UK Nuclear Activity

July 2013 Issue 1

In this issue,

---

1. Nuclear Physics Publications for June - July

Only papers that were published in this time period have been included (pre-prints and other online articles will be included in future months once they are published). If any papers are missing please get in touch so they can be added to the list next month.

Phys. Rev. C 87, 064301 (2013) http://prc.aps.org/abstract/PRC/v87/i6/e064301

γ-ray spectroscopy of the *A*=23, *T*=1/2 nuclei ^{23}Na and ^{23}Mg: High-spin states, mirror symmetry, and applications to nuclear astrophysical reaction rates

D. G. Jenkins[1,*], M. Bouhelal[2], S. Courtin[3], M. Freer[4], B. R. Fulton[1], F. Haas[3], R. V. F. Janssens[5], T. L. Khoo[5], C. J. Lister[5,†], E. F. Moore[5], W. A. Richter[6], B. Truett[5], and A. H. Wuosmaa[5,‡]

Published 4 June 2013

Phys. Rev. C 87, 064610 (2013) http://prc.aps.org/abstract/PRC/v87/i6/e064610

Nonlocality in the adiabatic model of *A*(*d*,*p*)*B* reactions

N. K. Timofeyuk and R. C. Johnson

Published 19 June 2013

Phys. Lett. B, 723, 302 (2013) http://www.sciencedirect.com/science/article/pii/S0370269313004024

The population of metastable states as a probe of relativistic-energy fragmentation reactions

A.M. Denis Bacelar[a], A.M. Bruce[a,], Zs. Podolyák[b], N. Al-Dahan[b], M. Górska[c], S. Lalkovski[a,d], S. Pietri[c], M.V. Ricciardi[c], A. Algora[e,f], N. Alkhomashi[b], J. Benlliure[g], P. Boutachkov[c], A. Bracco[h], E. Calore[i], E. Casarejos[j], I.J. Cullen[b], A.Y. Deo[b], P. Detistov[d,k], Zs. Dombradi[f], C. Domingo-Pardo[c], M. Doncel[k], F. Farinon[c], G.F. Farrelly[b], H. Geissel[c], W. Gelletly[b], J. Gerl[c], N. Goel[c], J. Grębosz[c,l], R. Hoischen[c,m], I. Kojouharov[c], N. Kurz[c], S. Leoni[h], F. Molina[e,], D. Montanari[h], A.I. Morales[g], A. Musumarra[n], D.R. Napoli[i], R. Nicolini[h], C. Nociforo[c], A. Prochazka[c], W. Prokopowicz[c], P.H. Regan[b], B. Rubio[e], D. Rudolph[m], K.-H. Schmidt[c], H. Schaffner[c], S.J. Steer[b], K. Steiger[o], P. Strmen[p], T.P.D. Swan[b], I. Szarka[p], J.J. Valiente-Dobón[i], S. Verma[g], P.M. Walker[b], H. Weick[c], H.J. Wollersheim[c]

Published 25 June 2013

Phys. Rev. C 87, 064613 (2013) http://prc.aps.org/abstract/PRC/v87/i6/e064613

Rapid convergence of the Weinberg expansion of the deuteron stripping amplitude

D. Y. Pang[1], N. K. Timofeyuk[2], R. C. Johnson[2], and J. A. Tostevin[2]

Published 26 June 2013

Phys. Rev. Lett. 110, 262502 (2013) http://prl.aps.org/abstract/PRL/v110/i26/e262502
Measurement of Radiative Proton Capture on ^{18}F and Implications for Oxygen-Neon Novae
C. Akers[1,2], A. M. Laird[2], B. R. Fulton[2], C. Ruiz[1], D. W. Bardayan[3], L. Buchmann[1], G. Christian[1], B. Davids[1], L. Erikson[4], J. Fallis[1], U. Hager[5], D. Hutcheon[1], L. Martin[1], A. St. J. Murphy[6], K. Nelson[7], A. Spyrou[8,9], C. Stanford[10], D. Ottewell[1], and A. Rojas[1]
Published 28 June 2013

Phys. Rev. C 88, 014319 (2013) http://prc.aps.org/abstract/PRC/v88/i1/e014319
β-delayed γ-ray spectroscopy of ^{203,204}Au and $^{200-202}$Pt
A. I. Morales[1,*], J. Benlliure[1], M. Górska[2], H. Grawe[2], S. Verma[1,†], P. H. Regan[3], Zs. Podolyák[3], S. Pietri[3,‡], R. Kumar[4], E. Casarejos[1,§], A. Algora[5,6], N. Alkhomashi[3,**], H. Álvarez-Pol[1], G. Benzoni[7], A. Blazhev[8], P. Boutachkov[2], A. M. Bruce[9], L. S. Cáceres[2], I. J. Cullen[3], A. M. Denis Bacelar[9], P. Doornenbal[2], M. E. Estévez-Aguado[1], G. Farrelly[3], Y. Fujita[10], A. B. Garnsworthy[3], W. Gelletly[3], J. Gerl[2], J. Grebosz[2,††], R. Hoischen[11], I. Kojouharov[2], N. Kurz[2], S. Lalkovski[9], Z. Liu[12], C. Mihai[13], F. Molina[5,‡‡], D. Mücher[8,a], W. Prokopowicz[2,††], B. Rubio[5], H. Schaffner[2], S. J. Steer[3], A. Tamii[14], S. Tashenov[2], J. J. Valiente-Dobón[15], P. M. Walker[3], H. J. Wollersheim[2], and P. J. Woods[12]
Published 22 July 2013

Phys. Rev. Lett. 111, 042502 (2013) http://prl.aps.org/abstract/PRL/v111/i4/e042502
Quenching of Cross Sections in Nucleon Transfer Reactions
B. P. Kay[1,2,*], J. P. Schiffer[1], and S. J. Freeman[3]
Published 24 July 2013

---

2. News to report

a. DiRAC Call for Proposals. Closing date: 5 August 2013
The DiRAC Project Management Board invites the UK theory and modelling communities in Astrophysics, Particle Physics and Nuclear Physics to apply for computational resources on the STFC DiRAC HPC Facility. The deadline for proposal submissions will be 5pm on Monday 5 August 2013. All proposal types, including Large Projects, will be accepted for this call. DiRAC will schedule successful peer reviewed proposals from 1 December 2013. The application form and guidance notes, plus descriptions of the DiRAC services, are available at www.dirac.ac.uk. For assistance please contact the Project Director, Dr Jeremy Yates, jyates@star.ucl.ac.uk, and/or the Chair of the Technical Working Group, Dr Peter Boyle, paboyle@ph.ed.ac.uk

b. Meeting of the INTC at CERN. Several members of the UK community presented new proposals at the 44th meeting of the INTC at CERN at the end of June. In particular, Wilton Catford (Surrey), Andrei Andreyev (York), Bradley Cheal (Manchester) and Thomas Cocolios (Manchester) defended projects for which they are to be spokesperson. More information can be found online at http://committees.web.cern.ch/committees/intc/welcome.html. The committee was also renewed to include a new member from the UK community - Wilton Catford (Surrey) - following the end of the term by Jon Billowes (Manchester). The outcome of the meeting and the minutes of the closed session will be made public following the decision of the CERN Research Council.
Contribution by Thomas Elias Cocolios (Manchester).

c. ISOLDE website. ISOLDE has launched a new website following the new CERN standard. Go and have a look at http://isolde.cern.ch/ !
Contribution by Thomas Elias Cocolios (Manchester).

d. ISOLDE computing cluster. Following the renewal of the ALICE computing cluster, ISOLDE has been donated 1000 cores to establish its own cluster. For more information on the details and progress of this project, you may contact Kieran Flanagan (Manchester) - Kieran.Flanagan@cern.ch.
Contribution by Thomas Elias Cocolios (Manchester).

e. ICTP-IAEA workshop on Advances in Digital Spectroscopy. Representatives from the UK nuclear physics community, Dr Laura Harkness (Liverpool) and Dr Paul Campbell (Manchester) travelled to Trieste, Italy, to teach on the Joint ICTP-IAEA workshop on Advances in Digital Spectroscopy. Digital pulse processing is a signal processing technique that is of particular interest in nuclear spectroscopy as it can provide real time digital processing of nuclear radiation data. Extracting quantities of interest, such as pulse height, shape and time of arrival can lead to significant improvements in performance. The workshop provided a unique training experience on technological innovations in applied spectrometry to scientists and students from members of the United Nations, UNESCO or IAEA. In particular, funds were made available to participants from developing countries through a programme of training activities within a framework of international cooperation. The workshop focused on sharing and exchanging knowledge on an international setting, through a series of practical and discussion sessions.
Contribution by Laura Harkness (Liverpool).

f. Quantum non-locality revealed in a nuclear reaction. This work is relevant to all experimentalists studying (d,p) reactions for structure and astrophysical reasons. Natasha Timofeyuk and Ron Johnson (Surrey) have used a nuclear reaction theory developed at Surrey to show that the velocity dependence of nuclear forces associated with quantum non-locality introduces a radical change in the way deuteron induced reactions must be interpreted. Their work, which is relevant to experiments carried out by the Surrey Nuclear Physics Group, has been published in Phys. Rev. Lett. 110, 112501 (2013) and all the missing details are available in Phys. Rev. C 87, 064610 (2013). Another paper aimed at better understanding of (d,p) reactions is Phys. Rev. C 87, 064613 (2013).
Contribution by Natasha Timofeyuk (Surrey).

g. Neutron Stars: Nuclear Physics, Gravitational Waves and Astronomy Meeting
29-30 July 2013. Meeting sponsored by the Institute of Advanced Studies and the Department of Physics, University of Surrey.
These are exciting times to study neutron stars: advanced gravitational wave facilities will come online on 2015, new astronomical observations in the whole electromagnetic spectrum (especially in the X-ray regime) and a new generation of radioactive ion beam facilities will provide a wealth of new information on compact objects.
On the modelling side, there are recent indications of a paradigm shift in the understanding of neutron star phenomenology, as we face the multi-messenger era from a quantitative perspective. The use of multi-disciplinary research tools are absolutely crucial and will be even more in the future. All of this has prompted us, at the nuclear theory group in Surrey, to join efforts with our colleagues at Southampton (world-leading experts on general relativity and astrophysics modelling) to organize a cross-fertilization meeting. This is a unique opportunity to gather the UK and international communities interested in compact objects - an effort that touches upon several of the research funded by STFC as a whole.
Contribution by Arnau Rios Huguet (Surrey).

h. IOP meeting ISNET: "Information and Statistics in Nuclear Experiment and Theory"
19-20 August 2013, University of Glasgow
Data is expensive to get, and comes with uncertainty. Before running an experiment, one would like to quantify the impact of a given data set to the theory and, in addition, how much this constraints the theoretical uncertainties. The answer to this lies in a necessary (and thus far possibly ignored)

combination of statistical tools both on the experimenter's side and on the theoretical framework as a whole. Advances in this area with new mathematical and statistical techniques will identify the information content of a given observable and help constrain both efforts in theory and experiment. In nuclear physics, this is particularly exemplified by recent advances in isospin-rich systems. The aim of the workshop is to discuss the use of information theory in the analysis of experiments, and the use of applied mathematics and statistics within the context of theoretical models. The meeting will gather an international set of experts in mathematical and statistical techniques, as well as nuclear theorists and experimentalists. Our somewhat paradoxical hope is to "exploit errors" to prepare for the next generation of models and experimental data.
Organizers: David Ireland (University of Glasgow), Witold Nazarewicz (University of Tennessee), Rolf Herzberg (University of Liverpool), David Jenkins (University of York), Paul Stevenson & Arnau Rios (University of Surrey)
Contribution by Arnau Rios Huguet (Surrey).

---

3. Outreach Activity

This section of the newsletter will try to gather information on the various nuclear physics outreach activities going on across the country. The goal is to find out what is going on, what is working well and to share ideas across the community.

Talks
Outreach talks are a great way to engage schools and the public with nuclear physics. It would be good to create a web page of speakers that teachers and others could use to arrange talks on nuclear physics. If you'd like to be put on this list please get in touch.

Paddy Regan (Surrey) has provided this list as an example of the types of talks and audiences that are interested in hearing from nuclear physicists:

- Nuclear Spectroscopy: From Natural Radioactivity to Studies of Exotic Isotopes. Invited seminar, The Heads of Physics Meeting, The Trinity Group of School, Emanuel School, London, 14 June 2013. (25 Heads of Physics).
- The Wonder of Science; An evening with Lord Winston and Profs. Regan and La Ragione at the Uni. of Surrey, Guildford, 2 July 2013. (~50 Heads of science and/or Heads of schools).
- Radioactivity Everywhere: How do we date the Earth? Invited Keynote address, Annual Stimulating Physics Conference, Charterhouse School, Godalming, 6th July 2013 (~100 Physics teachers).
- Why are we scared of the atom ? Invited lecture at the IOP teachers training course for Physics, Charterhouse School, Godalming, (~50 science teachers).
- Radioactive Rocks and The smallest things: School day presentation, St. Cuthbert Mayne Primary school, Cranleigh, Surrey, 27 June 2013 (5 x 30 minute presentations to groups of 30 children in years R, 1, 3, 4 & 5).
- Why are we scared of the atom ? Presentation to year 7 & 8 scholars, Cranleigh Prep school, 27 June 2013 (~60 students, aged 11-13).
- Radiation laboratory taster day – making new elements.; laboratory based session for St. Peters RC comprehensive Guildford, at the Uni. of Surrey, 1 July 2013 (~15 6 form students).
- The Future of Nuclear Physics. Invited talk, Celebrating the 100th Anniversary of Radioactivity at NPL, Teddington, UK 3-4 June 2013. (~150 mixed academic background).
- Energy – A lecture to ~120 year 9 school pupils for University open day, University of Surrey, Guildford, 11 July 2013.

Master classes
Is anyone else running or interested in running a nuclear physics master class? If so please get in touch.

The Nuclear Physics group at the University of Liverpool has delivered Master classes to two groups of Year 12 students during the past year. The classes are a mix of lectures by leading researchers and practical sessions. Lecture topics included: Alchemy in the 21st Century - making superheavy nuclei, Shapes and shells in nuclei, The limits of nuclear existence, Deformed and rotating shapes in nuclei, Medical diagnosis using gamma-ray spectroscopy, Applications of nuclear physics in energy, security and environmental monitoring. Practical sessions (based in our new teaching laboratories) included: Counting radioactivity using a Geiger tube, Half-life measurement for neutron activated vanadium, Determination of the stopping power of lead, copper and aluminium using gamma rays, Analysis of a variety of environmental samples using geranium detectors and gamma-ray spectroscopy.

At the end of the sessions students present a poster of a nuclear topic of their choice at an event where their teachers and parents are invited. 25-30 students attend these sessions. They were run in two different ways:

- The first was five 2 hour sessions from 3-5pm on Wednesday afternoons, with the last session being extended into the evening for the poster presentations with refreshments provided.
- The second was a two day session during a half term break covering the same ground in a concentrated timetable.

Contribution by Paul Nolan (Liverpool).

CPD Teacher Events
Teach the Teachers Workshop on 4th July 2013 at the Science Learning Centre North West, Manchester Metropolitan University. This event was organised by John Roberts (Manchester) and David Jenkins (York) on nuclear physics and nuclear energy. The day consisted of lectures on nuclear energy, nuclear physics at CERN and stellar evolution, with practical demonstrations at lunch. Approx. 30 teachers attended and the day was fully booked, before any proper advertising was done. The feedback from the teachers was very positive. There is a desire to repeat this event next year possibly in the south, if anyone is interested in getting involved, please get in touch.

Blogs
http://blogoftheisotopes.blogspot.co.uk/
http://theunstablenucleus.wordpress.com/
If you'd like your blog added to the list please email in the link.

Bright club
What happens when scientists try to be funny?
On 27th June Ed Simpson (Surrey) did a comedy sketch to ~180 people at the Electric Theatre in Guildford. There are videos on YouTube, that's all I'm saying!

Festivals/Gigs
On Sunday 7th July, Gemma Wilson (York) attended http://www.livefromjodrellbank.com/, on the Science Grrl stand in the Science Arena: We had a game to match the face of the female scientist to her name and field. I was talking about nuclear physics in general, to anyone who was passing. My props were a piece of diamond (used in detectors in the LYCCA array), a photomultiplier tube and a silicon detector. I was talking about how you use the detectors, and the potential outcomes of the research. Spoke to about 100. We were talking to people pretty much constantly from 13.30 till 7.
Contribution by Gemma Wilson (York).

STFC Public Engagement Awards/Grants http://www.stfc.ac.uk/pefunding

The ***Public Engagement Small Awards Scheme*** provides funds for small, local or 'pilot' projects promoting STFC science and technology. http://www.stfc.ac.uk/1838.aspx

The ***Large Awards Scheme*** provides funds for projects which are expected to have a significant regional or national impact. 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

---

4. Media interactions

Some great examples of nuclear physics stories that generated media interest

Going Pear Shaped http://www.nature.com/nature/journal/v497/n7448/index.html

Nature article published on May 9th 2013

http://www.nature.com/nature/journal/v497/n7448/full/nature12073.html [main article]

http://www.nature.com/nature/journal/v497/n7448/full/497190a.html [forum]

-

http://www.newstatesman.com/science/2013/06/its-all-gone-pear-shaped

http://www.bbc.co.uk/programmes/b01s8qxw

http://www.nature.com/nature/podcast/index-2013-05-09.html

http://articles.latimes.com/2013/may/07/science/la-sci-sn-pear-shaped-atomic-nuclei-20130508

http://cerncourier.com/cws/article/cern/53404

Contribution by Peter Butler (Liverpool).

Nuclear Batteries http://prl.aps.org/abstract/PRL/v110/i12/e122502

PRL article published on March 19th 2013

http://www.surrey.ac.uk/mediacentre/press/2013/99882_a_revolutionary_nuclear_battery_a_step_closer.htm [Press Release]

-

http://www.theengineer.co.uk/energy-and-environment/news/particle-research-could-lead-to-controllable-nuclear-batteries/1015817.article

Contribution by Phil Walker (Surrey).

Neon Lights up Exploding Stars http://prl.aps.org/abstract/PRL/v110/i3/e032502

PRL article published on Jan 15th 2013

http://www.york.ac.uk/news-and-events/news/2013/research/exploding-stars/ [Press Release]

-

http://www.bbc.co.uk/programmes/b01pw399

Contribution by Alison Laird (York – Boss of Nova).