CNS Annual Report 2021

Report of Contributions

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

Eigenvector continuation in nuclear shell-model calculations

W propose a new workflow of shell-model calculations using a method called eigenvector continuation (EC).
It enables us to efficiently approximate the eigenpairs under a given Hamiltonian by previously sampled eigenvectors.

Primary authors: SHIMIZU, Noritaka (Center for Nuclear Study, the University of Tokyo); YOSHIDA, Sota (University of Tokyo)

Track Classification: Theoretical Nuclear Physics

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

CP violation appeared in the superheavy molecules and experimental possibilities

Molecules containing radioactive heavy elements can be produced to serve as sensitive probes to study the origin of the fundamental symmetry violation. In this report, the experimental possibilities to search for the electron electric dipole moment (EDM) using the several candidate of the molecules with the heavy element will be discussed, and the EDM enhancement factor is evaluated using the relativistic coupled cluster model.

Primary author: SAKEMI, Yasuhiro (CNS)

Co-authors: NAGAHAMA, Hiroki (The University of Tokyo); NAKAMURA, Keisuke (CNS, The University of Tokyo)

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

Contribution ID: **3** Type: **not specified**

Direct photon production in inelastic and high-multiplicity proton-proton collisions at √s = 13 TeV

Direct photon production at midrapidity in inelastic and high-multiplicity proton-proton (pp) collisions at a center-of-mass energy of $\sqrt{s}$ = 13 TeV at the LHC via virtual photon method are reported. The contributions from light-hadron decays are calculated from their measured cross sections in pp collisions at √s = 13 TeV in same charged multiplicity class. The contributions from semileptonic decay of heavy-flavor hadrons are estimated by a MC event generator PYTHIA. The measured dielectron spectra as a function of invariant mass in inelastic events and high-charged particle multiplicity events are fitted with a function to extract virtual photon fraction. In this report, virtual direct photon as a function of p_T are shown.

Primary authors: MURAKAMI, Hikari; Dr GUNJI, Taku (CNS, Univ. of Tokyo)

Track Classification: Experimental Nuclear Physics: PHENIX Experiment at BNL-RHIC and ALICE Experiment at CERN-LHC

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

Improved Optics for the OEDO Low Energy Mode used in the 130Sn Experiment

Report on ion optics study of BigRIPS-OEDO for 130Sn(d,p) experiment.

Primary author: CHILLERY, Thomas

Co-authors: MICHIMASA, Shin'ichiro (Center for Nuclear Study, the Univ. of Tokyo); Dr HWANG, Jongwon (Center for Nuclear Study, University of Tokyo); IMAI, Nobu (CNS); Dr OTA, Shinsuke (Center for Nuclear Study, the University of Tokyo); SHIMOURA, Susumu (Center for Nuclear Study, the University of Tokyo); YAKO, Kentaro

Track Classification: Accelerator and Instrumentation

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

Constraining the Primordial Lithium Abundance: New Cross Section Measurement of the 7Be + n Reactions Updates the Total 7Be Destruction Rate

This is condensed from the article in Astrophys. J. Lett. 915, L13 (2021).

The cosmological lithium problem (CLP) stems from the outstanding discrepancy between theoretical predictions and astronomical observations of primordial lithium abundances. For the radiogenic production of 7Li, 7Be plays a pivotal role in the Big Bang nucleosynthesis (BBN). Nevertheless, the data for neutron-induced 7Be destruction processes were still sparse, and especially lacked information on the contributions of transitions to the 7Li excited states. In this work, we have determined the 7Be(n,p_0)7Li, 7Be(n,p_1)7Li*, and 7Be(alpha,n)4He reaction cross sections by means of the Trojan Horse method. The present and the previous data were analyzed together by a multichannel R-matrix fit, providing an improved uncertainty evaluation of the (n,p_0) channel and the first-ever quantification of the (n,p_1) contribution in the BBN-relevant energy range. We implemented the revised total reaction rate summing both the (n,p_0) and (n,p_1) contributions in a state-of-the-art BBN code PRIMAT. As a consequence, the present nuclear-physics data offers a reduction of the predicted 7Li abundance by about one-tenth, which would impose a stricter constraint on BBN and head us in the correct direction to the CLP solution.

Primary authors: HAYAKAWA, Seiya; Dr LA COGNATA, Marco; Dr LAMIA, Livio; YAMAGUCHI, Hidetoshi (Center for Nuclear Study, the University of Tokyo); KAHL, Daid (University of Edinburgh); Mr ABE, Keijiro; Mr SHIMIZU, Hideki (CNS, Univ. of Tokyo); YANG, Lei (Center for Nuclear Study, University of Tokyo); BELIUSKINA, Olga (CNS); Dr CHA, Soomi; CHAE, Kyungyuk; CHERUBINI, Silvio (University of Catania and INFN-LNS); Dr FIGUERA, Pierpaolo; GE, zhuang (University of Jyväskylä); Prof. GULINO, Marisa; HU, Jun (Institute of Modern Physics, Chinese Academy of Sciences); INOUE, Azusa; IWASA, Naohito (Department of Physics, Tohoku university); Dr KIM, Aram; Dr KIM, Dahee; Dr KISS, Gabor; KUBONO, Shigeru (RIKEN Nishina Center); Prof. LA COMMARA, Marco; Prof. LATTUADA, Marcello; Ms LEE, Eunji; Dr MOON, Jun Young; Dr PALMERINI, Sara; Dr PARASCANDOLO, Concetta; Dr PARK, Suyeon; Dr PHONG, Vi; Dr PIERROUTSAKOU, Dimitra; Prof. PIZZONE, Rosario Gianluca; Dr RAPISARDA, Giuseppe Gabriele; Prof. ROMANO, Stefano; Prof. SPITALERI, Claudio; TANG, Xiaodong (Institute of Modern Physics, CAS); Dr TRIPPELLA, Oscar; Prof. TUMINO, Aurora; ZHANG, Ningtao (Institute of Modern Physics, Lanzhou, China)

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

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

The study on beam viewer photography technique of the emittance monitor for the accelerated ion beams by AVF Cyclotron

This is the report of the study on beam viewer photography technique of the emittance monitor for the accelerated ion beams by AVF Cyclotron.

Primary authors: KOTAKA, Yasuteru; KAMAKURA, Keita (CNS, UTokyo); YAMAGUCHI, Hidetoshi (Center for Nuclear Study, the University of Tokyo); IMAI, Nobu (CNS); SAKEMI, Yasuhiro (CNS); SHIMOURA, Susumu (Center for Nuclear Study, the University of Tokyo); Prof. HATANAKA, Kichiji (RCNP); Dr OHNISHI, Jyun-Ichi (RIKEN Nishina center); Dr GOTO, Akira (KEK IMSS)

Track Classification: Accelerator and Instrumentation

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

Production of direct photons via internal conversions in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV with ALICE at the LHC

Direct photon production via internal conversion $\gamma^* \to e^+e^-$ is discussed in this article.

Primary author: SEKIHATA, Daiki

Track Classification: Experimental Nuclear Physics: PHENIX Experiment at BNL-RHIC and ALICE Experiment at CERN-LHC

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

Development of Multiplexer circuit at CRIB

The CRIB facility had a limited number of cables to the counting room and feedthroughs of the detector chamber, which limited the number of channels that could be acquired from the detectors. In order to obtain more data, a multiplexer module called MUX made by Mesytec, which could convert 16 channels data into two energy outputs, two position outputs and one timing output, was introduced. However, when we took data from the alpha source for the test, we could not get the data correctly due to low-frequency noise. Therefore, a high-pass filter was introduced and combined with the MUX to get the data correctly. This circuit was used in the 26Si(alpha,p)29P experiment in January 2022 at CRIB, and data from many channels was able to be obtained.

Primary authors: OKAWA, Kodai; HAYAKAWA, Seiya; YAMAGUCHI, Hidetoshi (Center for Nuclear Study, the University of Tokyo); MA, Nanru (Center for Nuclear Study); SHIMIZU, Hideki (CNS, Univ. of Tokyo)

Track Classification: Accelerator and Instrumentation

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

Astrophysical 26Si(a,p)29P nuclear reaction rate study

X-ray bursts are interesting astrophysical phenomena that occur in binary star systems of neutron stars and companion stars. As the results of the X-ray bursts, the heavy elements up to the Sn-Te region can be synthesized within only a few seconds. The ^{26}Si(α,p)^{29}P nuclear reaction rate plays a crucial role in understanding the X-ray burst phenomena, since the reaction rate significantly affects the X-ray light curves and the abundances of heavy nuclei. To estimate the reaction rate at stellar temperatures, the ^{26}Si + α scattering experiment was performed at Center for the Nuclear Study Radioactive Ion Beam Separator (CRIB) of the University of Tokyo. The 26Si radioactive ion beam was produced through the ^{3}He(^{24}Mg,^{26}Si)n reaction by In-flight method. The wide energy range in ^{30}S was investigated by adopting the thick target method. The ^{26}Si radioactive ion beams were monitored by two PPACs. The recoiling α particles were detected by silicon detector telescope. The detail of experiment will be discussed.

Primary authors: KIM, Minju (Sungkyunkwan University); CHAE, Kyungyuk; HAYAKAWA, Seiya

Co-authors: ADACHI, satoshi; Dr CHA, Soomi; CHILLERY, Thomas; FURUNO, tatsuya; GU, gyungmo; HANAI, Shutaro (CNS,the university of Tokyo); IMAI, Nobuaki (CNS); KAHL, david; KAWABATA, Takahiro; KIM, chanhee; Dr KIM, Dahee; KIM, sohyun; KUBONO, Shigeru (RIKEN Nishina Center); KWAG, minsik; LI, jiatai; MA, Nanru (Center for Nuclear Study); MICHIMASA, Shin'ichiro (Center for Nuclear Study, the Univ. of Tokyo); NGUYEN, Kim Uyen; NGUYEN, ngoc duy; OKAWA, Kodai; SAKANASHI, kohsuke; SHIMIZU, Hideki (CNS, Univ. of Tokyo); SIRBU, oana; YAMAGUCHI, Hidetoshi (Center for Nuclear Study, the University of Tokyo); YOKOYAMA, rin; ZHANG, qian

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

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

An improved reaction rate for the 22Mg(a, p)25Al and its implications on understanding type-I x-ray bursts

A new measurement of 25Al+p resonant scattering was performed up to the astrophysically interested energy region of 22Mg(a, p)25Al. Several resonances were observed in the excitation functions, and their level properties have been determined based on an R-matrix analysis. An improved reaction rate of 22Mg(a, p)25Al was determined based on the level properties of the corresponding resonances. The new rate advances a state-of-the-art model to remarkably reproduce light curves of the GS 1826–24 clocked burster with mean deviation < 9%.

Primary authors: HU, Jun (Institute of Modern Physics, Chinese Academy of Sciences); YAMAGUCHI, Hidetoshi (Center for Nuclear Study, the University of Tokyo); Dr LAM, Yi Hua (Institute of Modern Physics, Chinese Academy of Sciences); HAYAKAWA, Seiya

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

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

High-resolution spectroscopy at OEDO-SHARAQ – demonstration of ion optics

We have designed ion optics at OEDO-SHARAQ for high-resolution spectroscopy and reported CNS annual report 2018. In the present volume, we will report a demonstration of the beam transport with the ion-optical design.

Primary authors: MICHIMASA, Shin'ichiro (Center for Nuclear Study, the Univ. of Tokyo); HWANG, Jongwon (Center for Nuclear Study, University of Tokyo); CHILLERY, Thomas; DOZONO, Masanori (Center for Nuclear Study, the University of Tokyo); OTA, Shinsuke (Center for Nuclear Study, the University of Tokyo); IMAI, Nobu (CNS); YAKO, Kentaro; SHIMOURA, Susumu (Center for Nuclear Study, the University of Tokyo)

Track Classification: Accelerator and Instrumentation

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

Space-charge distortion correction for the ALICE-TPC using machine learning methods

The development of the framework for the ALICE-TPC space-charge distortion correction using machine learning methods will be discussed in this article.

Primary author: BABA, Hitoshi

Co-authors: SEKIHATA, Daiki; GUNJI, Taku (CNS, Univ. of Tokyo)

Track Classification: Experimental Nuclear Physics: PHENIX Experiment at BNL-RHIC and ALICE Experiment at CERN-LHC

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

Design of the optical lattice trap as a tool for precision spectroscopy using heavy atoms

Precision spectroscopy of heavy atoms, including francium, is expected to provide insight into the origins of fundamental symmetry violation. The key for achieving high experimental sensitivity is to cool the atoms and trap them within the measurement region. We report on the design of the optical lattice trap that is to be installed in our beamline for production and laser cooling of francium.

Primary author: OZAWA, Naoya (Center for Nuclear Study, The University of Tokyo)

Co-authors: NAKAMURA, Keisuke (CNS, The University of Tokyo); NAGAHAMA, Hiroki (The University of Tokyo); SAKEMI, Yasuhiro (CNS); Mr NAGASE, Shintaro (Center for Nuclear Study, The University of Tokyo); Mr NAKASHITA, Teruhito (Graduate School of Arts and Sciences, University of Tokyo)

Track Classification: Accelerator and Instrumentation

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

The search for double Gamow–Teller giant resonance at RIBF

We are aiming at the first observation of the giant resonance state in the double Gamow–Teller transition (Double Gamow–Teller Giant Resonance, DGTGR).
We utilize the double-charge exchange reaction (^{12}C, ^{12}Be(0^+_2)) reaction for the observation of the DGTGR.
We performed the first measurement of the (^{12}C, ^{12}Be(0^+_2)) at RIBF in May 2021.
In this contribution, the outline of the experiment and the preliminary result will be reported.

Primary author: SAKAUE, Akane (CNS)

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

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

Correlating the nuclear Schiff moment of ^{129}Xe with the magnetic moment

We compute the nuclear Schiff moment that is induced from the nucleon electric dipole moment by using the nuclear shell model. Our study establishes the strong correlation of the leading order contribution with the magnetic moment for ^{129}Xe. It may considerably reduce the theoretical uncertainty. We evaluate the influence of relevant single particle levels outside the standard model space and the next-to-leading order contribution. It is found that those secondary effects do not disturb the useful correlation. We also perform a shell-model calculation of ^{199}Hg, which provides a higher sensitivity to the neutron electric dipole moment than previous predictions.

Primary authors: YANASE, Kota; Prof. SHIMIZU, Noritaka (University of Tsukuba); Prof. HIGASHIYAMA, Koji (Chiba Institute of Technology); Prof. YOSHINAGA, Naotaka (Saitama University)

Track Classification: Theoretical Nuclear Physics

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

Shape transition of Nd and Sm isotopes and neutrinoless double-beta decay nuclear matrix element of 150Nd

We performed quasi-particle vacua shell-model calculations for even-even Nd and Sm isotopes. We discuss shape transition of Nd and Sm isotopes and neutrinoless double-beta decay nuclear matrix element of 150Nd.

Primary author: Dr TSUNODA, Yusuke (Center for Nuclear Study, the University of Tokyo)

Track Classification: Theoretical Nuclear Physics

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

The 3H(t,3He)3n experiment: the first experiment with 3H target at RIBF

We performed the missing mass spectroscopy of the three-neutron system via the 3H(t,3He)3n reaction at 170 MeV/u with the spectrometer SHARAQ. This was a first tritium target experiment at RIBF. We report on the experimental conditions.

Primary authors: Dr MIKI, Kenjiro (Tohoku University); SHARAQ11 COLLABORATION

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

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

Development of the cold Francium source with laser cooling technique for the atomic electric dipole moment search

We report a magneto-optical trap (MOT) to produce a cold francium source. Since francium has no stable isotope and its production is limited, a high-efficiency trap is needed. We have succeeded in rubidium MOT and optimized trap parameters to maximize the number of capture atoms using rubidium.

Primary authors: NAGAHAMA, Hiroki (The University of Tokyo); NAKAMURA, Keisuke (CNS, The University of Tokyo); SAKEMI, Yasuhiro (CNS)

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

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

Study of the production of high-spin isomers in fragmentation reaction of 58Ni and 59Co beams at 350 MeV/u

Giant monopole resonance of high spin isomer are one of the most attractive topics in the view of the resonance energy by comparing these energy of the isomer with ground sate.
To achieve high beam intensity and isomer ratio for the GMR experiment, we need to optimize some prameter in the fragmentation reaction.
In this report, we will show the result and discussion of the angular momentum transfer dependence of linear momentum distribution with changing the momentum transfer and initial spin in the projectile fragmentation.

Primary author: KAWATA, Keita (Center for Nuclear Study, University of Tokyo)

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

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

ECR Plasma Studies for Heavy Ion Production at HyperECR Ion Source

Recently we have been conducting research on ECR plasma using HyperECR Ion Source. Generally, a state of plasma is characterized by physical quantities such as electron density, electron temperature, and confinement time of ions. Those can be controlled by various operating parameters. Using Krypton ions, the effects of those parameters on heavy-ion production are studied.

Primary authors: KAMAKURA, Keita (CNS, UTokyo); KOTAKA, Yasuteru; Dr NAKAGAWA, Takahide (Nishina Center for Accelerator-Based Science, RIKEN); Dr OHNISHI, Jun-ichi (Nishina Center for Accelerator-Based Science, RIKEN); Dr HATANAKA, Kichiji (Research Center for Nuclear Physics, Osaka University); Dr GOTO, Akira (Institute of Materials Structure Science, KEK); YAMAGUCHI, Hidetoshi (Center for Nuclear Study, the University of Tokyo); IMAI, Nobu (CNS); SHIMOURA, Susumu (Center for Nuclear Study, the University of Tokyo); SAKEMI, Yasuhiro (CNS)

Track Classification: Accelerator and Instrumentation

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

Development of position-sensitive mosaic detector

In order to design the experiments to study Very/Super Heavy Nuclei (VHN/SHN) as well as towards Island of Stability, a model which can predict reaction cross section precisely is needed. However, reaction dynamics for Fusion-Evaporation reaction has not been eastablished yet. In particular, quantitative understanding of fusion hindrance effect is far from being achieved due to lack of experimental studies. Several experiments have been scheduled at HIMAC to evaluate the fusion hindrance effect in sub-symmetric systems. To extract fusion cross section, we will measure the energies of α particles of Evaporation Residuals (ERs). After the reaction, ERs will be stopped in the back material of the target and emit α particles at various angles. To compensate for the angular difference, a mosaic-type detector made of Si Photo-Diodes (PDs) has been developed. The details of the detector will be given.

Primary authors: LI, Jiatai (Center for Nuclear Study, University of Tokyo); IMAI, Nobu (CNS); KOJIMA, Reiko; CHILLERY, Thomas; MICHIMASA, Shin'ichiro (Center for Nuclear Study, the Univ. of Tokyo)

Track Classification: Accelerator and Instrumentation

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

Measurement of long-range two-particle correlation and pseudorapidity dependence of v_2 with ALICE

TBA

Primary author: SEKIGUCHI, Yuko (CNS)

Track Classification: Experimental Nuclear Physics: PHENIX Experiment at BNL-RHIC and ALICE Experiment at CERN-LHC

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

Angular distribution of the transfer reaction of 79Se(d,p) in inverse kinematics

To evaluate the neutron capture reaction on 79Se, we have studied the (d,p) reaction on 79Se in inverse kinematics at OEDO. To evalute the spin-dependent gamma emission probabilities at the unbound states, the reaction mechanism of the transfer reaction is needed to be cleared. We studied the double differential cross section of the trasnfer reaction, which are in good agreement with the theoretical model of the pre-equilibrium reaction. The neutron capture reaction on 79Se is also given with the updated the gamma emission probability.

Primary authors: IMAI, Nobu (CNS); DOZONO, Masanori (Center for Nuclear Study, the University of Tokyo); MICHIMASA, Shin'ichiro (Center for Nuclear Study, the Univ. of Tokyo); OTA, Shinsuke (Center for Nuclear Study, the University of Tokyo); HAYAKAWA, Seiya; KAWATA, Keita (Center for Nuclear Study, University of Tokyo); KITAMURA, Noritaka; Mr MASUOKA, Shoichiro (Center for Nuclear Study, the University of Tokyo); TSUNODA, Rieko

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

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

Single particle state coupled to the second 0+ state in 97Zr

The sudden onset of the deformation has been well known around 100Zn. This phenomenon is called as the quantum phase transition. In the theoretical calculations with the shell model framework, the deformation starts in the second 0+ state at 96Zr. We studied the inelastic decay to the scond 0+ state from the isobaric analog resonances of 97Zr by proton scattering on 96Zr at Kyushu University. The clear resonances have been observed in the exciation function of the inelastic channel. In addition, the angular distribution of the protons indicate the spin of 5/2+, which is different from the spin of the ground state.
This is the direct evidence of the deformation of the second state.

Primary authors: IMAI, Nobu (CNS); TSUNODA, Rieko; DOZONO, Masanori (Center for Nuclear Study, the University of Tokyo); KITAMURA, Noritaka; MICHIMASA, Shin'ichiro (Center for Nuclear Study, the Univ. of Tokyo); SHIMIZU, Noritaka (Center for Nuclear Study, the University of Tokyo)

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

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

Global commissioning of ALICE upgrade in 2021

This paper describes ALICE global commissioning performed in 2021 and achievements with pilot beams in 2021.

Primary author: GUNJI, Taku (CNS, Univ. of Tokyo)

Track Classification: Experimental Nuclear Physics: PHENIX Experiment at BNL-RHIC and ALICE Experiment at CERN-LHC

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

Overview of the activities with the gaseous active target CAT-M

Upgrade of the CAT-M and its performance evaluation, and the deuteron inelastic scattering measurement on 132Xe, 80Kr, 86Kr at HIMAC will be summarized

Primary author: OTA, Shinsuke (Center for Nuclear Study, the University of Tokyo)

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

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

Development and performance evaluation of Mini TPC for tracking heavy-ion high-intensity beam in CAT-M

For high-precision measurement of giant monopole resonance, it is necessary to measure the momentum of beam particle and recoil particles in the vicinity of reaction point with high precision. we have developed a new compact time projection chamber (Mini TPC) that can be irradiated with high-intensity heavy-ion beams, and performed heavy-ion beam irradiation experiments at HIMAC. In present study, We will report the results of simulation and performance for high-intensity heavy-ion beams.

Primary author: ENDO, Fumitaka (Tohoku Univ)

Co-authors: OTA, Shinsuke (Center for Nuclear Study, the University of Tokyo); KOJIMA, Reiko

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

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

Simulation studies of SR-PPAC

Strip Readout PPAC (SR-PPAC) has a high-speed response for heavy-ion beams owing to correcting signals of electrons drifting between narrow electrodes with no delay. We confirmed that the detector can be applied to RI beams with even more than several 10^5 Hz.
It is expected that SR-PPAC has a good time resolution owing to the fast response. The timing of signal correction is affected by the fluctuation in the process of generating electron avalanche. We performed the simulation of PPAC to estimate the time resolution and obtain a better understanding of the characteristic of PPAC. In this paper, the details of the simulation and the results are reported.

Primary author: Mr HANAI, Shutaro (CNS, the University of Tokyo)

Co-authors: Dr OTA, Shinsuke (RCNP, Osaka University); Dr KOJIMA, Reiko (CNS, the University of Tokyo); Dr DOZONO, Masanori (Kyoto University); Dr IMAI, Nobuaki (CNS, the University of Tokyo); Dr MICHIMASA, Shin'ichiro (CNS, the University of Tokyo); Prof. SHIMOURA, Susumu (CNS, the University of Tokyo); Dr ZENIHIRO, Juzo (Kyoto University); Mr INABA, Kento (Kyoto University); Mr HIJIKATA, Yuto (Kyoto University)

Track Classification: Accelerator and Instrumentation

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

Three-quasiparticle isomers in odd-even 159 , 161 Pm : Calling for modified spin-orbit interaction for the neutron-rich region

Neutron-rich Pm ($Z = 61$) isotopes were studied by delayed γ -ray spectroscopy at RIBF, RIKEN Nishina Center using the in-flight fission of a 345 MeV/nucleon ^{238}U beam. A cluster-type Ge detector array, EURICA, was used to measure the delayed γ rays from stopped ions. Isomeric γ decays were observed in ^{159}Pm and ^{161}Pm with half-lives of 4.97(12) μs and 0.79(4) μs , respectively. Level schemes for ^{159}Pm and ^{161}Pm were constructed in this study. The isomeric states of ^{159}Pm and ^{161}Pm could be interpreted as two quasiparticle excitations of neutrons with the configurations of $\nu(7/$

$2[633]\otimes 5/2[523])$ and $\nu(7/2[633]\otimes 1/2[521])$, respectively. They are analogous to the isomers that have been observed systematically in other even-mass $N=98$ and $N=100$ isotones in this region. A projected shell model calculation was performed and it reproduced the order of three-quasiparticle states only if new Nilsson parameters with an N-dependent spin-orbit interaction were used. This work demonstrates that the strength of spin-orbit interactions in standard Nilsson parameters needs to be modified to study the properties of neutron-rich rare-earth nuclei around $A=165$, and provides new evidence supporting the existence of the deformed $N=$

98
subshell gap in odd-mass nuclei for the first time.

Primary authors: YOKOYAMA, R.; IDEGUCHI, E.; SIMPSON, G. S.; TANAKA, Mn.; SUN, Yang; LV, Cui-Juan; LIU, Yan-Xin; WANG, Long-Jun; NISHIMURA, S.; DOORNENBAL, P.; LORUSSO, G.; S\"OERSTR\"OM, P.-A.; SUMIKAMA, T.; WU, J.; XU, X. Y.; AOI, N.; BABA, H.; BELLO GARROTE, F. L.; BENZONI, G; BROWNE, F.; DAIDO, R.; FANG, Y.; FUKUDA, N.; GOTTARDO, A.; GEY, G.; GO, S.; INABE, S.; ISOBE, T.; KAMEDA, D.; KOBAYASHI, K.; KOBAYASHI, M.; KOJOUHAROV, I.; KOMATSUBARA, T.; KUBO, T.; KURZ, N.; KUTI, I.; LI, Z.; MATSUSHITA, M.; MICHIMASA, S.; MOON, C. B.; NISHIBATA, H.; NISHIZUKA, I.; ODAHARA, A.; PATEL, Z.; RICE, S.; SAHIN, E.; SAKURAI, H.; SHAFFNER, H.; SINCLAIR, L.; SUZUKI, H.; TAKEDA, H.; TAPPROGE, J.; VAJTA, Zs.; WATANABE, H.; YAGI, A.

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies

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

TEST

test

Primary author: NAGAHAMA, Hiroki (The University of Tokyo)

Track Classification: Experimental Nuclear Physics: Low and Intermediate Energies