

## Nuclear Science and Transmutation Research Division Radioactive Isotope Physics Laboratory

### 1. Abstract

This Laboratory works as one of core research groups conducting programs at the world-premiere heavy-ion accelerator facility of RIKEN “RI Beam Factory (RIBF).” The Laboratory explores exotic nuclear structures and dynamics in exotic nuclei that have never been investigated before, such as those with largely imbalanced proton and neutron numbers. Our aim is to develop new experimental techniques utilizing fast radioactive isotope (RI) beams at RIBF, to discover new phenomena and properties in exotic nuclei. The Laboratory is focusing three major subjects; shell evolution of very neutron-rich nuclei, the  $r$ -process path and equation-of-state in asymmetric nuclear matter. The Laboratory has initiated international collaborations for in-beam gamma spectroscopy, decay spectroscopy and heavy-ion induced reactions, and has formed a discussion forum for next generation gamma-ray detectors.

### 2. Major Research Subjects

- (1) Study of structure and dynamics of exotic nuclei through developments of new tools in terms of reaction- and technique-based methodology
- (2) Research on EOS in asymmetric nuclear matter via heavy-ion induced reactions
- (3) Detector developments for spectroscopy and reaction studies

### 3. Summary of Research Activity

#### (1) In-beam gamma spectroscopy

In the medium and heavy mass region explored at RIBF, collective natures of nuclei are one of important subjects, which are obtained through production and observation of high excited and high spin states. To populate such states, heavy-ion induced reactions such as fragmentation, fission are useful. So far, we have developed two-step fragmentation method as an efficient method to identify and populate excited states, and lifetime measurements to deduce transition strength.

Devices utilized for the in-beam gamma spectroscopy are ZeroDegree Spectrometer (ZDS) and a NaI array DALI2. Since the end of 2008, the first spectroscopy on nuclei island-of-inversion region was performed, we have explored step-by-step new and unknown regions in the nuclear chart. The second campaign in 2009 was organized to study background components originating from atomic processes in a heavy target. Neutron-rich nuclei at  $N = 20$  to 28 were studied in 2010. In 2011–2013, we conducted experiment programs for Ca-54, Ni-78, neutron-rich nuclei at  $N = 82$  and neutron-deficient nuclei at  $Z = 50$ .

A multitude of data obtained with inelastic, nucleon knock-out, fragmentation channels have been analyzed and published. In 2011–2013, collective natures of Mg-36, 38 and Si-42 were both published in PRL. Excited states firstly observed in Ca-54 were reported in Nature to demonstrate a new nuclear magic number of 34. Fragmentation reaction has been found efficient for nuclei with  $A > 100$  and low-lying excited state in Pd-126 has been successfully observed and reported in PRC. In 2019, results of the first spectroscopy of  $^{40}\text{Mg}$  was published in PRL, to demonstrate the exotic structure which is very different from in other neutron-rich Mg isotopes.

To further strengthen the in-beam gamma spectroscopy at RIBF, we have proposed a new setup of MINOS + DALI2 to search for the 1st excited states in even-even neutron-rich nuclei with  $Z \sim 20$  to 40. The program was submitted to the PAC 2013 as a new category of proposal, “proposal for scientific program” and was S-ranked. A dedicated collaboration “SEASTAR” has been established as a subset of in-beam gamma collaboration “SUNFLOWER.” The three campaigns were organized in 2014, 2015 and 2017 to study very neutron-rich isotopes, and were very productive to access very neutron-rich nuclei such as Ar-52, Ca-56, Ni-78, Kr-100, Zr-110. In 2019, the result of the first spectroscopy of Ni-78 was published in Nature.

A new project of high resolution gamma spectroscopy with fast beams “HiCARI” has been proposed at PAC 2018. MINIBALL and several Ge tracking detectors from Japan, Europe, the USA and Korea are being combined to form an array of germanium detectors. The new setup aims to accelerate researches of the nuclear structure by observing gamma-lines in even-odd nuclei and measuring lifetimes of excited states. The two workshops were organized in 2019, and the machine time of 43.5 days in total was approved at PAC 2019. A part of the HiCARI programs was successfully conducted in 2020 and 2021.

Concerning a next generation detector, a discussion forum has been established to write up a white paper on tracking germanium detectors and high-efficient crystal detectors such LaBr<sub>3</sub> and GAGG.

#### (2) Decay spectroscopy

Beta- and isomer-spectroscopy is an efficient method for studying nuclear structure, especially for non-yrast levels. We had accumulated experimental techniques at the RIPS facility to investigate nuclear structure in light mass region via beta-gamma and beta- $p$  coincidence. Concerning the medium and heavy mass region available at RIBF, we have developed two position-sensitive active-stoppers, strip-silicon detectors and a cylindrical active stopper called CAITEN, to achieve a low-background measurement by taking correlation between heavy ion stop position and beta-ray emission position. A site of decay-spectroscopy at the new facility of RIBF is the final focal plane of ZDS, where high precision of TOF in particle identification is obtained due to a long flight path from BigRIPS to ZDS.

At the end of 2009, the first decay spectroscopy was organized with a minimum setup of four clover gamma detectors and silicon strip detectors, to study neutron-rich nuclei with  $A \sim 110$ . The first campaign was found successful and efficient to publish four letter articles in 2011, two PRL’s and two PLB’s. One of the PRL papers is associated to the  $r$ -process path where half-lives for 18

neutron-rich nuclei were determined for the first time. The other PRL paper reported a finding of deformed magic number 64 in the Zr isotopes.

The success of the first decay-spectroscopy campaign stimulated to form a new large-scale collaboration “EURICA,” where a twelve Euroball cluster array is coupled with the silicon-strip detectors to enhance gamma efficiency by a factor of 10. A construction proposal of “EURICA” was approved in the PAC 2011, and the commissioning was successfully organized in spring 2012. Since then, physics runs had been conducted for programs approved to survey nuclei of interest as many as possible, such as Ni-78, Pd-128, Sn-100. The EURICA collaboration finished its physics programs in summer 2016. So far, 54 papers including 14 PRL’s and 13 PLB’s were published. One of the highlights is discovery of a seniority isomer in Pd-128, of which cascade gamma decay gives the energy of first excited state and robustness of  $N = 82$  magic number, and the other is a half-life measurement for 110 neutron-rich nuclei across the  $N = 82$  shell gap, which shows implications for the mechanism and universality of the  $r$ -process path.

Beta-delayed neutron emission probability of medium and heavy neutron-rich nuclei is important to understand nuclear structure and the  $r$ -process path. In 2013, a new collaboration “BRIKEN” has been established to form a He-3 detector array. A present design of the array has neutron efficiency as high as 70% up to 3 MeV. The array was coupled with the AIDA silicon strip system. A construction proposal was approved at the PAC 2013 and three physics proposals have been approved. The commissioning run was conducted in autumn 2016. The major physics runs were conducted in 2017–2021.

A new project “IDATEN” has been launched in 2021 to measure lifetime of excited states with a large size LaBr<sub>3</sub> array, which is formed by combination of FATIMA and Khala arrays. The construction proposal was submitted to PAC, 2021, and proposals with IDATEN will be evaluated at PAC, 2022.

The CAITEN detector was successfully tested with fragments produced with a Ca-48 beam in 2010.

### (3) Equation-of-state via heavy-ion central collisions

Equation-of-state in asymmetric nuclear matter is one of major subjects in physics of exotic nuclei. Pi-plus and pi-minus yields in central heavy ion collisions at the RIBF energy are considered as one of EOS sensitive observables at the RIBF energy. To observe charged pions, a TPC for the SAMURAI spectrometer is being constructed under an international collaboration “S $\pi$ RIT,” Construction proposal was submitted at the PAC 2012, and physics proposals were approved at the PAC 2012 and 2013. The physics runs were successfully conducted in spring 2016. The first three papers were published in 2020 and 2021. One of them has been ranked as the TOP 1% paper by WoS in 2021.

An international symposium “NuSYM” on nuclear symmetry energy was organized at RIKEN July 2010 to invite researchers in three sub-fields, nuclear structure, nuclear reaction and nuclear astrophysics, and to discuss nuclear symmetry energy together. Since then, the symposium series have been held every year and been useful to encourage theoretical works and to strengthen the collaboration.

### (4) Nucleon correlation and cluster in nuclei

Nucleon correlation and cluster in nuclei are matters of central focus in a “beyond mean-field” picture. The relevant programs with in-beam gamma and missing-mass techniques are to depict nucleon condensations and correlations in nuclear media as a function of density as well as temperature. Neutron-halo and -skin nuclei are objects to study dilute neutron matter at the surface. By changing excitation energies in neutron-rich nuclei, clustering phenomena and role of neutrons are to be investigated.

In 2013, two programs were conducted at the SAMURAI spectrometer. One is related to proton-neutron correlation in the C-12 nucleus via  $p$ - $n$  knockout reaction with a carbon target. The other is to search for a cluster state in C-16, which was populated via inelastic alpha scattering. The data is being analyzed.

In 2018, a new project based on missing mass spectroscopy was launched to investigate an exotic cluster state in a very proton-rich nucleus. The experiment was organized at GANIL with combination of RIKEN liquid hydrogen target CRYPTA and the MUST2 detector array in 2018.

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## List of Publications & Presentations

### Publications

#### [Original Papers]

- R. -B. Gerst, A. Blazhev, K. Moschner, P. Doornenbal, A. Obertelli, K. Nomura, J. -P. Ebran, S. Hilaire, J. Libert, G. Authelet, H. Baba, D. Calvet, F. Chateau, S. Chen, A. Corsi, A. Delbart, J. -M. Gheller, A. Giganon, A. Gillibert, V. Lapoux, T. Motobayashi, M. Niikura, N. Paul, J. -Y. Rousse, H. Sakurai, C. Santamaria, D. Steppenbeck, R. Taniuchi, T. Uesaka, T. Ando, T. Arici, F. Browne, A. M. Bruce, R. Carroll, L. X. Chung, M. L. Cortes, M. Dewald, B. Ding, F. Flavigny, S. Franchoo, M. Gorska, A. Gottardo, J. Jolie, A. Jungclaus, J. Lee, M. Lettmann, B. D. Linh, J. Liu, Z. Liu, C. Lizarazo, S. Momiyama, S. Nagamine, N. Nakatsuka, C. R. Nita, C. Nobs, L. Olivier, R. Orlandi, Z. Patel, Zs. Podolyak, M. Rudigier, T. Saito, C. Shand, P. -A. Soderstrom, I. Stefan, V. Vaquero, V. Werner, K. Wimmer, and Z. Xu, “ $\gamma$ -ray spectroscopy of low-lying yrast and non-yrast states in neutron-rich  $^{94,95,96}\text{Kr}$ ,” *Phys. Rev. C* **105**, 024302 (2022).
- S. Kim, J. Hwang, Y. Satou, N. A. Orr, T. Nakamura, Y. Kondo, J. Gibelin, N. L. Achouri, T. Aumann, H. Baba, F. Delaunay, P. Doornenbal, N. Fukuda, N. Inabe, T. Isobe, D. Kameda, D. Kanno, N. Kobayashi, T. Kubo, S. Leblond, J. Lee, F. M. Marques, R. Minakata, T. Motobayashi, D. Murai, T. Murakami, K. Muto, T. Nakashima, N. Nakatsuka, A. Navin, S. Nishi, S. Ogoshi, H. Otsu, H. Sato, Y. Shimizu, H. Suzuki, K. Takahashi, H. Takeda, S. Takeuchi, R. Tanaka, Y. Togano, A. G. Tuff, M. Vandebrouck, and K. -I. Yoneda, “Spectroscopy of  $^{17}\text{C}$  above the neutron separation energy,” *Few-Body Syst.* **63**, 21 (2022).
- T. Koiwai, K. Wimmer, P. Doornenbal, A. Obertelli, C. Barbieri, T. Duguet, J. D. Holt, T. Miyagi, P. Navratil, K. Ogata, N. Shimizu, V. Soma, Y. Utsuno, K. Yoshida, N. L. Achouri, H. Baba, F. Browne, D. Calvet, F. Chateau, S. Chen, N. Chiga, A. Corsi, M. L. Cortes, A. Delbart, J. -M. Gheller, A. Giganon, A. Gillibert, C. Hilaire, T. Isobe, T. Kobayashi, Y. Kubota, V. Lapoux, H. N. Liu, T. Motobayashi, I. Murray, H. Otsu, V. Panin, N. Paul, W. Rodriguez, H. Sakurai, M. Sasano, D. Steppenbeck, L. Stuhl, Y. L. Sun, Y. Togano, T. Uesaka, K. Yoneda, O. Aktas, T. Aumann, L. X. Chung, F. Flavigny, S. Franchoo, I. Gasparic, R. -B. Gerst, J. Gibelin, K. I. Hahn, D. Kim, Y. Kondo, P. Koseoglou, J. Lee, C. Lehr, B. D. Linh, T. Lokotko, M. MacCormick, K. Moschner, T. Nakamura, S. Y. Park, D. Rossi, E. Sahin, P. -A. Soderstrom, D. Sohler, S. Takeuchi, H. Toernqvist, V. Vaquero, V. Wagner, S. Wang, V. Werner, X. Xu, H. Yamada, D. Yan, Z. Yang, M. Yasuda, and L. Zanetti, “A first glimpse at the shell structure beyond  $^{54}\text{Ca}$ : Spectroscopy of  $^{55}\text{K}$ ,  $^{55}\text{Ca}$ , and  $^{57}\text{Ca}$ ,” *Phys. Lett. B* **827**, 136953 (2022).
- B. Le Crom, M. Assie, Y. Blumenfeld, J. Guillot, H. Sagawa, T. Suzuki, M. Honma, N. L. Achouri, B. Bastin, R. Borcea, W. N. Catford, E. Clement, L. Caceres, M. Caamano, A. Corsi, G. De France, F. Delaunay, N. De Sereville, B. Fernandez-Dominguez, M. Fisichella, S. Franchoo, A. Georgiadou, J. Gibelin, A. Gillibert, F. Hammache, O. Kamalou, A. Knapton, V. Lapoux, S. Leblond, A. O. Macchiavelli, F. M. Marques, A. Matta, L. Menager, P. Morfouace, N. A. Orr, J. Pancin, X. Pereira-Lopez, L. Perrot, J. Piot, E. Polacco, D. Ramos, T. Roger, F. Rotaru, A. M. Sanchez-Benitez, M. Senoville, O. Sorlin, M. Stanoiu, I. Stefan, C. Stodel, D. Suzuki, J. -C. Thomas, and M. Vandebrouck, “Neutron-proton pairing in the  $N = Z$  radioactive  $fp$ -shell nuclei  $^{56}\text{Ni}$  and  $^{52}\text{Fe}$  probed by pair transfer,” *Phys. Lett. B* **829**, 137057 (2022).
- W. P. Liu, Z. H. Li, J. J. He, X. D. Tang, G. Lian, J. Su, Y. P. Shen, Z. An, F. Q. Chao, J. J. Chang, L. H. Chen, H. Chen, X. J. Chen, Y. H. Chen, Z. J. Chen, B. Q. Cui, X. C. Du, X. Fang, C. B. Fu, L. Gan, B. Guo, Z. Y. Han, X. Y. Guo, G. Z. He, J. R. He, A. Heger, S. Q. Hou, H. X. Huang, N. Huang, B. L. Jia, L. Y. Jiang, S. Kubono, J. M. Li, M. C. Li, K. A. Li, E. T. Li, T. Li, Y. J. Li, M. Lugaro, X. B. Luo, H. Y. Ma, S. B. Ma, D. M. Mei, W. Nan, W. K. Nan, N. C. Qi, Y. Z. Qian, J. C. Qin, J. Ren, C. S. Shang, L. T. Sun, W. L. Sun, W. P. Tan, I. Tanihata, S. Wang, P. Wang, Y. B. Wang, Q. Wu, S. W. Xu, S. Q. Yan, L. T. Yang, Y. Yang, X. Q. Yu, Q. Yue, S. Zeng, L. Zhang, H. Zhang, H. Y. Zhang, L. Y. Zhang, N. T. Zhang, P. Zhang, Q. W. Zhang, T. Zhang, X. P. Zhang, X. Z. Zhang, W. Zhao, J. F. Zhou, and Y. Zho, “Progress of underground nuclear astrophysics experiment JUNA in China,” *Few-Body Syst.* **63**, 43 (2022).
- B. Moon, A. Gargano, H. Naidja, C. -B. Moon, A. Odahara, R. Lozeva, S. Nishimura, C. Yuan, F. Browne, P. Doornenbal, G. Lorusso, Z. Patel, S. Rice, M. Si, L. Sinclair, P. -A. Soderstrom, T. Sumikama, H. Watanabe, J. Wu, Z. Y. Xu, A. Yagi, D. S. Ahn, H. Baba, F. L. Bello Garrote, R. Daido, J. M. Daugas, F. Didierjean, Y. Fang, N. Fukuda, B. Hong, E. Ideguchi, N. Inabe, T. Ishigaki, T. Isobe, H. S. Jung, D. Kameda, I. Kojouharov, T. Komatsubara, T. Kubo, Y. K. Kwon, C. S. Lee, P. Lee, S. Morimoto, D. Murai, M. Niikura, H. Nishibata, I. Nishizuka, H. Sakurai, Y. Shimizu, H. Suzuki, H. Takeda, K. Tshoo, and R. Yokoyama, “First observation of the  $\pi 0h_{11/2} \otimes \nu 0h_{9/2}$  partner orbital configuration in the odd-odd  $^{138}\text{I}$  nucleus,” *Phys. Rev. C* **105**, 034334 (2022).
- A. Vitez-Sveicz, A. Algora, A. I. Morales, B. Rubio, G. G. Kiss, P. Sarriguren, P. Van Isacker, G. de Angelis, F. Recchia, S. Nishimura, J. Agramunt, V. Guadilla, A. Montaner-Piza, S. E. A. Orrigo, A. Horvath, D. Napoli, S. Lenzi, A. Boso, V. H. Phong, J. Wu, P. -A. Soderstrom, T. Sumikama, H. Suzuki, H. Takeda, D. S. Ahn, H. Baba, P. Doornenbal, N. Fukuda, N. Inabe, T. Isobe, T. Kubo, S. Kubono, H. Sakurai, Y. Shimizu, C. Sidong, B. Blank, P. Ascher, M. Gerbaux, T. Goigoux, J. Giovinazzo, S. Grevy, T. Kurtukian Nieto, C. Margron, W. Gelletly, Zs. Dombradi, Y. Fujita, M. Tanaka, P. Aguilera, F. Molina, J. Eberth, F. Diel, D. Lubos, C. Borcea, E. Ganioglu, D. Nishimura, H. Oikawa, Y. Takei, S. Yagi, W. Korten, G. de France, P. Davies, J. Liu, J. Lee, T. Lokotko, I. Kojouharov, N. Kurz, H. Shaffner, and A. Petrovici, “The  $\beta$ -decay of  $^{70}\text{Kr}$  into  $^{70}\text{Br}$ : Restoration of the pseudo-SU(4) symmetry,” *Phys. Lett. B* **830**, 137123 (2022).
- A. Yagi, A. Odahara, H. Nishibata, R. Lozeva, C. -B. Moon, S. Nishimura, K. Yoshida, N. Yoshinaga, C. Watanabe, K. Higashiyama, T. Shimoda, R. Daido, Y. Fang, P. S. Lee, B. Moon, P. Doornenbal, G. Lorusso, P. -A. Soderstrom, T. Sumikama, H. Watanabe, T. Isobe, H. Baba, H. Sakurai, F. Browne, Z. Patel, S. Rice, L. Sinclair, J. Wu, Z. Y. Xu, R. Yokoyama, T. Kubo, N. Inabe, H. Suzuki, N. Fukuda, D. Kameda, H. Takeda, D. S. Ahn, Y. Shimizu, D. Murai, F. L. Bello Garrote, J. -M. Daugas, F. Didierjean, E. Ideguchi, S. Iimura, T. Ishigaki, H. S. Jung, T. Komatsubara, Y. K. Kwon, C. S. Lee, S. Morimoto, M. Niikura, I. Nishizuka, and K. Tshoo, “Various nuclear structures in  $^{140}\text{Xe}$  studied by  $\beta$  decay of ground and isomeric states in  $^{140}\text{I}$ ,” *Phys. Rev. C* **105**, 044325 (2022).
- D. Bazin, N. Aoi, H. Baba, J. Chen, H. Crawford, P. Doornenbal, P. Fallon, K. Li, J. Lee, M. Matsushita, T. Motobayashi, H. Sakurai, H. Scheit, D. Steppenbeck, R. Stroberg, S. Takeuchi, H. Wang, K. Yoneda, and C. X. Yuan, “Spectroscopy of  $^{33}\text{Mg}$  with knockout reactions,” *Phys. Rev. C* **103**, 064318 (2021).

- F. Browne, S. Chen, P. Doornenbal, A. Obertelli, K. Ogata, Y. Utsuno, K. Yoshida, N. L. Achouri, H. Baba, D. Calvet, F. Chateau, N. Chiga, A. Corsi, M. L. Cortes, A. Delbart, J. -M. Gheller, A. Giganon, A. Gillibert, C. Hilaire, T. Isobe, T. Kobayashi, Y. Kubota, V. Lapoux, H. N. Liu, T. Motobayashi, I. Murray, H. Otsu, V. Panin, N. Paul, W. Rodriguez, H. Sakurai, M. Sasano, D. Steppenbeck, L. Stuhl, Y. L. Sun, Y. Togano, T. Uesaka, K. Wimmer, K. Yoneda, O. Aktas, T. Aumann, K. Boretzky, C. Caesar, L. X. Chung, F. Flavigny, S. Franchoo, I. Gasparic, R. -B. Gerst, J. Gibelin, K. I. Hahn, M. Holl, J. Kahlbow, D. Kim, D. Korper, T. Koiwai, Y. Kondo, P. Koseoglou, J. Lee, C. Lehr, B. D. Linh, T. Lokotko, M. MacCormick, K. Miki, K. Moschner, T. Nakamura, S. Y. Park, D. Rossi, E. Sahin, F. Schindler, H. Simon, P. -A. Soderstrom, D. Sohler, S. Takeuchi, H. Tornqvist, J. Tscheuschner, V. Vaquero, V. Wagner, S. Wang, V. Werner, X. Xu, H. Yamada, D. Yan, Z. Yang, M. Yasuda, and L. Zanetti, "Pairing forces govern population of doubly magic  $^{54}\text{Ca}$  from direct reactions," *Phys. Rev. Lett* **126**, 252501 (2021).
- S. Escrig, A. I. Morales, S. Nishimura, M. Niikura, A. Poves, Z. Y. Xu, G. Lorusso, F. Browne, P. Doornenbal, G. Gey, H. -S. Jung, Z. Li, P. -A. Soderstrom, T. Sumikama, J. Taprogge, Zs. Vajta, H. Watanabe, J. Wu, A. Yagi, K. Yoshinaga, H. Baba, S. Franchoo, T. Isobe, P. R. John, I. Kojouharov, S. Kubono, N. Kurz, I. Matea, K. Matsui, D. Mengoni, P. Morfouace, D. R. Napoli, F. Naqvi, H. Nishibata, A. Odahara, E. Sahin, H. Sakurai, H. Schaffner, I. G. Stefan, D. Suzuki, R. Taniuchi, V. Werner, and D. Sohler, "Persistence of the  $Z = 28$  shell gap in  $A = 75$  isobars: Identification of a possible  $(1/2^-)\mu\text{s}$  isomer in  $^{75}\text{Co}$  and  $\beta$  decay to  $^{75}\text{Ni}$ ," *Phys. Rev. C* **103**, 064328 (2021).
- A. Fernandez, A. Jungclaus, P. Doornenbal, M. A. Bentley, S. M. Lenzi, D. Rudolph, F. Browne, M. L. Cortes, T. Koiwai, R. Taniuchi, V. Vaquero, K. Wimmer, T. Arici, N. Imai, N. Kitamura, B. Longfellow, R. Lozeva, B. Mauss, D. R. Napoli, M. Niikura, X. Pereira-Lopez, S.igliapoco, A. Poves, F. Recchia, P. Ruotsalainen, H. Sakurai, S. Uthayakumaar, R. Wadsworth, and R. Yajzey, "Mirror energy differences above the  $0f_{7/2}$  shell: First  $\gamma$ -ray spectroscopy of the  $T_z = -2$  nucleus  $^{56}\text{Zn}$ ," *Phys. Lett. B* **823**, 136784 (2021).
- V. Girard Alcindor, I. Stefan, F. de Oliveira Santos, O. Sorlin, D. Ackermann, P. Adsley, J. C. Angeli, M. Assie, M. Assuncao, D. Beaumel, E. Berthoumieux, R. Borcea, L. Caceres, I. Celikovic, M. Ciemala, V. Chudoba, G. D'Agata, F. de Grancey, G. Dumitru, F. Flavigny, C. Fougeres, S. Franchoo, A. Georgiadou, N. Goyal, S. Grevy, J. Guillot, V. Guimaraes, F. Hammache, O. Kamalou, J. Kiener, S. Koyama, L. Lalanne, V. Lapoux, I. Matea, A. Matta, A. Meyer, N. Michel, P. Morfouace, J. Mrazek, F. Negoita, M. Niikura, D. Pantelica, L. Perrot, C. Petrone, J. Piot, C. Portail, T. Roger, F. Rotaru, A. M. Sanchez-Benitez, N. de Sereville, M. Stanoiu, C. Stodel, K. Subotic, D. Suzuki, V. Tatischeff, J. C. Thomas, P. Ujic, and D. Verney, "Probing nuclear forces beyond the nuclear drip line: the cases of  $^{16}\text{F}$  and  $^{15}\text{F}$ ," *Eur. Phys. J. A* **57**, 93 (2021).
- O. Hall, T. Davinson, A. Estrade, J. Liu, G. Lorusso, F. Montes, S. Nishimura, V. H. Phong, P. J. Woods, J. Agramunt, D. S. Ahn, A. Algora, J. M. Allmond, H. Baba, S. Bae, N. T. Brewer, C. G. Bruno, R. Caballero-Folch, F. Calvino, P. J. Coleman-Smith, G. Cortes, I. Dillmann, C. Domingo-Pardo, A. Fijalkowska, N. Fukuda, S. Go, C. J. Griffin, R. Grzywacz, J. Ha, L. J. Harkness-Brennan, T. Isobe, D. Kahl, L. H. Kheim, G. G. Kiss, A. Korgul, S. Kubono, M. Labiche, I. Lazarus, J. Liang, Z. Liu, K. Matsui, K. Miernik, B. Moon, A. I. Morales, P. Morrall, M. R. Mumpower, N. Nepal, R. D. Page, M. Piersa, V. F. E. Pucknell, B. C. Rasco, B. Rubio, K. P. Rykaczewski, H. Sakurai, Y. Shimizu, D. W. Stracener, T. Sumikama, H. Suzuki, J. L. Tain, H. Takeda, A. Tarifeno-Saldivia, A. Tolosa-Delgado, M. Wolinska-Cichocka, and R. Yokoyama, " $\beta$ -delayed neutron emission of  $r$ -process nuclei at the  $N = 82$  shell closure," *Phys. Lett. B* **816**, 136266 (2021).
- J. Hu, H. Yamaguchi, Y. H. Lam, A. Heger, D. Kahl, A. M. Jacobs, Z. Johnston, S. W. Xu, N. T. Zhang, S. B. Ma, L. H. Ru, E. Q. Liu, T. Liu, S. Hayakawa, L. Yang, H. Shimizu, C. B. Hamill, A. St J. Murphy, J. Su, X. Fang, K. Y. Chae, M. S. Kwag, S. M. Cha, N. N. Duy, N. K. Uyen, D. H. Kim, R. G. Pizzone, M. La Cognata, S. Cherubini, S. Romano, A. Tumino, J. Liang, A. Psaltis, M. Sferrazza, D. Kim, Y. Y. Li, and S. Kubono, "Advancement of photospheric radius expansion and clocked type-I X-ray burst models with the new  $^{22}\text{Mg}(\alpha, p)^{25}\text{Al}$  reaction rate determined at the Gamow energy," *Phys. Rev. Lett.* **127**, 172701 (2021).
- S. W. Huang, Z. H. Yang, F. M. Marques, N. L. Achouri, D. S. Ahn, T. Aumann, H. Baba, D. Beaumel, M. Bohmer, K. Boretzky, M. Caamano, S. Chen, N. Chiga, M. L. Cortes, D. Cortina, P. Doornenbal, C. A. Douma, F. Dufter, J. Feng, B. Fernandez-Dominguez, Z. Elekes, U. Forsberg, T. Fujino, N. Fukuda, I. Gasparic, Z. Ge, R. Gernhauser, J. M. Gheller, J. Gibelin, A. Gillibert, Z. Halasz, T. Harada, M. N. Harakeh, A. Hirayama, N. Inabe, T. Isobe, J. Kahlbow, N. Kalantar-Nayestanaki, D. Kim, S. Kim, S. Kiyotake, T. Kobayashi, Y. Kondo, P. Koseoglou, Y. Kubota, I. Kuti, C. Lehr, C. Lenain, P. J. Li, Y. Liu, Y. Maeda, S. Masuoka, M. Matsumoto, A. Matta, J. Mayer, H. Miki, M. Miwa, B. Monteagudo, I. Murray, T. Nakamura, A. Obertelli, N. A. Orr, H. Otsu, V. Panin, S. Park, M. Parlog, S. Paschalis, M. Potlog, S. Reichert, A. Revel, D. Rossi, A. Saito, M. Sasano, H. Sato, H. Scheit, F. Schindler, T. Shimada, Y. Shimizu, S. Shimoura, H. Simon, I. Stefan, S. Storck, L. Stuhl, H. Suzuki, D. Symochko, H. Takeda, S. Takeuchi, J. Tanaka, Y. Togano, T. Tomai, H. T. Tornqvist, E. Tronchin, J. Tscheuschner, T. Uesaka, V. Wagner, K. Wimmer, H. Yamada, B. Yang, L. Yang, Y. Yasuda, K. Yoneda, L. Zanetti, and J. Zenihiro, "Experimental study of  $^4n$  by directly detecting the decay neutrons," *Few-Body Syst.* **62**, 102 (2021).
- S. Y. Jin, S. T. Wang, J. Lee, A. Corsi, K. Wimmer, F. Browne, S. Chen, M. L. Cortes, P. Doornenbal, T. Koiwai, C. X. Yuan, A. Algora, D. Brugnara, J. Cederkall, J. Gerl, M. Gorska, G. Hafner, K. Kokubun, P. Koseoglou, S. Kubono, P. Li, P. Liang, J. Liu, Z. Liu, T. Lokotko, J. Park, H. Sakurai, L. G. Sarmiento, Z. Y. Sun, R. Taniuchi, W. Xian, and I. Zanon, "Spectroscopy of  $^{98}\text{Cd}$  by two-nucleon removal from  $^{100}\text{In}$ ," *Phys. Rev. C* **104**, 024302 (2021).
- M. M. Juhasz, Z. Elekes, D. Sohler, K. Sieja, K. Yoshida, K. Ogata, P. Doornenbal, A. Obertelli, H. Baba, F. Browne, D. Calvet, F. Chateau, S. Chen, N. Chiga, A. Corsi, M. L. Cortes, A. Delbart, J. -M. Gheller, A. Giganon, A. Gillibert, C. Hilaire, T. Isobe, T. Kobayashi, Y. Kubota, V. Lapoux, T. Motobayashi, I. Murray, H. Otsu, V. Panin, N. Paul, W. Rodriguez, H. Sakurai, M. Sasano, D. Steppenbeck, L. Stuhl, Y. L. Sun, Y. Togano, T. Uesaka, K. Wimmer, K. Yoneda, N. L. Achouri, O. Aktas, T. Aumann, L. X. Chung, Zs. Dombradi, F. Flavigny, S. Franchoo, I. Gasparic, R. -B. Gerst, J. Gibelin, K. I. Hahn, D. Kim, T. Koiwai, Y. Kondo, P. Koseoglou, J. Lee, C. Lehr, B. D. Linh, H. N. Liu, T. Lokotko, M. MacCormick, K. Moschner, T. Nakamura, S. Y. Park, D. Rossi, E. Sahin, P. -A. Soderstrom, S. Takeuchi, H. Tornqvist, V. Vaquero, V. Wagner, S. Wang, V. Werner, X. Xu, H. Yamada, D. Yan, Z. Yang, M. Yasuda, and L. Zanetti, "First spectroscopic study of  $^{63}\text{V}$  at the  $N = 40$  island of inversion," *Phys. Rev. C* **103**, 064308 (2021).
- M. Kaneko, T. Murakami, T. Isobe, M. Kurata-Nishimura, A. Ono, N. Ikeno, J. Barney, G. Cerizza, J. Estee, G. Jhang, J. W. Lee, W. G. Lynch, C. Santamaria, C. Y. Tsang, M. B. Tsang, R. Wang, D. S. Ahn, L. Atar, T. Aumann, H. Baba, K. Boretzky, J. Brzychczyk,

- N. Chiga, N. Fukuda, I. Gasparic, B. Hong, A. Horvat, T. Ichihara, K. Ieki, N. Inabe, Y. J. Kim, T. Kobayashi, Y. Kondo, P. Lasko, H. S. Lee, Y. Leifels, J. Lukasik, J. Manfredi, A. B. McIntosh, P. Morfouace, T. Nakamura, N. Nakatsuka, S. Nishimura, R. Olsen, H. Otsu, P. Pawlowski, K. Pelczar, D. Rossi, H. Sakurai, H. Sato, H. Scheit, R. Shane, Y. Shimizu, H. Simon, T. Sumikama, D. Suzuki, H. Suzuki, H. Takeda, S. Tangwancharoen, Y. Togano, H. Tornqvist, Z. Xiao, S. J. Yennello, J. Yurkon, and Y. Zhang, “Rapidity distributions of  $Z = 1$  isotopes and the nuclear symmetry energy from Sn+Sn collisions with radioactive beams at 270 MeV/nucleon,” *Phys. Lett. B* **822**, 136681 (2021).
- A. Kubiela, H. Suzuki, O. B. Tarasov, M. Pfutzner, D. -S. Ahn, H. Baba, A. Bezbakh, A. A. Ciemny, W. Dominik, N. Fukuda, A. Giska, R. Grzywacz, Y. Ichikawa, Z. Janas, L. Janiak, G. Kaminski, K. Kawata, T. Kubo, M. Madurga, C. Mazzocchi, H. Nishibata, M. Pomorski, Y. Shimizu, N. Sokolowska, D. Suzuki, P. Szymkiewicz, A. Swiercz, M. Tajima, A. Takamine, H. Takeda, Y. Takeuchi, C. R. Thornsberry, H. Ueno, H. Yamazaki, R. Yokoyama, and K. Yoshida, “Production of the most neutron-deficient Zn isotopes by projectile fragmentation of  $^{78}\text{Kr}$ ,” *Phys. Rev. C* **104**, 064610 (2021).
- L. Lalanne, O. Sorlin, M. Assie, F. Hammache, N. de Sereville, S. Koyama, D. Suzuki, F. Flavigny, D. Beaumel, Y. Blumenfeld, B. A. Brown, F. De Oliveira Santos, F. Delaunay, S. Franchoo, J. Gibelin, V. Girard Alcindor, J. Guillot, O. Kamalou, N. Kitamura, V. Lapoux, A. Lemasson, A. Matta, B. Mauss, P. Morfouace, M. Niikura, J. Pancin, A. Poves, T. Roger, T. Saito, C. Stodel, and J. -C. Thomas, “Evaluation of the  $^{35}\text{K}(p, \gamma)^{36}\text{Ca}$  reaction rate using the  $^{37}\text{Ca}(p, d)^{36}\text{Ca}$  transfer reaction,” *Phys. Rev. C* **103**, 055809 (2021).
- B. D. Linh, A. Corsi, A. Gillibert, A. Obertelli, P. Doornenbal, C. Barbieri, S. Chen, L. X. Chung, T. Duguet, M. Gomez-Ramos, J. D. Holt, A. Moro, P. Navratil, K. Ogata, N. T. T. Phuc, N. Shimizu, V. Soma, Y. Utsuno, N. L. Achouri, H. Baba, F. Browne, D. Calvet, F. Chateau, N. Chiga, M. L. Cortes, A. Delbart, J. -M. Gheller, A. Giganon, C. Hilaire, T. Isobe, T. Kobayashi, Y. Kubota, V. Lapoux, H. N. Liu, T. Motobayashi, I. Murray, H. Otsu, V. Panin, N. Paul, W. Rodriguez, H. Sakurai, M. Sasano, D. Steppenbeck, L. Stuhl, Y. L. Sun, Y. Togano, T. Uesaka, K. Wimmer, K. Yoneda, O. Aktas, T. Aumann, F. Flavigny, S. Franchoo, I. Gasparic, R. -B. Gerst, J. Gibelin, K. I. Hahn, N. T. Khai, D. Kim, T. Koiwai, Y. Kondo, P. Koseoglou, J. Lee, C. Lehr, T. Lokotko, M. MacCormick, K. Moschner, T. Nakamura, S. Y. Park, D. Rossi, E. Sahin, D. Sohler, P. -A. Soderstrom, S. Takeuchi, N. D. Ton, H. Tornqvist, V. Vaquero, V. Wagner, H. Wang, V. Werner, X. Xu, Y. Yamada, D. Yan, Z. Yang, M. Yasuda, and L. Zanetti, “Investigation of the ground-state spin inversion in the neutron-rich  $^{47,49}\text{Cl}$  isotopes,” *Phys. Rev. C* **104**, 044331 (2021).
- J. E. Riley, A. M. Laird, N. de Sereville, A. Parikh, S. P. Fox, F. Hammache, I. Stefan, P. Adsley, M. Assie, B. Bastin, F. Boulay, A. Coc, S. Franchoo, R. Garg, S. A. Gillespie, V. Guimaraes, C. Hamadache, N. Hubbard, J. Kiener, A. Lefebvre-Schuhl, F. de Oliveira Santos, A. Remadi, L. Perrot, D. Suzuki, G. Verde, V. Tatischeff, and M. Williams, “Sub-threshold states in  $^{19}\text{Ne}$  relevant to  $^{18}\text{F}(p, \alpha)^{15}\text{O}$ ,” *Phys. Rev. C* **103**, 015807 (2021).
- Y. Shigekawa, A. Yamaguchi, K. Suzuki, H. Haba, T. Hiraki, H. Kikunaga, T. Masuda, S. Nishimura, N. Sasao, A. Yoshimi, and K. Yoshimura, “Estimation of radiative half-life of  $^{229m}\text{Th}$  by half-life measurement of other nuclear excited states in  $^{229}\text{Th}$ ,” *Phys. Rev. C* **104**, 024306 (2021).
- M. Tsumura, T. Kawabata, Y. Takahashi, S. Adachi, H. Akimune, S. Ashikaga, T. Baba, Y. Fujikawa, H. Fujimura, H. Fujioka, T. Furuno, T. Hashimoto, T. Harada, M. Ichikawa, K. Inaba, Y. Ishii, N. Itagaki, M. Itoh, C. Iwamoto, N. Kobayashi, A. Koshikawa, S. Kubono, Y. Maeda, Y. Matsuda, S. Matsumoto, K. Miki, T. Morimoto, M. Murata, T. Nanamura, I. Ou, S. Sakaguchi, A. Sakaue, M. Sferrazza, K. N. Suzuki, T. Takeda, A. Tamii, K. Watanabe, Y. N. Watanabe, H. P. Yoshida, and J. Zenihiro, “First experimental determination of the radiative-decay probability of the  $3_1^-$  state in  $^{12}\text{C}$  for estimating the triple alpha reaction rate in high temperature environments,” *Phys. Lett. B* **817**, 136283 (2021).
- H. Watanabe, C. X. Yuan, G. Lorusso, S. Nishimura, Z. Y. Xu, T. Sumikama, P. -A. Soderstrom, P. Doornenbal, F. Browne, G. Gey, H. S. Jung, J. Taprogge, Zs. Vajta, H. K. Wang, J. Wu, A. Yagi, H. Baba, G. Benzoni, K. Y. Chae, F. C. L. Crespi, N. Fukuda, R. Gernhauser, N. Inabe, T. Isobe, A. Jungclaus, D. Kameda, G. D. Kim, Y. K. Kim, I. Kojouharov, F. G. Kondev, T. Kubo, N. Kurz, Y. K. Kwon, G. J. Lane, Z. Li, C. -B. Moon, A. Montaner-Piza, K. Moschner, F. Naqvi, M. Niikura, H. Nishibata, D. Nishimura, A. Odahara, R. Orlandi, Z. Patel, Zs. Podolyak, H. Sakurai, H. Schaffner, G. S. Simpson, K. Steiger, H. Suzuki, H. Takeda, A. Wendt, and K. Yoshinaga, “Impact of shell evolution on Gamow-Teller  $\beta$  decay from a high-spin long-lived isomer in  $^{127}\text{Ag}$ ,” *Phys. Lett. B* **823**, 136766 (2021).
- K. Wimmer, F. Recchia, S. M. Lenzi, S. Riccetto, T. Davinson, A. Estrade, C. J. Griffin, S. Nishimura, V. Phong, P. -A. Soderstrom, O. Aktas, M. Al-Aqeel, T. Ando, H. Baba, S. Bae, S. Choi, P. Doornenbal, J. Ha, L. Harkness-Brennan, T. Isobe, P. R. John, D. Kahl, G. Kiss, I. Kojouharov, N. Kurz, M. Labiche, K. Matsui, S. Momiyama, D. R. Napoli, M. Niikura, C. Nita, Y. Saito, H. Sakurai, H. Schaffner, P. Schrock, C. Stahl, T. Sumikama, V. Werner, W. Witt, and P. J. Woods, “Isomeric states in neutron-rich nuclei near  $N = 40$ ,” *Phys. Rev. C* **104**, 014304 (2021).
- D. Wu, C. L. Bai, H. Sagawa, S. Nishimura, and H. Q. Zhang, “ $\beta$ -delayed one-neutron emission probabilities within a neural network model,” *Phys. Rev. C* **104**, 054303 (2021).
- R. Yokoyama, E. Ideguchi, G. S. Simpson, M. Tanaka, Y. Sun, C. -J. Lv, Y. -X. Liu, L. -J. Wang, S. Nishimura, P. Doornenbal, G. Lorusso, P. -A. Soderstrom, T. Sumikama, J. Wu, Z. Y. Xu, N. Aoi, H. Baba, F. L. Bello Garrote, G. Benzoni, F. Browne, R. Daido, Y. Fang, N. Fukuda, A. Gottardo, G. Gey, S. Go, S. Inabe, T. Isobe, D. Kameda, K. Kobayashi, M. Kobayashi, I. Kojouharov, T. Komatsubara, T. Kubo, N. Kurz, I. Kuti, Z. Li, M. Matsushita, S. Michimasa, C. B. Moon, H. Nishibata, I. Nishizuka, A. Odahara, Z. Patel, S. Rice, E. Sahin, H. Sakurai, H. Schaffner, L. Sinclair, H. Suzuki, H. Takeda, J. Taprogge, Zs. Vajta, H. Watanabe, and A. Yagi, “Three-quasiparticle isomers in odd-even  $^{159,161}\text{Pm}$ : Calling for modified spin-orbit interaction for the neutron-rich region,” *Phys. Rev. C* **104**, L021303 (2021).
- S. Hayakawa, M. La Cognata, L. Lamia, H. Yamaguchi, D. Kahl, K. Abe, H. Shimizu, L. Yang, O. Beliuskina, S. M. Cha, K. Y. Chae, S. Cherubini, P. Figuera, Z. Ge, M. Gulino, J. Hu, A. Inoue, N. Iwasa, A. Kim, D. Kim, G. Kiss, S. Kubono, M. La Commara, M. Latuada, E. J. Lee, J. Y. Moon, S. Palmerini, C. Parascandolo, S. Y. Park, V. H. Phong, D. Pierroutsakou, R. G. Pizzone, G. G. Rapisarda, S. Romano, C. Spitaleri, X. D. Tang, O. Trippella, A. Tumino, and N. T. Zhang, “Constraining the primordial lithium abundance: New cross section measurement of the  $^7\text{Be} + n$  reactions updates the total  $^7\text{Be}$  destruction rate,” *Astrophys. J. Lett.* **915**, L13 (2021).

- J. Estee, W. G. Lynch, C. Y. Tsang, J. Barney, G. Jhang, M. B. Tsang, R. Wang, M. Kaneko, J. W. Lee, T. Isobe, M. Kurata-Nishimura, T. Murakami, D. S. Ahn, L. Atar, T. Aumann, H. Baba, K. Boretzky, J. Brzychczyk, G. Cerizza, N. Chiga, N. Fukuda, I. Gasparic, B. Hong, A. Horvat, K. Ieki, N. Inabe, Y. J. Kim, T. Kobayashi, Y. Kondo, P. Lasko, H. S. Lee, Y. Leifels, J. Lukasik, J. Manfredi, A. B. McIntosh, P. Morfouace, T. Nakamura, N. Nakatsuka, S. Nishimura, H. Otsu, P. Pawlowski, K. Pelczar, D. Rossi, H. Sakurai, C. Santamaria, H. Sato, H. Scheit, R. Shane, Y. Shimizu, H. Simon, K. Snoch, A. Sochocka, T. Sumikama, H. Suzuki, D. Suzuki, H. Takeda, S. Tangwanchaoen, Y. Togano, H. Tornqvist, Z. Xiao, S. J. Yennello, Y. Zhang, and M. D. Cozma, “Probing the symmetry energy with the spectral pion ratio,” *Phys. Rev. Lett* **126**, 162701 (2021).
- J. Barney, J. Estee, W. G. Lynch, T. Isobe, G. Jhang, M. Kurata-Nishimura, A. B. McIntosh, T. Murakami, R. Shane, S. Tangwanchaoen, M. B. Tsang, G. Cerizza, M. Kaneko, J. W. Lee, C. Y. Tsang, R. Wang, C. Anderson, H. Baba, Z. Chajecski, M. Famiano, R. Hodges-Showalter, B. Hong, T. Kobayashi, P. Lasko, J. Lukasik, N. Nakatsuka, R. Olsen, H. Otsu, P. Pawlowski, K. Pelczar, H. Sakurai, C. Santamaria, H. Setiawan, A. Taketani, J. R. Winkelbauer, Z. Xiao, S. J. Yennello, J. Yurkon, and Y. Zhang, “The  $S\pi$ RIT time projection chamber,” *Rev. Sci. Instrum.* **92**, 063302 (2021).
- S. Koyama, D. Suzuki, M. Assie, N. Kitamura, L. Lalanne, M. Niikura, H. Otsu, T. Y. Saito, and O. Sorlin, “A liquid hydrogen target for radioactive beam experiments using the missing mass method,” *Nucl. Instrum. Methods Phys. Res. A* **1010**, 165477 (2021).
- H. Baba, T. Ichihara, T. Isobe, T. Ohnishi, K. Yoshida, Y. Watanabe, S. Ota, H. Shimizu, S. Shimoura, S. Takeuchi, D. Nishimura, J. Zenihiro, A. O. Tokiyasu, and R. Yokoyama, “MPV-parallel readout architecture for the VME data acquisition system,” *IEEE Trans. Nucl. Sci.* **68**, 1841 (2021).
- T. Okumura, T. Azuma, D. A. Bennett, P. Caradonna, I. H. Chiu, W. B. Doriese, M. S. Durkin, J. W. Fowler, J. D. Gard, T. Hashimoto, R. Hayakawa, G. C. Hilton, Y. Ichinohe, P. Indelicato, T. Isobe, S. Kanda, M. Katsuragawa, N. Kawamura, Y. Kino, K. Mine, Y. Miyake, K. M. Morgan, K. Ninomiya, H. Noda, G. C. O’Neil, S. Okada, K. Okutsu, T. Osawa, N. Paul, C. D. Reintsema, D. R. Schmidt, K. Shimomura, P. Strasser, H. Suda, D. S. Swetz, T. Takahashi, S. Takeda, S. Takeshita, H. Tatsuno, Y. Ueno, J. N., Ullom, S. Watanabe, and S. Yamada, “Dynamical response of transition-edge sensor microcalorimeters to a pulsed charged-particle beam,” *IEEE Trans. Appl. Supercond.* **31**, 2101704 (2021).
- M. Holl *et al.* (SAMURAI21 Collaboration), “Border of the island of inversion: Unbound states in  $^{29}\text{Ne}$ ,” *Phys. Rev. C* **105**, 034301 (2021).
- H. Grawe, K. Straub, T. Faestermann, M. Górska, C. Hinke, R. Krücken, F. Nowacki, M. Böhmer, P. Boutachkov, H. Geissel, R. Gernhäuser, A. Gottardo, J. Gregosz, N. Kurz, Z. Liu, L. Maier, S. Pietri, Zs. Podolyák, K. Steiger, H. Weick, H. J. Wollersheim, P. J. Woods, N. Al-Dahan, N. Alkhomashi, A. Ataç, A. Blazhev, N. Braun, T. Davinson, I. Dillmann, C. Domingo-Pardo, P. Doornenbal, G. Farrelly, F. Farinon, G. de France, J. Gerl, N. Goel, T. Habermann, R. Hoischen, R. Janik, M. Karny, A. Kaskas, I. Kojouharov, Th. Kröll, M. Lewitowicz, Yu. A. Litvinov, S. Myalski, F. Nebel, S. Nishimura, C. Nociforo, J. Nyberg, A. Parikh, A. Procházka, P. H. Regan, C. Rigollet, H. Schaffner, C. Scheidenberger, S. Schwertel, P. -A. Söderström, S. Steer, A. Stolz, P. Strmeň, and the RISING Collaboration, “The  $(6^+)$  isomer in  $^{102}\text{Sn}$  revisited: Neutron and proton effective charges close to the double shell closure,” *Phys. Lett. B* **820**, 136591 (2021).

### [Review Article]

- A. A. Aziz, N. S. Ahmad, S. Ahn, W. Aoki, M. Bhuyan, K. J. Chen, G. Guo, K. I. Hahn, T. Kajino, H. Abu Kassim, D. Kim, S. Kubono, M. Kusakabe, A. Li, H. N. Li, Z. H. Li, W. P. Liu, Z. W. Liu, T. Motobayashi, K. C. Pan, T. -S. Park, J. R. Shi, X. D. Tang, W. Wang, L. J. Wen, M. R. Wu, H. L. Yan, and N. Yusof, “Progress in nuclear astrophysics of east and southeast Asia,” *AAPPS Bulletin* **31**, 18 (2021).

## Presentations

### [Seminars]

- R. Taniuchi, “Gamma-ray spectroscopy in the vicinity of double-magic  $^{78}\text{Ni}$ ,” NUSTAR Seminar, Online/GSI, Germany, June 2, 2021.  
櫻井博儀, 「現代の錬金術による元素変換科学—元素合成, 魔法数から核変換まで—」, 日本物理学会第 5 回オンライン物理講話, 2021 年 10 月 23 日.

## Award

- 谷内稜, 第 38 回 井上研究奨励賞 (Inoue Research Award for Young Scientists), 公益財団法人 井上科学振興財団, 2022 年 2 月 4 日.

## Press Releases

- 「高密度な中性子物質の硬さの測定に初めて成功—中性子星内の状態を実験室で再現—」, 2021 年 5 月 11 日.  
「荷電対称性の破れを発見—クリプトン-70 とセレン-70 の形状は大きく異なっていた—」, 2021 年 5 月 19 日.

## Outreach Activity

- 櫻井博儀, 2021 年度 「はかる!」, 埼玉県立不動岡高等学校.