## Sunflower - In-beam gamma-ray spectroscopy at the RIBF

# **Report of Contributions**

Search for PDR in neutron rich nu...

Contribution ID: 0

Type: not specified

### Search for PDR in neutron rich nuclei below and above the threshold

Wednesday, 11 September 2013 10:00 (30 minutes)

The structure and nature of the pygmy dipole resonance (PDR) state below and above the neutron threshold in exotic nuclei is still far away from beeing understood. Recent experimental observations give only few information on this subject. New and combined experiments using different methods are needed. The presentation we will give information on how relativistic coulomb excitation combined with gamma ray detectors could help to measure the PDR.

Primary author: Dr WIELAND, Oliver (INFN)Presenter: Dr WIELAND, Oliver (INFN)Session Classification: Session 4

Overview of In-beam Gamma-ray...

Contribution ID: 1

Type: not specified

## Overview of In-beam Gamma-ray Spectroscopy at the RIBF

*Tuesday, 10 September 2013 10:10 (40 minutes)* 

Primary author: Dr DOORNENBAL, Pieter (RIKEN)Presenter: Dr DOORNENBAL, Pieter (RIKEN)Session Classification: Session 1

Status of the MINOS project

Contribution ID: 2

Type: not specified

#### Status of the MINOS project

Tuesday, 10 September 2013 10:50 (30 minutes)

MINOS (acronym for MagIc Numbers Off Stability) is a device dedicated to perform in-flight gamma spectroscopy of very exotic nuclei in knockout reactions. It consists of a thick liquid hydrogen target (15-20 cm) surrounded by a TPC acting as a tracking detector. The vertex position is reconstructed from the direction of the emitted protons and the beam. In this way one can profit of the increase of luminosity (up to one order of magnitude) due to the thick target without losing resolution in the Doppler correction, as would occur if the vertex position in the target was not measured.

The MINOS device has been assembled and tested at CEA Saclay. An in-beam test is scheduled in October at the HIMAC facility in Chiba, Japan. It will be ready since the beginning of 2014 to perform experiments at the RIBF facility coupled with the DALI2 gamma array and the SAMURAI or ZeroDegree spectrometer. It is expected to allow the spectroscopy of key nuclei for the question of the evolution of magic numbers (e.g. 78Ni and 40Mg) that nowadays would be hard (if not impossible) to reach without such a thick target.

The device will be described and the status of the project will be presented.

Primary author: Dr CORSI, Anna (CEA Saclay) Presenter: Dr CORSI, Anna (CEA Saclay)

Study of proton shell evolution to ...

Contribution ID: 3

Type: not specified

#### Study of proton shell evolution towards 78Ni

Wednesday, 11 September 2013 13:30 (20 minutes)

We will propose an experiment to investigate proton shell evolution towards 78Ni by means of in-beam gamma-ray spectroscopy with MINOS at RIBF. The goal of the experiment is to characterize a proton f7/2 hole states in the Cu isotopes populated by one-proton knockout reaction: (p,2p). This will allow us to understand a migration of shell structure induced by the tensor part of the nucleon-nucleon interaction. In the workshop, a physics motivation and feasibility for MI-NOS@RIBF campaign will be discussed.

Primary author: Dr NIIKURA, Megumi (University of Tokyo)Presenter: Dr NIIKURA, Megumi (University of Tokyo)Session Classification: Session 5

Contribution ID: 4

Type: not specified

### Proton-neutron interactions around double-magic 58Ni and 78Ni

Wednesday, 11 September 2013 13:50 (20 minutes)

Nuclei with two-proton and two-neutron holes and particles will be studied in order to get a better understanding of the proton-neutron interactions. The nuclei and properties aimed at include: (i) around 56Ni: 56Zn (2+ energy), 58,60Zn (B(E2) transition strength), and (ii) 82Zn (2+ energy and possibly B(E2), 80Zn (B(E2)) and possibly 74Fe.

The nuclei around 56Ni and 78Ni will be populated using the primary beams 78Kr and 238U, respectively.

#### Summary

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The nuclei around 56Ni and 78Ni will be populated using the primary beams 78Kr and 238U, respectively.

Primary author: Prof. PODOLYAK, Zsolt (University of Surrey)

Co-author: Dr GORSKA, Magda (GSI Darmstadt, Germany)

Presenter: Prof. PODOLYAK, Zsolt (University of Surrey)

Coulomb excitation of fast ...

Contribution ID: 5

Type: not specified

### Coulomb excitation of fast neutron-deficient Pb beams

Wednesday, 11 September 2013 11:40 (20 minutes)

The present proposal aims to exploit the unique capabilities of BigRIPS in delivering Pb beams from 238U fragments at RIKEN. Coulomb excitation studies of fast radioactive beams will be extended to very neutron-deficient Pb nuclei and to excited states inaccessible with other methods. The measurements of B(E2) values to the 2+ states in the even-mass 184-188Pb nuclei in Coulomb excitation experiments are discussed. The proposed studies will be carried out with 345 AMev primary 238U beam. The Pb fragments will be separated with BigRIPS and the Coulomb excitation gamma-ray yield will be recorded with DALI2 at the F7 focal plane of Big RIPS. The proposed measurements will be unique to RIKEN and complementary to the lifetime measurements at JYFL and low-energy Coulomb excitation measurements at REX-ISOLDE providing stringent experimental constraints to the related theory development.

#### **Summary**

Possible Coulomb excitation studies of fast neutron-deficient Pb beams at BigRIPS will be discussed.

Primary author: Dr GRAHN, Tuomas (University of Jyväskylä)Presenter: Dr GRAHN, Tuomas (University of Jyväskylä)Session Classification: Session 4

Contribution ID: 6

Type: not specified

#### **Overview of the PreSPEC-AGATA campaigns at GSI.**

Tuesday, 10 September 2013 16:00 (30 minutes)

In 2012, Coulomb excitation and secondary fragmentation experiments using radioactive ion beams at relativistic energies have been performed for the first time with the new PreSPEC-AGATA setup.

PreSPEC-AGATA is a unique combination of the FRagment Separator(FRS), used for providing and selecting specific radioactive ion beams, the Lund-York-Cologne CAlorimeter (LYCCA), which discriminates heavy ions produced in nuclear reactions taking place in a secondary target, the HECTOR+ (LaBr3/BaF2) array and the Advanced Gamma Tracking Array(AGATA), for the precise measurement of gamma-ray energies.

The first campaign was dedicated to the questions of how the collectivity is build-up from single particle excitations and how it evolves away from magic nuclei.

Excitation probabilities of the first excited states in nuclei south-west of 208Pb were measured, including heavy Pb, Hg and Pt isotopes. The level scheme of 52Fe,nucleus with only two valence proton and neutron holes in the doubly magic 56Ni, shows rotational behavior for the low spin states. The nucleus was not only populated in its ground state but also in the 12+ isomeric excited state, which was Coulomb excited using a gold target. For 64Fe the Pygmy dipole resonance was studied, which probes the properties of neutron skin.

Finally, neutron rich Zr isotopes were excited to determine their shape evolution.

An overview of the 2012 physics campaign and the planed PreSPEC-AGATA experiments for 2014 will be presented.

**Primary author:** Dr BOUTACHKOV, Plamen (TU Darmstadt)

Presenter: Dr BOUTACHKOV, Plamen (TU Darmstadt)

Contribution ID: 7

Type: not specified

#### Relativistic coulex of 73,74,75Ni

Tuesday, 10 September 2013 16:30 (20 minutes)

The study of neutron-rich Ni isotopes, towards 78Ni, is one of the main topics in nuclear physics with exotic beams. In fact, the persistency of the N=50 shell gap far from stability is still an open question with many profound implications on the study of the nuclear structure. The availability of radioactive beams has provided the opportunity to study such neutron-rich Ni isotopes with the in-flight separation technique. Results have been obtained for 70Ni with coulex at GANIL (LISE facility) [1], and for 72Ni with the plunger technique at MSU, although the experiment is still under analysis. For 74Ni a p,p' measurement was performed at MSU [2], providing information on its nuclear deformation.

In this talk we will report the preliminary results on the coulex of 73,74,75Ni, performed at Riken. The isotopes of interest were obtained from the fission of a primary 238U beam, at an energy of 345 MeV/u and an intensity of about 8-9 pnA. The separated secondary beam impinged on a 208Pb target at the centre of the DALI array, made of 186 scintillators for gamma detection. The first excited states in 73,74,75Ni were observed, allowing one to estimate the E2 strength from the ground state. The experiment was run in parallel with another experiment of the EURICA stopped beam campaign, aimed at studying neutron-rich nuclei below Z=28 via decay spectroscopy.

[1] O. Perru et al., Phys. Rev. C96, 232501 (2006)[2] N. Aoi et Al., Phys. Lett. B692, 302 (2010)

**Primary author:** Dr GOTTARDO, Andrea (Laboratori Nazionali di Legnaro, Istituto Nazionale di Fisica Nucleare)

**Co-author:** Dr DE ANGELIS, Giacomo (Laboratori Nazionali di Legnaro, Istituto Nazionale di Fisica Nucleare)

**Presenter:** Dr GOTTARDO, Andrea (Laboratori Nazionali di Legnaro, Istituto Nazionale di Fisica Nucleare)

Search for proton-skin evidence

Contribution ID: 8

Type: not specified

#### Search for proton-skin evidence

Tuesday, 10 September 2013 16:50 (20 minutes)

#### Summary

The nuclear mesoscopic system is based on the subtle interplay between single and collective degrees of freedom which manifest themselves depending on the nuclear configuration and excitation. In recent years many efforts have been devoted to investigate evidences for this manifestation and to clarify when one description holds at the expense of the other, when the two coexist and finally when the other takes over.

One of the still disputed phenomenon is the single-particle/collective origin of strength accumulated at the low energy tail of the giant-resonance coherent excitation, commonly referred to as a pygmy resonance.

Experimental observations started in the 50's and 60's, yet only recently NRF focused on the photo-response of nuclei in the region of the particle threshold. The field received a boost with the advent of high-energy radioactive beams and the possibility to study their properties in reaction experiments, see [1] and references therein. Started from 11 Li the predicted and observed large E1 transition probabilities for halo nuclei at the threshold has triggered the idea that a dipole vibrational mode of loosely bound neutrons against a core nucleus should appear and might be observable in neutron-rich nuclei. The gross feature of the E1 response, which is mainly given by the IVGDR, is reproduced quite consistently in many models, the fine structure and especially the energetically low-lying part of the E1 strength often differs more drastically between different calculations, since it is much more dependent on the details of the nuclear forces and theoretical models. An extensive work has been recently deployed to describe the low-energy electric dipole strength. Various approaches are being used, from HartreeFockBogoliubov plus (quasi-particle) random- phase approximations (Q)RPA based on different interactions [2] to the algebraic Interacting Boson Model [3]. Many of these models predict the E1 strength located at low excitation energies as a signature of the neutron-skin oscillation. While the low-lying component of the E1 strength is observed in almost all calculations, the degree of collectivity is under debate. In parallel with the neutron skin phenomenon, expected to take place mostly in the neutron-rich nuclei, a proton skin might exist. Calculations have predicted the existence of such evidence in neutron deficient nuclei [4], which are nowadays within reach at the frontier nuclear physics facilities with an adequate intensity. This LoI aims at investigation of the pygmy strength in neutron-deficient isotopes to establish the degree of collectivity and the possible evidence of a proton skin. To this end, we plan to populate 42Ti and the completely unknown 44Cr by fragmenting a 78Kr beam, at an energy of 345 MeV/u, onto a thick Be target. The predicted intensity of the 78Kr beam is about 50 pnA. A LISE++ simulation with a 1 g/cm 9 Be target gives a transmission efficiency of about 50% up to the secondary target. In the case of 42Ti more than 10E3 pps are expected at the secondary target, assuming a cross section of about 1 µb. The fragmentation cross section used for the 44Cr yield estimate is 1.1 nb, from EPAX 3.1. The resulting 44 Cr intensity at the position of the secondary target is therefore 12 pps. The use of the DALI2 gamma-ray array is also envisaged to detect the decay out of the pygmy, populated at about 10MeV via a Coulex on a 197Au secondary target.

#### References

[1] D. Savran, T. Aumann, A. Zilges, Progr. in Part. and Nuc. Phys. 70 (2013) 210-245.

[2] N. Paar, D. Vretenar, E. Khan, G. Col', Rep. Progr. Phys. 70 (2007) 691.

[3] S. Pascu, J. Endres, N.V. Zamfir, A. Zilges, Phys. Rev. C 85 (2012) 064315.

[4] N. Paar, D. Vretenar, P. Ring, Phys. Rev. Lett. 94 (2005) 182501.

Primary author: Dr MENGONI, Daniele (University of Padova)

**Co-authors:** Dr GOTTARDO, Andrea (INFN-LNL); Dr GADEA, Andres (CSIC - Valencia); Dr DE ANGELIS, Giacomo (INFN-LNL); Dr VALIENTE DOBON, Jose Javier (INFN-LNL); Dr SCHECK, Marcus (UWS-Paisley)

Presenter: Dr GOTTARDO, Andrea (INFN-LNL)

Welcome

Contribution ID: 9

Type: not specified

### Welcome

Tuesday, 10 September 2013 10:00 (10 minutes)

Presenter: GORSKA, Magdalena (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI))

Experimental opportunities for the ...

Contribution ID: 10

Type: not specified

# Experimental opportunities for the high-resolution spectroscopy using GRAPE and/or SHARAQ

Tuesday, 10 September 2013 11:20 (30 minutes)

Presenter: Prof. SHIMOURA, Susumu (CNS, University of Tokyo)

In-beam spectroscopy towards 100...

Contribution ID: 11

Type: not specified

## In-beam spectroscopy towards 100Sn and beyond 132Sn

*Tuesday, 10 September 2013 14:30 (20 minutes)* 

Presenter: Dr JUNGCLAUS, Andrea (CSIC)

Overview of the 48Ca campaign

Contribution ID: 12

Type: not specified

### Overview of the 48Ca campaign

Wednesday, 11 September 2013 10:30 (30 minutes)

**Presenter:** Dr MOTOBAYASHI, Tohru (RIKEN Nishina Center) **Session Classification:** Session 4

In-beam spectroscopy around 132S...

Contribution ID: 13

Type: not specified

# In-beam spectroscopy around 132Sn and Overview of RCNP

Tuesday, 10 September 2013 14:00 (30 minutes)

**Presenter:** Prof. AOI, Nori (RCNP)

Spectroscopy of Neutron-Rich Ca,...

Contribution ID: 14

Type: not specified

# Spectroscopy of Neutron-Rich Ca, K and Ar Isotopes (N=32,34)

Wednesday, 11 September 2013 11:00 (20 minutes)

**Presenter:** Dr LEE, Jenny (RIKEN) **Session Classification:** Session 4

Coulomb excitation of ground stat ...

Contribution ID: 16

Type: not specified

#### Coulomb excitation of ground states and isomeric states in Pd and Cd nuclei between the N=50 shell closure and N=Z

Tuesday, 10 September 2013 14:50 (20 minutes)

Presenter: Prof. CEDERWALL, Bo (Royal Institute of Technology (KTH))

The study of excited states of N=Z...

Contribution ID: 17

Type: not specified

## The study of excited states of N=Z nuclei below 100Sn

Tuesday, 10 September 2013 15:10 (20 minutes)

**Presenter:** Prof. LIU, Zhong (Institute of Modern Physics, Chinese Academy of Sciences)

The N=56 sub-shell closure and on...

Contribution ID: 18

Type: not specified

# The N=56 sub-shell closure and onset of collectivity beyond N=58

Wednesday, 11 September 2013 14:10 (20 minutes)

**Presenter:** Prof. WERNER, Volker (Yale University)

Nuclear structure from 100-132Sn...

Contribution ID: 19

Type: not specified

# Nuclear structure from 100-132Sn on the way from stopped to fast beams

*Tuesday, 10 September 2013 13:30 (30 minutes)* 

**Presenter:** Dr GRAWE, Hubert (GSI) **Session Classification:** Session 2

Discussion

Contribution ID: 20

Type: not specified

### Discussion

Tuesday, 10 September 2013 17:10 (50 minutes)

**Presenters:** GORSKA, Magdalena (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); DOOR-NENBAL, Pieter (RIKEN)

Discussion and Closing

Contribution ID: 21

Type: not specified

### **Discussion and Closing**

Wednesday, 11 September 2013 14:30 (1 hour)

**Presenters:** GORSKA, Magdalena (GSI Helmholtzzentrum für Schwerionenforschung GmbH(GSI)); DOOR-NENBAL, Pieter (RIKEN)

Coherent Proton–Neutron Contrib...

Contribution ID: 22

Type: not specified

#### Coherent Proton-Neutron Contribution to Octupole Correlations in 114Xe studied by inelastic proton and deuteron scattering

Wednesday, 11 September 2013 11:20 (20 minutes)

This letter of intent is aiming to investigate the collective nature of low lying Octupole states, in the region of the N=Z 112Ba, by measuring the octupole deformation and the neutron and proton contribution to the octupole excitation by means of the isovector (p,p') and isoscalar (d,d') reactions, in inverse-kinematics, of secondary BigRIPS beams in the target position of the DALI2 - BigRIPS/ZeroDegree setup. The goal is to investigate the nature of the enhanced octupoles located in the vicinity of the N=Z line close to 112Ba and in particular of the 114Xe octupole state, the lightest one with sufficient production yield

Presenter: Mr HUYUK, Tayfun (IFIC - Instituto de Fisica Corpuscular)