UK Nuclear Activity

September 2013 Issue 3

In this issue,

NEW: Newsletter archive: http://npg.dl.ac.uk/OutreachNewsletter/index.html

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1. Nuclear Physics Publications for September

Int. J. Mass Spec. 349-350, 247 (2013)
http://www.sciencedirect.com/science/article/pii/S1387380613001334
The ILIMA project at FAIR
P.M. Walker[a], Yu. A. Litvinov[b, c], H. Geissel[b, d]
Published 1st September 2013

Phys. Rev. C 88, 034302 (2013) http://prc.aps.org/abstract/PRC/v88/i3/e034302
First observation of excited states in ^{87}Se: Collectivity and $j-1$ anomaly at N=53
T. Rząca-Urban[1], M. Czerwiński[1], W. Urban[1], A. G. Smith[2], I. Ahmad[3], F. Nowacki[4,5], and K. Sieja[4,5]
Published 3rd September 2013

Phys. Rev. C 88, 031304(R) (2013) http://prc.aps.org/abstract/PRC/v88/i3/e031304
Quadrupole moments of coexisting collective shapes at high spin in ^{154}Er
J. P. Revill[1], E. S. Paul[1], X. Wang[2], M. A. Riley[2], J. Simpson[3], R. V. F. Janssens[4], J. Ollier[3], A. J. Boston[1], M. P. Carpenter[4], C. J. Chiara[4,5], C. R. Hoffman[4], F. G. Kondev[6], T. Lauritsen[4], P. J. Nolan[1], J. M. Rees[1], S. V. Rigby[1], C. Unsworth[1], S. Zhu[4], and I. Ragnarsson[7]
Published 9th September 2013

Phys. Rev. Lett. 111, 112502 (2013) http://prl.aps.org/abstract/PRL/v111/i11/e112502
Spectroscopy of Element 115 Decay Chains
D. Rudolph[1,*], U. Forsberg[1], P. Golubev[1], L. G. Sarmiento[1], A. Yakushev[2], L.-L. Andersson[3], A. Di Nitto[4], Ch. E. Düllmann[2,3,4], J. M. Gates[5], K. E. Gregorich[5], C. J. Gross[6], F. P. Heßberger[2,3], R.-D. Herzberg[7], J. Khuyagbaatar[3], J. V. Kratz[4], K. Rykaczewski[6], M. Schädel[2,8], S. Åberg[1], D. Ackermann[2], M. Block[2], H. Brand[2], B. G. Carlsson[1], D. Cox[7], X. Derkx[3,4], K. Eberhardt[3,4], J. Even[3], C. Fahlander[1], J. Gerl[2], E. Jäger[2], B. Kindler[2], J. Krier[2], I. Kojouharov[2], N. Kurz[2], B. Lommel[2], A. Mistry[7], C. Mokry[3,4], H. Nitsche[5], J. P. Omtvedt[9], P. Papadakis[7], I. Ragnarsson[1], J. Runke[2], H. Schaffner[2], B. Schausten[2], P. Thörle-Pospiech[3,4], T. Torres[2], T. Traut[4], N. Trautmann[4], A. Türler[10], A. Ward[7], D. E. Ward[1], and N. Wiehl[3,4]
Published 10th September 2013

Edited by Elizabeth Cunningham, STFC Particle and Nuclear Physics Outreach Officer.
Elizabeth.Cunningham@stfc.ac.uk or E.Cunningham@surrey.ac.uk

Phys. Rev. C 88, 034312 (2013) http://prc.aps.org/abstract/PRC/v88/i3/e034312
Global properties of *K* hindrance probed by the *γ* decay of the warm rotating ^{174}W nucleus
V. Vandone[1,2], S. Leoni[1,2,*], G. Benzoni[2], N. Blasi[2], A. Bracco[1,2], S. Brambilla[2], C. Boiano[2], S. Bottoni[1,2], F. Camera[1,2], A. Corsi[1,2,†], F. C. L. Crespi[1,2], A. Giaz[1,2], B. Million[2], R. Nicolini[1,2], L. Pellegri[1,2], A. Pullia[1,2], O. Wieland[2], D. Bortolato[3], G. de Angelis[3], E. Calore[3], A. Gottardo[3], G. Maron[3], D. R. Napoli[3], D. Rosso[3], E. Sahin[3], J. J. Valiente-Dobon[3], D. Bazzacco[4], M. Bellato[4,5], E. Farnea[4], S. Lunardi[4,5], R. Menegazzo[4,5], D. Mengoni[4,5,6], P. Molini[4,5], C. Michelagnoli[4,5], D. Montanari[4,5], F. Recchia[4,5], C. A. Ur[4], A. Gadea[7], T. Hüyük[7], N. Cieplicka[8], A. Maj[8], M. Kmiecik[8], A. Atac[9], S. Akkoyun[9,‡], A. Kaskas[9], P.-A. Söderström[10], B. Birkenbach[11], B. Cederwall[12], P. J. Coleman-Smith[13], D. M. Cullen[14], P. Désesquelles[15], J. Eberth[11], A. Görgen[16,17], J. Grebosz[8], H. Hess[11], D. Judson[18], A. Jungclaus[19], N. Karkour[15], P. Nolan[18], A. Obertelli[16], P. Reiter[11], M. D. Salsac[16], O. Stezowski[20], Ch. Theisen[16], M. Matsuo[21], and E. Vigezzi[2]
Published 13 September 2013

Phys. Rev. C 88, 034313 (2013) http://prc.aps.org/abstract/PRC/v88/i3/e034313
Beyond the neutron drip line: The unbound oxygen isotopes ^{25}O and ^{26}O
C. Caesar *et al.* (R3B collaboration)
Published 16th September 2013

Phys. Rev. Lett. 111, 122501 (2013) http://prl.aps.org/abstract/PRL/v111/i12/e122501
First Use of High-Frequency Intensity Modulation of Narrow-Linewidth Laser Light and Its Application in Determination of ^{206,205,204}Fr Ground-State Properties
Annika Voss[1,*], Matthew R. Pearson[1], Jonathan Billowes[2], Fritz Buchinger[3], Bradley Cheal[2], John E. Crawford[3], Anna A. Kwiatkowski[1], C. D. Philip Levy[1], and Olivier Shelbaya[3]
Published 16th September 2013

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2. News to report

a. New superheavy elements can be uniquely identified. An international team of researchers has found fresh evidence that confirms the existence of the superheavy chemical element 115. The experiment was conducted at the GSI Helmholtz Center for Heavy Ion Research. Under the lead of physicists from Lund University in Sweden, the group, which included researchers from the University of Liverpool was able to present a way to directly identify new superheavy elements. For the new experiment, scientists at the Institute of Nuclear Chemistry at Mainz University took a sample of the exotic element americium. They deposited an americium layer on a thin foil, which was subsequently bombarded with calcium ions at the GSI facility. For the first time, the exploitation of a new detector system built in collaboration between U Lund and U Liverpool allowed registering photons along with the alpha-decay of the new element and its daughter products. Measured photon energies correspond to those expected for X-rays from these products and thus serve as the element's fingerprint. "This can be regarded as one of the most important experiments in the field in recent years, because at last it is clear that even the heaviest elements' fingerprints can be taken", agreed Professor Rodi Herzberg from the University of Liverpool, Professor Dirk Rudolph from Lund University in Sweden, and Professor Christoph Düllmann from GSI and Mainz University. "The result gives high confidence to previous reports. It also lays the basis for future measurements of this kind." Besides the X-ray events, the researchers have also obtained data giving them a deeper insight into the structure and properties of the heaviest currently known atomic nuclei. This paves the way towards improved predictions for properties of nuclei beyond the border of current knowledge. The new findings have been published in Phys. Rev. Lett. 111, 112502 (2013) http://prl.aps.org/abstract/PRL/v111/i11/e112502.
Contribution by Rodi Herzberg
R.Herzberg@Liverpool.ac.uk (Liverpool)

b. QFS-RB 13 2nd International Workshop on Quasi-Free Scattering with Radioactive-Ion Beams: 16-20 September 2013, Azores, Portugal
http://cfnul.cii.fc.ul.pt/events/QFS-RB13/.
Recent experimental developments at radioactive-beam facilities with incident energies from intermediate to high energy (100 AMeV - 1 AGeV) now allow for quasi-free knockout reactions in full kinematics and with high resolution. First experimental results are available and plans for future programs are underway for several experiments such as R3B, EXL, and ELISe at FAIR (Germany), as well as at RIBF/RIKEN (Japan), and NSCL (USA). The most direct experimental probes to study single-particle properties of nuclei and investigate the role of correlations in nuclei and nuclear matter are the high-energy proton- and electron-induced quasifree scattering reactions, such as (p,2p) and (e,e'p), which enable to construct spectral functions of bound nucleons (both valence and deeply-bound) and the derivation of absolute spectroscopic factors or occupation probabilities. In order to extract reliable information from the experimental data the interplay between experiment, reaction and structure theory has to be addressed in detail. A tight control on the reaction formalism, a proper assessment of all excitation mechanisms and a reliable description of all the pair dynamical interactions are clearly needed. The role of *ab initio* versus shell-model calculations, non-locality effects, and the role of higher excited states in the continuum also need to be explored fully. The workshop aimed to bring together experimental and theoretical experts in the field of quasi-free scattering and discuss current experimental results obtained from fully exclusive measurements (with or without polarization) as well as future experimental and theoretical developments.
Participants from the UK: Carlo Barbieri (Surrey) Ab-Initio theory for mid-mass isotopes and role of three-nucleon forces on nuclear correlations. Martin Freer (Birmingham) How might clustering influence nuclei close to the neutron drip-line. Marielle Chartier (Liverpool) The R3B Silicon Tracker - a new detector optimised to select quasi-free scattering events in inverse kinematics.
Contribution by Marielle Chartier M.Chartier@liverpool.ac.uk (Liverpool)

c. R3B silicon tracker beam test: A team of scientists and engineers from the nuclear physics groups at the Universities of Birmingham, Edinburgh, and Liverpool, and from STFC Daresbury Laboratory, recently performed a beam test for the R3B silicon tracker detector. R3B is an experimental setup for studies of reactions with relativistic radioactive beams, which will be a major component of the program for nuclear structure and astrophysics with unstable isotopes in the future Facility for Antimatter and Ion Research (FAIR) in Darmstadt, Germany. The silicon tracker project, led by Roy Lemmon at STFC Daresbury Laboratory, is the main UK contribution to R3B. The array, consistent of 30 ladders of micro-strip silicon detectors with a trapezoidal shape, will surround the reaction target to detect light recoils. A first prototype detector was tested at the MC40 cyclotron of the University of Birmingham in August, using a beam of 12 MeV alpha particles scattered by a gold foil. The test demonstrated the operation of the detector under vacuum and *in beam* conditions, sustaining count rates above 100 kHz, and provided useful information to characterize the pre-production series of ASICs for the readout electronics. Further tests are planned in the upcoming months, following on going developments in the DAQ and detector readout.
Contribution by Alfredo Estrade aestrade@ph.ed.ac.uk (Edinburgh)

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3. Outreach Activity

Investigation of Fukushima samples. Over the summer the Central Teaching Laboratory at the University of Liverpool hosted a number of year 12 students sponsored by Nuffield. A group of those students led by Janet Sampson of the Department of Physics used high resolution gamma ray spectrometry with state of the art germanium detectors to measure the gamma rays being emitted by several samples of ceramic bowls and vases. Many of

the samples were obtained by Janet when she was in Japan, where she made contact directly with the craftsmen who made them. She obtained samples that were fired both before and after the Fukushima event in March 2011. It was expected that the wood used in the firing process may have been contaminated by the post Fukushima fallout. As a comparison Janet also obtained some ceramic samples of UK origin. The results clearly showed that the pre-Fukushima samples from Japan and the UK samples only contained natural radioactivity from the Uranium and Thorium decay chains as well as Potassium 40. In contrast the post Fukushima samples showed clear evidence of Caesium 137 and Caesium 134, there was also evidence for Ruthenium 106. As the samples were of complex shapes it was a challenge to obtained the absolute efficiency of the detector systems. With help from Paul Nolan and some modelling software a good estimate was made of the absolute detector efficiency. The results showed that each Caesium isotope has an activity in the samples of up to 100 Bq. The craftsmen in Japan have been informed to reassure them that the results do not show high levels of radioactivity. The group of year 12 students involved have prepared a series of posters to present their results at the Nuffield celebration evening to be held at World Museum, Liverpool in October 2013. This event is open to the public and their results will be seen by a wide audience. Janet is now arranging for further samples to be sent from Japan, they will be used for experiment by the group of year 12 students that will attend the Nuclear Physics Master classes to be held at the University of Liverpool over the next couple of months.
Contribution by Paul Nolan
pjn@ns.ph.liv.ac.uk (Liverpool)

STFC Public Engagement Awards/Grants
http://www.stfc.ac.uk/pefunding
STFC are pleased to announce the following Public Engagement funding schemes for projects that aim to engage and inspire a wider audience with STFC Science and Technology, including work done at its world-leading facilities.
- *Small Awards Scheme* – offers up to £10,000 for small, local or 'pilot' PE projects.
Closing date for Autumn 2013 Round applications – 10 October 2013 at 16:00
For further details please go to
http://www.stfc.ac.uk/1838.aspx
- *Large Awards Scheme* – funding for PE projects that will have a significant regional or national impact. Up to £100,000 (£125,000 fEC) can be applied for. This is a 2-stage process with short-listing in December.
Closing date for 2013 Round Stage 1 applications – 07 November 2013 at 16:00
For further details please go to
http://www.stfc.ac.uk/1839.aspx
- *Public Engagement fellowships* – are aimed at those with significant research experience who have demonstrated a track record in outreach or communications work.
http://www.stfc.ac.uk/1840.aspx
- *Bursary Scheme* – for media workshops.
http://www.stfc.ac.uk/1601.aspx

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4. Media interactions

The ELI-Nuclear Physics Facility to be built in Bucharest-Magurele http://www.eli-np.ro/
Hot News video report featuring Pete Mason in the last 30 seconds (the rest of the video is in Romanian). http://bit.ly/16Sj0Wl
Contribution by Pete Mason
peter.mason@stfc.ac.uk *(Daresbury)*

New superheavy elements can be uniquely identified
http://prl.aps.org/abstract/PRL/v111/i11/e112502.
PRL published 10th September (see 1 and 2a)
http://www.uni-mainz.de/presse/16675_ENG_HTML.php
[press release]
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http://www.bbc.co.uk/news/science-environment-23849334,
http://blogs.nature.com/news/2013/08/swedes-claim-confirmation-of-element-115.html,
http://www.telegraph.co.uk/science/science-news/10269129/Evidence-for-new-element-Ununpentium-may-swell-Periodic-Table.html
Contribution by Rodi Herzberg
R.Herzberg@Liverpool.ac.uk (Liverpool)