

## Dear RIBF users

We are sending the 4th issues of the RIBF Quarterly. The past issues are available at our web site: <http://www.nishina.riken.jp/UsersGuide/>

## A Happy New Year !

RIBF made great progress last year. In the uranium-beam experiment by using BigRIPS in November, we found more than 20 new neutron rich isotopes whose atomic numbers are from 29 to 53 all at once, a result proving the overwhelming power of RI production at RIBF. In particular, we found two new neutron rich isotopes of palladium whose mass numbers are 127 and 128, meaning that we have reached a magic number nucleus whose neutron number is 82. There are three peaks regarded as the isotopes by the r-process in the distribution in the solar system. Because this palladium-128 may be one of the origins of the second peak, much is anticipated from measuring the mass and the lifetime precisely using the experimental facilities of the RIBF.

In the succeeding experiment, we achieved a calcium-48 beam as strong as 200 pA, which impressed overseas expert experimentalists as the truly the largest intensity in the world.

I heard that some new halo nuclei and many isomers were found in this series of experiments.

The first half of last year was that of a long and hard struggle. We were pressed by the washing repair of the helium refrigerator of SRC and BigRIPS contaminated with oil, and the remodeling and the reinforcement of the compressor. We did not overlook abnormal behavior of the devices, persuaded manufacturers that it was a bad omen that may lead to a serious accident, and finally had them admit that it was an oversight on the part of the manufacturer side. I deeply admired the passion and the commitment of the staff of SRC and BigRIPS who managed to turn the potential disaster into their advantage.

The Director's first dream of the New Year are as follows:

1) The RI-electron scattering experiment will start in 2010, about a half century after the stable nuclei-electron scattering experiment by a Nobel prize winner, Hofstadter. Now, we will be able to make a precise measurement of the charge distribution of unstable nuclei. I am waiting with great interest the possible outcome of the experiment. An ISOL-type ion source is necessary for this experiment. The collaboration between RIBF and KEK will begin for the development of the ion source.



2) The RI-electron scattering equipment can also be used as a soft X-ray source. With this opportunity, the collaboration with RIKEN Harima Institute may start in the usage of synchrotron radiation and the development of a superconducting electron linac.

3) The new heavy ion linear accelerator, RILAC-II, will start its operation with a large intensity 28GHz superconducting ECR ion source. Because the intensity of the uranium-beam increases drastically with this device, we will find several hundreds of new isotopes and open the door into a new aspect of the dark nucleus world.

4) The present RILAC will be able to independently work non-stop with the operation of RILAC-II. GARIS-II will also be constructed. The RILAC facility will become the best facility in the world in the study of physics and chemistry of superheavy elements. The next goal is the discovery of a new element whose atomic number is 126.

The construction of the RIBF is still ongoing. Let's pay attention to safety and proceed carefully without a hurry as we have been doing in the past. Let's pay special attention to radiation safety because the beam intensity of RIBF will increase in the near future.

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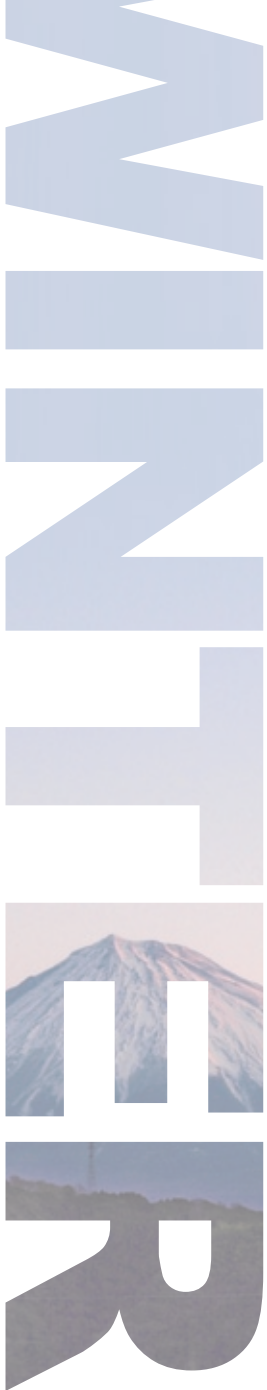
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Beam Time Schedule  
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Seminar information  
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The world underwent an economic depression last year. The recent excessively competitive society seems hollow and lacks sustainable vigor. We need wisdom in order to avoid our society from collapsing. The traditional Japanese value, 'harmony is the most precious', may come back again. It is important for the leaders to make the right decision at the right time without forgetting generosity, to enable each researcher to devote to

work, and to let everybody contribute the society in his/her own style.

RIKEN Nishina Center will greet its third anniversary in coming April. I wish you all the very best in 2009.

Director of the Nishina Center, Yasushige Yano

## Present status, operation schedules of RIBF

### BigRIPS/ZD experiments conducted in November and December, 2008 - RIBF started its full-scale operation -

After successful recovery from the oil contamination problem (see Quarterly #3), we conducted the ZeroDegree (ZD) commissioning and a series of BigRIPS/ZD experiments from the beginning of November, 2008.

The primary beams were U and  $^{48}\text{Ca}$  accelerated up to 345 AMeV, and their maximum intensities were 0.4 and 170 pnA, respectively. The U beam intensity was improved nearly one order, and the  $^{48}\text{Ca}$  beam power,  $\sim 2.8$  kW, provided to experiments was the world's highest. In addition, the long-term stability of the primary beam has been remarkably improved.

The ZD commissioning ran first using the U beam. Using fission fragments having wide angular and momentum spreads, the optical properties of the ZD have been carefully measured.

Afterwards, the PAC-approved BigRIPS experiment, new-isotope search using U beam, was carried out for one week without any serious beam off. Several tens of new isotopes in the  $Z=30 \sim 50$  region were unambiguously identified, one of which was  $^{128}\text{Pd}$  that is considered to be one of key nuclei in the r-process path. We could get a glimpse of this nucleus for the first time using still "quite faint" U beam of 0.3 pnA compared to the goal intensity of 1 puA. Much is anticipated in the future.

A series of experiments using  $^{48}\text{Ca}$ -beam, then, followed. To exploit fully the new and precious opportunity, four experiments, which are for measuring matter radii, inclusive Coulomb breakup reaction, and degree of shell-closure in very neutron-rich region, were coordinated to share their setup and even secondary beams sometimes.

Based on comparisons with the results of simulations and the measured residual activities at the downstream of the first dipole of the

BigRIPS, which had been monitored during the experiments, the in-house safety management decided on Dec. 21 to terminate the series of  $^{48}\text{Ca}$  experiments. Continuation of the experiments may cause difficulty to keep the activities in an acceptable level for engineering works in the beam-dump area planned in this summer period. Consequently, the third and fourth experiments mentioned above were unfortunately canceled in their large and whole parts, respectively, while their first two experiments could obtain data with the world's most powerful  $^{48}\text{Ca}$  beam.

The quick-release mechanisms will be fully installed in BigRIPS this summer, and then handling of more intense primary-beams will become possible.

### Beam-time scheduling for the first half of the FY2009 underway

On Dec. 15, 2008, a call for beam-time requests has been sent out to all the spokespersons of the PAC-approved experiments, which targeted experiments ready to run in the first half of the fiscal year 2009, specifically from April to the end of September. The beam-time schedule will soon be finalized, and the spokespersons requesting their beam-time will be contacted accordingly.

### Constructions

The construction of a new beam line connecting the BigRIPS and SHARAQ, which will also be used for dispersion matching purpose, is in the final stage.

For the PAC-approved BigRIPS experiments using light ions such as deuteron, a new beam line connecting RRC directly with SRC which bypasses IRC is currently being installed. In this mode, AVF is used as an injector instead of RILAC. The commissioning will be carried out in this February.

The first SHARAQ commissioning using these newly constructed beam lines will be performed in the end of March.



## Toward intense primary beams

The installation of a 28 GHz superconducting ECR ion source is underway as scheduled. After the installation of a new beam line connecting the ECR to RILAC, the commissioning will start from the beginning of this April. It is expected that nearly one-order higher intense U-beam, ~ a few pA, will be available.

Another intensive activities in the coming half year will be beam-development efforts. The acceleration tests of Kr, Xe and U beams including charge stripper developments will be performed in the period of February to March, and in June. The intensities and the stripper lifetime especially for Kr and Xe will be thoroughly examined.

## Reports

### PAC meetings

The 4th NP (Nuclear Physics) PAC meeting was held in Nov. 20-21, 2008, and the submitted 12 proposals were presented and discussed. See the following web page for details of the PAC meeting.

<http://www.nishina.riken.jp/UsersGuide/NP-PAC>

The 4th ML (Material and Life Science) PAC meeting was held in Jan. 13-14, 2009, and the submitted 21 proposals (18 for RAL, 3 for RIBF) were discussed.

<http://www.nishina.riken.jp/UsersGuide/ML-PAC>

### Nishina Center Advisory Council

Prior to RIKEN Advisory Council (RAC) to be held in April 22-24, 2009, the activities of Nishina Center for Accelerator-Based Science were reviewed by the Nishina Center Advisory Council (NCAC) consisting of 14 members, chaired by Prof. S. Gales, GANIL. The followings are the terms of references to NCAC given by the president of RIKEN, Prof. R. Noyori ;



President R. Noyori

1. Are there achievements with major scientific significance or achievements with significant social impacts ?
2. How does the Nishina Center compare with similar research institutions abroad ? Make recommendations for possible improvement based on this investigation.
3. Evaluate the Center's collaborations within RIKEN and with outside institutions, and evaluate the Center's effort to promote international collaborations.

The NCAC report will be published later on the internet.



## User Group Activities

The 2nd International Users Group Meeting was held on Nov. 22 (Sat.), the day after the 4th NP-PAC meeting. The slides used in the meeting are available at ;

[http://ribfwww.riken.go.jp/exp/RIBF\\_uec\\_eng/UserMeeting/UserMeeting08/presentation](http://ribfwww.riken.go.jp/exp/RIBF_uec_eng/UserMeeting/UserMeeting08/presentation)

The minutes of the meeting are under preparation by the UEC members.

## Lecture Series

Two lectures of the Lecture Series on Nuclear Physics have been given as follows. The lecture notes are available in the following web page.

1	Prof. K. Langanke (GSI) "Nuclear Astrophysics"	Nov. 17-18, 2008 <a href="http://ribf.riken.jp/~seminar/Lecture/Langanke/index-1.html">http://ribf.riken.jp/~seminar/Lecture/Langanke/index-1.html</a>
2	Prof. I. Hamamoto (Lund) "One-particle motion in nuclear many-body problem III"	Dec. 24, 2008 <a href="http://ribf.riken.jp/~seminar/Lecture/hamamoto/hamamoto070918-0919/index-1.html">http://ribf.riken.jp/~seminar/Lecture/hamamoto/hamamoto070918-0919/index-1.html</a>

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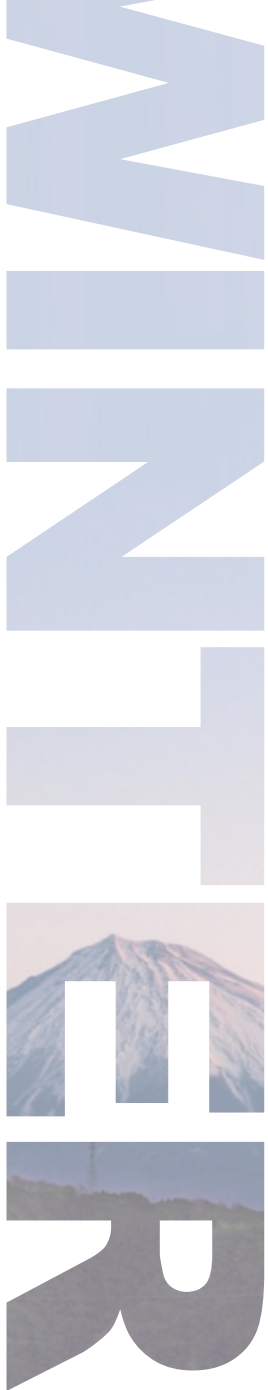
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## Recent News of RIBF

The FY2008 supplementary budget which recently passed through the Diet includes those for the construction of a new injector linac, RILAC-II, and the SCRIT facility, both of which were in the list of the budgetary request of Nishina Center for the past few years.

RILAC-II will make it possible to carry out a series of super-heavy element search experiments completely independent of the BigRIPS experiments at RIBF. The SCRIT facility will realize electron scattering off short-lived nuclei for the first time in human history. Their construction will start soon, and will be completed within FY2009.

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