, Yiyang (Institute of Modern Physics, Chinese Academy of Sciences); Prof. HU, Jun (Institute of Modern Physics, Chinese Academy of Sciences); Dr RU, Longhui (Institute of Modern Physics, Chinese Academy of Sciences); Dr TIAN, Ning (Institute of Modern Physics, Chinese Academy of Sciences); Mr LV, Jinfeng (Lanzhou University)

Presenter: Mr LI, Yiyang (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: Young scientist session 1

Contribution ID: **8** Type: **oral presentation**

Ab initio methods for nuclear structure 1

Friday 22 August 2025 10:00 (50 minutes)

Research field of your presentation

Contribution ID: **9** Type: **oral presentation**

Ab initio methods for nuclear structure 2

Saturday 23 August 2025 11:05 (50 minutes)

Research field of your presentation

Contribution ID: **10** Type: **oral presentation**

Ab initio methods for nuclear structure 3

Monday 25 August 2025 13:30 (50 minutes)

Research field of your presentation

Contribution ID: **11** Type: **oral presentation**

Ab initio methods for nuclear structure (4/4)

Wednesday 27 August 2025 10:00 (50 minutes)

Research field of your presentation

Contribution ID: **12** Type: **oral presentation**

Probing buclear structure with electron beam (TBC)

Wednesday 27 August 2025 14:35 (50 minutes)

Research field of your presentation

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

in-beam gamma-ray spectroscopy in the era of GRETA (tentative) (1/4)

Monday 25 August 2025 10:00 (50 minutes)

Research field of your presentation

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

in-beam gamma-ray spectroscopy in the era of GRETA (tentative) (2/4)

Tuesday 26 August 2025 10:00 (50 minutes)

Research field of your presentation

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

in-beam gamma-ray spectroscopy in the era of GRETA (tentative) (3/4)

Wednesday 27 August 2025 13:30 (50 minutes)

Research field of your presentation

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

in-beam gamma-ray spectroscopy in the era of GRETA (tentative) (4/4)

Thursday 28 August 2025 10:00 (50 minutes)

Research field of your presentation

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

Climate change and energy

Monday 25 August 2025 11:05 (50 minutes)

Research field of your presentation

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

International responses to climate change

Tuesday 26 August 2025 14:35 (50 minutes)

Research field of your presentation

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

Overview of RIBF and related topics (2/2)

Friday 22 August 2025 14:35 (50 minutes)

Research field of your presentation

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

Qantum many-body formulation of nuclear shapes, rotations, and vibrations (1/4)

Saturday 23 August 2025 13:30 (50 minutes)

Research field of your presentation

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

Quantum many-body formulation of nuclear shapes, rotations, and vibrations (2/4)

Tuesday 26 August 2025 13:30 (50 minutes)

Research field of your presentation

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

Quantum many-body formulation of nuclear shapes, rotations, and vibrations (3/4)

Wednesday 27 August 2025 11:05 (50 minutes)

Research field of your presentation

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

Quantum many-body formulation of nuclear shapes, rotations, and vibrations (4/4)

Thursday 28 August 2025 11:05 (50 minutes)

Research field of your presentation

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

Introduction of RAON and new opportunities

Saturday 23 August 2025 14:35 (50 minutes)

Research field of your presentation

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

Beyond the Conventional: Hyperdeformation and Exotic Superfluidity in Atomic Nuclei (1/4)

Friday 22 August 2025 13:30 (50 minutes)

Research field of your presentation

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

Beyond the Conventional: Hyperdeformation and Exotic Superfluidity in Atomic Nuclei (2/4)

Saturday 23 August 2025 10:00 (50 minutes)

Research field of your presentation

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

Beyond the Conventional: Hyperdeformation and Exotic Superfluidity in Atomic Nuclei (3/4)

Monday 25 August 2025 14:35 (50 minutes)

Research field of your presentation

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

Beyond the Conventional: Hyperdeformation and Exotic Superfluidity in Atomic Nuclei (4/4)

Tuesday 26 August 2025 11:05 (50 minutes)

Research field of your presentation

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

Greetings

Friday 22 August 2025 09:50 (10 minutes)

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

Overview of RIBF and related topics (1/2)

Friday 22 August 2025 11:05 (50 minutes)

Research field of your presentation

Contribution ID: **31** Type: **poster presentation**

Proton Emission Phenomenon of the Deformed Nuclide 185Bi

Wednesday 27 August 2025 19:06 (12 minutes)

As a proton-emitter located beyond the proton drip line, ^{185}**Bi** possesses unique properties, such as susceptibility to deformation, continuum effects, etc. A recent experiment confirmed the $1/2^+$ ground state, but left long-lived isomeric state hard to explain. The study of proton emission can promote a large number of exotic phenomena and new physics. The difficulties in experimental measurement brought about by low reaction cross-sections and short half-lives provide opportunities and challenges for related theoretical studies. Its achievements will also lay the foundation for future research and provide certain guiding.

The GCC method is used, while a deformed proton-emitter is constructed using the particle-rotor model, and it is expanded in complex momentum space using Berggren basis. As Berggren basis includes bound and unbound states, the wave functions of the internal and asymptotic regions can be processed in a unified framework, thereby introducing the continuum effect.

Taking ^{185}**Bi** as the research object, we calculate the variation of the single particle energy level of the core with deformation. By comparing it with the Nilsson energy level, the Thomas-Ehrman effect is studied. Further, the energy spectrum of ^{185}**Bi** under different deformation parameters is calculated. The calculated energy spectrum is cross checked with the results obtained by the TRS method, reproducing the $1/2^+$ ground state measured in the experiment, and the ground state should be formed by a long ellipsoidal nucleus of $_2$ 0.3. In a nearly spherical case, it is highly likely that there are two $7/2^-$ state and $9/2^-$ state.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: XU, Qingyuan

Presenter: XU, Qingyuan

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **32** Type: **oral presentation**

Emergence of High-Purity Spin-Triplet States and Quantum Entanglement in Proton–Proton Scattering

Tuesday 26 August 2025 16:40 (12 minutes)

Entanglement is a unique feature of quantum mechanics that remains relatively unexplored in the context of nuclear physics. In this work, we investigate spin entanglement in elastic proton-proton scattering with unpolarized beams. By analyzing the final spin density matrix from the scattering amplitude, we find two regimes where the outgoing spin state has near-maximal purity: a known low-energy S-wave singlet-dominated region, and a new intermediate-energy region at $E_{\text{lab}} \approx 151\,\text{MeV}$ and $\theta_{\text{c.m.}} \approx 90^\circ$, with a highly pure spin-triplet configuration. We show that the triplet-dominated final state exhibits strong nonclassical correlations, violating the Bell inequality with substantial potential. Furthermore, we quantify the entanglement using concurrence and entanglement power, both of which peak in the same kinematic domain. These results demonstrate that unpolarized pp scattering can serve as a practical source of entangled triplet spin states, offering a new platform for experimental tests of quantum nonlocality and to investigate the spin structure of the nuclear force.

Research field of your presentation

Theoretical Low-energy nuclear physics

Authors: Prof. BAI, Dong (Hohai University); Prof. WANG, Simin (Fudan University); Prof. MA, Yugang (Fudan University); SHEN, zhaoxin (Fudan University)

Presenter: SHEN, zhaoxin (Fudan University)

Session Classification: Young Scientist Session 3

Contribution ID: **33** Type: **oral presentation**

Interplay Between 3P2 Neutron Quantum Vortices and 1S0 Proton Fluxtubes in the Outer Core of Neutron Stars

Tuesday 26 August 2025 15:52 (12 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 ${}^3P_2$ superfluid vortices interact with proton fluxtubes under a magnetic field in the outer core of neutron star.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: HATTORI, Tatsuhiro (Institute of Science Tokyo)

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

Presenter: HATTORI, Tatsuhiro (Institute of Science Tokyo)

Session Classification: Young Scientist Session 3

Contribution ID: **34** Type: **poster presentation**

Antisymmetrized molecular dynamics for exotic nuclear structures

Wednesday 27 August 2025 17:42 (12 minutes)

Antisymmetrized Molecular Dynamics (AMD) has emerged as a powerful microscopic framework for investigating exotic structures in unstable nuclei, especially those near the drip lines. Unlike traditional mean-field models, AMD treats each nucleon as a Gaussian wave packet, allowing the emergence of deformation, clustering, and halo phenomena from first principles without assuming predefined symmetries. This work presents a comprehensive study of exotic nuclear structures—including α clustering, neutron and proton halos, skin effects, and shape coexistence—within the AMD framework. We want to explore the structural evolution in light to medium-mass nuclei, analyze the impact of weak binding and continuum coupling, and highlight the role of isospin asymmetry and shell evolution. Our results will compared with experimental observables such as radii, energy spectra, and transition strengths, demonstrating the versatility of AMD in capturing the complex dynamics of exotic nuclei. This study underscores the importance of microscopic approaches in advancing our understanding of nuclear structure at the limits of stability.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: Prof. WANG, Siming

Presenter: Prof. WANG, Siming

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **35** Type: **oral presentation**

Theoretical investigation of the production of superheavy nuclei near neutron closed and deformed shell regions

Saturday 23 August 2025 15:52 (12 minutes)

The existence of the island of stability has been predicted [1]. One of the major topics in nuclear physics is the production of ^{298}Fl, which is located at the center of this island.
A previous study [2] predicted that synthesizing a compound nucleus more neutron-rich than ^{298}Fl (e.g. ^{304}Fl) may offer an advantage in terms of production probability. Firstly, due to its lower neutron binding energy, neutrons can be more easily evaporated. Furthermore, neutron emission brings the nucleus closer to the predicted neutron shell closure at $N = 184$, which increases the shell correction energy. These effects help to prevent a significant decrease in survival probability at high excitation energies.
In this study, these mechanisms are theoretically investigated using experimentally studied reaction systems. Particular attention is paid to ^{278}Ds and ^{280}Ds ($Z = 110$), formed via the ^{40}Ar+^{238}U and ^{48}Ca +^{232} Th reactions [3], respectively, near the deformed shell region at $N = 162$. We also discuss the synthesis of new elements in which these mechanisms may be confirmed.
We calculated the entire fusion-fission process in the superheavy region in three stages: (i) the projectile-target contact, (ii) the competition between fusion and quasi-fission, and (iii) the decay of the excited compound nucleus. We employed the coupled-channel method [4, 5] for stage (i), the multidimensional Langevin approach [5] for stage (ii), and the statistical model [6] for stage (iii).
In this presentation, we primarily discuss the effect of neutron evaporation and the resulting increase in the shell correction energy. This effect plays a crucial role in the survival probability of the compound nucleus. It may also play an important role in reaching the island of stability.

References

[1] W. D. Myers and W. J. Swiatecki, Nucl. Phys. 81, 1 (1966).
[2] Y. Aritomo, Phys. Rev. C 75, 024602 (2007).
[3] Yu. Ts. Oganessian, et al., Phys. Rev. C 109, 054307 (2024).
[4] K. Hagino, et al., Computer Physics Communications 123 (1999) 143–152.
[5] Y. Aritomo, et al., Phys. Rev. C 85, 044614 (2012).
[6] M. Ohta, Proceedings of Fusion Dynamics at the Extremes, pp. 110-122 (2001).

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: KAWAI, Kosuke (Kindai University)

Co-authors: Mr NAKAJIMA, Kohta (Kindai University); Prof. ARITOMO, Yoshihiro (Kindai University)

Presenter: KAWAI, Kosuke (Kindai University)

Session Classification: Young scientist session 1

Contribution ID: **36** Type: **oral presentation**

The multimodality of Ir-187 fission

Saturday 23 August 2025 16:04 (12 minutes)

As a complex, large-amplitude deformation quantum many-body system, nuclear fission reflects the competition between single-particle and collective behaviors, leading to the coexistence of multiple fission modes for the same fissioning nucleus. Both past and recent experiments indicate that ^{187}Ir undergoes predominantly symmetric fission, while several theoretical predictions favored asymmetric fission. In this presentation, I will report our analysis of the fission modes of ^{187}Ir and discuss possible reasons for the dominance of symmetric fission.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: Mr HUANG, Yingge (Sun Yat-sen Univ. / Univ. of Tokyo)

Co-author: Prof. SU, Jun (Sun Yat-sen Univ.)

Presenter: Mr HUANG, Yingge (Sun Yat-sen Univ. / Univ. of Tokyo)

Session Classification: Young scientist session 1

Contribution ID: **37** Type: **oral presentation**

Beyond the Conventional: Hyperdeformation and Exotic Superfluidity in Atomic Nuclei

Atomic nuclei, as strongly correlated many-nucleon systems, exhibit a variety of collective phenomena. Prominent examples include nuclear deformation and superfluidity. In this lecture, I will discuss unconventional types of deformation and superfluidity that differ from the usual ones. As an introduction, I will briefly review how conventional deformation and superfluidity are described within the framework of the nuclear mean-field theory. I will then extend the mean-field theory to high-spin and superdeformed states and discuss hyperdeformed states. In the latter part of the lecture, I will discuss proton–neutron pair correlations and triplet-P type pair correlations as examples of exotic pairing correlations.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: YOSHIDA, Kenichi

Presenter: YOSHIDA, Kenichi

Contribution ID: **38** Type: **oral presentation**

Quantum entanglement entropy: unveiling the shell evolution

Tuesday 26 August 2025 17:16 (12 minutes)

We investigate the evolution of nuclear shell structure in neutron-rich isotopes through the lens of quantum information theory, using quantum entanglement entropy as a diagnostic tool. Employing shell model calculations, we compute both single-orbital and total correlation entropy for oxygen and calcium isotopic chains. Our results identify the emergence of new magic numbers at \(N=14, 16 \) in oxygen and \(N=32, 34 \) in calcium, evidenced by pronounced minima in total entropy. The single-orbital entropy further reveals orbital-level decoupling at these closures, confirming enhanced nuclear stability. Extending the analysis to iron, chromium, and nickel isotopes, we explore entanglement patterns near the merging regions of the islands of inversion around \(N=40 \) and \(N=50 \), highlighting collective effects. This study demonstrates that quantum entanglement measures provide a powerful, complementary perspective to conventional observables in tracing shell evolution and uncovering underlying correlations in exotic nuclei.

Research field of your presentation

Theoretical Low-energy nuclear physics

Authors: Prof. KRUPPA, András (Institute for Nuclear Research (Atomki)); XU, Di (School of Physics,Xi'an jiaotong university); LI, jianguo (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: XU, Di (School of Physics,Xi'an jiaotong university)

Session Classification: Young Scientist Session 3

Contribution ID: **40** Type: **oral presentation**

Microscopic Study of 10C: 2α + 2p Clustering Structure and Diproton Correlations

Saturday 23 August 2025 16:16 (12 minutes)

We investigate the cluster structure of $^{10}\mathrm{C}$ using a microscopic four-body $\alpha + \alpha + p + p$ cluster model within the Generator Coordinate Method (GCM) framework. The calculated low-lying energy spectrum is in good agreement with the experimental data. Based on the analysis of reduced width amplitudes (RWA) and spectroscopic factors (SF) for the two-body decay channels ($^{9}\mathrm{B} + p$, $^{6}\mathrm{Be} + \alpha$, and $^{8}\mathrm{Be} + 2p$), as well as the three-body clustering configuration ($^{8}\mathrm{Be} + p + p$), several developed cluster structures are identified. The analysis reveals that the 0_1^+ state corresponds to a compact structure, while the 0_2^+ and 2_3^+ states show significant diproton clustering components. In particular, the 0_2^+ state is found to exhibit a mixed structure, characterized by both pronounced α-clustering and diproton configurations, consistent with previous theoretical predictions and experimental observations. It is also found that the 2_1^+ and 2_2^+ states predominantly indicate shell-model-like characteristics, while the 0_3^+ state displays a more spatially extended configuration.

Research field of your presentation

Theoretical Low-energy nuclear physics

Authors: Prof. ZHOU, Bo (Fudan university); Prof. FANG, DeQing (Fudan university); Dr TAO, DeYe (Fundan university); SONG, Liudi (Fudan university); Prof. MA, WeiHu (Fudan university); Prof. MA, YuGang (Fudan university)

Presenter: SONG, Liudi (Fudan university)

Session Classification: Young scientist session 1

Contribution ID: **41** Type: **poster presentation**

Neutron Irradiation Effects on SiPM

Wednesday 27 August 2025 17:54 (12 minutes)

Silicon Photomultipliers (SiPMs), which operate in Geiger mode, are widely used in high energy physics experiments due to their excellent photon detection capabilities. However, their performance can degrade when exposed to high radiation environments which may significantly impact experimental results.
In this study, we investigate the radiation induced performance degradation of two different types of SiPMs by comparing their characteristics before and after neutron irradiation. Key performance metrics including IV characteristics, single photon electron, and LED Response current levels were measured and analyzed. The results provide insights into the radiation hardness of each SiPM model and offer guidance for their application in radiation rich environments.

Research field of your presentation

Experimental Low-energy nuclear physics

Authors: Mr SEO, BoGyeong (Department of Physics, Kyungpook National University); Ms KIM, ChaeYeon (Department of Physics, Kyungpook National University); Mr PARK, JunHyung (Department of Physics, Kyungpook National University); Mr SHIN, JunSeop (Department of Physics, Kyungpook National University); Prof. KIM, ShinHyung (Department of Physics, Kyungpook National University)

Presenter: Mr PARK, JunHyung (Department of Physics, Kyungpook National University)

Session Classification: Young Scietist Session 5 (Poster)

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

Advanced Signal Processing for Transient Oscillations

Wednesday 27 August 2025 15:40 (12 minutes)

Experimental physics often involves detecting weak, time-varying signals embedded in noise-challenges common to both nuclear and biomedical systems. This work explores techniques for extracting and analyzing non-sinusoidal oscillations in noisy, multichannel datasets. Using time-frequency analysis and adaptive denoising methods, we address issues such as amplitude and frequency modulation, phase deviation, and transiet signal detection.

Originally applied to physiological data mimicking dynamic pressure changes in biological systems, these tools are broadly applicable to nuclear epxeriments, including beam diagnostics, gamma-ray detection, and rare eent analysis. The methods enhance signal fidelity and temporal resoltion, offering framework that could improve the acccuracy and interpreability of experimental data in complex, noisy environments.

Research field of your presentation

Author: Mr ABDI, abdikarim (Washington University)

Presenter: Mr ABDI, abdikarim (Washington University)

Session Classification: Young Scientist Session 4

Contribution ID: **43**   Type: **oral presentation**

Research on high time resolution pulsed slow positron beam technology and its applications

Wednesday 27 August 2025 15:52 (12 minutes)

Pulsed slow-positron beams enable atomic-scale characterisation of surface and near-surface microdefects, furnishing precise data on defect size, concentration and spatial distribution. This study establishes a high brightness, high time resolution pulsed slow positron platform based on a solid-neon moderator that incorporates two distinct pulsing technologies within a common magnetic transport line. The first approach employs an integrated three-stage pulsing unit—comprising a chopper, prebuncher, and buncher—to generate a pulsed slow-positron beam with a count rate of 13 000 cps and a time resolution of 187 ps. The second approach combines a Penning-trap accumulation scheme with a buncher to generate positron burst with 600 ps time resolution, and a dedicated 2048-channel array detector has been developed to accommodate the resulting high-intensity gamma bursts. Together, the two pulsed slow-positron beamlines established in this study provide a versatile, high-resolution probe for nanoscale surface and near-surface physics, while high-brightness positron bursts also hold definite significance for advancing antimatter research.

Research field of your presentation

Others

Author: YU, Xiaotian (Institute of High Energy Physics, Chinese Academy of Sciences)

Co-authors: Prof. WANG, Baoyi (Institute of High Energy Physics, Chinese Academy of Sciences); Prof. LIU, Fuyan (Institute of High Energy Physics, Chinese Academy of Sciences)

Presenter: YU, Xiaotian (Institute of High Energy Physics, Chinese Academy of Sciences)

Session Classification: Young Scientist Session 4

Contribution ID: **44** Type: **oral presentation**

β-decay spectroscopy of proton-rich nucleus 28S

Monday 25 August 2025 15:52 (12 minutes)

As member of the Tz=-2 family, 28S is a nucleus rather light near the proton drop line, and has high β-delayed proton (βp) branching ratio. Precise β-decay spectroscopy of proton-rich nucleus 28S serves as a powerful tool to study the isospin symmetry breaking, and to test the unitarity of CKM matrix through the superallowed Fermi transition between isobaric analog states. Nevertheless, only one experimental study was previously published by Pougheon et al. without detecting γ rays in 1989. The present work was conducted at Heavy Ion National Laboratory of Accelerator (HIRFL) in Lanzhou. The interested nucleus 28S was produced through projectile fragmentation (PF) method where 32S16+ beam (about 80 MeV/u) bombarded 9Be target, and subsequently implanted in a detector system composed of double-sided silicon strip detectors (DSSD), quadrant silicon detectors (QSD), and clover-type high-purity germanium detectors. Based on this detector system, our team has achieved excellent results for 22Si, 26Si, 26P, and 27S in recent years.
By measuring p and γ following β decay, the half-life and energy with higher accuracy were obtained. Different decay channels were clearly identified through the coincidence method to construct complete decay scheme, and the results were consistent with theoretical calculations. The mirror nuclei 28S-28Mg was also studied, which gave no evidence for existence of isospin symmetry breaking.

Research field of your presentation

Experimental Low-energy nuclear physics

Authors: GAO, YUFENG (Institute of Modern Physics, Chinese Academy of Sciences); Prof. XU, XINXING (Institute of Modern Physics, Chinese Academy of Sciences)

Presenter: GAO, YUFENG (Institute of Modern Physics, Chinese Academy of Sciences)

Session Classification: Young Scientist Session 2

Contribution ID: **45** Type: **oral presentation**

Probing shell structure at N=32 and 34 far from stability with realistic nuclear forces

Saturday 23 August 2025 16:28 (12 minutes)

The nuclei, characterized by large N/Z ratios, are often referred to as exotic nuclei and challenge the traditional understanding of nuclear shell structure. The conventional magic numbers, such as N =8, 20, 28, etc., tend to diminish or vanish, and new magic numbers emerge in the exotic systems. In this work, we investigated the appearance of new magic numbers at $N = 32$ and 34 and their evolution in neutron-rich isotopes lying above and below Ca. We studied the shell gaps from the underlying two- and three-nucleon forces obtained from QCD-based chiral effective field theory, employing the state-of-the-art *ab initio* valence-space in-medium similarity renormalization group method. The development of shell gaps at $N = 32$ and 34 is discussed from various nuclear observables and effective single-particle energies. Our calculated results align well with the available experimental data and suggest a strengthening of the $N = 34$ sub-shell gap while the $N = 32$ sub-shell gap weakens or disappears below Ca. To understand the microscopic origin of these shell effects, we analyzed different components of the nuclear interaction -central, spin-orbit, and tensor- through spin-tensor decomposition and elucidated their roles in establishing shell gaps far from stability. Then, the low-energy structures of the exotic $N = 32$ isotones, adjacent to the $N = 34$ shell gap, are studied in detail. It is observed that these nuclei exhibit deformed ground states and coexist with a weakly deformed band at low-excitation energy. The present work demonstrates essential components of nuclear force in shaping magic numbers far from stability and offers deeper insights into the structure of exotic nuclei from the underlying nucleon-nucleon interactions.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: SAHOO, Subhrajit (Indian Institue of Technology Roorkee)

Co-author: Prof. SRIVASTAVA, Praveen C. (Indian Institute of Technology Roorkee)

Presenter: SAHOO, Subhrajit (Indian Institue of Technology Roorkee)

Session Classification: Young scientist session 1

Contribution ID: **46** Type: **oral presentation**

Construction of 1S0 pair collective Hamiltonian using the constrained BCS + local QRPA method

Tuesday 26 August 2025 16:52 (12 minutes)

One of the important correlations in atomic nuclei is pairing, where two nucleons form a pair. The pairing correlation can lead to a phase transition into a superfluid state, analogous to the superconducting state observed in electronic systems. In the superfluid phase, the global U(1) gauge symmetry is spontaneously broken. As a result, a new type of the collective mode emerges: the pair rotational mode (Nambu-Goldstone mode) which corresponds to the motion along the bottom of a wine-bottle-shaped effective potential, in addition to the pair vibrational mode which involves fluctuations in the magnitude of the order parameter.
In finite systems such as nuclei, phase transitions do not occur sharply due to significant quantum fluctuations. Instead, a critical state exists between the normal and the superfluid phase. Nuclei near closed-shell configurations are typically considered to exhibit pair vibrational modes. However, previous studies (Clark et al. 2006) have shown that some magic-number nuclei may actually be in a critical state.
To describe shape coexistence phenomena (Kris and John 2011) with quantum fluctuations, such as those observed in 98Kr, five-dimensional quadrupole collective Hamiltonian has been extensively used (Próchniak and Rohoziński 2009). In a similar spirit, describing nuclei in a pairing critical state requires the construction of a pair collective Hamiltonian that can simultaneously include both pair rotational and vibrational dynamics and their couplings. Despite its importance, research on pair collective Hamiltonians remains limited, with most models relying on simple monopole pairing interactions (Bes et al. 1970). Consequently, current approaches are restricted to narrow model spaces and can only be applied to a limited number of nuclei.

To extend the applicability of the pair collective models to a wider range of nuclides, we aim to construct the pair collective Hamiltonian based on nuclear density functional theory. The potential energy surface is expressed as a function of the pairing gap (the collective variable), while the inertial functions, namely the pair rotational moment of inertia and the pair vibrational mass, are obtained using local QRPA calculations that account for the pairing gap dependence. We then construct a pair collective Hamiltonian that can describe the pair dynamics in the critical regime and allows us to reassess the stability of the magic nuclei from the perspective of the pairing correlations.
As a first step toward this goal, we have obtained the potential energy surface using BCS calculations with constraints on the pairing gap, employing monopole pairing interactions. In this presentation, we will also discuss the pairing gap dependence of the pair rotational moment of inertia and the pair vibrational mass using the local QRPA method.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: RUIKE, Chisato (Pure and Applied Sciences, University of Tsukuba)

Co-author: HINOHARA, Nobuo (University of Tsukuba)

Presenter: RUIKE, Chisato (Pure and Applied Sciences, University of Tsukuba)

Session Classification: Young Scientist Session 3

Contribution ID: **47** Type: **oral presentation**

The candidates of 2alpha condensate around the oxygen16 nucleus studied by the Real-time evolution method

Saturday 23 August 2025 16:40 (12 minutes)

Nowadays, searching for α condensation around a core nucleus is an interesting topic. Previous theoretical studies predicted ^{16}O+2α condensed states. However, there was strong mixing with non-resonant states and it causes the identification of true resonant states non-trivial.
To address this issue, we aim to provide a more robust theoretical verification of the ^{16}O+2α condensation to identify the resonant states and predict their properties.
We employ the real-time evolution method(REM), which generates physically important basis states using the equation of motion, minimizing contamination from the continuum. The analytical continuation in the coupling constant (ACCC) was used to estimate the α-decay widths.
The present results point out much better convergence of eigenstates, and the 0_3^+ and 0_4^+ states showed remarkable isoscalar monopole transition strengths, which were in good agreement with the previous theoretical work. The small α-decay widths for these states suggest that experimental observation appears feasible.
Therefore, The real-time evolution method (REM) proved effective in identifying the candidates of 2α condensate around the ^{16}O nucleus.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: Ms HTET, Ya Min (Faculty of Science, Hokkaido University)

Presenter: Ms HTET, Ya Min (Faculty of Science, Hokkaido University)

Session Classification: Young scientist session 1

Contribution ID: **48** Type: **oral presentation**

(Cancelled) Toward global calculations for charge-exchanging processes using Gogny energy density functional

Tuesday 26 August 2025 17:28 (12 minutes)

Charge-exchanging processes such as beta decay, neutrinoless double-beta decay, and Gamow-Teller giant resonances are observed in a wide region of the nuclear chart and play important roles in nuclear physics and related fields. Theoretical descriptions based on nuclear density functional theory (DFT) enable us to calculate all the nuclei in the chart. A standard approach for describing charge-exchanging processes within nuclear DFT is the proton-neutron quasiparticle random-phase approximation (pnQRPA). QRPA is computationally demanding, as it involves the diagonalization of a large-dimensional matrix in its original formulation, but an efficient solution called the finite amplitude method (FAM) was developed recently [1]. The proton-neutron FAM (pnFAM) [2] has been successfully applied to beta decay, Gamow-Teller resonances, and two-neutrino emitting double-beta decay using Skyrme-type energy density functionals [3, 4].
In this presentation, we will present the current status of implementing the Gogny-type energy density functional, which has less uncertainty in the proton-neutron pairing channel than the Skyrme-type one, into the pnFAM code to calculate the transition strength for charge-exchanging processes.

[1] T. Nakatsukasa, T. Inakura, and K. Yabana, Phys. Rev. C 76, 024318 (2007).
[2] M. Mustonen, T. Shafer, Z. Zenginerler, and J. Engel, Phys. Rev. C 90, 024308 (2014).
[3] M. Mustonen and J. Engel, Phys. Rev. C 93, 014304 (2016).
[4] N. Hinohara and J. Engel, Phys. Rev. C 105, 044314 (2022).

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: AKAI, Kenta (University of Tsukuba)

Co-author: HINOHARA, Nobuo (University of Tsukuba)

Presenter: AKAI, Kenta (University of Tsukuba)

Session Classification: Young Scientist Session 3

Contribution ID: **50** Type: **oral presentation**

Beta Decay Study Using Shell Model

Saturday 23 August 2025 16:52 (12 minutes)

Beta decay is one of the fundamental weak interaction processes in nuclear physics that is crucial in shaping our understanding of nuclear structure. It also provides important insights into various astrophysical phenomena like r–process which is responsible for forming about half of the heavy elements in the universe beyond iron [1]. In this talk, I will discuss the beta decay properties which includes Fermi and Gamow Teller transitions, phase-space factor, $\log ft$ and half-life. These concepts help to explain which transitions are allowed, how strong they are and how likely they occur. They are also essential for calculating decay rates and comparing theoretical predictions with experimental data. Studying nuclei in the lighter mass region with Z= 8–15 are particularly important because these nuclei are relatively simple, well understood, making them ideal for testing nuclear models like the shell model [2]. Our work focuses on studying the allowed beta decay properties in sd-shell nuclei, such as Gamow Teller matrix elements, their transition strengths (B(GT)), $\log ft$ values, and branching ratios..etc. Our preliminary results obtained for several transitions like ^{21}O $\rightarrow^{21}$F, ^{21}F $\rightarrow^{21}$Ne and ^{24}Ne $\rightarrow^{24}$Na are in good agreement with available experimental data. We aim to address these fundamental properties in nuclei that are of current experimental interest and relevant to astrophysical nucleosynthesis processes.

References
[1] I. N. Borzov, "Beta-decay rates", Nucl. Phys. A 777, 645 (2006).
[2] A. Kumar, P. C. Srivastava, and T. Suzuki, "Shell model results for nuclear β−-decay properties of sd-shell nuclei, "Prog. Theor. Exp. Phys. 2020, 033D01 (2020).

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: Ms PANT, Nidhi (Research Scholar, Department of Physics, IIT Roorkee, India)

Co-author: Prof. SRIVASTAVA, Praveen C. (IIT Roorkee, India)

Presenter: Ms PANT, Nidhi (Research Scholar, Department of Physics, IIT Roorkee, India)

Session Classification: Young scientist session 1

Contribution ID: **51** Type: **oral presentation**

Accelerating Nuclear Structure Studies: A ResNet-18 Machine Learning Approach for Event Classification in the MATE-TPC

Wednesday 27 August 2025 16:40 (12 minutes)

The study of nuclear structure, particularly clustering phenomena in light nuclei such as Carbon-12 (^{12}C), is essential for advancing our understanding of nuclear forces and stellar nucleosynthesis. Elastic and inelastic scattering reactions, like $^{12}C(p,p)^{12}C$ and $^{12}C(\alpha,\alpha)^{12}C$, are powerful probes for investigating these fundatmental properties. The Active Target Time Projection Chamber (AT-TPC), such as the MATE-TPC developed at Institute of Modern Physics, offers comprehensive 3D tracking of reaction products, allowing for precise reconstruction of reaction kinematics and missing-mass spectra. However, the large volume and complexity of the resulting point-cloud data pose significant challenges for conventional data analysis methods, which are often labor-intensive and time-consuming.

To overcome this challenges, we have developed an automated event classification framework utilizing a deep convolutional neural network (CNN). In this work, we apply the ResNet-18 architecture to classify reaction events from ^{12}C+p and $^{12}C+\alpha$ scatterings simulated with the MATESIM toolkit in the MATEROOT code. The 3D particle tracks "detected"by the MATE-TPC are projected onto 2D planes, generating image-like input for the network. Our trained model achieves high performance, attaining over 94% classification accuracy in distinguishing proton events from none-proton events. Analysis of the model's performance, including its confusion matrix, and examination of misclassified events demonstrate its robustness and identifies areas for further improvement. This deep learning approach greatly enhances the efficiency and objectivity of data analysis in AT-TPC experiments, paving the way for rapid processing of large datasets and enabling searches for rare reaction channels that are essential for advancing nuclear physics research.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: HU, ZhiHeng (Institute of Modern Physics,Chinese Academy of Sciences)

Co-authors: Prof. ONG, Hooi Jin (Institute of Modern Physics,Chinese Academy of Sciences); LI, Lu (Institute of Modern Physics,Chinese Academy of Sciences); Prof. ZHANG, Ningtao (Institute of Modern Physics,Chinese Academy of Sciences); Dr HUANG, Taisen (Institute of Modern Physics,Chinese Academy of Sciences); Dr ZHANG, Zhichao (Institute of Modern Physics,Chinese Academy of Sciences)

Presenter: HU, ZhiHeng (Institute of Modern Physics,Chinese Academy of Sciences)

Session Classification: Young Scientist Session 4

Contribution ID: **52** Type: **not specified**

Latest Achievement on the UCN source of the TRIUMF Ultracold Neutron and the EDM Experiment

Monday 25 August 2025 16:04 (12 minutes)

A non-zero electric dipole moment of the neutron (nEDM) would violate the CP symmetry and be related to baryon asymmetry in our universe. The TRIUMF Ultracold Advanced Neutron (TUCAN) collaboration is commissioning a world-leading ultracold neutron (UCN) source for such precise measurements of the nEDM. With such an intensive UCN source, the TUCAN collaboration aims to push the statistical nEDM measurement sensitivity to the scale of 10^{-27} e·cm within 400 days. Spallation neutrons will be cooled with room temperature heavy water and 20K liquid deuterium, after which, the UCNs will be produced in a spherical volume in 1K superfluid helium. These UCNs are then extracted from the production volume and introduced to the experimental equipment with coated vacuum neutron guides. Once the source is completed, it will provide a UCN production rate of 1.6×10^7/s.

The UCNs produced from the source will be transferred to the storage unit, and the nEDM will be measured later by the Ramsey resonance technique with separated oscillating magnetic fields. This source can also be applied to other experimental proposals, such as neutron lifetime measurement or the search for axion-like particles. This presentation will focus on the latest achievement on the UCN source commissioning and the nEDM experiment at TRIUMF, including initial UCN production results from operating the superfluid He-II source prior to installation of the LD2 moderator.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: QIAO (ON BEHALF OF THE TUCAN COLLABORATION), Kelin (The University of Osaka / Research Center for Nuclear Physics (RCNP))

Presenter: QIAO (ON BEHALF OF THE TUCAN COLLABORATION), Kelin (The University of Osaka / Research Center for Nuclear Physics (RCNP))

Session Classification: Young Scientist Session 2

Contribution ID: **53** Type: **oral presentation**

Greeting

Saturday 23 August 2025 09:45 (10 minutes)

Research field of your presentation

Presenter: Prof. OHKOSHI, Shin'ichi (School of Science)

Contribution ID: **54** Type: **oral presentation**

Octuple Correlation in 67Ga

Monday 25 August 2025 16:16 (12 minutes)

High-spin states of ^{67}Ga have been studied via the ^{58}Ni(^{12}C, 3p)^{67}Ga fusion-evaporation reaction at a beam energy of 50.4 MeV. Three negative-parity bands and three positive-parity bands in ^{67}Ga are established. The observation of one new $E3$ transition linking the positive-parity $\pi 1g_{9/2}$ band and negative-parity $\pi 2p_{3/2}$ band provides evidence of octuple correlations in ^{67}Ga. The characteristics of octuple correlations in the ^{67}Ga are discussed in terms of the reflection-asymmetric triaxial partical rotor model and microscopic relativistic mean field+Bardeen-Cooper-Schrieffer model.

Research field of your presentation

Experimental Low-energy nuclear physics

Authors: YI, Jiayi (School of Physics and State Key Laboratory of Nuclear Physics and Technology, Peking University); ZHOU, Z.X. (School of Physics and State Key Laboratory of Nuclear Physics and Technology, Peking University); HUA, H. (School of Physics and State Key Laboratory of Nuclear Physics and Technology, Peking University)

Presenter: YI, Jiayi (School of Physics and State Key Laboratory of Nuclear Physics and Technology, Peking University)

Session Classification: Young Scientist Session 2

Contribution ID: **55** Type: **not specified**

Implication of neutron star observations to the origin of nucleon mass

Tuesday 26 August 2025 15:40 (12 minutes)

We investigate the implications of neutron star observations for understanding the origin of nucleon mass using a framework that combines three complementary approaches: the parity doublet model for hadronic matter below 2n0, the Nambu-Jona-Lasinio (NJL) model for quark matter above 5n0, and a model-independent analysis of the intermediate density region based on fundamental physical principles. By systematically exploring parameter spaces and comparing theoretical predictions with recent observational constraints, we establish constraints on the chiral invariant mass in the PDM. Our results suggest that more than a half of the nucleon mass originates from sources beyond spontaneous chiral symmetry breaking, challenging conventional understanding of nucleon mass generation. These constraints arise solely from fundamental physical principles and observational data, independent of specific assumptions about the nature of the quark-hadron transition, providing robust insights into the microscopic origin of hadron masses.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: GAO, Bikai (RCNP, Osaka University)

Co-authors: LIU, Xiang (Nagoya University); Prof. HARADA, Masayasu (Nagoya University); Prof. MA, Yongliang (Nanjing University)

Presenter: LIU, Xiang (Nagoya University)

Session Classification: Young Scientist Session 3

Contribution ID: **56**   Type: **poster presentation**

Development of an MR-ToF combined with Inductively Coupled Plasma Mass Spectrometry at the University of Manchester

Wednesday 27 August 2025 18:06 (12 minutes)

The laser spectroscopy group at the University of Manchester aims to realise a combination of Inductively Coupled Plasma Mass Spectrometry (ICP-MS) with a Multi-Reflection Time-of-Flight Mass-Spectrometer (MR-ToF).
The MR-ToF has in recent decades become a powerful technique for high-precision mass measurement of exotic nuclides at RIB facilities, using multiple reflections of an ion cluster to extend the flight path up to 1000s of times, demonstrating mass resolution of over $m/m = 10^6$. In combination with an ICP-MS source, the superior mass resolving power and dynamic range of the MR-ToF can be applied to ultra-trace analysis of low-level waste. The proposed spectrometer will include a region of laser overlap for selective ionisation of the ICP-MS output, enhancing the chemical selectivity of the instrument.
I will present the current status of this spectrometer under construction at UoM, and the development of a linear cooler-buncher, which will create pulsed ion bunches nanoseconds in width for injection into the laser spectroscopy and MR-ToF stages.

Research field of your presentation

Experimental Low-energy nuclear physics

Authors: AGG, Emily (University of Manchester); Dr LORUSSO, Giuseppe (National Physical Laboratory, UK); Prof. FLANAGAN, Kieran (University of Manchester)

Presenter: AGG, Emily (University of Manchester)

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **57** Type: **oral presentation**

Performance Evaluation of the Ion Chambers for a Wide Range of Atomic Numbers in the RIKEN TRIP-S3CAN Experiment

Wednesday 27 August 2025 16:04 (12 minutes)

In the RIKEN TRIP-S3CAN experiment, a series of measurements has been initiated to determine interaction and charge-changing cross sections over a wide range of atomic numbers (Z). The particle identification capability for heavy ions plays an important role in this experiment. By applying velocity corrections to the energy loss measured with ionization chambers, the atomic number of each particle can be determined. In this study, newly developed ionization chambers at F3 and F8 were installed, in addition to the standard ionization chambers located at focal planes F7 and F11. In this presentation, we discuss the performance evaluation of these ionization chambers in the Z = 25–60 region.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: YOU, ka (Tokyo city university)

Co-authors: A. OZAWA; A. YANO; C. INOUE; D. NAGAE; D. NISHIMURA; F. SATO; H. BABA; H. KOBAYASHI; H. SUZUKI; H. TAKEDA; I. YASUDA; K. ADACHI; K. KUSAKA; K. MAEDA; K. MATSUYAMA; K. TEZUKA^; K. YASUDA; M. FUKUDA; M. FUKUTOME; M. MIHARA; M. MIKAWA; M. MITSUI; M. OHTAKE; M. TANAKA; M. YOSHIMOTO; N. FUKUDA; N. KOBAYASHI; R. KAGEYAMA; R. SASAMORI; R. TAGUCHI; S. CLAUDO; S. ENDO; S. ISHITANI; S. MICHIMASA; S. NISHIZAWA; S. TAKESHIGE; T. MORIGUCHI; T. OHTSUBO; T. SHIMAMURA; T. SUZUKI; TAKAYAMA; W. WATANABE; Y. ICHINOHE; Y. KIKUCHI; Y. SHIMIZU; Y. TOGANO; Y. WEI; Y. YAMAGUCHI; Y.YANAGISAWA

Presenter: YOU, ka (Tokyo city university)

Session Classification: Young Scientist Session 4

Contribution ID: **59** Type: **not specified**

Proton elastic scattering from 50Ca at the RIKEN RIBF toward future studies of the nuclear matter EoS

Monday 25 August 2025 16:28 (12 minutes)

Constraining the equation of state (EoS) of nuclear matter remains one of the key open questions in both nuclear physics and astrophysics, with significant implications for phenomena such as neutron stars and supernova explosions. One approach is to investigate the differences in proton and neutron density distributions across isotopic chains, which are expected to provide a valuable insight into the symmetry energy of the nuclear matter EoS. Proton elastic scattering is known to be highly sensitive to the neutron and proton density distributions, particularly in magic nuclei such as calcium ($Z = 20$) and tin ($Z = 50$), where the closed proton shells enhance this sensitivity. A measurement of proton elastic scattering for the neutron-rich nucleus ^{50}Ca has been performed in inverse kinematics at the RIKEN RI Beam Factory (RIBF). The experiment employed a newly developed $E - E$ telescope array, DELTA, consisting of Silicon Strip Detectors (SSD) and GAGG(Ce) calorimeters, to reconstruct the four-momentum of recoil protons. In this presentation, we report the results of the ^{50}Ca(p, p) elastic scattering experiment, focusing on the extracted angular distributions. We also outline future plans to extend this study to rare isotopes ^{52}Ca and ^{104}Sn and present ongoing developments toward the next experimental campaign.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: NAKADA, Tomoya (Kyoto University)

Co-authors: ZENIHIRO, Juzo (Kyoto University); THE TRIP COLLABORATION; THE ESPRI COLLABORATION

Presenter: NAKADA, Tomoya (Kyoto University)

Session Classification: Young Scientist Session 2

Contribution ID: **60** Type: **poster presentation**

Current Status of The Segmented La-GPS Scintillation Crystal Detector as a New Implant-β Detection Tool at Fragmentation Facilities

Wednesday 27 August 2025 18:18 (12 minutes)

The rapid neutron capture (*r*-) process holds a significant amount of interest as a means for nucleosynthesis of elements in astrophysical environments. From the perspectives of both nuclear physics and astrophysics, ongoing efforts are being carried out to better understand it. Such efforts include the measurements of β-decay and delayed neutron emissions of the *r*-process elements in order to obtain a more accurate input for the calculations in relation to its theoretical modelling [1].
Typically, β-γ spectroscopies are conducted with implantation detectors at fragmentation facilities such as the implementation of the Silicon Strip Detectors (SSDs) at Radioactive Isotope Beam Factory (RIBF). However, SSDs are incapable of fast timing response for the purpose of neutron time-of-flight measurements of the delayed neutron emissions. Therefore, to address this limitation, the Yttrium Orthosilicate (YSO) segmented scintillation crystal detector ($Z \approx 35$, $\rho \approx 4.5$ g/cm³) was developed. The characteristics of the YSO allow for 80% correlation efficiency with 3mm correlation radius between implant events and β-decay events [2].
The success of the YSO prompted the development of the Lanthanum-enriched Gadolinium Pyrosilicate (La-GPS) segmented scintillation crystal detector ($Z \approx 51$, $\rho \approx 5.2$ g/cm³) to achieve better correlation radius and higher energy resolution compared to the YSO, and faster timing response than SSDs [3]. This presentation will then showcase the current status of the La-GPS scintillation crystal detector of (1.5 x 1.5)mm arranged into a 32 x 32 array in the *x*-*y* plane.

References

1. M. R. Mumpower et al., "The impact of individual nuclear properties on r-process nucleosynthesis,"*Prog. in Particle and Nucl. Phys.*, vol. 86, pp. 86-126, 2016.
2. R. Yokoyama et al., "Segmented YSO Scintillation Detectors as a New β-Implant Detection Tool for Decay Spectroscopy in Fragmentation Facilities,"*Nucl. Instrum. Methods Phys. Res. A, Accel. Spectrom. Detect. Assoc. Equip.*, vol. 937, pp. 93–97, 2019.
3. A. Suzuki et al., "Fast and high-energy-resolution oxide scintillator: Ce-Doped (La,Gd)2Si2O7," *Appl. Phys. Express*, vol. 5, no. 10, p. 102601, 2012.

Research field of your presentation

Experimental Low-energy nuclear physics

Authors: YOKOYAMA, Rin; ANUAR, Yasmin

Co-authors: YAMAJI, A. (NICHe, Tohoku University); IMAI, Nobu (CNS); KUROSAWA, S. (NICHe, Tohoku University); NISHIMURA, Shunji (RIKEN); PHONG, V. H. (Nishina Center, RIKEN)

Presenter: ANUAR, Yasmin

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **61** Type: **oral presentation**

Probing the shell structure and interplay of configuration in neutron-rich N=50 nuclei

Saturday 23 August 2025 17:04 (12 minutes)

Exploring the nuclear shell structure of neutron-rich N = 50 nuclei is one of the most interesting and mysterious phenomena in nuclear physics, and it has become the forefront of both experimental and theoretical research in recent years. We have constructed the shell model Hamiltonian in the π(f p)-ν(sdg) model space based on an ab initio approach using VS-IMSRG(3f2) with minimal phenomenological adjustments to the single-particle energies to reproduce the recently available experimental data in the N = 50 region. To perform the large-scale shell model calculations, we have carried out the state-of-the-art
advanced Monte-Carlo Shell Model (MCSM) to interpret the nuclear structure properties of nuclei near the neutron magic number N = 50. Our MCSM-calculated nuclear structure properties, based on the new shell model Hamiltonian derived from VS-IMSRG(3f2), show a rather good qualitative agreement with the experimental data and previous shell model predictions. The prediction of structural properties in the N = 50
The region has significant implications for nuclear astrophysics, as it affects nucleosynthesis pathways and contributes to the distribution of elemental abundances in the universe.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: KUMAR, ANIL (Center for Computational Sciences, University of Tsukuba, Tsukuba, Japan)

Co-authors: Prof. SHIMIZU, Noritaka (Center for Computational Sciences, University of Tsukuba, Tsukuba); Prof. MIYAGI, Takayuki (Center for Computational Sciences, University of Tsukuba, Tsukuba); Dr TSUNODA, Yusuke (Center for Computational Sciences, University of Tsukuba, Tsukuba); Prof. UTSUNO, Yutaka (JAEA, Tokai, Japan)

Presenter: KUMAR, ANIL (Center for Computational Sciences, University of Tsukuba, Tsukuba, Japan)

Session Classification: Young scientist session 1

Contribution ID: **62** Type: **oral presentation**

Status of R&D activities for FAZIA detector upgrade in Korea

Wednesday 27 August 2025 16:52 (12 minutes)

FAZIA (Forward-angle A and Z Identification Array) is a multi-detector array designed to identify charges and masses of the reaction fragments from heavy ion collisions in the Fermi energy domain. One basic unit of FAZIA detector consists of three layers which include two Si sensors with different thicknesses and one CsI scintillator detector read out by a photodiode, forming the FAZIA telescope. The detector signals are analyzed using digital signal processing implemented on FPGAs, which are integrated into the front-end electronics board (FEB). The telescope structure enabled the charge identification of nuclei with Z up to 54 and the isotopic nuclei discrimination with Z up to 25 by using the ΔE - E information and Z up to 20 with the pulse shape analysis. A single FAZIA detector module consists of 16 telescopes.

The FAZIA upgrade project began a few years ago with the goal of extending beam-energy coverage and enhancing acceptance. The Korean FAZIA team takes major responsibility for developing new Si sensors with various thicknesses and improving the performance of FEBs. The Si sensors, designed through TCAD simulations, have been successfully fabricated and tested for their I-V characteristics and performance using an Am-241 source. Additionally, prototype FEBs have been developed using modern FPGA chips and other advanced components. New VHDL code has also been developed. The testing system for prototype detectors and FEBs is complete at present. This presentation will highlight recent efforts by the team in the upgrade project, with a particular focus on the R&D of new Si sensors and electronics.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: KIM, Giyeong (Inha University (KR))

Presenter: KIM, Giyeong (Inha University (KR))

Session Classification: Young Scientist Session 4

Contribution ID: **63** Type: **oral presentation**

ab initio effective operator study dripline nuclei observables

Tuesday 26 August 2025 16:28 (12 minutes)

Recent studies of nuclei near driplines have signifcantly enhanced our understanding of nuclear structure. In those nuclei, the continuum coupling is crucial in reproducing weakly bound and unbound phenomena. To study the observables of the nuclei as open quantum systems self-consistently, we developed valence-space efective operators in the Berggren basis using many-body perturbation theory[1]. The two- plus three-nucleon force from the chiral efective feld theory has been used.
The observed β-decay isospin asymmetry between the dripline nucleus ^{22}Si and its mirror partner ^{22}O is reproduced, highlighting the crucial role of the $s_{1/2}$ continuum. Additionally, continuum efects also play a pivotal role in the signifcant Tomas-Ehrman shift observed between the mirror daughters ^{22}Al and ^{22}F[1].
Recent measurements of the E2 transition rate from the ground state to the frst 2^+ excited state of the proton dripline nucleus ^{36}Ca show an unusual patern when compared to its isotopic neighbor ^{38}Ca: despite having a higher $E(2_1^+)$ excitation energy, the $B(E2; 0_1^+ \rightarrow 2_1^+)$ rate in ^{36}Ca is larger. We found that in the threshold 2^+ state, ^{36}Ca is spatially difused, which accounts for the abnormal $B(E2)$ trend observed[2].

[1] Z. C. Xu, S. Zhang, J. G. Li, et al. Phys. Rev. C 108, L031301 (2023)
[2] Z. C. Xu, S. M. Wang, T. Beck, et al. Phys. Rev. C 112, L011302 (2025)

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: Dr XU, Zhicheng (Fudan University)

Presenter: Dr XU, Zhicheng (Fudan University)

Session Classification: Young Scientist Session 3

Contribution ID: **64** Type: **oral presentation**

Harmonic oscillator model analysis of nuclear radius and neutron skin thickness

Saturday 23 August 2025 17:16 (12 minutes)

improve the harmonic oscillator model and test its performance for nuclear charge radii and neutron skin thicknesses

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: KIM, Seong Yeon (Soongsil University)

Presenter: KIM, Seong Yeon (Soongsil University)

Session Classification: Young scientist session 1

Contribution ID: **65** Type: **oral presentation**

Developments of Radioactive Isotope Beams using Long-Lived Nuclides from Accelerator Mass Spectrometry System

Wednesday 27 August 2025 16:16 (12 minutes)

Accelerator Mass Spectrometry (AMS) can detect extremely small amounts of long-lived nuclides (^{10}Be, ^{14}C, ^{36}Cl, ^{129}I, etc.) in sample. It is applied for studies of environmental dynamics using seawater or rainwater, cosmic ray event exploration using Antarctic ice core and so on.
We have been developing RI beams using long-lived nuclides provided from the AMS system at the University of Tsukuba Tandem Accelerator Complex (UTTAC) for experiments of nuclear physics. We developed ^{10}Be and ^{14}C beams. In the AMS, an ionization chamber (IC) is used to count the number of rare isotopes, and an absorber gas is used to remove isobaric interferences. Considering the use of the beam for nuclear physics, it is desirable to minimize the energy loss and maintain the beam energy as much as possible. Therefore, we investigated the response of the gas detector when the gas pressure of the P10 gas in the IC, and the argon gas in the absorber cell were reduced. We also examined the beam size. The count rate is also important for beam utilization, and we are trying to improve the isotope ratio of ^{10}Be by preparing samples with rainwater.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: MIKAWA, Misaki (University of Tsukuba)

Co-authors: MORIGUCHI, Tetsuaki (University of Tsukuba, University of Tsukuba Tandem Accelerator Complex); OZAWA, Akira (University of Tsukuba); SASA, Kimikazu (University of Tsukuba, University of Tsukuba Tandem Accelerator Complex); TAKAHASHI, Tsutomu (University of Tsukuba Tandem Accelerator Complex); MATSUMURA, Masumi (University of Tsukuba Tandem Accelerator Complex); YOSHIDA, Tetsurou (University of Tsukuba Tandem Accelerator Complex); YANO, Asahi (University of Tsukuba); ZHANG, Hanbin (University of Tsukuba); MITSUI, Maoto (University of Tsukuba); MATSUMOTO, Tatsuki (University of Tsukuba); KOBAYASHI, Hayato (University of Tsukuba)

Presenter: MIKAWA, Misaki (University of Tsukuba)

Session Classification: Young Scientist Session 4

Contribution ID: **66** Type: **oral presentation**

Hypernuclear Structure and Hyperon Star Properties with Relativistic Density Functional Theory

Tuesday 26 August 2025 17:04 (12 minutes)

Hypernuclear systems and neutron stars offer complementary environments for exploring baryon interactions across a wide range of densities. This report investigates Ξ^- hypernuclear structure and the equation of state (EOS) of hyperon-rich matter using relativistic density functional theory. The structure of selected light Ξ^- hypernuclei, such as $^{15}_{\Xi^-}$C and $^{13}_{\Xi^-}$B, are described within the density-dependent relativistic mean-field (DDRMF) framework, where the in-medium behavior of meson-hyperon couplings and the role of the isovector scalar δ meson are analyzed in detail. To extend the constraints toward supranuclear densities, experimental information from hypernuclei is incorporated into a Bayesian inference scheme. A statistically significant linear correlation between scalar and vector ΞN coupling strengths is established and used as a nuclear-physics prior. When combined with multimessenger astrophysical observations, including neutron star masses, radii, and tidal deformabilities, the resulting posterior distribution enables a more constrained and realistic description of hyperonic matter. This approach improves the stiffness of the EOS and supports the existence of $2M_{\odot}$ hyperon stars, offering new insights into the hyperon puzzle from a joint nuclear and astrophysical perspective.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: DING, ShiYuan (Lanzhou University)

Co-authors: Prof. SUN, BaoYuan (Lanzhou University); Prof. SUN, TingTing (Zhengzhou University); Dr SUN, XiangDong (Xiamen University); Prof. LI, Ang (Xiamen University)

Presenter: DING, ShiYuan (Lanzhou University)

Session Classification: Young Scientist Session 3

Contribution ID: **67** Type: **oral presentation**

Mass Prediction of Neutron-Deficient Fe, Ni, Zn, and Kr Isotopes Based on Mirror Energy Differences

Saturday 23 August 2025 17:28 (12 minutes)

Recent $B\rho$-defined isochronous mass spectrometry experiments have determined the masses of proton-rich nuclei such as ^{23}Si, ^{26}P, ^{27}S, and ^{31}Ar. These results confirm the bound nature of these isotopes and establish the location of the proton dripline for several isotopic chains. Notably, the measured mirror energy differences (MEDs) exhibit clear deviations from mirror symmetry in P, S, and Ar isotopes, suggesting the presence of extended proton distributions.

Based on these findings, we conducted a systematic theoretical study of MEDs across mirror nuclei, revealing a smooth quadratic dependence on the neutron–proton asymmetry $(N - Z)$. Utilizing this regularity, we made high-precision mass predictions for a series of neutron-deficient nuclei. Furthermore, the predicted masses are consistent with the Isobaric Multiplet Mass Equation (IMME), and the cubic term is found to be negligible, reinforcing the validity of isospin symmetry in this region.

Research field of your presentation

Experimental high-energy nuclear physics

Author: YU, YUE (Institude of Modern Physics, Chinese Academy of Science)

Presenter: YU, YUE (Institude of Modern Physics, Chinese Academy of Science)

Session Classification: Young scientist session 1

Contribution ID: **68** Type: **poster presentation**

Combining Improved Thermoluminescence (TL) Dating and Nuclear Techniques for The Study of Ancient Sites

Wednesday 27 August 2025 18:42 (12 minutes)

The report presents an overview on the combination of improved thermoluminescence (TL) dating and nuclear techniques - such as neutron activation analysis (NAA) and isotope ratio analysis - for the study of ancient sites. Applications of these techniques for ancient architectures built by bricks, stones and their challenging issues. Our recent improved thermoluminescence (imTL) technique is introduced in this study as an optimal solution for dating of ancient architectures having heterogeneous, multilayered and overlapped structures with highly reliable results compared to traditional TL methods. Besides, neutron activation analysis (NAA) and isotope ratio analysis are helpful for our study of ancient sites. We also briefly introduce in this study the important role of The Oc Eo-Ba The relic, the White Stone Citadel archaeological site and the Nguom rock shelter in the historical and archaeological aspects, based on which our improved TL dating technique can be applied.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: Ms THI NGOC HUE, Nguyen (Center for Nuclear Technology Hochiminh City)

Presenter: Ms THI NGOC HUE, Nguyen (Center for Nuclear Technology Hochiminh City)

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **69** Type: **poster presentation**

Polarised Deuteron Breakup as a Probe of the Nuclear Symmetry Energy

Wednesday 27 August 2025 19:18 (12 minutes)

The Nuclear Equation of State (EoS) provides a fundamental link between nuclear physics and astrophysics, yet its predictive power is limited by our incomplete understanding of the nuclear symmetry energy, $E_{\mathrm{sym}}(\rho)$. This critical component, which quantifies the energy cost of proton–neutron asymmetry, is well constrained at the saturation density found in stable nuclei, but remains a major uncertainty at the sub-saturation and supra-saturation densities relevant to neutron stars. This uncertainty leads to significant discrepancies in astrophysical models, particularly those predicting the mass–radius relationship of neutron stars.

This research outlines a novel laboratory experiment designed to directly constrain the symmetry energy, reducing our reliance on rare astrophysical observations. The core of the approach is to use the Improved Quantum Molecular Dynamics (ImQMD) framework to model the peripheral collision of a polarised deuteron with a heavy, neutron-rich target. The isovector force - a component of the strong nuclear interaction that distinguishes between protons and neutrons - acts attractively on the deuteron's proton and repulsively on its neutron. These opposing forces cause the two nucleons to scatter at different angles.

The resulting difference in scattering angle serves as a highly sensitive probe of the symmetry energy's "stiffness", a property parameterised by the variable γ in the model. By measuring the differential cross-sections of the outgoing protons and neutrons in an experiment conducted at RIKEN's Radioactive Isotope Beam Factory (RIBF) using the SAMURAI spectrometer, the data can be compared to a library of ImQMD simulations. This comparison enables the determination of the γ value that best fits the experimental results, providing a new and precise constraint on the nuclear symmetry energy —and ultimately refining our understanding of nuclear matter, from the laboratory to the cosmos.

Research field of your presentation

Experimental Low-energy nuclear physics

Authors: Mr TIAN, Baiting (Department of Physics, Tsinghua University); Dr ISOBE, Tadaaki (RIKEN Nishina Center); Prof. XIAO, Zhigang (Department of Physics, Tsinghua University); LUO, Zichen (Department of Physics, Tsinghua University)

Presenter: LUO, Zichen (Department of Physics, Tsinghua University)

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **70** Type: **oral presentation**

Development of ^{10,11}B Targets and Data Acquisition Systems for the Measurement of the ^{10,11}B(^{3}He,t)^{10,11}C Reactions

Monday 25 August 2025 16:40 (12 minutes)

Big Bang Nucleosynthesis (BBN) refers to the nuclear reactions that occurred approximately from 10 seconds to 20 minutes after the birth of the universe. These reactions produced light elements, mainly ^{2}H, ^{3}He, ^{4}He, and ^{7}Li. The standard BBN model reproduces the abundances of these elements with high precision, except for ^{7}Li. This agreement is regarded as strong evidence that the universe was once in a hot and dense state in the early phase of its evolution. However, BBN has an unresolved major issue known as the "cosmological lithium problem." The abundance of ^{7}Li calculated by BBN is approximately three times higher than the value inferred from astronomical observations. This discrepancy remains a serious challenge in modern physics.

Our research aims to address this ^{7}Li problem from the perspective of a nuclear experiment. ^{7}Li was produced primarily through the electron capture decay of ^{7}Be, which was synthesized during BBN. Many studies have already investigated the production of ^{7}Be, and there is little room to significantly alter its abundance in standard BBN calculations.

We investigate the possibility that ^{7}Be is transformed into nuclei other than ^{7}Li through unknown reaction channels before it undergoes electron capture. Theoretical studies have proposed that unknown resonant states exist in ^{10}C and ^{11}C. These nuclei are formed through the ^{7}Be + ^{3}He and ^{7}Be + ^{4}He reactions, respectively. If such resonant states exist and allow the conversion of ^{7}Be into other nuclei via these resonances, the final abundance of ^{7}Li in BBN would decrease.

We plan to measure the (^{3}He,t) reactions on ^{10}B and ^{11}B to search for these resonant states. The ^{7}Be + ^{3}He and ^{7}Be + ^{4}He resonances are expected to appear at excitation energies of 14.9–15.2 MeV in ^{10}C and 7.79–7.90 MeV in ^{11}C, respectively. Therefore, we will conduct high-resolution measurements using the Grand Raiden (GR) spectrometer at RCNP. In addition to detecting tritons with GR, we will also identify the decay particles from the excited states of ^{10}C and ^{11}C using Si detectors.

To conduct this experiment, we have carried out two technological developments. First, in collaboration with MicroMatter Technologies in Canada, we fabricated a self-supporting ^{11}B thin film target using pulsed laser deposition. The impurity content of this target was evaluated through the ^{10,11}B(d,p) reaction, which revealed approximately 8% contamination from ^{12}C. We are also planning to develop a ^{10}B target in July and to evaluate its impurity content using the same method. The results will be presented in this poster.

Second, we addressed the challenge of identifying coincident events between GR and Si detectors. The GR system is based on a trigger-less streaming DAQ, whereas the Si detectors use a trigger-based DAQ system. Since these two systems employ different data acquisition methods, reconstructing events between them required a creative approach. We solved this issue by reading the accepted trigger signal from the Si detectors with the GR system.

This poster presents the development of thin film targets, impurity evaluation results, and the integration of DAQ systems between GR and silicon detectors.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: 前里, 奨太朗 (大阪大学)

Co-authors: KOBAYASHI, Nobuyuki (RCNP, Osaka University); Prof. OTA, Shinsuke (RCNP, Osaka University); KAWABATA, Takahiro (Department of Physics, Osaka University); FURUNO, Tatsuya (Osaka University)

Presenter: 前里, 奨太朗 (大阪大学)

Session Classification: Young Scientist Session 2

Contribution ID: **71** Type: **oral presentation**

Real-time monitoring nuclear motion using high-order harmonic generation

Tuesday 26 August 2025 16:16 (12 minutes)

Nuclear motion in molecules can be monitored in real time by using the combination of two laser pulses, one for initializing the interest dynamics and one for exciting the molecule to emiss the high-frequency photons, which is also known as high-order harmonic generation (HHG). In this work, we study the possibility of using HHG to monitor the movement of hydrogen nucleus in the dissociative process of H2 molecule and isomerization of HCN/HNC. Within adiabtic approximation, the nuclear and electronic motions are treated separately and simulated by solving the time-dependent Schrodinger equation. The results show the significant changes in HHG spectra versus the movement of H nucleus in the interest processes, proving for the possibility of using HHG to monitor molecular dynamics in real time. The project is still ongoing.

Research field of your presentation

Others

Author: TRIEU, An (Institute of Fundamental and Applied Sciences, Duy Tan Univeristy, Vietnam)

Co-authors: Prof. PHAN, Ngoc-Loan (Computational Physics Key Laboratory, Ho Chi Minh City University of Education, Ho Chi Minh City, Vietnam); Prof. NGUYEN, Quang Hung (Institute of Fundamental and Applied Sciences, Duy Tan Univeristy, Vietnam); Prof. LE, Van-Hoang (Computational Physics Key Laboratory, Ho Chi Minh City University of Education, Ho Chi Minh City, Vietnam)

Presenter: TRIEU, An (Institute of Fundamental and Applied Sciences, Duy Tan Univeristy, Vietnam)

Session Classification: Young Scientist Session 3

Contribution ID: **72** Type: **oral presentation**

Status of the Si-detector development for FAZIA

Wednesday 27 August 2025 20:18 (12 minutes)

A unit detector of the FAZIA(Forward-angle A and Z Identification Array) telescope consists of three layers with two silicon sensors and a CsI scintillator. The silicon sensors measure the energy loss of charged particles passing through or stopped in the detector. The FAZIA detector can distinguish charges up to Z = 52 and isotopes up to Z = 25 by using ΔE-E correlation and the pulse shape analysis (PSA). The Korean FAZIA group has developed silicon sensors with the thickness of about 750 and 115 µm, employing various configurations. The energy resolutions measured by using the Am-241 alpha radiation source can provide one of the criteria for adoption. In this presentation, the characteristics of the prototype FAZIA silicon chips, measured by using the Am-241 source, are presented.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: Mr JEONG, Wonjun (INHA university)

Presenter: Mr JEONG, Wonjun (INHA university)

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **73** Type: **poster presentation**

Momentum kick model with multiplicity dependence in pp collisions and p-Pb collisions

Wednesday 27 August 2025 19:42 (12 minutes)

The long-range near-side ridge phenomenon in two-particle correlation($\Delta\varphi$-$\Delta\eta$) is one of powerful tools in exploring strong interaction. Although the hydrodynamic model describes this ridge structure in heavy ion collisions, this could not offer the explanation that ridge phenomenon occurs in the small systems such as pp collisions and p-Pb collisions because density and temperature are not enough to generate a hydrodynamic medium. The Momentum Kick Model (MKM) explains this effect via high-momentum jet particles transferring momentum to medium partons, inducing collective motion. We extend MKM to momentum kick model with multiplicity dependence (MKMwM), which is the MKM considering the average number of kicked partons with an impact parameter, using new experimental data to analyze and predict ridge structures in pp collisions and p-Pb collisions at the LHC.

Research field of your presentation

Theoretical high-energy nuclear physics

Author: NOH, Hyeongwoo (Inha University)

Presenter: NOH, Hyeongwoo (Inha University)

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **74** Type: **poster presentation**

Accurate velocity determination of stored ions in CSRe by correcting the non-isochronicity of time-of-flight detectors

Wednesday 27 August 2025 19:54 (12 minutes)

Accurate velocity determination of stored ions in storage rings plays a key role for nuclear mass measurements using the technique of Bρ-defined isochronous mass spectrometry (Bρ-IMS). However, the accuracy and precision of the ion's velocity are seriously deteriorated by the non-isochonicity of the time-of-flight (TOF) detectors. In this paper, the non-isochonicity is described by a correlation function between the time-delay difference, t_d, of the two TOF detectors and the orbital length, C, of the stored ions. The obtained correlation functions, $t_d \sim C$, allow for accurate determination of the ion's velocity which is then used for mass calibration in the Bρ-IMS technique. The present data analysis method is proved to be capable of resolving the effects of the non-isochronicity of TOF detectors.

Research field of your presentation

Authors: SHI, Jinyang; WANG, Meng; ZHANG, Yuhu

Co-authors: SI, Min; LITVINOV, Yu.A.

Presenter: SHI, Jinyang

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **75** Type: **oral presentation**

Sensitivity study of Neutrino opacities to Skyrme EOS in CCSNe

Tuesday 26 August 2025 16:04 (12 minutes)

When a core-collapse supernova (CCSN) explodes, it emits an enormous number of neutrinos, which carry away approximately 99% of the total energy.
These energetic neutrinos play a crucial role in both the explosion mechanism and nucleosynthesis as they propagate through the CCSN environment.
The propagation of neutrinos can be described by the general relativistic Boltzmann equation, in which the collision can affected by term equation of state .
In the equation of state, there are nonrelativistic models based on Skyrme interactions and relativistic models using relativistic mean field (RMF) theory.
Such modifications can alter neutrino opacities and transport properties, potentially affecting the supernova explosion and neutrino process.
We present a comparative study quantifying the sensitivity of neutrino interaction rates to representative Skyrme and RMF EOSs and discuss the resulting implications for neutrino luminosity predictions in CCSN.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: CHOI, Young_so (Soongsil University)

Co-authors: JANG, Dukjae (Gachon University); Prof. CHEOUN, Myung-Ki (Soongsil University)

Presenter: CHOI, Young_so (Soongsil University)

Session Classification: Young Scientist Session 3

Contribution ID: **76** Type: **poster presentation**

Multi-photon Propagation in an X-ray Cavity with Resonant Nuclei

Wednesday 27 August 2025 19:30 (12 minutes)

With the development of the X-ray source, stimulating nuclear quantum states directly becomes possible experimentally with synchrotrons and XFELs. The collective behaviors of the stimulated nuclear ensemble were studied theoretically in the past decade as a new frontier of nuclear science and quantum science. With specific numerical method and theoretical model, the correlation between scattering photons by the nuclear ensemble are the topic of my interest.

Research field of your presentation

Others

Author: DENG, Boyi (University of Chinese Academy of Science)

Presenter: DENG, Boyi (University of Chinese Academy of Science)

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **77** Type: **oral presentation**

Development and Full Realization of PLASEN: Precision Laser Spectroscopy for Exotic Nuclei

Wednesday 27 August 2025 16:28 (12 minutes)

Z. Yan¹, X. F. Yang¹, on behalf of PLASEN collaboration
¹School of Physics and State Key Laboratory of Nuclear Physics and Technology, Peking University, Beijing 100871, China.

The study of exotic structures in unstable nuclei lies at the forefront of nuclear physics [1]. The fundamental properties of these nuclei are intimately related to nuclear structure and nucleon-nucleon interactions, making them crucial for exploring a variety of exotic phenomena, including halo structure, island of inversion, and shell evolution. Laser spectroscopy can accurately measure the hyperfine structure and isotope shifts of atoms and ions, enabling the extraction of fundamental nuclear properties such as spins, magnetic moments, electric quadrupole moments, and charge radii in a nuclear-model-independent manner [2]. Among various laser spectroscopy techniques, collinear resonance ionization spectroscopy is distinguished by its high resolution and sensitivity, offering a powerful approach for studying unstable nuclei and evaluating nuclear structure models.

Our group focuses on developing advanced laser spectroscopy systems for radioactive ion beam facilities in China [3-4]. Currently, we have successfully established PLASEN (Precision Laser Spectroscopy for Exotic Nuclei), a fully functional high-resolution and high-sensitivity collinear resonance ionization laser spectroscopy system for off-line and on-line experiments. In off-line experiments, multiple lasers were employed for the excitation and ionization of the corresponding atoms, and optimal schemes with the highest efficiency were chosen. Under these conditions, the hyperfine structure spectra of ^{85, 87}Rb and ¹³³Cs were successfully measured [5-6]. With these experimental configurations established, on-line experiments have recently been conducted at BRIF in China, where the hyperfine structure spectra of unstable Rb isotopes have been measured.

In this presentation, the principles of collinear resonance ionization laser spectroscopy will be introduced, followed by an overview of the PLASEN setup. Recent on-line and off-line experimental configurations and results will be presented, along with an outline of future developments.

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[1] Ye, Y., Yang, X., Sakurai, H. et al. Physics of exotic nuclei. *Nat Rev Phys* **7**, 21–37 (2025). https://doi.org/10.1038/s42254-024-00782-5
[2] Yang, X., Wang, S., Wilkins, S. G. et al. Laser spectroscopy for the study of exotic nuclei. *Prog Part Nucl Phys* **129** (2023): 104005.
[3] Bai, S., Yang, X. et al. Commissioning of a high-resolution collinear laser spectroscopy apparatus with a laser ablation ion source. *Nucl Sci Tech* **33.1** (2022): 9.
[4] Wang, S., Yang, X. et al. Construction and commissioning of the collinear laser spectroscopy system at BRIF. *Nucl Instrum Meth A* **1032** (2022): 166622.
[5] Hu, H., Guo, Y. et al. Development and characterization of a high-resolution, high-sensitivity collinear resonance ionization spectroscopy system. *Sci Bull* (2025). https://doi.org/10.1016/j.scib.2025.06.036
[6] Guo, Y., Yan, Z. et al. Development of Cesium Laser Resonance Ionization Schemes for the PLASEN Experiment. *Chin Phys C* (2025). https://doi.org/10.1088/1674-1137/adf49e

Research field of your presentation

Experimental Low-energy nuclear physics

Authors: YAN, Zhou (Peking University); Prof. YANG, Xiaofei (Peking University)

Presenter: YAN, Zhou (Peking University)

Session Classification: Young Scientist Session 4

Contribution ID: **78** Type: **oral presentation**

Direct measurement of the carbon-carbon fusion cross section at stellar energies

Monday 25 August 2025 16:52 (12 minutes)

The carbon-carbon fusion reaction serves as a crucial reaction for stellar evolution and explosive events, significantly influencing the evolution of massive stars and the explosion of superburst in the Universe. Despite decades of research, there remains considerable uncertainty in the cross section, particularly at stellar energies below $E_{C.M.}$=3MeV. The extrapolation techniques cannot provide a clear picture of the reaction within the Gamow window. We measured the cross section of $^{12}C(^{12}C,a_{0})^{20}Ne$ in the energy range of $E_{C.M.}$=2.3 MeV to 3.6 MeV using an intense carbon beam with intensity up to 100 particle microamperes, provided by the LEAF accelerator in Lanzhou, and a novel detection system comprising a time projection chamber (TPC) and a silicon detector array. Our direct measurement results yield new values for the reaction cross section, indicating that further improvements are needed in the THM indirect method. A new reaction rate is recommended based on our experimental result.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: LI, Yunzhen (Institute of Modern Physics)

Presenter: LI, Yunzhen (Institute of Modern Physics)

Session Classification: Young Scientist Session 2

Contribution ID: **79** Type: **oral presentation**

Resonance of K*0(892) in and out of jets in pp collisions at sqrt(s) = 13.6 TeV

Monday 25 August 2025 17:04 (12 minutes)

Recent measurements of two-particle correlations within jets in high-multiplicity pp collisions at $\sqrt{s}$ = 13.6 TeV reveal flow-like patterns among jet constituents. Such effects were previously considered unique to heavy-ion collisions, suggesting that a hot, dense QCD medium may form even inside jets in small systems. As this medium hadronizes, substantial final-state hadronic interactions can persist, leading to significant modifications of short-lived resonance yields through (pseudo-)elastic scatterings with other hadrons after chemical freeze-out. To investigate this, we analyze yields of the short-lived K^{0} *meson using high-multiplicity jets in pp collision data at* $\sqrt{s}$ *= 13.6 TeV collected by the ALICE Collaboration during LHC Run 3. Charged-particle jets are reconstructed, and per-jet* K^0 yields are measured in and out of the jet cone. Comparing these yields for this resonance offers new insight into final-state hadronic interactions inside jets produced in small collision systems.

Research field of your presentation

Experimental high-energy nuclear physics

Author: LEE, Jimun (Sejong University)

Presenter: LEE, Jimun (Sejong University)

Session Classification: Young Scientist Session 2

Contribution ID: **80** Type: **oral presentation**

Development of an active target TPC for studying alpha cluster structure in 12C and 16O

Wednesday 27 August 2025 17:04 (12 minutes)

We aim to investigate alpha-clusters in alpha-conjugate nuclei, such as 12C and 16O, using the Active-Target Time Projection Chamber (AT-TPC). Performance test of prototype AT-TPCs were conducted using a 200 MeV/u carbon beam at the Heavy Ion Medical Accelerator in Chiba (HIMAC). The results from this test provide valuable insights for the development and optimization of the Sejong TPC-Drum, which will be utilized in the Large Acceptance Multi-Purpose Spectrometer (LAMPS) experiment for low-energy studies at RAON. In this presentation, we report on the performance results of the prototype AT-TPCs and the current status of the Sejong TPC-Drum.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: HWANG, Seonggeun (Sejong University)

Presenter: HWANG, Seonggeun (Sejong University)

Session Classification: Young Scientist Session 4

Contribution ID: **81** Type: **oral presentation**

Resonance of K*0(892) in and out of jets in pp collisions at sqrt(s) = 13.6 TeV

Wednesday 27 August 2025 20:06 (12 minutes)

Recent measurements of two-particle correlations within jets in high-multiplicity pp collisions at $\sqrt{s}$ = 13.6 TeV reveal flow-like patterns among jet constituents. Such effects were previously considered unique to heavy-ion collisions, suggesting that a hot, dense QCD medium may form even inside jets in small systems. As this medium hadronizes, substantial final-state hadronic interactions can persist, leading to significant modifications of short-lived resonance yields through (pseudo-)elastic scatterings with other hadrons after chemical freeze-out. To investigate this, we analyze yields of the short-lived K^{*0} *meson using high-multiplicity jets in pp collision data at $\sqrt{s}$ = 13.6 TeV collected by the ALICE Collaboration during LHC Run 3. Charged-particle jets are reconstructed, and per-jet* K^{*0} yields are measured in and out of the jet cone. Comparing these yields for this resonance offers new insight into final-state hadronic interactions inside jets produced in small collision systems.

Research field of your presentation

Experimental high-energy nuclear physics

Author: LEE, Jimun (Sejong University)

Presenter: LEE, Jimun (Sejong University)

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **82** Type: **poster presentation**

Calibration and Simulation of the Proton Polarimeter 2nd-FPP and Track Calibration using Cosmic Rays

Wednesday 27 August 2025 20:30 (12 minutes)

Nucleon–nucleon (NN) interactions inside nuclei are expected to be modified by nuclear medium effects. To investigate these effects, we are developing the focal-plane proton polarimeter (2nd-FPP), designed to measure proton polarization via the left–right asymmetry in elastic p–^{12}C scattering, with particle tracking provided by multi-wire drift chambers (MWDCs).
A calibration experiment at RCNP successfully separated p–^{12}C events from p–p events; however the effective analyzing power in the forward angular range was lower than reference values. GEANT4 simulations incorporating polarization effects reproduced this result, indicating that the discrepancy is likely due to overestimated scattering angles caused by bulging of the MWDC window films. To address this issue, we are calibrating the drift-time–to-distance relationship using cosmic rays. T The progress of this calibration will be reported.

Research field of your presentation

Author: 多恵, 佐藤 (九州大学大学院理学府物理学専攻)

Co-author: THE 2ND-FPP COLLABORATION

Presenter: 多恵, 佐藤 (九州大学大学院理学府物理学専攻)

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **83** Type: **poster presentation**

|Delta I| = 1/2 rule of hyperon decays in covariant baryon chiral perturbation theory

The ΔI = 1/2 rule is a universal pattern in weak interactions: decays involving an isospin change are dominated by transitions with ΔI = 1/2, far outweighing those with ΔI = 3/2. This regularity is surprising because weak interactions break many symmetries conserved in strong interactions, such as parity (P) and charge-parity (CP). Amid such extensive symmetry violation, the persistence of this rule is unexpected, making it a key puzzle in particle physics.
The famous example of ΔI = 1/2 rule is kaon decays, where it manifests as the isospin I = 0 final state being about 450 times more likely than the I = 2 state in K⟶ππ decays, reflecting the extreme enhancement of the ΔI = 1/2 transition over the ΔI = 3/2 transition. Specifically, the ratio of the real parts of the decay amplitudes, $Re(A_0)/Re(A_2)$, is measured to be approximately 22.4, a value far larger than naive expectations (Eur. Phys. J. C (2017) 77:10).
Lattice QCD calculations have offered key insights into the ΔI=1/2 rule. They reveal that the two dominant contributions to the ΔI=3/2 K⟶ππ correlation functions have opposite signs, leading to significant cancellation in ReA_2, with this effect present in calculations using physical quark masses and kinematics and for heavier pions at threshold. These contributions, which partially cancel in ReA_2, are the largest in ReA_0 and carry the same sign, thereby enhancing this amplitude (Phys. Rev. Lett. 110, 152001). These calculations, performed with physical quark masses and kinematics, have successfully reproduced the experimental value of A_2 and provided a non-perturbative foundation for understanding the rule's origin, though the precise dynamical mechanisms behind the large enhancement remain an active area of investigation (Phys. Rev. D 102, 054509).
Hyperons, as the hadronic counterparts of kaons, offer a complementary system to study the ΔI = 1/2 rule. Studying the ΔI = 1/2 rule in hyperons can provide supplementary information for understanding kaons and the relevant dynamical mechanisms in weak interactions. Early experimental results had large uncertainties, but theoretical studies, particularly within heavy-baryon chiral perturbation theory (HBChPT), suggested that the ΔI = 1/2 rule might also hold in hyperon decays, such as $\Lambda \to p\pi^-$ and $\Lambda \to n\pi^0$. These theories expect that observables like the ratio of asymmetry parameters ($\alpha\_\Lambda_0/\alpha\_\Lambda_-$) should approximate 1 if only ΔI = 1/2 transitions dominate. However, recent experiments, such as BESIII, reported deviations of around 10% in such ratios, suggesting at non-negligible ΔI = 3/2 contributions and challenging the strict validity of the rule in hyperon systems (arXiv:2508.03950). These results indicate that some important contributions may have neglected in previous theotical framework, such as some counterterms or parts of loop diagrams, which play a significant role in baryonic weak decays.
To address this discrepancy, we made efforts to re-examining the ΔI = 1/2 rule in hyperon decays using extended frameworks.We applied EOMS chiral perturbation theory to analyze the latest experimental data, with a more complete set of Feynman diagrams calculated.This research contributes to a deeper understanding of the ΔI = 1/2 rule and serves to examine the validity of chiral perturbation theory.

Research field of your presentation

Theoretical high-energy nuclear physics

Author: Mr 胥, 杰 (北京航空航天大学)

Co-authors: 李, 双一 (北京航空航天大学); Prof. 史, 瑞祥 (广西师范大学); Prof. 耿, 立升 (北京航空航天大学)

Presenter: 李, 双一 (北京航空航天大学)

Session Classification: Young Scietist Session 5 (Poster)

Contribution ID: **84** Type: **poster presentation**

Exploring the possible two-proton radioactivity of 38,39Ti

Two-proton (2⊠) radioactivity represents a rare decay mode that has been experimentally observed only in a selected few nuclei. The exploration of 2⊠ emission is crucial for elucidating the structure, mass, and nucleon-nucleon interactions within exotic proton-rich nuclei. 39Ti has long been postulated as a potential candidate for 2⊠ emission; however, experimental investigations have yet to confirm its 2⊠ decay. To provide more accurate information for further studies, we utilize the Gamow shell model (GSM) and the Gamow coupled channel (GCC) method to analyze the prospective 2⊠ radioactivity of isotopes 38,39Ti. Our calculations suggest that 39Ti is indeed a viable candidate for 2⊠ emission. Notably, the estimated partial 2⊠ decay width for 39Ti, predicted from the three-body GCC method, suggests that its 2⊠ decay could rival its ⊠ decay in likelihood, although this is highly dependent on the specific 2⊠ decay energy. Additionally, our analysis indicates a propensity for pairing between the valence protons in 39Ti. A similar investigative approach reveals that 38Ti exhibits a higher 2⊠ decay energy and a broader decay width than 39Ti, positioning it as a more promising candidate for 2⊠ decay.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: Mr HUANG, Bo (Institute of Modern Physics, Fudan University)

Presenter: Mr HUANG, Bo (Institute of Modern Physics, Fudan University)

Contribution ID: **85** Type: **poster presentation**

Antisymmetrized molecular dynamics for exotic nuclear structures

Antisymmetrized Molecular Dynamics (AMD) has emerged as a powerful microscopic framework for investigating exotic structures in unstable nuclei, especially those near the drip lines. Unlike traditional mean-field models, AMD treats each nucleon as a Gaussian wave packet, allowing the emergence of deformation, clustering, and halo phenomena from first principles without assuming predefined symmetries. This work presents a comprehensive study of exotic nuclear structures—including α clustering, neutron and proton halos, skin effects, and shape coexistence—within the AMD framework. We want to explore the structural evolution in light to medium-mass nuclei, analyze the impact of weak binding and continuum coupling, and highlight the role of isospin asymmetry and shell evolution. Our results will compared with experimental observables such as radii, energy spectra, and transition strengths, demonstrating the versatility of AMD in capturing the complex dynamics of exotic nuclei. This study underscores the importance of microscopic approaches in advancing our understanding of nuclear structure at the limits of stability.

Research field of your presentation

Theoretical Low-energy nuclear physics

Author: NIE, Xin (Fudan University)

Presenter: NIE, Xin (Fudan University)

Contribution ID: **86** Type: **poster presentation**

Evaluation of position detector SR-PPAC using ASAGI ASD readout electronics

The beamlines at RIBF of RIKEN use a delay-line parallel plate avalanche counter (DL-PPAC) as a standard heavy-ion detector. On the other hand, we are developing Strip-Readout PPAC (SR-PPAC), which reads out signals for each strip and raise position resolution by taking the weighted average of charge information. SR-PPAC uses the RPA-132 preamplifier discriminator developed by Hayashi Repic Co., Ltd. as a cathode strip readout electronics. However, RPA132 has low gain for SR-PPAC and it will not be available commercially. Therefore, the aim is to evaluate the specification of the ASAGI (AGASA based General Interface for wire) ASD readout electronics currently under development by the SPADI-Alliance, led by Osaka University RCNP, and to evaluate the position resolution and time resolution of SR-PPAC with ASAGI.

Research field of your presentation

Experimental Low-energy nuclear physics

Author: TSUCHIYA, Ryo (Rikkyo University)

Co-author: IMAI, Nobu (CNS)

Presenter: TSUCHIYA, Ryo (Rikkyo University)

Session Classification: Young Scietist Session 5 (Poster)