Users Meeting to Memorize the 25-Years of the RIKEN-RAL Muon Facility Project in the UK

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The RIKEN-RAL Muon Facility project was started from 1990. This project was the biggest scientific international collaboration in between Japan and the UK in that year. The facility construction has been successfully completed in 1994 and the user program has been running until now after that. The facility operation is still on going and many researchers and students are enjoying the muon science at the RIKEN-RAL on the collaboration basis. In the beginning of the history of the facility operation, Japanese collaborators were mainly using the facility. Recently, Asian and worldwide groups were joining to this RIKEN-RAL project year by year making scientific activities and human resource exchanges wider and bigger.

The year of 2015 is the memorial year as a milestone of the 25-years of the RIKEN-RAL project. In order to memorize this milestone, we planned to organize the celebration ceremony and users workshop inviting all staffs, researchers and students who are related to and/or have used the RIKEN-RAL Muon Facility in this 25 years. The cerebration event has been held at the RIKEN Wako Campus on 16th and 17th of Feb in 2016 which is the end of the fiscal year of 2015. The event was organized with the 12th the RIKEN-RAL PAC meeting in order to invite all committee members.

As the beginning of the memorial event for the RIKEN-RAL, the ASIA-RIKEN workshop was organized with Indonesian and Malaysian collaborators from the afternoon on 16th of Feb. More than 40 people including students attended this meeting and discussed recent scientific achievement on the muon science by Asian groups as shown in Fig. 1.

Figure 1: The ASIA-RIKEN workshop held on 16th of Feb .

The RIKEN-RAL celebration ceremony was organized on 17th in conjunction with the RIKEN-RAL Users Workshop as the RIKEN Symposium. Attendances to the Users Workshop presented posters to introduce their scientific achievements. Figure 2 shows the atmosphere of the workshop. Eighty-eight scientific posters were presented during the workshop and more than 150 researchers, students and administrators enjoyed

Figure 2: RIKEN-RAL Users Workshop

communications and discussions.

The 25-Years celebration of the RIKEN-RAL project was organized after the Users Workshop. Celebration talks were given from the Executive Director of RIKEN, Director of Nihina Center, Director of the RIKEN-RAL and a guest representative from KEK. A letter of the congratulatory address from the Ambassador of British Embassy was also introduced by the chief administrator.

A celebration cake was prepared by laboratory students and secretaries and served in the ceremony. After celebration talks, we cut the cake and celebrate the RIKEN-RAL Muon Facility as shown Fig. 3.

Figure 3: Photograph of the cake-cut event. The cake was hand made by students who are studying at the RIKEN-RAL.

The RIKEN-RAL Muon Facility is still being operated e delivering pulsed muon beams for a wide range of the muon science. We continuously have new users opening doors to new sciences. Recently, Ph.D. students are continuously joining from Asian countries to the RIKEN-RAL Project. They are working at the experimental side by using the RIKEN-RAL Muon Facility and/or at the computational side by using RIKEN supercomputing resources. The muon-science activity is expanding to the world and young human resources are growing up year by year from the RIKEN-RAL Muon Facility even after this 25-years memorial celebration.

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The 14th International Symposium on Nuclei in the Cosmos

S. Nishimura[*1] and T. Kajino[*2]

The Nuclei in the Cosmos is the foremost bi-annual symposium of nuclear physics, astrophysics, astronomy, cosmo-chemistry, and other related fields and it is considered as the most important international symposium in the research field of nuclear astrophysics. In 2016, the 14th International Symposium on Nuclei in the Cosmos (NIC-XIV) was held on 19th – 24th June at the Toki Messe in Niigata, Japan. The NIC-XIV[a)] was jointly organized by two major institutes in Japan: the National Astronomical Observatory of Japan (NAOJ) and the RIKEN Nishina Center for Accelerator-Based Science (RNC).

The symposium was started on 19th June with a welcome reception. The scientific program from 20th – 24th June started with the opening ceremony overseen by the director general of NAOJ, M. Hayashi, and the director of RNC, H. En'yo, who introduced variety of research activities related to the nuclear astrophysics in Japan. On 20th June, Professor T. Kajita, the 2015 Nobel Laureate in Physics for the discovery of neutrino masses, gave a special lecture on "The Discovery of Neutrino Oscillations" in the main conference hall to an audience of NIC participants and the general public, including thirty students from super science high schools in Niigata. A special invited talk was given by Professor K. Morita with the title "The Discovery of Super-Heavy Element of Atomic Number Z = 113 Nihonium and Beyond" on 22nd June.

In NIC-XIV, fifteen sessions of the symposium were devoted to thirty-seven plenary talks and fifty-nine oral talks to cover a wide range of subjects relevant to nuclear astrophysics: (a) Big-Bang Cosmology, Nucleosynthesis, Dark Matter, and Dark Energy, (b) Neutrino Astrophysics and Weak Processes, (c) Novae and X-Ray Bursts, (d) Stellar Evolution and Hydrostatic Nuclear Burning Processes, (e) Radioactive Nuclei Far From Stability, (f) Explosive nucleosynthesis in Stars, (g) Nuclear Theory and Experiments in Astrophysics, (h) Supernovae, Gamma-Ray Bursts and Mergers, (i) Nuclear Data and Astrophysics, (j) First Generations of Stars and Galactic Chemo-Dynamical Evolution, (j) Neutron Stars and Hadron Physics, (k) Meteoritic Abundances, Interstellar Gas and Dust Astronomy, and (l) X- and γ-Ray Astronomy and Cosmic Ray Astrophysics.

Two poster sessions were also held on 21st and 23rd June with 189 poster presentations; six young scientists were awarded prizes (Cupper, Silver, and Gold) for excellent poster presentations delivered on the last day of the symposium. Many discussions and debates were shared during the symposium. One of the highlighted topics was related to the rapid neutron-capture process (r process) and the equation of state (EOS) in high density matter. In relation to the question "Where is the site of the r-process?", the candidates of the r-process site, the supernovae and neutron-star merger scenarios, were discussed deeply. It was decided that the next NIC symposium would be held in Gran Sasso, Italy and will be announced in due time.

Associated with the NIC symposium, the NIC School was conducted at Niigata University immediately before NIC-XIV, where lectures were given by internationally recognized experts on theories, experiments, and observations, which covered the areas of research relevant to nuclear astrophysics. Moreover, public lectures associated with the NIC symposium were organized on 11th June at Hitotsubashi hall after the post symposiums (SEA, 2nd NAOJ-ECT*, MOTO16) around Tokyo.

The poster presentations and the invited and oral talks of NIC-XIV were published in the conference proceedings[1)].

Figure 1. Participants of the NIC-XIV symposium at Toki Messe

Figure 2. Posters (from left) for NIC-XIV, special lecture of Prof. Kajita, and public lecture, respectively (designed by N. Miyauchi)

[1] JPS Conf. Proc. Vol. 14 (2017); http://jpscp.jps.jp

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a) The NIC-XIV was supported by IUPAP, Physical Society of Japan (JPS), RIKEN iTHES, Niigata Prefecture, the Japan World Exposition 1970 Commemorative Fund, European Physical Journal (EPJ), KAKENHI Grant-In-Aid for Scientific Research on Innovative Area (2404), Japan Radioisotope Association, Nuclear Reaction Data Center Hokkaido University, CNS, RCNP, JAEA, KEK, JINA-CEE, JRIA, JCPRG. Sponsors of NIC-Xiv were SEIKO EG&G Co. Ltd., REPIC Corp. PTEP, Burbon Corp., Canberra Japan KK, Techno AP Co. Ltd. Clear Pulse Co. Ltd. G-Tech Corp. Fuji Diamond Int. Co. Ltd.

International Symposium on Modern Technique and its Outlook in Heavy Ion Science (MOTO16)

H. Sakurai, on behalf of MOTO16 organizers

International Symposium on Modern Technique and its Outlook in Heavy Ion Science (MOTO16) was organized by Rikkyo University and RIKEN Nishina Center (RNC), on 26th and 27th June 2016 at Rikkyo University, to commemorate Prof. Tohru Motobayashi's outstanding scientific achievements during his lifelong dedication to the field of heavy ion science.

Since the dawn of the history of fast radioactive isotope beams (RIB) about 30 years ago, multitudes of radioactive nuclei have been experimentally investigated and their exotic structure revealed at the heavy-ion accelerator facilities worldwide. The rapid growths of this field can be attributed to the enthusiasm of many physicists who aspired to develop new techniques. The techniques would overcome experimental difficulties in terms of intensity and quality of RIB. Emphasis should be given not only to experimental methods but also to instrumentation developments and reliable theoretical-models, all of which should be worked out closely together to promote further progress in the field.

This Symposium provided both reviews and contribution talks on modern technique and its outlook for both experimental and theoretical studies of nuclear structure, reactions and nuclear astrophysics, and encouraged discussions on perspectives of future growths at the facilities around the world.

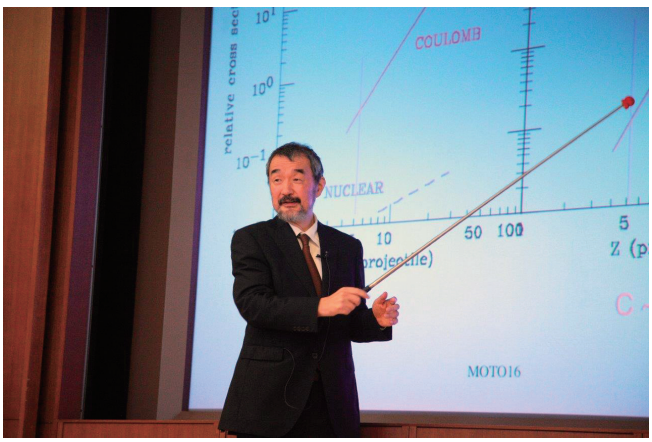
This Symposium was started from opening address by S. Kitamoto, the Dean, Faculty of Science, Rikkyo Univ. and by H. En'yo, the Director of RNC. The first session was arranged to cover Tohru's pioneering works of Coulomb dissociation and excitation with fast RIB. S. Shimoura, N. Iwasa and R. Casten overviewed the works. The second and third sessions were dedicated to present activities running at RIBF and theoretical works; SEASTAR (A. Obertelli), resonant scattering (T. Teranishi), shell model work (T. Suzuki), SCRIT (K. Kurita), missing and invariant mass spectroscopy (D. Beaumel), Coulomb dissociation for halo nuclei (T. Nakamura).

The last session of the 1st day had one-hour lecture given by Tohru Motobayashi, entitled "Technological and methodological developments in reaction studies with fast radioactive-ion beams -their application to nuclear spectroscopy and nuclear astrophysics -".

About 80 persons joined the Symposium Dinner. The venue was the No.1 Dining Hall in Rikkyo Univ. campus. Speeches and special gifts were given to Tohru by H. Sakai, Z. Fulop, R. Casten, K. Hahn, R. Yamukhamedov, N. Aoi, M. Kurokawa, S. Takeuchi. Tohru and his colleagues (H. Baba, N. Nakagawa, Y. Watanabe) gave a music performance. Music pieces presented were "Beachcomber" (Clive Richardson), "A ce Joy Moys de May" (Clement Janequin) and "Now is the Month of Maying" (Thomas Morley). The pleasant, friendly and unforgettable Dinner was finished by a speech of Tohru.

The second day covered recent activities associated with the early works of Tohru; invariant mass method (Y. Kondo), transfer reaction (K. Wimmer), mean-field theory (M. Yamagami), reaction theory (T. Fukui), Coulomb dissociation (Y. Togano), nuclear astrophysics (K. Hahn, Z. Fulop), detector R&D (M.Kurokawa), ANC (R. Yamukhamedov), high-energy gamma (O. Wieland). Other people who have connection with Tohru gave interesting talks; T-violation search in beta-decay (J. Murata), medical application (A. Saito), SHARAQ (M. Dozono) and double-gamma decay (H. Scheit). The last talk in this Symposium was overview of DALI2, given by S. Takeuchi. At the end of this Symposium, two co-chairmen, K. Ieiki and H. Sakurai, gave closing remarks.

Organizers of this Symposium were N. Aoi (RCNP, Osaka Univ.), K. Ieki (Rikkyo Univ., co-chair), K. Kurita (Rikkyo Univ.), S. Nishimura (RIKEN), H. Sakurai (RIKEN, co-chair), S. Shimoura (CNS, Univ. of Tokyo), T. Uesaka (RIKEN), Y. Yanagisawa (RIKEN) and K. Yoneda (RIKEN). Special thanks would be given to a secretary E. Isogai (RIKEN) and N. Miyauchi (RIKEN) for photos.



The 14th International Conference on Meson-Nucleon Physics and the Structure of the Nucleon (MENU2016) †

S. Yokkaichi*1

The 14th International Conference on Meson-Nucleon Physics and the Structure of the Nucleon (MENU 2016) was held at Kyoto University Clock Tower Centennial Hall from July 25th to July 30th, 2016. The conference was co-hosted by Kyoto University and RIKEN Nishina Center (RNC), and supported by the Research Center for Nuclear Physics, Osaka University (RCNP), and the Kyoto University Foundation. This conference series had been launched in 1983 at Karlsruhe, Germany. We were very pleased to host at Kyoto, where Hideki Yukawa had first arrived the idea of the "meson" about 80 years ago.

The conference had 142 participants from 20 countries. There were 29 plenary talks and 80 parallel talks (including 11 invited talks) in seven parallel sessions as "Meson-Nucleon Interactions," "Baryons," "Mesons," "Pentaquarks," "Nucleon structure," "Fundamental symmetries," and "Few body systems." From RNC, T. Izubuchi (Lattice QCD), I. Nakagawa (RHIC spin physics) and F. Sakuma (K-pp bound states) were invited as plenary speakers. About three-quarters of all the talks are summarized in the proceedings published online: JPS Conference Proceedings volume 13. The full program and presentation files are available at the conference website (`http://menu2016.riken.jp/`).

The recent progress in meson-nucleon physics, especially hadron spectroscopy, was well summarized at the conference by the presenters covering high-precision photo-, electro-, and hadroproduction data. There were overview talks on spectroscopy from CLAS, BESIII, CBELSA/TAPS, and COMPASS experiments. As the key topics, multi-quark states or hadronic molecular states such as X, Y, and Z states or pentaquarks were discussed. Based on the recent observation of the pentaquark at LHCb, possible explanations and future prospects of hidden charm pentaquarks were discussed. Furthurmore, the current status of the pentaquark at LEPS was reported. New results of K-pp bound states and related results were also presented from four J-PARC and LEPS experiments. In addition, developments in η/η'-N bound state searches were reviewed from experimental and theoretical points of view. It should be noted that there were inspiring talks reporting the recent study of lattice QCD, which has advanced dramatically over the past 5 years. On the last day, there were numerous discussions on prospects at a variety of future facilities: CLAS12, Belle II, PANDA, Electron-Ion Collider, and the J-PARC Hadron-Hall extension. The conference gave us a very unique opportunity to discuss a wide range of topics and its intersections.

A satellite workshop "Meson In Nuclei 2016" followed MENU 2016 at Yukawa Institute of theoretical physics, Kyoto University (YITP), from July 31st to August 2nd (`http://www2.yukawa.kyoto-u.ac.jp/~min2016/`). Topics focused on "mesonic atoms/nuclei" and "meson properties in nuclear matter" were discussed intensively.

The conference was also supported by a subsidy from Kyoto City and the Kyoto Convention and Visitors Bureau, and was held as a part of the RIKEN Symposium Series. We thank INFN, Italy, for their endorsement and financial help. We appreciate the supportive works by the young-physicist and student team and secretaries from RNC. We are very grateful to Dr. N. Miyauchi from the User Liaison Team of RNC, who designed a stylish logo (Fig. 1 left) and a chic poster with a motif of the Nanzenji temple (Fig. 1 right).

The next MENU conference is scheduled to be held in the USA in 2019.

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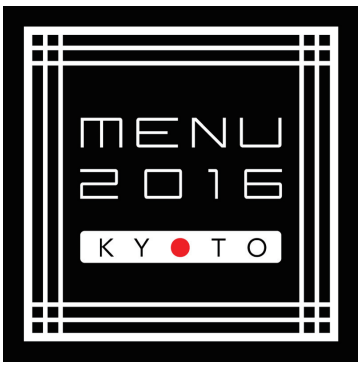
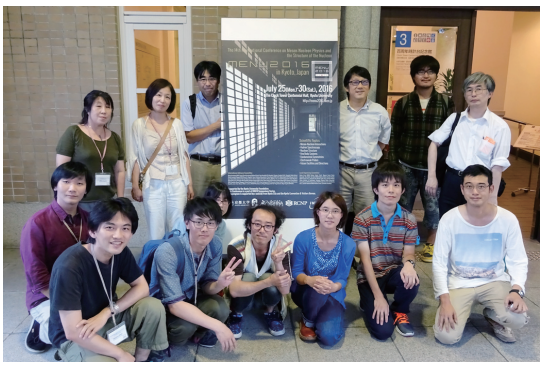
*1 RIKEN Nishina Center

Fig. 1. From left to right, the conference logo; an opening address by Dr. H. En'yo (Conference Chair); and the supporting team from Kyoto University, Osaka University, and RIKEN Nishina Center.





Nishina School 2016

T. Motobayashi*1 and H. Ueno*1

The Nishina School aims at contributing to the development of nuclear physics research in Asia by encouraging undergraduate students who are deciding their future field of study. It started in 2008 after intense discussions among scientists and officers of RIKEN and Peking University, China. Seoul National University, Korea joined the School in 2012, and Honkong University newly became a Nishina School member in this 10th School held from August 1 to 12, 2016. A photograph taken at the beginning of the School is shown in Fig. 1. In addition to the students from the three universities, high-school students from Phillips Exeter Academy, USA with their teacher participated in most of the School programs.

Fig. 1. Photograph of Nishina School 2016 participants.

The two-weeks program of the 10th School started with a welcome address by Shigeharu Kato, RIKEN's Executive Director, and the introduction of participating universities by the professors supervising the students, followed by other welcome statements by Hideto En'yo, Nishina Center Director. The school program consisted of lectures, trainings, and a nuclear reaction experiment using proton beams from the Pelletron accelerator at RIKEN Nishina Center. The lectures were given in the first week. They were on a few basic topics for research including overviews of nuclear physics and nuclear astrophysics, the function of particle accelerators, and methods of radiation measurements. Other lectures were devoted to radiation safety, important issues in paper writing and oral presentation, and issues that researchers may encounter. The subjects of training were electronic-pulse propagation and radiation detection. The detectors, electronics, and data acquisition systems to be used in the experiment in the following week were employed in the training.

The second-week program was focused on the one-day reaction experiment. The students were divided into four teams, which were in charge of four types of measurements. They evaluated the feasibility of measurements by themselves before the experiment, analyzed the data obtained in the experiments, and finally made presentations. The reaction they studied is the proton radiative capture by the ^{12}C nucleus, which is relevant to the CNO cycle hydrogen burning in stars.

Figure 2 is an example of the γ ray spectra measured with a NaI(Tl) scintillator. Proton beams with 1 MeV or 2 MeV energy bombarded a carbon target, which stopped the protons to provide a so-called thick target yield of the ^{12}C(p,γ)^{13}N reaction. Two methods were employed for resonance yield measurements: detection of "in-beam" γ rays emitted during the collision of the beam with the carbon target and measurement of ^{13}N activities by detecting positron-anihiration photons or the 511-keV γ line, known as the "activation" technique. The four teams took care of four independent measurements: "in-beam" and "activation" at the two proton energies. Within the limited time, the teams could reach the stage of extracting the capture cross sections at the two resonances in ^{13}N and comparing them with the data published in the 1970s.

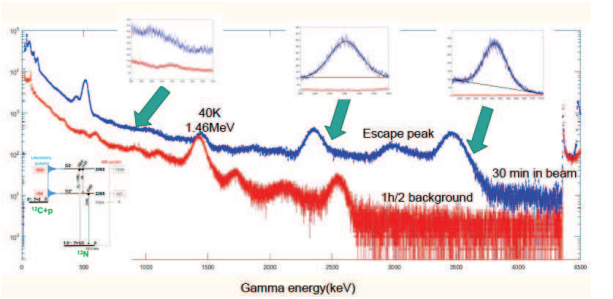


Fig. 2. An example of the γ-ray spectra. The histogram in blue color was obtained in the "in-beam" measurement for the ^{12}C(p,γ)^{13}N reaction with a 2 MeV proton beam. Two γ ray peaks corresponding to the two low-lying resonances in ^{13}N (see the inset for the level diagram) are clearly seen. The other peaks are of the natural background, which is identified in the spectrum taken without the beam (in red color).

The school was operated by the Nishina School Steering Committee headed by Hideki Ueno, in collaboration with many staff members of the Nishina Center. Takashi Kisida had been the School master for 8 years until the last School in 2015. Tohru Motobayashi suceeded him and served as the master of this 10th School in 2016.

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RIBF Users Meeting 2016

T. Isobe,[*1] M. Asai,[*1] P. Fallon,[*1] N. Imai,[*1] Y. Kanada-En'yo,[*1] M. Kimura,[*1] J. Lee,[*1] T. Nakamura,[*1] A. Obertelli,[*1] K. Ogata,[*1] S. Ota,[*1] and K. Yoshida[*1]

The RIBF Users Meeting 2016 was held on September 8th and 9th in 2016. This meeting aims at mutual understanding among RIBF users through discussion on the latest results obtained every year at RIBF. We, the RIBF User Group Executive Committee (UEC), organize the Users Meeting independently from RIKEN Nishina Center. While we sought help from the RIBF user liaison, the meeting was held by the RIBF user community for RIBF users. The number of participants was about 70, which is less than usual for an RIBF Users Meeting. The program mainly consists of status reports from each of the following collaborations: EURICA, SAMURAI, MRTOF, SCRIT, KISS, Super Heavy, BigRIPS, ImPACT, SUNFLOWER, SπRIT, OEDO/SHARAQ, CRIB, and R3. The details of each report were presented in the poster session held in conjunction with the get-together party on the evening of the first day. Fig. 1 shows the number of time slots for each type of presentation.

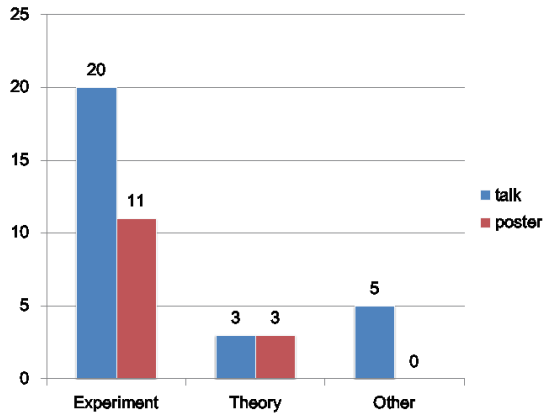

Fig. 1. Number of talks/posters presented at the Users Meeting. "Other" corresponds to the activity report, opening/closing remarks, and so on.

In addition to the report by each group, a ceremony to present the RIBF thesis award to two winners was conducted, as shown in Fig. 2, together with a special talk by the recipients. The awards honor the achievements of Dr. Kosho Minomo (Research Center for Nuclear Physics, Osaka University) and Dr. Clementine Santamaria (National Superconducting Cyclotron Laboratory, Michigan State University) for the Ph.D theses titled "Determination of deformed and halo structure of unstable nuclei by fully microscopic theory" (Kyushu University in 2013) and "Quest for new nuclear magic numbers with MINOS" (Universite Paris Sud XI in 2015), respectively. The RIBF Thesis Award is co-hosted by UEC and Nishina Center from this year. Plates for the award were newly prepared.

Fig. 2. Ceremony for RIBF Thesis award 2016. It was presented to Dr. Clementine Santamaria (2nd from left hand side) and Dr. Kosho Minomo (3rd from left hand side). Certification and plates were given to winners.

Finally, we conducted a session to discuss the post-RIBF activities. In this session, after the status report and upgrade plan of the RIBF accelerator were presented, we discussed how we will endorse the physics of exotic nuclei in Japan.

The next RIBF Users Meeting will be held at the beginning of December in 2017. As the year 2017 is the 10th year since the first experiment at RIBF, a special symposium to celebrate the 10th year of RIBF is planned.

Reference

1) https://indico2.riken.jp/indico/conferenceDisplay.py?confId=2340

*1 RIBF User Group Executive Committee