[RIBF-ULIC-Symposium-007] E(U)RICA International Workshop

Report of Contributions

https://indico2.riken.jp/e/423

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

Scientific Achievements of the Stopped Beam RISING Campaign at GSI

Tuesday 24 May 2011 10:35 (35 minutes)

Some of the science highlights for the Stopped Beam RISING experimental campaigns at GSI will be reviewed using both passive and active stopping materials. These include isomer and beta-decay studies along the N=Z line from 56Ni up to 100Sn; isomer spectroscopy of shell-model configurations around the doubly magic systems 132Sn and 208Pb; and the use of beta-delayed gamma-ray spectroscopy for studies of the transition from shell-model to deformed collective systems in heavy, neutron-rich nuclei with A>180.

Primary author: REGAN, Patrick (University of Surrey)

Presenter: REGAN, Patrick (University of Surrey)

Session Classification: RISING and other gamma-ray measurement techniques

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

Study of the N=50 major shell effect towards 78Ni : contribution from beta-decay studies at IPN Orsay

Monday 23 May 2011 16:00 (20 minutes)

The PARRNe ISOL device has been operating at IPN Orsay since 10 years. Originally conceived as a test bench for R&D studies in the framework of SPIRAL2, the performance of the setup has proven suitable to undertake a physics research program on the evolution of N=50 towards 78Ni by beta-decay studies. During the past decade, several experiments were realized using either the Tandem as a deuteron driver or ALTO as an electron driver. Physics results from these experiments will be presented as well as the way they connect to other results obtained elsewhere (and for other observables) in this mass region. Most of the data obtained were largely pioneering at their time and a parallel effort on the theoretical side had to be undertaken in order to provide a correct description and global understanding.

Primary author: VERNEY, David (Institut de Physique Nucleaire - IN2P3-CNRS / University Paris Sud-11)

Presenter: VERNEY, David (Institut de Physique Nucleaire - IN2P3-CNRS / University Paris Sud-11)

Session Classification: Isomer and beta-gamma spectroscopy of neutron-rich nuclei

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

b-decay spectroscopy study of neutron rich nuclei around the N=82 shell closure including the r-process waiting points 128Pd

Monday 23 May 2011 17:00 (20 minutes)

The b-decay study of the region around the N=82 shell closure is critical for r-process models. The experiment that we intend to perform with the addition of the EURICA spectrometer aims to study the decay of the N=82 nuclei 128Pd and 129Ag that are expected to be waiting points for the the r-process in most r-process models, and therefore their study will dramatically improve the reliability of the r-process calculations.
New half-lives will also be measured for more than 30 isotopes with N<82 including the r-process nuclei 124Ru, 113Nb that are predicted to be waiting points in some r–process models.
Our experiment will also extend the E(2+) systematics of the Pd isotopic chain to 122,124Pd. These nuclei are the first isotopes that are affected by the rapid decrease in deformation predicted by the FRDM model that for more exotic nuclei leads to pronounced changes in the r-process path. E(2+) will also be measured for 116,118Ru and 112Mo, three important nuclei in a region where deformation is the focus of intense theoretical and experimental efforts.
The nuclei of interest will be produced by fission of a 345 A/MeV 238U beam colliding with a 9Be target. Fission fragments will be selected by the BigRIPS spectrometer, and implanted in a stack of Si detectors surrounded by g detector setup such as the EURICA detectors.
With our experimental apparatus we will be able to measure half–lives, b–delayed g rays as well as photons from the decay of microsecond isomers. The results will have implications for nuclear structure studies by providing data to improve the parametrization of mass formulas, and will reveal new insights into important open questions such as shell quenching and the neutron pairing interaction.
The use of the EURICA spectrometer will be highly beneficial for this experiment due to the g-detection efficiency that is up to five times higher than compared to the efficiency of the Clover detectors setup available at the RIBF.

Primary author: LORUSSO, Giuseppe (RIKEN)

Presenter: LORUSSO, Giuseppe (RIKEN)

Session Classification: Isomer and beta-gamma spectroscopy of neutron-rich nuclei

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

g-factor measurements for highly spin-aligned isomeric states

Tuesday 24 May 2011 11:45 (20 minutes)

The nuclear spin alignment in an excited state results in anisotropy of angular distribution in Gamma-ray emission, which provides us a chance to measure nuclear observables through various spectroscopic techniques. Especially the time-differential perturbed angular distribution (TDPAD) method is one of the major techniques to determine a g-factor of an isomeric state with a lifetime of ns - ms order, where the g-factor is determined from a time dependence of anisotropy of de-excitation Gamma rays emitted from spin-aligned nuclei precessing in an external magnetic field. In this study, we have developed a novel method to produce an RI beam with high spin-alignment, that is the two-step fragmentation method with a technique of momentum-dispersion matching. The experiment to apply the new method to study of 32Al was carried out with BigRIPS in RIKEN RIBF. The isomeric states of 32Al was produced by two-step fragmentation of a primary beam of 48Ca via 33Al, then its g-factor was determined for the first time using the TDPAD method. The experimental results will be given in the presentation.

Primary author: ICHIKAWA, Yuichi (RIKEN Nishina Center)

Co-authors: YOSHIMI, Akihiro (RIKEN Nishina Center); KAMEDA, Daisuke (RIKEN Nishina Center); BALABANSKI, Dimiter (INRNE, Bulgaria); GEORGIEV, Georgi (CSNSM, IN2P3-CNRS, France); UENO, Hideki (RIKEN Nishina Center); IIJIMA, Hiroaki (Tokyo Institute of Technology); HAYASHI, Hironori (Tokyo Institute of Technology); WATANABE, Hiroshi (RIKEN Nishina Center); TAKEDA, Hiroyuki (RIKEN Nishina Center); DAUGAS, Jean-Michel (CEA, France); ASAHI, Koichiro (Tokyo Institute of Technology); SUZUKI, Kunifumi (Tokyo Institute of Technology); TSUCHIYA, Masato (Tokyo Institute of Technology); ISHIHARA, Masayasu (RIKEN Nishina Center); RAJABALI, Mustafa (Katholieke Universiteit Leuven, Belgium); FUKUDA, Naoki (RIKEN Nishina Center); INABE, Naoto (RIKEN Nishina Center); AOI, Nori (RIKEN Nishina Center); CHEVRIER, Raphael (CEA, France); FURUKAWA, Takeshi (Tokyo Institute of Technology); INOUE, Takeshi (Tokyo Institute of Technology); OHNISHI, Tetsuya (RIKEN Nishina Center); KUBO, Toshiyuki (RIKEN Nishina Center); NANAO, Tsubasa (Tokyo Institute of Technology); ISHII, Yuji (Tokyo Institute of Technology)

Presenter: ICHIKAWA, Yuichi (RIKEN Nishina Center)

Session Classification: RISING and other gamma-ray measurement techniques

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

Study of the N=34 subshell gap (and abstract Ids 12,13,16)

Monday 23 May 2011 14:30 (40 minutes)

Shell closures are a fundamental concept in nuclear physics
and most of our knowledge of effective nucleon-nucleon interactions comes from the
study of nuclei with few valence particles around doubly-magic cores. There are by now a wealth of data coming from the study of exotic nuclei showing that the relative energies of the shell-model orbitals are not immutable but can change and evolve as a function of neutron number. This leads to the disappearance of well established magic numbers or to the appearance of new ones. For example, the presence of a $N = 32$ subshell closure has been recently derived from various experiments on neutron-rich nuclei from Ca to Cr. The existence of this energy gap at N=32 around Z=20 arises from a large energy spacing between the neutron p3/2 orbital and the higher lying p1/2 and f5/2 orbitals.

Otsuka and collaborators have also predicted that the N=34 isotones around Z=20 could exhibit characteristics of a shell closure due to the proton f7/2 - neutron f5/2
monopole tensor interaction. This effect could be revealed by measuring the first excited states involving the f5/2 neutron single particle orbital in the 55Sc nucleus.
The most direct evidence of the subshell at N=34 would be the high
energy of the first $+ state in 54Ca, not accessible today. However, the low-lying excited states of 55Sc, populated via the beta decay of 55Ca (g.s. 5/2-), involving the
f5/2 neutron single particle orbital will help to elucidate the gap
at N=34 and this will represent a crucial test for theoretical calculations
predicting a new shell clousure at N=34 around Z=20.

This nucleus will be produced in a fragmentation reaction at relativistic energies,
using a 86Kr primary beam at 350MeV.A. The BigRIPS fragment separator in combination with some of the Euroball Cluster detectors will be used for this study.
Probably a total of 7 days of beam time would be enough to
perform this experiment with final relevant results.

Primary authors: SAHIN, Eda (INFN-LNL); DE ANGELIS, Giacomo (INFN Laboratori Nazionali di Legnaro); VALIENTE DOBON, Jose Javier (LNL-INFN)

Presenter: VALIENTE DOBON, Jose Javier (LNL-INFN)

Session Classification: Isomer and beta-gamma spectroscopy of light and proton-rich nuclei

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

Decay Spectroscopy in the vicinity of 78Ni

Monday 23 May 2011 16:20 (20 minutes)

Study of doubly-closed-shell and neighboring nuclei provides great opportunities for testing of nuclear models and expanding our knowledge of nucleosynthesis processes. Especially, the region around 78Ni (Z=28, N=50) has attracted great interests because of its extreme neutron-to-proton ratio in the region far from the valley of stability. Despite of a great deal of theoretical activity devoted to the 78Ni, a little is known for 78Ni itself and nothing beyond because of their extremely low production yield in the experiment.
RIBF facility has started providing very neutron-rich nuclei with the world's highest intensity uranium beam. Recent discovery of very neutron-rich nuclei including 79Ni [1] assures that systematic study of decay properties (half-lives, beta-delayed gamma) of nuclei around 78Ni becomes feasible eventually.
Here, our proposal of decay spectroscopy in the vicinity of 78Ni will be presented together with possible scientific program with a combination of our high efficiency beta-counting system and high efficiency euroball cluster (E(U)RICA).

[1] T.Ohnishi, et al., JPSJ 79, 073201 (2010).

Primary author: NISHIMURA, Shunji (Researcher)

Presenter: NISHIMURA, Shunji (Researcher)

Session Classification: Isomer and beta-gamma spectroscopy of neutron-rich nuclei

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

Spectroscopy of neutron-rich nuclei around 110Zr

Monday 23 May 2011 16:40 (20 minutes)

Shape evolution around 110Zr attracts much attention because shape transition from prolate to oblate, spherical or more exotic tetrahedral shapes has been predicted by many authors. 110Zr is expected to be a spherical shape due to a possible subshell closure at N=70 [1]. Furthermore, the transition to an oblate shape may appear in more neutron-rich region [2].

We performed the experiment around 110Zr with stopped beams as a first decay experiment at RIBF [3, 4, 5]. The observed low-lying states of 106, 108Zr indicate that these two nuclei are well deformed, and the deformation reaches maximum at N=64 by deformed subshell closure at N=64 [3]. By combining a higher intensity expected for 238U beam and a high-efficiency-gamma-ray array E(U)RICA, we will be able to approach more neutron-rich Zr and Mo isotopes around N=70. We also expect a detailed spectroscopy of the 108Zr isomer which is a candidate to search for the tetrahedral shape [3].

In this workshop, I will show the results of ^{106,108}Zr at the first decay experiment and a future plan of the decay experiment with EURICA around 110Zr.

[1] M. Bender et al., Phys. Rev. C 80, 064302 (2009).
[2] J. Skalski et al., Nucl. Phys,
[3] T. Sumikama et al., Phys. Rev. Lett. to be published.
[4] H. Watanabe et al., Phys. Lett. B 696, 186 (2011).
[5] S. Nishimura et al., Phys. Rev. Lett. 106, 052502 (2011).

Primary author: SUMIKAMA, Toshiyuki (Tokyo University of Science)

Presenter: SUMIKAMA, Toshiyuki (Tokyo University of Science)

Session Classification: Isomer and beta-gamma spectroscopy of neutron-rich nuclei

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

Development of Energy-degraded RI beams at RIBF

Tuesday 24 May 2011 14:25 (15 minutes)

Low-energy nuclear reactions such as fusion-evaporation, multi-step Coulomb excitation, transfer reactions, etc. are important probes to investigate exotic structure of unstable nuclei. While RIBF provides world's most intense RI beams, an energy of about 250 MeV/A is much higher than required energies for low-energy reactions.

At the last NP-PAC meeting, we proposed the development of energy-degraded RI beams at RIBF. We will produce RI beams with 2–10 MeV/u at the final focal plane F11 of ZeroDegree spectrometer in order to perform gamma-ray spectroscopy. In this development beam time, we plan to use the 110Mo beam as a test case. In order to produce the required low energy RI beams, we will develop a momentum-bunched and achromatic RI beam, which is achieved by the combination of the momentum bunching degrader and new optics mode at the second stage of BigRIPS. With this new method, the beam energy will be pre-degraded from 250 MeV/u to 100 MeV/u, while the momentum spread will be reduced from 6% to 2.4% after the second stage. At the final focal plane, the beam energy is degraded by flat-plate degraders. The beam energy with 0–15 MeV/u and spot size of ~35 mm (FWHM) will be achieved. By considering the transmission and the requirement for energy range and beam spot size at F11, 41% of RI beams produced at F3 can be used for the low energy reactions.

In this workshop, I will show the proposed experiment to develop the energy-degraded RI beams.

Primary author: SUMIKAMA, Toshiyuki (Tokyo University of Science)

Presenter: SUMIKAMA, Toshiyuki (Tokyo University of Science)

Session Classification: Other gamma-ray measurement techniques II

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

Mirror energy and transition strength differences beyond the fp shell. Isomeric decay of 71Kr −71Br

Isospin formalism, which describes the neutron and the proton as two states of the same particle, the nucleon, is amongst the essential descriptive tools of a vast range of nuclear phenomena. The broad success of the isospin symmetry concept belies its broken nature. Not only is the symmetry broken by the proton-neutron mass difference and the Coulomb interaction, but also by the nucleon-nucleon interaction itself. The investigation of isospin symmetry conservation and breaking effects has revealed a wealth of nuclear structure information. The so-called MED, defined by the differences of the excitation energies of analog states, are regarded as a measure of isospin symmetry breaking in an effective interaction that includes the Coulomb force. The MED have been extensively studied for mirror pair nuclei in the upper sd- and the lower fp- shell regions. The remarkable agreement found between experimental data and shell model calculations has allowed a clear identification of the origin of the MED based on the isospin-non conserving Coulomb and strong NN force. One of the open problems concerns the strength of the isospin non conserving NN force in particular for mirror nuclei in the upper part of the fp shell where little experimental data exists. Also the study of E1 transition rates in mirror nuclei, with the determination of the isovector (allowed) and of the induced-isoscalar (forbidden) strength components, offers a sensitive test of the isospin symmetry breaking.

In this LOI we intent to investigate the mirror energy and transition strength differences for the A=71 mirror nuclei. A 33 ns 9/2+ isomeric state is known to exists in 71Br. The same isomeric state is predicted to exist in 71Kr, where non information on the excited states is available, with a lifetime of the order of about 100 ns. We propose therefore to investigate at RIKEN the gamma decay from such isomeric states using the E(U)RIKA set-up in the stopped beam configuration.

Isomeric states in the 71Kr should be populated by in flight fragmentation of 78Kr beam at 345 MeV /nucleon. Fragments will be separated in-flight using the BigRIPS facility. The first stage of the BigRIPS separator will be used to collect and separate fission fragments while the second stage will be used as a spectrometer for particle identification.

Assuming a primary beam intensity of 30 pps of 78Kr we estimate a particle rate of about 50 pps for 71Kr. With a gamma efficiency of the E(U)RIKA spectrometer in the stopped beam configuration of about 15% and an isomeric ratio of 5%, we expect about 500 counts per day in the main E1 transition.

Primary author: Dr DE ANGELIS, Giacomo (INFN Laboratori Nazionali di Legnaro)

Co-author: Dr VALIENTE DOBON, Javier (INFN Laboratori Nazionali di Legnaro)

Presenter: Dr VALIENTE DOBON, Javier (INFN Laboratori Nazionali di Legnaro)

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

Decay Spectroscopy of 110Zr

Several theoretical studies based on the concept of the mean field, Woods-Saxon, Strutinsky and Hartree-Fock have predicted tetrahedral symmetry in nuclei. Tetrahedral symmetry leads to a tetrahedron shape which would be the most symmetric shape in nuclei to be discovered. Although some evidences for such structures have been found no conclusive proof has yet been provided for their existence. This LOI aims to investigate their existence, setting much more precise limitations for the relevant observables. 110Zr is one of the best predicted examples of doubly magic tetrahedral deformed nucleus. Prolate, Oblate and tetrahedral states have been predicted in the neutron rich Zr nuclei based on different mean field approaches. Also the formation of subshell gaps at N=64 and 80 have been foreseen. We propose to search for the existence of low lying isomeric states in 110Zr. Excitation energy and lifetime information will be used to compare with the results of different theoretical models.

We propose to populate isomeric states in the neutron rich Zr nuclei using the induced fission reactions of a 238U beam accelerated at the RIKEN facility. The E(U)RIKA setup in the stopped beam configuration will be used for detecting the gamma decays. The first stage of the BigRIPS separator will be used to collect and separate the fission fragments while the second stage will be used as a spectrometer for particle identification. Assuming a primary beam intensity of 0.22 pnA, an isomeric ratio of about 5% (estimated on the basis of the expected excitation energy of such states ~ 1.5 MeV) and 8 days of beam time we expect for 110Zr 103 cunts in the gamma peaks deexciting the isomers.

Primary author: Dr DE ANGELIS, Giacomo (INFN Laboratori Nazionali di Legnaro)

Co-author: Dr VALIENTE DOBON, Javier (INFN Laboratori Nazionali di Legnaro)

Presenter: Dr VALIENTE DOBON, Javier (INFN Laboratori Nazionali di Legnaro)

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

First results of beta-gamma spectroscopy for neutron-rich nuclei around A=110 at RIBF

Monday 23 May 2011 11:10 (25 minutes)

A drastic shape evolution is predicted in neutron-rich nuclei around A=110 [1].
For the Zr isotopes, a deformation may reach a maximum by a deformed shell-closure.
Energies of low-lying states which are known up to N=64 show the increase of the deformation from N=60 to 64.
However, the maximization of the deformation has not been observed as a function of neutron numbers.
Furthermore, a spherical shape may appear around 110Zr due to a possible sub-shell closure at N=70 [2].
For neutron-rich isotopes with Z > 40, a shape transition from prolate to oblate shapes is predicted around A=110 [1] and an oblate-shape isomer may appear.
In addition, beta-decay half-lives of this neutron-rich region are required to study the r-process nucleosynthesis.

We performed a first beta-gamma spectroscopy experiment with stopped beams at RIBF for neutron-rich A~110 nuclei.
In this workshop, I'll show an experimental overview and first results related to the shape evolution of the Zr and Nb isotopes [3,4], and beta-decay half-lives [5].

[1] J. Skalski et al., Nucl. Phys. A 617, 282 (1997).
[2] M. Bender et al., Phys. Rev. C 80, 064302 (2009).
[3] T. Sumikama et al., Phys. Rev. Lett. to be published.
[5] H. Watanabe et al., Phys. Lett. B 696, 186 (2011).
[4] S. Nishimura et al., Phys. Rev. Lett. 106, 052502 (2011).

Primary author: YOSHINAGA, Kenta (Tokyo University of Science)

Co-author: SUMIKAMA, Toshiyuki (Tokyo University of Science)

Presenter: YOSHINAGA, Kenta (Tokyo University of Science)

Session Classification: Opening

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

Achievements with g-RISING

Tuesday 24 May 2011 11:10 (35 minutes)

Within the RISING collaboration a g-factor campaign has been performed on magnetic moment measurements of isomeric states in neutron-rich Sn isotopes and in the neutron-deficient Pb-region. For the first time the experimental technique has been successfully applied at relativistic energies for radioactive isotopes produced by 238U fission and 136Xe fragmentation on 9Be targets and traversing the FRS spectrometer. An overview of the experimental campaign together with its major achievements
will be presented during the workshop.

Primary author: LOZEVA, Radomira (IPHC, CNRS, IN2P3)

Presenter: LOZEVA, Radomira (IPHC, CNRS, IN2P3)

Session Classification: RISING and other gamma-ray measurement techniques

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

Shell structure around 78Ni : Beta-decay studies of neutron-rich 77Cu

The magic numbers, originated by the large shell gaps in the energy spectrum of the single-particle states, represent a fundamental quantity governing nuclear structure. They can be reproduced using a single-particle harmonic oscillator potential with a strong spin-ortbit interaction and they are predicted to change for large N/Z ratios. Exotic nuclei close to the shell closures on the neutron drip-line play an important role on nuclear shell structure studies since they allow to search for possible modifications of magic numbers with increasing N/Z ratio. The tensor component, one of the non-central components of the effective nucleon-nucleon interaction, is expected to modify the relative single particle energies when one goes further from stability on the neutron drip line [1,2]. It is expected an attraction for orbitals with anti-parallel spin configuration and a repulsion for orbitals with parallel spin configuration. The change of the shell structure due to the tensor mechanism has been recently discussed in different mass regions [3, 4]. The magic numbers at N=20 and 28 disappear with increasing neutron number and new magic numbers at N=14, 16 and 32 seem to appear. It is also predicted that the Z=28 gap for protons in the pf-shell becomes smaller moving from 68Ni to 78Ni as a result of the attraction between the f5/2 and the g9/2 orbits and repulsion between the f7/2 and g9/2 configurations.

In the case of Cu isotopes the changing of effective single-particle energies comes directly from the attraction between the πf5/2 and the υg9/2 orbits and the repulsion between the πf7/2 and the υg9/2 orbits. Recent calculations in the fpg shell seems to indicate that the Z=28 shell gap gets reduced by about 0.7 MeV when filling the neutron g9/2 orbital [5]. The same Shell Model calculations together with the effect of the tensor force performed for the neutron-rich Cu isotopes predict a lowering of the πf5/2 state causing an inversion of the πf5/2 -πp3/2 effective single-particle states when approaching 78Ni. This inversion has been recently confirmed by nuclear spin and magnetic moment measurements for 75Cu by identifying its spin of the ground state as I= 5/2 [6].

Aim of the present proposal is to identify experimentally the location of such low-lying excitations as test of the microscopic interaction in the fpg shell model space.
Unlikely to its neighboring isotope 75Cu [7], no evidence for isomerism was found in 77Cu according to the fragmentation study of 86Kr at 140 MeV/a at the Coupled Cyclotron Facility of NSCL/MSU [8]. Therefore, the nuclei of interest will be populated via beta-decay of the 77Ni through the in flight fragmentation of 86Kr beam at 350 MeV/nucleon. Fragments will be separated in-flight using the BigRIPS facility. The detailed information on the experimental settings will be given in the presentation.

[1] T. Otsuka et al., Phys.Rev.Lett.87 (2001) 082502.
[2] T. Otsuka et al., Prog.Theor.Phys. Supp.146 (2002) 6.
[3] T. Otsuka et al., Phys.Rev.Lett.95 (2005) 232502.
[4] H. Grawe et al., Springer Lect. Notes in Phys. 651, (2004).
[5] K.Sieja and F. Nowacki, Phys. Rev. C 81, 061303 R (2010).
[6]K.T. Flanagan et al., Phys. Rev. Lett. 103, 142501 (2009).
[7] J.M Daugas et al., Phys. Rev. C 81, 034304 (2010).
[8] D. S. Cross et al., private communication.

Primary authors: Ms SAHIN, Eda (INFN-LNL); VALIENTE DOBON, Jose Javier (INFN-LNL)

Presenter: VALIENTE DOBON, Jose Javier (INFN-LNL)

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

Gamma spectroscopy and B(E2) measurements to study shape transitions in neutron rich Mo and Tc isotopes

Tuesday 24 May 2011 14:05 (20 minutes)

We plan to perform an experiment at the BigRIPS fragment separator at RIKEN to study prolate-oblate shape transitions in neutron rich Mo and Tc nuclides. Existing mean field calculations predict dramatic changes in the ground-state shape in this part of the nuclide chart. To test the validity of the theoretical model framework in the regime, new experimental data in the form of energies of excited states and transition rates are of fundamental importance. Studying shell effects in this region could also shed more light on the astrophysical scenarios along the r-process path. Our proposed experiment aims at, using gamma-ray spectroscopy, measuring B(E2;0+⟶2+) values in the nuclides 110,112Mo as well as identifying excited states for the first time in A>111 Tc isotopes. CNS GRAPE will be used for gamma-ray measurements and ejectile from the secondary target will be identified by using the ZeroDegree spectrometer.In addition, E(U)RICA spectrometer at final focal plane (F11) will be used to perform life-time measurement of short-lived isomer in these nuclei.

Primary author: IDEGUCHI, Eiji (CNS, University of Tokyo)

Presenter: IDEGUCHI, Eiji (CNS, University of Tokyo)

Session Classification: Other gamma-ray measurement techniques II

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

Studies of the Beta Decays of very neutron-deficient nuclei and a comparison with Charge Exchange reactions.

Monday 23 May 2011 14:10 (20 minutes)

Studies of the Tz = -1 ⟶ 0 beta decays of 42Ti, 46Cr, 50Fe and 54Ni to the self-conjugate nuclei 42Sc, 46V, 50Mn, and 54Co respectively (P.h.D Thesis,Francisco Molina- Univ. Valencia) will be presented. The nuclei of interest were produced in the fragmentation of a 58Ni beam of 680 MeV/nucleon at GSI. The ions were separated using the Fragment Recoil Separator (FRS) and implanted into a set of DSSSD detectors surrounded by the RISING CLUSTER array. The recorded number of implanted ions of the nucleus of interest was typically 3-6 x106 in total. With this large number we were able to make correlations between the Heavy Ion implants and the subsequent beta or beta-gamma decays that follow and thus to a) measure the beta-decay half-lives with one order-of-magnitude better accuracy than the values existing in the literature, b) establish decay schemes, c) determine the direct ground state to ground state feeding in the decays, d) measure the decay intensity to the 1+ states populated in the daughter and hence the absolute B(GT) values for the Gamow-Teller beta decays. The B(GT) values are of importance in terms of the comparison with the analogous Charge Exchange (CE) reactions on the mirror nuclei (Fujita et al.,PRL95(2005)212501), which populate the same levels.

One interesting observation in these experiments is that the T=0, 1+ states populated in the beta decay predominantly by M1 transitions to the T=1, 0+ g.s. No M1 gamma transitions were observed to any other T=0, 1+ excited states. This is the result of a selection rule, called a "Quasi-rule"by Warburton and Weneser (D.H. Wilkinson "Isospin in Nuclear Physics", 1969, SBN 7204 0155 0) and it is observed for the first time in the fp shell nuclei.

Encouraged by this success we have now pursued experiments at GANIL, studying the Tz=-1 58Zn and Tz=-2 56Zn beta decays. However these nuclei are more difficult to produce because they are further from stability, ie from the stable nucleus used as a beam to produce them.

The high intensity beam at RIKEN would allow us to extend these studies to higher masses and more exotic cases. This would facilitate a comparison of the beta decay and charge exchange reactions in heavier mass systems.

Amongst the cases of interest are the very neutron-deficient 63,64 and 66Se isotopes. The first two would allow us to extend our comparison with the mirror CE process on 64Zn and 63Cu. The 66Se case is of particular interest from several viewpoints, a) to study the evolution of the B(GT) strength in the fp shell, b) to study if the "Quasi-rule"for the M1 transitions persists and c) to study a possible proton-neutron condensate.

These experiments could be carried out using the fragmentation of 78Kr and could be carried out in tandem with the experiment proposed by B. Blank and collaborators, which is focussed on two proton radioactivity and is already approved.

Primary author: RUBIO, Berta (CSIC Valencia)

Co-authors: ALGORA, Alejandro (CSIC Valencia); MOLINA, Francisco (CSIC Valencia); ORRIGO, Sonja (CSIC Valencia); GELLETLY, William (Surrey University); FUJITA, Yoshitaka (univ. Osaka)

Presenter: RUBIO, Berta (CSIC Valencia)

Session Classification: Isomer and beta-gamma spectroscopy of light and proton-rich nuclei

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

Opening

Monday 23 May 2011 10:00 (10 minutes)

Primary author: SAKAI, Hideyuki

Presenter: SAKAI, Hideyuki

Session Classification: Opening

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

Overview of the RIBF

Monday 23 May 2011 10:10 (20 minutes)

Primary author: SAKURAI, Hiroyoshi (RIKEN Nishina Center for Accelerator-Based Science)

Presenter: SAKURAI, Hiroyoshi (RIKEN Nishina Center for Accelerator-Based Science)

Session Classification: Opening

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

Overview of the BigRIPS fragment separator

Monday 23 May 2011 10:30 (20 minutes)

Primary author: KUBO, Toshiyuki (RIKEN Nishina Center)

Presenter: KUBO, Toshiyuki (RIKEN Nishina Center)

Session Classification: Opening

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

Achievements of the RISING Fast Beam Campaign

Tuesday 24 May 2011 10:00 (35 minutes)

Primary author: WOLLERSHEIM, Hans-Jürgen (GSI Helmholtzzentrum)

Presenter: WOLLERSHEIM, Hans-Jürgen (GSI Helmholtzzentrum)

Session Classification: RISING and other gamma-ray measurement techniques

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

E(U)RICA introduction

Monday 23 May 2011 10:50 (20 minutes)

Primary authors: DOORNENBAL, Pieter (RIKEN); NISHIMURA, Shunji (Researcher)

Presenters: DOORNENBAL, Pieter (RIKEN); NISHIMURA, Shunji (Researcher)

Session Classification: Opening

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

Spectroscopy of the doubly magic nucleus 100Sn and its neighbourhood with RISING

Monday 23 May 2011 11:35 (25 minutes)

The investigation of the shell structure far from the valley of stability
is a major task in modern nuclear structure physics, especially close to the drip lines. By fragmentation of a 1.0 A GeV 124Xe beam from the GSI accelerators 100Sn and neighbouring nuclei have been produced, separated in the FRS and identified by multiple deltaE, Brho and ToF measurements. The nuclei were stopped in an implantation detector with high spatial resolution in order to correlate implantations with succeeding decays. The device was surrounded by the "Stopped Beam Rising" array of 15x7 Ge-detectors in close geometry. In this
configuration the setup enabled us to do nearly 4Pi spectroscopy of the emitted gamma and particle decay radiation. With a photo peak efficiency of about 10% (E=1MeV) for gamma ray detection and nearly 100% for full energy detection of decay particles up to 5MeV, this high resolution setup allowed for a maximum use of the secondary beam. The presentation will focus on the decay spectroscopy of the doubly magic nucleus 100Sn which decays by a super Gamow Teller spin flip transition populating mostly a single final state
in the daughter nucleus. New and more precise values of the half life, the beta
endpoint energy and the Gamow Teller strength in the decay of 100Sn have been
determined in order to address the question of the Gamow Teller quenching in
100Sn. First insight into the nuclear structure of excited states in 100In was
obtained from beta-coincident gamma ray spectroscopy. Also new results
concerning the particle stability of exotic nuclei in the vicinity of 100Sn will be presented. Isomer spectroscopy in these nuclei will be discussed with a focus on the first observation of the 6+ to 4+ transition from the already known 102Sn isomer.

Primary author: HINKE, Christoph (Physik Department E12 TU Muenchen, Germany)

Presenter: HINKE, Christoph (Physik Department E12 TU Muenchen, Germany)

Session Classification: Opening

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

Decay Spectroscopy in Proton-Rich Nuclei

Monday 23 May 2011 13:30 (20 minutes)

Primary author: NISHIMURA, Shunji (Researcher)

Presenter: NISHIMURA, Shunji (Researcher)

Session Classification: Isomer and beta-gamma spectroscopy of light and proton-rich nuclei

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

Thoughts on the E(U)RICA DAQ

Tuesday 24 May 2011 14:40 (20 minutes)

Primary author: BABA, Hidetada (RIKEN)

Presenter: BABA, Hidetada (RIKEN)

Session Classification: Other gamma-ray measurement techniques II

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

Closing remarks

Tuesday 24 May 2011 17:00 (10 minutes)

Primary authors: DOORNENBAL, Pieter (RIKEN); NISHIMURA, Shunji (Researcher)

Presenter: NISHIMURA, Shunji (Researcher)

Session Classification: Discussions and closing

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

Discussions

Tuesday 24 May 2011 15:30 (1h 30m)

Primary authors: DOORNENBAL, Pieter (RIKEN); NISHIMURA, Shunji (Researcher)

Presenters: DOORNENBAL, Pieter (RIKEN); NISHIMURA, Shunji (Researcher)

Session Classification: Discussions and closing

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

Study of mid-shell nuclei based on the beta-gamma spectroscopy method

Monday 23 May 2011 15:10 (20 minutes)

Primary author: ODAHARA, Atsuko (Department of Physics, Osaka University)

Presenter: ODAHARA, Atsuko (Department of Physics, Osaka University)

Session Classification: Isomer and beta-gamma spectroscopy of light and proton-rich nuclei

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

Beta decay of the neutron-rich 132,134Cd isotopes and search for 6+ isomers in 136,138Sn

Monday 23 May 2011 17:20 (20 minutes)

Primary authors: JUNGCLAUS, Andrea; GADEA, Andres; SIMPSON, Gary

Presenter: DOORNENBAL, Pieter (RIKEN)

Session Classification: Isomer and beta-gamma spectroscopy of neutron-rich nuclei

Contribution ID: **31** Type: **not specified**

Beta Decay Studies Near N=28

Monday 23 May 2011 13:50 (20 minutes)

The nuclear structure in the region of nuclei around N=28 depends strongly on the filling of both proton and neutron orbitals. In the present proposed experiment, we plan to make systematic study the low lying energy levels for those nuclei as well as the following daughter nuclei via the b-decay and lifetime measurements. We observe the b rays using plastic scintillators. The b-delayed g rays and neurons are measured using the Ge detectors and neutron wall, respectively. In addition, the lifetime of the excited states are measured by two fast LaBr3 counters using time-delayed bgg(t) measurement. The deduced level schemes and the lifetimes of the excited states in these nuclei will help us to understand shell evolution around N=28.

Primary author: LI, Zhihuan (RIKEN)

Presenter: LI, Zhihuan (RIKEN)

Session Classification: Isomer and beta-gamma spectroscopy of light and proton-rich nuclei

Contribution ID: **32** Type: **not specified**

In-Beam Gamma-ray Spectroscopy at the RIBF

Tuesday 24 May 2011 13:30 (35 minutes)

Primary author: AOI, Nori (RIKEN Nishina Center)

Presenter: AOI, Nori (RIKEN Nishina Center)

Session Classification: Other gamma-ray measurement techniques II

Contribution ID: **34** Type: **not specified**

Probing neutron-rich isotopes around doubly closed-shell 132Sn and doubly mid-shell 170Dy by combined beta-gamma and isomer spectroscopy

Monday 23 May 2011 17:40 (20 minutes)

I will present possible decay spectroscopy experiments using the E(U)RICA
array
at RIBF, aiming at studying neutron-rich nuclei in the vicinity of the
doubly magic
nucleus 132Sn and the doubly mid-shell nucleus 170Dy

Primary author: WATANABE, Hiroshi (RIKEN Nishina Center)

Presenter: WATANABE, Hiroshi (RIKEN Nishina Center)

Session Classification: Isomer and beta-gamma spectroscopy of neutron-rich nuclei