UK Nuclear Activity

March 2014 Issue 9

In this issue,

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

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1. Nuclear Physics Publications for March*

If you are publishing a paper that you think would be of media value please let Wendy Ellison wendy.ellison@stfc.ac.uk , STFC Press Officer, know. 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.

JHEP 02, 073 (2014) http://link.springer.com/article/10.1007/JHEP02%282014%29073
J/ψ production and nuclear effects in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV
B. Abelev et al., ALICE Collaboration, UK Authors:D. Alexandre, L.S. Barnby, D. Evans, M. A. S. Figueredo, L.D. Hanratty, P.G. Jones, A. Jusko, M. Krivda, G.R. Lee, R.C. Lemmon, R. Lietava, A. Palaha, P. Petrov, P.A. Scott, O. Villalobos-Baillie
*Published 18 February 2014

Phys. Rev. C 89, 024911(2014) http://journals.aps.org/prc/abstract/10.1103/PhysRevC.89.024911
Two- and Three-Pion Quantum Statistics Correlations in Pb–Pb Collisions at $\sqrt{s_{NN}}$ = 2.76 TeV at the CERN Large Hadron Collider
B. Abelev et al., ALICE Collaboration, UK Authors: D. Alexandre, L.S. Barnby, D. Evans, M. A. S. Figueredo, L.D. Hanratty, P.G. Jones, A. Jusko, M. Krivda, G.R. Lee, R.C. Lemmon, R. Lietava, R. Romita, P.A. Scott, O. Villalobos-Baillie
*Published: 26 February 2014

JHEP 03, 013 (2014) http://link.springer.com/article/10.1007/JHEP03%282014%29013
Measurement of charged jet suppression in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV
B. Abelev et al., ALICE Collaboration, UK Authors: D. Alexandre, L.S. Barnby, D. Evans, M. A. S. Figueredo, L.D. Hanratty, P.G. Jones, A. Jusko, M. Krivda, G.R. Lee, R.C. Lemmon, R. Lietava, R. Romita, P.A. Scott, O. Villalobos-Baillie
Published 3 March 2014

Phys. Rev. Lett. 112, 092501 (2014) http://journals.aps.org/prl/abstract/10.1103/PhysRevLett.112.092501
Blurring the Boundaries: Decays of Multiparticle Isomers at the Proton Drip Line
R. J. Carroll[1], R. D. Page[1], D. T. Joss[1], J. Uusitalo[2], I. G. Darby[1], K. Andgren[3], B. Cederwall[3], S. Eeckhaudt[2], T. Grahn[2], C. Gray-Jones[1], P. T. Greenlees[2], B. Hadinia[3], P. M. Jones[2], R. Julin[2], S. Juutinen[2], M. Leino[2], A.-P. Leppänen[2], M. Nyman[2], D. O'Donnell[1,4], J. Pakarinen[2], P. Rahkila[2], M. Sandzelius[2], J. Sarén[2], C. Scholey[2], D. Seweryniak[5], and J. Simpson[4]
Published 4 March 2014

*Also including missed publications from February.

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 89, 034607 (2014) http://journals.aps.org/prc/abstract/10.1103/PhysRevC.89.034607
Intermediate-energy four-body breakup calculations for ^{22}C
Y. Kucuk[1,2,*] and J. A. Tostevin[2]
Published 11 March 2014

Phys. Rev. C 89, 035806 (2014) http://journals.aps.org/prc/abstract/10.1103/PhysRevC.89.035806
Thermonuclear reaction ^{30}S(p,γ)^{31}Cl studied via Coulomb breakup of ^{31}Cl
C. Langer[1,2,†], O. Lepyoshkina[3], Y. Aksyutina[2], T. Aumann[2,4], S. Beceiro Novo[5,†], J. Benlliure[1], K. Boretzky[2], M. Chartier[6], D. Cortina[5], U. Datta Pramanik[7], O. Ershova[1,2], H. Geissel[2], R. Gernhäuser[3], M. Heil[2], G. Ickert[2], H. T. Johansson[2,8], B. Jonson[8], A. Kelić-Heil[2], A. Klimkiewicz[2,9], J. V. Kratz[10], R. Krücken[3,11], R. Kulessa[9], K. Larsson[2], T. Le Bleis[1,2,12], R. Lemmon[13], K. Mahata[2], J. Marganiec[2,14], T. Nilsson[8], V. Panin[2,4], R. Plag[1,2], W. Prokopowicz[2], R. Reifarth[1,2,‡], V. Ricciardi[2], D. M. Rossi[2,10,†], S. Schwertel[3], H. Simon[2], K. Sümmerer[2], B. Streicher[2], J. Taylor[6], J. R. Vignote[2], F. Wamers[2,4], C. Wimmer[1,2], and P. Z. Wu[6]
Published 20 March 2014

Phys. Rev. Lett. 112, 112503 (2014) http://journals.aps.org/prl/abstract/10.1103/PhysRevLett.112.112503
Nuclear Structure Towards N=40 ^{60}Ca: In-Beam γ-Ray Spectroscopy of ^{58,60}Ti
A. Gade[1,2], R. V. F. Janssens[3], D. Weisshaar[1], B. A. Brown[1,2], E. Lunderberg[1,2], M. Albers[3], V. M. Bader[1,2], T. Baugher[1,2], D. Bazin[1], J. S. Berryman[1], C. M. Campbell[4], M. P. Carpenter[3], C. J. Chiara[3,5], H. L. Crawford[4,*], M. Cromaz[4], U. Garg[6], C. R. Hoffman[3], F. G. Kondev[7], C. Langer[1,8], T. Lauritsen[3], I. Y. Lee[4], S. M. Lenzi[9], J. T. Matta[6], F. Nowacki[10], F. Recchia[1,†], K. Sieja[10], S. R. Stroberg[1,2], J. A. Tostevin[11], S. J. Williams[1], K. Wimmer[1,12], and S. Zhu[3]
Published 21 March 2014

Eur. Phys. J. A 50, 53 (2014) http://link.springer.com/article/10.1140/epja/i2014-14053-6
The SAGE spectrometer
J. Pakarinen, P. Papadakis, J. Sorri, R. -D. Herzberg, P. T. Greenlees, P. A. Butler, P. J. Coleman-Smith, D. M. Cox, J. R. Cresswell, P. Jones, R. Julin, J. Konki, I. H. Lazarus, S. C. Letts, A. Mistry, R. D. Page, E. Parr, V. F. E. Pucknell, P. Rahkila, J. Sampson, M. Sandzelius, D. A. Seddon, J. Simpson, J. Thornhill, D. Wells
Published March 2014

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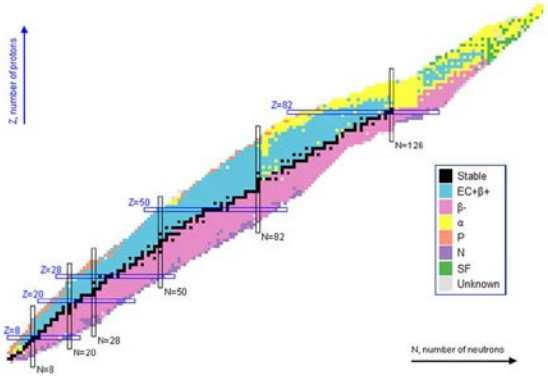
2. News to Report

a. Blurring the boundaries of existence:
A team of researchers led by the nuclear physics groups at the University of Liverpool, STFC's Daresbury Laboratory and the University of Jyväskylä in Finland have discovered that nuclei can exist in special states that blur the boundaries of existence. This research highlights how UK technology and expertise is enabling research into the behaviour of elements that are so very rare they might only exist momentarily during stellar explosions. Until now, these could have only been predicted through theoretical calculations; but the reality is proving to be very different to the theory.
In a paper published in Physical Review Letters, the team, which was supported by STFC, report the experimental discovery of an isomer of tantalum with a structure that allows it to live longer than expected before decaying.
The research was carried out at the nuclear physics research facility at the University of Jyväskylä in Finland, where some of the key technology, including the highly powerful GREAT and JUROGAM spectrometers were designed and developed by STFC's Nuclear Physics Group and UK Universities, including Liverpool.
Identifying the full extent of the nuclear landscape – essentially how many isotopes exist – is a long-standing issue of fundamental importance for nuclear physics. Beyond the stable nuclei that we find on Earth, there are many unstable nuclei that are formed in stellar events such as supernovae, but which are short-lived. There is a limit to how many protons and neutrons a nucleus can hold – too many and the excess literally 'pop out'. These limits are known as the proton and neutron 'drip lines'.
The University of Liverpool's Professor Robert Page, who led the research, said: "We usually think of nuclear ground states as being the most stable, but these results show that certain excited states have enhanced stability and could extend the range of observable nuclei far beyond the drip lines."
Although these drip lines can be calculated theoretically, experimental results rarely agree. Finding them experimentally is a difficult prospect, and the research outlined in



Nuclear chart showing the principal modes of radioactive decay of known nuclei. Figure taken from http://www.nndc.bnl.gov/chart

this paper was only made possible by instrumentation designed and realised in the UK, and is now running successfully in Finland.

Professor John Simpson, Head of STFC's Nuclear Physics Group, said: "Nuclear physicists look to create and study the very rarest elements predicted to exist. It is really exciting to see technology developed by the Nuclear Physics Group at STFC and UK Universities contribute to this research that challenges theories that, until now, we have only been able to predict. These scientific advances that are now emerging are the result of years of innovative technical development and investment by the UK and a strong and fruitful collaboration with the University of Jyväskylä".
Contribution by Robert Page rdp@ns.ph.liv.ac.uk (Liverpool) and John Simpson john.simpson@stfc.ac.uk (Daresbury)

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3. Outreach Activity

School Talk. On 7th March, to celebrate International Woman's Day Elizabeth Cunningham gave a keynote talk about careers in science for the event 'Inspiring Change: A Future for Girls from Physics' to year 9 and 10 students at Ursuline High School for Girls in Wimbledon.
Contribution by Elizabeth Cunningham e.cunningham@surrey.ac.uk (Surrey)

ScienceGrrl Event. International Women's Day (8th March) was celebrated at the Yorkshire Museum in an event organised by Dr Gemma Wilson (University of York). Around 20 female scientists spent the day in the Museum, speaking to the public and children about their work. Along with Gemma, nuclear physics was also represented by Dr Lianne Scruton and Victoria Truesdale (both University of York).


The physics of Geiger counters and natural radioactivity, silicon and diamond detectors, and particle classes were discussed. Over the course of the day, about 60 children were spoken to, in addition to their parents and other adults. Both the children and the adults were eager to listen, and asked some good questions. The other female scientists in attendance were astronomers from York's Astrocampus, biologists, chemists, archaeologists and engineers from industry. The event was organised on behalf of ScienceGrrl http://sciencegrrl.co.uk, which is a national organisation celebrating women in science, and promoting science to everybody.
Contribution by Gemma Wilson gemma.wilson@york.ac.uk (York)

School Talk. On the 18th March, Alison Bruce gave a talk at Worthing 6th form college to AS and A2 physics students about the research done by the Brighton group. She also talked about how great it was to do physics at University.
Contribution by Alison Bruce alison.bruce@brighton.ac.uk (Brighton)

Public Talk. On the 20th of March, Thomas Henry and Jack Henderson gave a thirty minute talk to eleven members of the public on the subject of radiation and detection methods. The talk was given at the York Cold-War Bunker (http://www.english-heritage.org.uk/daysout/properties/york-cold-war-bunker/) as part of the department's outreach program in collaboration with Katherine Leech.
Contribution by Jack Henderson jh1234@york.ac.uk (York)

School Talk. On 20th March, Elizabeth Cunningham went back to her old secondary school, Carshalton High School for Girls and gave an assembly and two lessons to year 9 –

13 students about nuclear physics and careers in science.
Contribution by Elizabeth Cunningham e.cunningham@surrey.ac.uk (Surrey)

I'm a scientist, get me out here!
In the 2014 edition of this popular outreach event, STFC funded a 'Nuclear Zone' dedicated to the matters of the atomic nucleus and its applications. It was occupied by 5 STFC-funded students and researchers who got to chat live with high-school students from all across the UK and answer all their questions, from the impact that faith & beliefs can have on research, to how hot the collisions are at the LHC. Blowing up things in the lab was also a general concern and source of excitement! Thomas Cocolios made sure to fuel their interest to the best of his abilities and made it to the final round of the game. Unfortunately he lost to Clara Nellist, an ATLAS Physicist, also from The University of Manchester (currently doing a post-doc at the Laboratoire de l'Accélérateur Linéaire in Orsay, France), whose charm seemed to sweep the students' hearts!
Thomas said: "It was a great experience and I am really glad I got to take part in it. It was very challenging to answer all the questions that were coming at the same time, while covering a large range of topics, sometimes not really even connected to nuclear physics. I do hope that I have inspired some young minds and scientists to be. I sincerely invite everyone to take part in this adventure if given the opportunity."
More info can be found at http://nuclearm14.imascientist.org.uk .
Contribution by Thomas Cocolios thomas.elias.cocolios@cern.ch (Manchester)

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4. Media Interactions

Dark Matter Interview on Radio New Zealand

Alex Murphy is interviewed about the evidence for dark matter, how we are trying to detect it and what dark matter may be.

http://tinyurl.com/ppaxvu3

Contribution by Alexander Murphy a.s.murphy@ed.ac.uk (Edinburgh)