UK Nuclear Activity

December 2016 Issue 42

In this issue,

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

Nuclear Physics Public Engagement Website: www.stfc.ac.uk/NuclearPhysicsForYou

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1. Nuclear Physics Publications for December*

If you are publishing a paper that you think would be of media value please contact Wendy Ellison, STFC Press Officer. She can help with press releases and publicity. If you get in touch with her before publication she can also get material ready in advance for the day of publication.

Physica Scripta 91 (2016) 123002
http://iopscience.iop.org/article/10.1088/0031-8949/91/12/123002/meta
High resolution gamma-ray spectroscopy and the fascinating angular momentum realm of the atomic nucleus
M A Riley[1,4], J Simpson[2] and E S Paul[3]
*Published 16 November 2016

Phys. Rev. C 94, 055804 (2016) http://journals.aps.org/prc/abstract/10.1103/PhysRevC.94.055804
Direct measurement of low-energy ^{22}Ne(p,γ)^{23}Na resonances
R. Depalo[1,2], F. Cavanna[3], M. Aliotta[4], M. Anders[5,6], D. Bemmerer[5,*], A. Best[7], A. Boeltzig[8], C. Broggini[2], C. G. Bruno[4], A. Caciolli[1,2], G. F. Ciani[8], P. Corvisiero[3], T. Davinson[4], A. Di Leva[9], Z. Elekes[10], F. Ferraro[3], A. Formicola[7], Zs. Fülöp[10], G. Gervino[11], A. Guglielmetti[12], C. Gustavino[13], Gy. Gyürky[10], G. Imbriani[9], M. Junker[7], R. Menegazzo[2], V. Mossa[14], F. R. Pantaleo[14], D. Piatti[1,2], P. Prati[3], O. Straniero[7,15], T. Szücs[10], M. P. Takács[5,6], and D. Trezzi[12] (LUNA Collaboration)
*Published 21 November 2016

Phys. Rev. C 94, 054324 (2016) http://journals.aps.org/prc/abstract/10.1103/PhysRevC.94.054324
Neutron single-particle strengths at N=40, 42: Neutron knockout from ^{68,70}Ni ground and isomeric states
F. Recchia[1,2,*], D. Weisshaar[1], A. Gade[1,3], J. A. Tostevin[4], R. V. F. Janssens[5], M. Albers[5], V. M. Bader[1,3],

*Also including missed publications from previous months.

T. Baugher[1,3,†], D. Bazin[1], J. S. Berryman[1], B. A. Brown[1,3], C. M. Campbell[6], M. P. Carpenter[5], J. Chen[7,‡], C. J. Chiara[5,§], H. L. Crawford[6], C. R. Hoffman[5], F. G. Kondev[7], A. Korichi[5,8], C. Langer[1], T. Lauritsen[5], S. N. Liddick[1,9], E. Lunderberg[1,3], S. Noji[1], C. Prokop[1,9], S. R. Stroberg[1,3,‖], S. Suchyta[1,9,¶], K. Wimmer[1,10,#], and S. Zhu[5]
*Published 28 November 2016

Phys. Rev. C 94, 064304 (2016) http://journals.aps.org/prc/abstract/10.1103/PhysRevC.94.064304
Configurations and decay hindrances of high-K states in Hf180
S. K. Tandel[1,2], P. Chowdhury[1], F. G. Kondev[3], R. V. F. Janssens[3], T. L. Khoo[3], M. P. Carpenter[3], T. Lauritsen[3], C. J. Lister[1,3], D. Seweryniak[3], S. Zhu[3], A. Deacon[4], S. J. Freeman[4], N. J. Hammond[3,*], G. D. Jones[5], E. F. Moore[3], and J. F. Smith[4,†]
Published 2 December 2016

Phys. Rev. C 94, 064311 (2016) http://journals.aps.org/prc/abstract/10.1103/PhysRevC.94.064311
Multiparticle configurations of excited states in ^{155}Lu
R. J. Carroll[1,*], B. Hadinia[2,†], C. Qi[2], D. T. Joss[1], R. D. Page[1], J. Uusitalo[3], K. Andgren[2], B. Cederwall[2], I. G. Darby[1,‡], S. Eeckhaudt[3], T. Grahn[3], C. Gray-Jones[3], P. T. Greenlees[3], P. M. Jones[3,§], R. Julin[3], S. Juutinen[3], M. Leino[3], A.-P. Leppänen[3,‖], M. Nyman[3,¶], J. Pakarinen[3], P. Rahkila[3], M. Sandzelius[2,3], J. Sarén[3], C. Scholey[3], D. Seweryniak[4], and J. Simpson[5]
Published 12 December 2016

Phys. Rev. C 94, 064316 (2016) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.94.064316
Decay of the N=126, Fr213 nucleus
Pragati[1], A. Y. Deo[1,*], Zs. Podolyák[2], P. M. Walker[2,†], A. Algora[3,‡], B. Rubio[3], J. Agramunt[3], L. M. Fraile[4], N. Al-Dahan[2,§], N. Alkhomashi[2,‖], J. A. Briz[5], M. E. Estevez Aguado[3], G. Farrelly[2], W. Gelletly[2,3], A. Herlert[6,¶], U. Köster[7], and A. Maira[5,#]
Published 14 December 2016

MNRAS 463, 4153 (2016) http://mnras.oxfordjournals.org/content/463/4/4153.abstract
Uncertainties in the production of p nuclei in massive stars obtained from Monte Carlo variations
T. Rauscher[1,2,3,★], N. Nishimura[3,4], R. Hirschi[3,4,5], G. Cescutti[2,3], A. St. J. Murphy[3,6] and A. Heger[7]
Published 21 December 2016

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2. News to Report

a. Professor John Simpson awarded Institute of Physics' Rutherford Medal

Professor John Simpson, head of the Science and Technology Facilities Council (STFC) nuclear physics group at Daresbury Laboratory and Visiting Professor at the University of Liverpool has been awarded the prestigious Institute of Physics (IOP) Rutherford Medal and Prize. The medal is awarded biannually to a nuclear physicist who has made an outstanding contribution to the field.

Credit IOP Awards 2016

The Rutherford Medal and Prize has been previously awarded to Professor Peter Butler (2012) and Professor Paul Nolan (2014), from the University of Liverpool nuclear physics group. Professors Butler and Nolan were in attendance at the 2016 award ceremony. Professor Simpson's field of research is in probing the properties of nuclei at the limits of angular momentum, deformation and stability. He has contributed to major discoveries in nuclear structure and has led the development of new detector technologies, which have shaped the experimental programme for gamma-ray spectroscopy across several decades. Scientific highlights include the discovery of robust exotic triaxial superdeformed collective structures and the spectroscopy of extremely neutron-deficient nuclei. To underpin such discoveries, Professor Simpson has led the development of large arrays of germanium detector including EXOGAM, in which he was project leader, and EUROBALL, in which he was chair of the Design and Infrastructure Group. More recently, he has been a driving force in the development of the AGATA detector array for next-generation

gamma-ray spectroscopy, using gamma-ray tracking. He has been the AGATA project manager, chair of the AGATA management board and the international spokesperson of the AGATA collaboration, which involves 12 countries within Europe. Professor Simpson is also exploiting the instrumentation and technical advances resulting from these collaborations in areas of societal importance, particularly in medical imaging, security systems, nuclear decommissioning monitoring and environmental assay.

Prof Simpson said "I am delighted and honoured to be recognised by the Institute Of Physics with this award and I feel very grateful to those I have worked with, at STFC, the University of Liverpool and across the UK, and through international collaborations, all of which are playing their part in revolutionising what we understand about nuclear structure today."

Professor Robert Page, head of the Nuclear Physics research group at the University of Liverpool said "John Simpson has been a key collaborator on many of the Liverpool group's research programmes in both pure and applied nuclear physics. This award is a thoroughly deserved recognition of John's seminal contributions to the field."

Credit IOP Awards 2016

Contribution from
https://www.liverpool.ac.uk/physics/news/stories/title,913824,en.html#.WFuy7FPyjIV
written by Laura Harkness-Brennan
Laura.Harkness@liverpool.ac.uk (Liverpool)

b. 40th ASRC International Workshop "Experimental and Theoretical Advances in Fission and Heavy Nuclei"

An international workshop on "Experimental and Theoretical Advances in Fission and Heavy Nuclei" was held on 12th-13th December at the Advanced Science Research Centre (ASRC) at Japan Atomic Energy Agency (JAEA) , Tokai (Japan). The workshop was co-organized and co-chaired by Professor Andrei Andreyev (University of York) and his long-term colleague Dr. Katsuhisa Nishio from JAEA. This was the 6th workshop in a series of similar events organized in 2012-2016 by Andreyev and Nishio at JAEA. More than 50 colleagues (22 from abroad) attended the meeting, with 31 talks presented. More information can be found here: http://asrc.jaea.go.jp/soshiki/gr/HENS-gr/workshop6/index6.html.

Contribution by Andrei Andreyev
andrei.andreyev@york.ac.uk (York)

c. The Silver Moon Workshop – Celebrating 25 years of the LUNA Collaboration

The LUNA Collaboration celebrated its 25 years of scientific activities with a Silver Moon Workshop that took place at Gran Sasso (Italy) on 1-2 December 2016 (http://home.infn.it/newsletter-eu/newsletter-infn-eu-29.html). The workshop attracted over 50 scientists from all over the world. Reviews of LUNA's past achievements and future developments were presented and provided an opportunity for lively discussions and possible new collaborations. Updates on other underground laboratories currently being developed in the US, China, and Spain were also presented (see http://silvermoon.lngs.infn.it for the full programme).

LUNA (Laboratory for Underground Nuclear Astrophysics) started its activity with a home-made 50kV accelerator in 1992. The extremely low background afforded by the Gran Sasso mountain allowed to access for the first time the low-energy frontiers (Gamow peak) of hydrogen burning in the Sun and made it possible to measure extremely low count rates (down to a few events per month) previously thought to be beyond technical capabilities. With the acquisition of a 400 kV accelerator in 2002, a rich program of experimental work spanning several years was then devoted to study the nuclear reactions involved in Big Bang nucleosynthesis and in the creation of elements through the CNO, Mg-Al and Ne-Na cycles in different stars and under different burning conditions.

LUNA's pioneering experiments have paved the way to major breakthroughs in our understanding of the inner working of stars, the age of the Universe, and the ways in which new elements are created from primordial hydrogen and helium.
Today, the Collaboration embarks on another exciting new adventure with the acquisition of a 3.5MV accelerator that will make it possible to study reactions of helium- and carbon burning, including the neutron source reactions responsible for the synthesis of elements heavier than iron. The new accelerator will be installed at the Laboratori Nazionali del Gran Sasso in 2018.
On the occasion of the Silver Moon celebration, the Collaboration has launched a yearly Newsletter and a new website: luna.lngs.infn.it
Prof Marialuisa Aliotta, Chair of the LUNA Editorial Board, appeared in two television interview broadcasts on Rai3 and Rete8. The latter is available (in Italian) at: https://www.youtube.com/watch?v=TB0faVbzF0U
Contribution by Marialuisa Aliotta maliotta@staffmail.ed.ac.uk (Edinburgh)

d. IBA-Europhysics Prize
Nominations are open until 15th January 2017 for the IBA-Europhysics Prize. This prize is awarded every second year for Applied Nuclear Science and Nuclear Methods in Medicine. The Nuclear Physics Division board of the European Physical Society administers the prize. It welcomes proposals which represent the breadth and strength of these fields in Europe. For further details, see http://www.epsnews.eu/2016/11/2017-iba-europhysics-prize-call-for-nominations/
Contribution by Paul Stevenson p.stevenson@surrey.ac.uk (Surrey)

e. European Few-Body Conference comes to Surrey
It seems that the UK is becoming a popular conference destination. Only a few months have passed since we heard that the next INPC event will take place in Glasgow. Now more good news comes from Surrey.
The University of Surrey has successfully bid to host the next European Conference on Few-Body Problems in Physics which will take place from 2-6 September 2019 in Guildford. This is the 24th event of the series, promoted by the European Few-Body Physics Research Committee, which started in 1972 in Budapest. The previous conferences took place in Aarhus (2016), Kraków (2013), Salamanca (2010), Pisa (2007), Groningen (2004), Bled (2002), Evora (2000), Grenoble (1998), Peniscola (1995), Amsterdam (1993), Elba (1991), Uzhgorod (1990), Fontevraud (1987), Balatonfüred (1985), Tbilisi (1984), Ferrara (1981), Sesimbra (1980), Dubna (1979), Uppsala (1977), Vlieland (1976), Tübingen (1975), Graz (1973) and Budapest (1972).
The European Few-Body Conferences represent a wonderful opportunity for European scientists and colleagues from countries across the world, to come together to discusss and update their knowledge of the current state-of-the-art in the research field of few-body systems — that is, systems which can be understood in terms of a few effective degrees of freedom, both from theoretical and experimental prospective. Although the origin of the Few-Body Conferences is closely related to the study of few-nucleon systems', their scope is nowadays much wider, ranging from particle physics (mesons and baryons described in terms of their constituents), to atomic, molecular, and even solid state physics. This *interdisciplinary character* is an essential part of the culture of the few-body community.
The UK involvement in few-body research, within the STFC remit, is represented by studies of hadron structure and spectroscopy, short-range nuclear structure, nuclear halos and clustering phenomena and the dynamics of few-body reactions. The EPSRC also has a large portfolio of programs on cold atoms including few-body studies. Yet, the UK is usually not well-represented at European Few-Body Conferences. The upcoming 24th conference in Guildford will provide an opportunity for the UK to make themselves visible at this multidisciplinary event. The Local Organizing Committee hopes to attract UK physicists who have not previously attended Few-Body conferences thus increasing the European Few-Body conference community. The Local Organizing Committee consists of J. Al-Khalili, C. Barbieri, W. Catford, A. Diaz-Torres, E. Ginossar, K. Litvinenko, A. Rios, P. Stevenson, and is chaired by N. Timofeyuk.
Contribution by Natasha Timofeyuk n.timofeyuk@surrey.ac.uk (Surrey)

3. Outreach Activity

Outreach Talk

Arnau Rios gave an evening talk to the Cambridge University Astronomical Society (http://www.srcf.ucam.org/astronomy/posters/cuas_termcard_michaelmas_2016b.jpg) on 22nd November. The title of the talk was "Neutron stars: beyond-ordinary stellar objects" and the audience, of about ~40 people, included undergraduates and senior citizens. It felt awkward to talk about neutron stars in the birthplace of both the neutron and the pulsar!

Contribution by Arnau Rios Huguet a.rios@surrey.ac.uk (Surrey)

Binding Blocks Update: Physics@Work, Morsø Gymnasium events, and paper acceptance for publication.

On the 1st December, Binding Blocks ran a Physics@Work event in the National STEM Learning Centre (NSLC), and an event on the 20th December at Morsø Gymnasium in Denmark.

The purpose of the Binding Blocks chart is to explain nuclear phenomena to the general public and schools, for all age ranges and anyone with an enthusiasm for LEGO. On the chart, black blocks represent stable nuclei, yellow alpha decay, red beta+ decay, orange proton decay, light blue beta- decay and dark blue neutron decay. The height represents the available energy per kg material (in units of 25TJ/kg). This project revolves around building a full 8m, ~27000 brick chart of the nuclides, and two smaller portions can be built up to Yttrium (our Iron+ chart) and up to Neon (our Neon chart), depending on the event.

Binding Blocks ran a Physics@Work event for 3 groups of school-children aged 13 – 16, totalling 55 participants. Construction of the full chart was combined with the practical demonstration of detecting radiation by using the latest Kromek detectors. A talk on nuclear fission was given and discussions were had on industrial applications of nuclear physics, radiation and radionuclides, space exploration and defence/security.

An event was also run at Morsø Gymnasium in Denmark for 25 A-Level students. An activity involving just the Neon Chart was trialled, with feedback being positive. It was trialled with the aim of implementation as part of the core Binding Blocks event.

Furthermore, we are very happy to announce that our Binding Blocks paper, viewable at https://arxiv.org/abs/1610.02296, has been formally accepted for publication within the IOP's Journal of Physics Education as a Special Issue Article. The paper details everything about the project, from the chart itself and the physics behind it to building instructions, implementation, usage and much more. This will be included in a future edition of the journal after final checks/proofs are undertaken.

The Binding Blocks team are organising several events for the New Year and beyond. These include a multi-school event for A-Level students within the York area; the possibility of attending a Stargazing Live event at St Peters School in York in January as well as a teacher's event in collaboration with the NSLC at York.

Check out our website: http://www.york.ac.uk/physics/bindingblocks as well as our own YouTube channel: https://www.youtube.com/channel/UCvIXlFgJyGh4Jle_4_KE2aA, Twitter account: https://twitter.com/BindingBlocks and Facebook page: https://www.facebook.com/bindingblocks/

Contribution by Thomas Sanders tjs529@york.ac.uk and Thoryn Haylett th637@york.ac.uk (York)

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4. Media Interactions

Prof Marialuisa Aliotta, Chair of the LUNA Editorial Board (see article c. The Silver Moon Workshop – Celebrating 25 years of the LUNA Collaboration), appeared in two television interview broadcasts on Rai3 and Rete8. The latter is available (in Italian) at: https://www.youtube.com/watch?v=TB0faVbzF0U

Contribution by Marialuisa Aliotta maliotta@staffmail.ed.ac.uk (Edinburgh)