UK Nuclear Activity

July 2018 Issue 61

In this issue,

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

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

Nuclear Physics Outreach Poster – order hardcopies from STFC free of charge here

---

1. Nuclear Physics Publications for July*

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.

Phys. Rev. Lett. 120, 239901 (2018) https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.120.239901
Erratum: Three New Low-Energy Resonances in the ^{22}Ne(p,γ)^{23}Na Reaction [Phys. Rev. Lett. 115, 252501 (2015)]
F. Cavanna et al. (The LUNA Collaboration)
*Published 5 June 2018

Phys. Rev. Lett. 120, 263003 (2018) https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.120.263003
Precision Measurement of the First Ionization Potential of Nobelium
P. Chhetri[1,2,*], D. Ackermann[2,3], H. Backe[4], M. Block[2,5,6], B. Cheal[7], C. Droese[8], Ch. E. Düllmann[2,5,6], J. Even[6,9], R. Ferrer[10], F. Giacoppo[2,6], S. Götz[2,5,6], F. P. Heßberger[2,6], M. Huyse[10], O. Kaleja[2,11,†], J. Khuyagbaatar[2,6], P. Kunz[12], M. Laatiaoui[2,6], F. Lautenschläger[1,2], W. Lauth[4], N. Lecesne[3], L. Lens[2,5], E. Minaya Ramirez[13], A. K. Mistry[2,6], S. Raeder[2,6], P. Van Duppen[10], Th. Walther[1], A. Yakushev[2,6], and Z. Zhang[14]
*Published 29 June 2018

Phys. Rev. C 98, 014603 (2018) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.98.014603
Two-body dissipation effect in nuclear fusion reactions
Kai Wen[*], M. C. Barton, Arnau Rios, and P. D. Stevenson
Published 3 July 2018

Phys. Rev. C 98, 014309 (2018) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.98.014309
High-spin structure in the transitional nucleus ^{131}Xe: Competitive neutron and proton alignment in the

*Also including missed publications from previous months.

vicinity of the N=82 shell closure
L. Kaya[1,*], A. Vogt[1], P. Reiter[1], M. Siciliano[2,3], B. Birkenbach[1], A. Blazhev[1], L. Coraggio[4], E. Teruya[5], N. Yoshinaga[5], K. Higashiyama[6], K. Arnswald[1], D. Bazzacco[7], A. Bracco[8], B. Bruyneel[9], L. Corradi[3], F. C. L. Crespi[8], G. de Angelis[3], J. Eberth[1], E. Farnea[7,†], E. Fioretto[3], C. Fransen[1], B. Fu[1], A. Gadea[10], A. Gargano[4], A. Giaz[8], A. Görgen[11,12,13], A. Gottardo[3], K. Hadyńska-Klęk[3], H. Hess[1], R. Hetzenegger[1], R. Hirsch[1], N. Itaco[4,14], P. R. John[15], J. Jolie[1], A. Jungclaus[16], W. Korten[17], S. Leoni[8], L. Lewandowski[1], S. Lunardi[2,7], R. Menegazzo[7], D. Mengoni[18,2,7], C. Michelagnoli[19], T. Mijatović[20], G. Montagnoli[2,7], D. Montanari[2,7], C. Müller-Gatermann[1], D. Napoli[3], Zs. Podolyák[21], G. Pollarolo[22], A. Pullia[8], M. Queiser[1], F. Recchia[2,7], D. Rosiak[1], N. Saed-Samii[1], E. Şahin[11], F. Scarlassara[2,7], D. Schneiders[1], M. Seidlitz[1], B. Siebeck[1], J. F. Smith[23], P.-A. Söderström[24], A. M. Stefanini[3], T. Steinbach[1], O. Stezowski[25], S. Szilner[20], B. Szpak[26], C. Ur[7], J. J. Valiente-Dobón[3], K. Wolf[1], and K. O. Zell[1]
Published 6 July 2018

Phys. Lett. B 782, 468 (2018) https://www.sciencedirect.com/science/article/pii/S0370269318304283
Testing microscopically derived descriptions of nuclear collectivity: Coulomb excitation of ^{22}Mg
J.Henderson[ab], G.Hackman[a], P.Ruotsalainen[c], S.R.Stroberg[a1], K.D.Launey[d], J.D.Holt[a], F.A.Ali[ef], N.Bernier[ag], M.A.Bentley[h], M.Bowry[a], R.Caballero-Folch[a], L.J.Evitts[ai], R.Frederick[a], A.B.Garnsworthy[a], P.E.Garrett[f], B.Jigmeddorj[f], A.I.Kilic[f], J.Lassen[a], J.Measures[ai], D.Muecher[f], B.Olaizola[af], E.O'Sullivan[a], O.Paetkau[a], J.Park[ag2], J.Smallcombe[a], C.E.Svensson[f], R.Wadsworth[h], C.Y.Wu[b]
Published 10 July 2018

EPL, 122, 5 (2018) http://iopscience.iop.org/article/10.1209/0295-5075/122/52001
Effect of beam energy straggling on resonant yield in thin gas targets: The cases ^{22}Ne(p, γ)^{23}Na and ^{14}N(p, γ)^{15}O
D. Bemmerer[1], F. Cavanna[2], R. Depalo[3,4], M. Aliotta[5], M. Anders[1,6], A. Boeltzig[7], C. Broggini[3], C. Bruno[5], A. Caciolli[3], T. Chillery[5], P. Corvisiero[2], T. Davinson[5], Z. Elekes[8], F. Ferraro[2], A. Formicola[9], Zs. Fülöp[8],G. Gervino[10], A. Guglielmetti[11,12], C. Gustavino[13], Gy. Gyürky[8], R. Menegazzo[3], V. Mossa[14], F. R. Pantaleo[14],P. Prati[2], D. A. Scott[5], K. Stöcker[1,6], O. Straniero[9,15], T. Szücs[8], M. P. Takács[1,6] and D. Trezzi[12]
Published 12 July 2018

Phys. Rev. Lett. 121, 032502 (2018) https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.121.032502
Neutron Skin Effects in Mirror Energy Differences: The Case of ^{23}Mg–^{23}Na
A. Boso[1,2,*], S. M. Lenzi[1,2], F. Recchia[1,2], J. Bonnard[2,3], A. P. Zuker[1,4], S. Aydin[5], M. A. Bentley[6], B. Cederwall[7], E. Clement[8], G. de France[8], A. Di Nitto[9,10], A. Dijon[8], M. Doncel[7], F. Ghazi-Moradi[7], A. Gadea[11], A. Gottardo[12], T. Henry[6], T. Hüyük[11], G. Jaworski[13], P. R. John[1,2,†], K. Juhász[14], I. Kuti[14], B. Melon[15], D. Mengoni[1,2], C. Michelagnoli[1,2], V. Modamio[12], D. R. Napoli[12], B. M. Nyakó[14], J. Nyberg[16], M. Palacz[13], J. Timár[14], and J. J. Valiente-Dobón[12]
Published 19 July 2018

Phys. Rev. C 98, 011601(R) (2018) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.98.011601
Reduced sensitivity of the (d,p) cross sections to the deuteron model beyond the adiabatic approximation
M. Gómez-Ramos[1] and N. K. Timofeyuk[2]
Published 19 July 2018

Phys. Rev. C 98, 014612 (2018) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.98.014612
Statistical study of the prompt-fission γ-ray spectrum for 238U(n, f) in the fast-neutron region
L. Qi[1], M. Lebois[1,*], J. N. Wilson[1], A. Chatillon[2], S. Courtin[3], G. Fruet[3], G. Georgiev[4], D. G. Jenkins[5], B. Laurent[2], L. Le Meur[6], A. Maj[7], P. Marini[2], I. Matea[1], L. Morris[5], V. Nanal[8], P. Napiorkowski[9], A. Oberstedt[10], S. Oberstedt[11], C. Schmitt[12], O. Serot[13], M. Stanoiu[14], and B. Wasilewska[7]
Published 20 July 2018

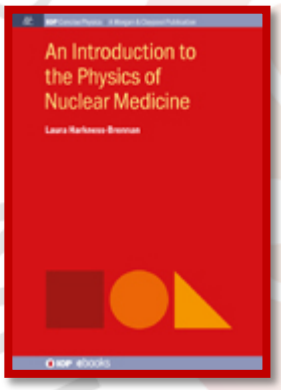
NIMA 897, 59 (2018) https://www.sciencedirect.com/science/article/pii/S0168900218304455
Pulse pile-up identification and reconstruction for liquid scintillator based neutron detectors
X.L.Luo[ab], V.Modamio[c], J.Nyberg[b],, J.J.Valiente-Dobón[c], Q.Nishada[b], G.de Angelis[c], J.Agramunt[d], F.J.Egea[de], M.N.Erduran[f], S.Ertürk[g], G.de France[h], A.Gadea[d], V.González[e], A.Goasduff[i], T.Hüyük[d], G.Jaworski[jk], M.Moszyński[kl], A.Di Nitto[m], M.Palacz[k], P.-A.Söderström[no], E.Sanchis[e], A.Triossi[c], R.Wadsworth[p]
Published 21 July 2018

---

2. News to Report

a. IOP Concise Physics Series: An Introduction to the Physics of Nuclear Medicine

Laura Harkness-Brennan has published a book entitled: An Introduction to the Physics of Nuclear Medicine as part of the IOP Concise Physics Series. This book will offer an insight into the physics of nuclear medicine by explaining the principles of radioactivity, how radionuclides are produced and administered as radiopharmaceuticals to the body and how radiation can be detected and used to produce images for diagnosis. The treatment of diseases such as thyroid cancer, hyperthyroidism and lymphoma by radionuclide therapy will also be explored. The book is available through institutional access to the IOP Concise Physics Digital Library. It is also available in print and eBook format from Morgan and Claypool publishers: http://www.morganclaypoolpublishers.com/catalog_Orig/product_info.php?products_id=1267.



Contribution by Laura Harkness-Brennan *Laura.Harkness@liverpool.ac.uk* *(Liverpool)*

b. Nuclear Physics Success at the IoP Jocelyn Bell-Burnell Awards

Two of the four finalists for the IoP Jocelyn Bell-Burnell Award this year were Nuclear Physics PhD students:
See original press release.
A postdoc at the Cavendish Laboratory, University of Cambridge won the Jocelyn Bell Burnell Medal and Prize – an IOP award for female physicists in very early career. She was congratulated by the Women In Physics Group chair, Dr Joanne Cole, along with the other finalists, Sarah-Jane Lonsdale (Edinburgh), Lucy McAreavey (Liverpool) and Dr Hannah Williams (Imperial).
At the award celebration Sarah-Jane, a third-year PhD student at the University of Edinburgh, spoke about her research on nucleosynthesis in stars and her activities to support grassroots initiatives to increase diversity in STEM, including the LGBT+ Physical Sciences Network. Commenting on the finals, she said: "Taking part in this has been a really exciting opportunity. It's nice to be able to discuss not only my research but also my work to encourage other people in physics, particularly women in physics. I have been very active in supporting diversity in STEM."
Lucy, a third-year PhD student at the University of Liverpool, spoke about her research on imaging in molecular radiotherapy and her outreach work. She regularly volunteers at university open days and her activities have included being part of a team of three women to visit a primary school and get the pupils to draw a scientist. Only one – a girl – drew a female scientist, drawing an image of herself. "The school thanked us and said 'you have changed perceptions of what a scientist looks like – your coming in today has made them think differently'," she said.
Contribution by Sarah Lonsdale *sarah.lonsdale@ed.ac.uk* *(Edinburgh)*

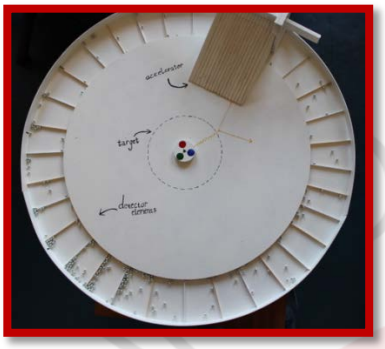
c. Nuclear Physics Masterclasses 2018 – More events and groups engaged than ever before!

This summer Nuclear Physics Masterclass style events took place at Birmingham, Daresbury, Glasgow, Manchester, Surrey and York – the highest number of groups participating so far. Details of some of the events are given below:

Glasgow

The first Nuclear Physics Outreach Event organised by the University of Glasgow's Nuclear and Hadron Physics Research Group successfully took place on the morning of Monday 11th June, in the University's School of Physics and Astronomy. Staff and PhD students from the research group welcomed 30 pupils and 4 teachers to participate in the nuclear and hadron physics themed event. The attendees travelled from 3 different high schools based in Glasgow and North Ayrshire, and the pupils had recently completed their Scottish Qualifications Authority (SQA) National 5 physics exam.
The event consisted of a lecture in introductory nuclear physics, followed by 4 experiments. Each experiment comprised a short introductory lecture and a hands-on

activity for every pupil to partake in. Experiments were complimented by worksheets to record results. The experimental physics topics included cloud chambers/particle detection, the photoelectric effect, scattering experiments and the nuclide chart (via the Binding Blocks outreach activity). The Binding Blocks activity training and materials were provided by the University of York.

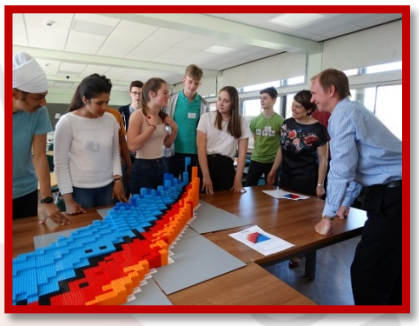


Masterclass scattering experiment

The pupils built cloud chambers, which were innovatively made from cups, polystyrene and dry ice, to detect radiation from cosmic rays and view particle tracks. This was supplemented by a separate Cosmic Counter outreach stand set up in the laboratory, which allowed pupils to measure the cosmic muon flux with cutting edge scintillation counters and electronics used in hadron physics experiments.
The photoelectric effect experiment was a simplified version of one offered by the school of Physics and Astronomy for SQA advanced higher projects and undergraduate labs. The experiment demonstrated a concept instrumental to the functionality of several particle detectors used in nuclear and hadron physics research. Measuring the current released from a cathode exposed to light of different wavelengths, the pupils calculated Planck's constant. The pupils could also simulate the experiment on a laptop, and compare their measured and expected values.
Contribution by Rachel Montgomery Rachel.Montgomery@glasgow.ac.uk & Abby-Rhian Powell a.powell.2@research.gla.ac.uk (Glasgow)

Birmingham

On the 25th June, the nuclear physics group at the University of Birmingham ran a Nuclear Physics Masterclass as part of the Physics Experience week. The event was attended by 32 year-11 and -12 pupils. They spent the whole day with the nuclear physics group attempting different activities. Part of their time was spent in the Nuclear Laboratory under the supervision of Carl Wheldon, Jack Bishop and PhD-student Pedro Santa Rita Alcibia. The experiments ranged from nuclear forensics to the binding energy of the deuteron and measuring the speed of light. Following a talk on nuclear physics delivered by Tzany Kokalova, they engaged with building part of the Segrè chart using the York Binding Blocks kindly provided by Christian Diget.



This activity was led by Tzany and David Evans together with PhD-students Stuart Pirrie and Tony Turner. This was a great day and shortly after, on the 4th of July, the group repeated the laboratory session for the Nuclear Engineering Taster Day, where, around 40 year-12 and -13 pupils took part.

Contribution by Tzany Kokalova Wheldon t.kokalova@bham.ac.uk (Birmingham)

Surrey

The fifth Surrey nuclear physics masterclass, on Friday 29th June, was the biggest yet with 50 students and teachers attending.
The day celebrating nuclear physics started with an introduction by Jim Al-Khalili. The attendees were then split and while one group had an opportunity to use Surrey's undergraduate radiation teaching laboratory to investigate neutron activated copper samples and learn more about the astrophysical s-process, the other group did the University of York Lego Binding Blocks activity. Thanks again to York for supporting our event. In the afternoon the students

learnt about polonium and neutron stars in talks by Paddy Regan and Arnau Rios.
The masterclass was organised by the Surrey outreach officer Heather Campbell and supported by Surrey's finest postdocs, PhD students and undergrads. The day finished with a 'making ice cream from liquid nitrogen' activity, which (given the heat) was enjoyed by all.
Contribution by Elizabeth Cunningham elizabeth.cunningham@stfc.ac.uk (Surrey/STFC)

Daresbury
Daresbury's third masterclass was truly a team effort with contributions from the nuclear physics groups at Daresbury, Liverpool, Manchester and York. Held over two days: 5-6th July, the event engaged 123 students and teachers with lectures and interactive workshops.
Students got to learn about gamma ray absorption with radiation detection activities and materials provided by Paul Nolan, Andy Boston, Laura Harkness-Brennan and the rest of the team from the University of Liverpool;

they also used Geant-4 to simulate radiation interaction with matter using computers run by Marc Labiche and David Laff, and worked to build 3D nuclear chart of all isotopes made completely out of Lego with Christian Diget, Alessandro Pastore and students from the University of York.

Laura Harkness Brennan (Liverpool) and John Simpson (Daresbury) set the scene for the day with an introduction to nuclear physics and Daresbury Laboratory whilst John Roberts (Manchester) rounded the day off with an engaging discussion about nuclear energy that separated the facts from the fuss!
The event was the result of a large amount of work and collaboration between the Daresbury Nuclear Physics group, the University of Liverpool, University of York, University of Manchester and the Public Engagement teams at Swindon and Daresbury. Thank you to everyone involved.
Contribution by Elizabeth Cunningham elizabeth.cunningham@stfc.ac.uk (STFC/Surrey) & Gemma Reed gemma.reed@stfc.ac.uk (STFC)

-

This year nuclear physics groups across the UK engaged almost 400 students and teachers with the wonders of our science. If you would like to get involved in this ever expanding family of events please contact your STFC outreach officer Elizabeth Cunningham Elizabeth.Cunningham@stfc.ac.uk

d. STOP PRESS: Nuclear Physics Division of the EPS announce the 2015-2017 PhD Prize
See announcement.
The Nuclear Physics Division of the EPS has awarded the 2015-2017 PhD Prize jointly to Dr Ronald Fernando Garzia Ruiz, Dr Carlo Giulio Bruno and Dr José Luis Rodríguez Sánchez.
The theses of the winners:
Ronald Fernando Garcia Ruiz, Investigating the possible magicity of N=32,34 in exotic Ca isotopes using laser spectroscopy methods, KU, Lueven, Belgium, September, 2015.
Carlo Giulio Bruno, Underground measurement of hydrogen-burning reactions on 17,18O at energies of astrophysical interest, University of Edinburgh, UK, November, 2017.
José Luis Rodríguez Sánchez, Pre- and post-saddle fission dynamics using lead on proton reactions in complete kinematics measurements, Univ. Santiago del Compostela, Spain, November, 2015.
The winners of the PhD Prize will be presented with diplomas on the final day of the 4th European Nuclear Physics Conference (Bologna - September 2-7, 2018) where they will give a plenary invited talk on their work on September 7, 2018. The winners will also receive 1000 EUR, to cover their conference costs, through the generous sponsorship from the organisers of the conference.
Contribution by Carlo Bruno carlo.bruno@ed.ac.uk (Edinburgh)

3. Outreach Activity

Science and Technology Festival at King Edward VI School

On 27th June Dr Chantal Nobs from the Culham Centre for Fusion Energy was invited to the King Edward VI School in Southampton to talk to A-level and GCSE students about fusion research and to participate in the "science street fair" as part of the school's Science and Technology Festival 2018. Her talk titled "Fusion energy: Harnessing the power of a man-made sun" gave an introduction to fusion research (demonstrated with beach balls and Velcro), how fusion energy differs from alternative energy sources and the challenges currently faced in developing fusion energy. Following the talk Chantal set up a variety of science busking activities for students across the whole school to get involved with, including balloon kebabs and straw oboes.

Contribution by Chantal Nobs
chantal.nobs@ukaea.uk (CCFE)

---

4. Media Interactions

-