UK Nuclear Activity

June 2017 Issue 48

In this issue,

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

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1. Nuclear Physics Publications for June*

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.

Physics Letters B 768 203-217 (2017) http://www.sciencedirect.com/science/article/pii/S0370269317301156
φ-Meson production at forward rapidity in p–Pb collisions at √sNN = 5.02 TeV and in pp collisions at √sNN = 2.76 TeV
ALICE Collaboration, UK Authors: D. Alexandre, L. S. Barnby, M. Borri, M. Chartier, D. Evans, M. A. S. Figueredo, K. L. Graham, P. G. Jones, A. Jusko, K. Krivda, G. R. Lee, R. Lemmon, R. Lietava, J. Norman, R. Romita, O. Villalobos Baillie, N. Zardoshti
*Published 10 May 2017

Eur. Phys. J. C (2017) 77: 339 https://link.springer.com/article/10.1140/epjc/s10052-017-4890-x
Production of π^0 and η mesons up to high transverse momentum in pp collisions at 2.76 TeV
ALICE Collaboration, UK Authors: D. Alexandre, H. A. Andrews, L. S. Barnby, M. Borri, M. Chartier, D. Evans, K. L. Graham, P. G. Jones, A. Jusko, M. Krivda, R. C. Lemmon, R. Lietava, J. Norman, O. Villalobos Baillie, N. Zardoshti
*Published 22 May 2017

Nature Physics 13, 535–539 (2017) https://www.nature.com/nphys/journal/v13/n6/full/nphys4111.html
Enhanced production of multi-strange hadrons in high-multiplicity proton–proton collisions
ALICE Collaboration, UK Authors: D. Alexandre, H. A. Andrews, L. S. Barnby, M. Borri, M. Chartier, D. Evans, M. A. S. Figueredo, K. L. Graham, P. G. Jones, A. Jusko, M. Krivda, R. C. Lemmon, R. Lietava, J. Norman, O. Villalobos Baillie, N. Zardoshti
Published June 2017

Eur. Phys. J. A (2017) 53:134 https://link.springer.com/article/10.1140/epja/i2017-12327-1
Half-life determination of T_z = -1 and T_z = - 1/2 proton-rich nuclei and the β decay of ^{58}Zn

L. Kucuk, S. E. A. Orrigo, A. Montaner-Pizá, B. Rubio, Y. Fujita, W. Gelletly, B. Blank, Y. Oktem, T. Adachi, A. Algora, P. Ascher, R. B. Cakirli, G. de France, H. Fujita, E. Ganioğlu, J. Giovinazzo, S. Grévy, F. M. Marqués, F. Molina, F. de Oliveira Santos, L. Perrot, R. Raabe, P. C. Srivastava, G. Susoy, A. Tamii, J. C. Thomas
Published June 2017

Phys. Rev. Lett. 118, 222501 (2017) https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.118.222501
Anomalies in the Charge Yields of Fission Fragments from the ^{238}U(n,f) Reaction
J. N. Wilson[1], M. Lebois[1], L. Qi[1], P. Amador-Celdran[2], D. Bleuel[3], J. A. Briz[4], R. Carroll[5], W. Catford[5], H. De Witte[6], D. T. Doherty[7], R. Eloirdi[2], G. Georgiev[8], A. Gottardo[1], A. Goasduff[8], K. Hadyńska-Klęk[9], K. Hauschild[8], H. Hess[10], V. Ingeberg[11], T. Konstantinopoulos[8], J. Ljungvall[8], A. Lopez-Martens[8], G. Lorusso[12], R. Lozeva[8], R. Lutter[13], P. Marini[14], I. Matea[1], T. Materna[7], L. Mathieu[15], A. Oberstedt[16], S. Oberstedt[17], S. Panebianco[7], Zs. Podolyák[5], A. Porta[4], P. H. Regan[5,12], P. Reiter[10], K. Rezynkina[6], S. J. Rose[11], E. Sahin[11], M. Seidlitz[10], O. Serot[18], R. Shearman[5,12], B. Siebeck[10], S. Siem[11], A. G. Smith[19], G. M. Tveten[11], D. Verney[1], N. Warr[10], F. Zeiser[11], and M. Zielinska[7]
Published 1 June 2017

NIM A 856, 133 (2017) http://www.sciencedirect.com/science/article/pii/S0168900216312815
Simultaneous measurement of neutron-induced fission and capture cross sections for ^{241}Am at neutron energies below fission threshold
K. Hirose[a,*], K. Nishio[a], H. Makii[a], I. Nishinaka[a], S. Ota[a], T. Nagayama[a,b], N. Tamura[a,c], S. Goto[c], A.N. Andreyev[a,d], M.J. Vermeulen[a], S. Gillespie[d], C. Barton[d], A. Kimura[e], H. Harada[e], S. Meigo[f], S. Chiba[g], T. Ohtsuki[h]
Published 1 June 2017

Phys. Rev. Lett. 118, 222301 (2017) https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.118.222301
Azimuthally Differential Pion Femtoscopy in Pb-Pb Collisions at √sNN = 2.76 TeV
ALICE Collaboration, UK Authors: D. Alexandre, H. A. Andrews, L. S. Barnby, M. Borri, M. Chartier, D. Evans, K. L. Graham, P. G. Jones, A. Jusko, M. Krivda, R. C. Lemmon, R. Lietava, J. Norman, O. Villalobos Baillie, N. Zardoshti
Published 2 June 2017

Phys. Rev. C 95, 061302(R) (2017) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.95.061302
De-excitation of the strongly coupled band in ^{177}Au and implications for core intruder configurations in the light Hg isotopes
M. Venhart[1,*], F. A. Ali[2,3,†], W. Ryssens[4], J. L. Wood[5], D. T. Joss[2], A. N. Andreyev[6,7], K. Auranen[8], B. Bally[9], M. Balogh[1], M. Bender[10,11], R. J. Carroll[2], J. L. Easton[12], P. T. Greenlees[8], T. Grahn[8], P.-H. Heenen[4], A. Herzáň[2,8], U. Jakobsson[8], R. Julin[8], S. Juutinen[8], D. Kíč[1], J. Konki[8], E. Lawrie[12], M. Leino[8], V. Matoušek[1], C. G. McPeake[2], D. O'Donnell[2,‡], R. D. Page[2], J. Pakarinen[8], J. Partanen[8], P. Peura[8], P. Rahkila[8], P. Ruotsalainen[8], M. Sandzelius[8], J. Sarén[8], B. Sayği[2], M. Sedlák[1,13], C. Scholey[8], J. Sorri[8], S. Stolze[8], A. Thornthwaite[2], J. Uusitalo[8], and M. Veselský[1]
Published 5 June 2017

J. High Energy Phys. (2017) 2017:1 https://link.springer.com/article/10.1007/JHEP06%282017%29032
Addendum to: Centrality dependence of high-pT D-meson suppression in Pb-Pb collisions at √sNN = 2.76 TeV
ALICE Collaboration, UK Authors: D. Alexandre, L. S. Barnby, M. Borri, M. Chartier, D. Evans, M. A. S. Figueredo, K. L. Graham, P. G. Jones, A. Jusko, M. Krivda, G. R. Lee, R. C. Lemmon, R. Lietava, J. Norman, R. Romita, O. Villalobos Baillie, N. Zardoshti
Published 6 June 2017

Phys. Educ. 52, 044004 (2017) http://iopscience.iop.org/article/10.1088/1361-6552/aa71e4
The ISOLDE LEGO® robot: building interest in frontier research
Thomas Elias Cocolios[1,4], Kara M Lynch[2] and Emma Nichols[3]
Published 8 June 2017

Phys. Lett. B 769, 549 (2017) http://www.sciencedirect.com/science/article/pii/S0370269317301338
Measurement of key resonance states for the $^{30}\mathrm{P}(p,\gamma)^{31}\mathrm{S}$ reaction rate, and the production of intermediate-mass elements in nova explosions
A. Kankainen[a,*,1], P.J. Woods[a], H. Schatz[b,c,d], T. Poxon-Pearson[b,c,d], D.T. Doherty[a,2], V. Bader[b,c], T. Baugher[b,3], D. Bazin[b], B.A. Brown[b,c,d], J. Browne[b,c,d], A. Estrade[a,4], A. Gade[b,c], J. José[e,f], A. Kontos[b], C. Langer[b,5], G. Lotay[a,2], Z. Meisel[b,c,d,6], F. Montes[b,d], S. Noji[b], F. Nunes[b,c,d], G. Perdikakis[d,g], J. Pereira[b,d], F. Recchia[b,7], T. Redpath[g], R. Stroberg[b,c], M. Scott[b,c], D. Seweryniak[h], J. Stevens[b,d], D. Weisshaar[b], K. Wimmer[g,8], R. Zegers[b,c,d]
Published 10 June 2017

Phys. Rev. C 95, 064606 (2017) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.95.064606
K*(892)0 and φ(1020) meson production at high transverse momentum in pp and Pb-Pb collisions at √sNN = 2.76 TeV
ALICE Collaboration, UK Authors: D. Alexandre, H. A. Andrews, L. S. Barnby, M. Borri, M. Chartier, D. Evans, K. L. Graham, P. G. Jones, A. Jusko, M. Krivda, R. C. Lemmon, R. Lietava, J. Norman, O. Villalobos Baillie, N. Zardoshti
Published 12 June 2017

Phys. Rev. C 95, 064308 (2017) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.95.064308
Doubly magic ^{208}Pb: High-spin states, isomers, and E3 collectivity in the yrast decay
R. Broda[1], R. V. F. Janssens[2], Ł. W. Iskra[1], J. Wrzesinski[1], B. Fornal[1], M. P. Carpenter[2], C. J. Chiara[2,3,*], N. Cieplicka-Oryńczak[1], C. R. Hoffman[2], F. G. Kondev[4], W. Królas[1], T. Lauritsen[2], Zs. Podolyak[5], D. Seweryniak[2], C. M. Shand[5], B. Szpak[1], W. B. Walters[3], S. Zhu[2], and B. A. Brown[6]
Published 12 June 2017

Phys. Educ. 52, 044005 (2017) http://iopscience.iop.org/article/10.1088/1361-6552/aa74f9
How do we know what is 'inside the atom'?—Simulating scattering experiments in the classroom
E S Cunningham
Published 13 June 2017

Eur. Phys. J. C (2017) 77: 389 https://link.springer.com/article/10.1140/epjc/s10052-017-4943-1
Production of Σ(1385)± and Ξ(1530)0 in p–Pb collisions at √sNN = 5.02 TeV
ALICE Collaboration, UK Authors: D. Alexandre, H. A. Andrews, L. S. Barnby, M. Borri, M. Chartier, D. Evans, K. L. Graham, P. G. Jones, A. Jusko, M. Krivda, R. C. Lemmon, R. Lietava, J. Norman, O. Villalobos Baillie, N. Zardoshti
Published 13 June 2017

Phys. Rev. C 95, 064610 (2017) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.95.064610
Translation invariance and antisymmetry in the theory of the nucleon optical model
R. C. Johnson[*]
Published 13 June 2017

Eur. Phys. J. C (2017) 77: 392 https://link.springer.com/article/10.1140/epjc/s10052-017-4940-4
Energy dependence of forward-rapidity J/Ψ and Ψ(2S) production in pp collisions at the LHC
ALICE Collaboration, UK Authors: D. Alexandre, H. A. Andrews, L. S. Barnby, M. Borri, M. Chartier, D. Evans, K. L. Graham, P. G. Jones, A. Jusko, M. Krivda, R. C. Lemmon, R. Lietava, J. Norman, O. Villalobos Baillie, N. Zardoshti
Published 14 June 2017

Phys. Rev. Lett. 118, 242501 (2017) https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.118.242501
Shape Evolution in Neutron-Rich Krypton Isotopes Beyond N=60: First Spectroscopy of ^{98,100}Kr
F. Flavigny[1,*], P. Doornenbal[2], A. Obertelli[3,2], J.-P. Delaroche[4], M. Girod[4], J. Libert[4], T. R. Rodriguez[5], G. Authelet[3], H. Baba[2], D. Calvet[3], F. Château[3], S. Chen[2,6], A. Corsi[3], A. Delbart[3], J.-M. Gheller[3], A. Giganon[3], A. Gillibert[3], V. Lapoux[3], T. Motobayashi[2], M. Niikura[7], N. Paul[2,3], J.-Y. Roussé[3], H. Sakurai[2,7], C. Santamaria[3], D. Steppenbeck[2], R. Taniuchi[2,7], T. Uesaka[2], T. Ando[2,7], T. Arici[8], A. Blazhev[9], F. Browne[10], A. Bruce[10], R. Carroll[11], L. X. Chung[12], M. L. Cortés[8,13,†], M. Dewald[9], B. Ding[14], S. Franchoo[1], M. Górska[8], A. Gottardo[1], A. Jungclaus[15], J. Lee[16], M. Lettmann[13], B. D. Linh[12], J. Liu[16], Z. Liu[14], C. Lizarazo[8,13], S. Momiyama[2,7], K. Moschner[9], S. Nagamine[7], N. Nakatsuka[17], C. Nita[18], C. R. Nobs[10], L. Olivier[1], R. Orlandi[19], Z. Patel[11], Zs. Podolyák[11], M. Rudigier[11], T. Saito[7], C. Shand[11], P. A. Söderström[2], I. Stefan[1], V. Vaquero[15], V. Werner[13], K. Wimmer[7], and Z. Xu[16]
Published 14 June 2017

Phys. Rev. C 95, 064314 (2017) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.95.064314
Systematic study of multi-quasiparticle K-isomeric bands in tungsten isotopes by the extended projected shell model
Xin-Yi Wu[1,2], S. K. Ghorui[1,2], Long-Jun Wang[1,*], Yang Sun[1,2,3,†], Mike Guidry[4], and Philip M. Walker[5]
Published 16 June 2017

Phys. Rev. C 95, 064317 (2017) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.95.064317
Unexpected distribution of $v1f_{7/2}$ strength in ^{49}Ca
H. L. Crawford[1,2,*], A. O. Macchiavelli[1], P. Fallon[1], M. Albers[3], V. M. Bader[4,5], D. Bazin[4], C. M. Campbell[1], R. M. Clark[1], M. Cromaz[1], J. Dilling[6,7], A. Gade[4,5], A. Gallant[6,7], J. D. Holt[6], R. V. F. Janssens[3], R. Krücken[6,7], C. Langer[4], T.

Lauritsen[3], I. Y. Lee[1], J. Menéndez[8], S. Noji[4], S. Paschalis[9,†], F. Recchia[4], J. Rissanen[1], A. Schwenk[9,10], M. Scott[4,5], J. Simonis[9,10], S. R. Stroberg[4,5,‡], J. A. Tostevin[11], C. Walz[9], D. Weisshaar[4], A. Wiens[1], K. Wimmer[12,§], and S. Zhu[3]
Published 21 June 2017

Phys. Rev. C 95, 064321 (2017) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.95.064321
In-beam γ-ray spectroscopy of the neutron-rich platinum isotope 200Pt toward the N=126 shell gap
P. R. John[1,2,*], J. J. Valiente-Dobón[3], D. Mengoni[1,2], V. Modamio[3,†], S. Lunardi[1,2], D. Bazzacco[2], A. Gadea[4], C. Wheldon[5], T. R. Rodríguez[6,7], T. Alexander[8], G. de Angelis[3], N. Ashwood[5], M. Barr[5], G. Benzoni[9,10], B. Birkenbach[11], P. G. Bizzeti[12,13], A. M. Bizzeti-Sona[12,13], S. Bottoni[9,10,‡], M. Bowry[8], A. Bracco[9,10], F. Browne[14], M. Bunce[8], F. Camera[9,10], L. Corradi[3], F. C. L. Crespi[9,10], B. Melon[12,13], E. Farnea[2], E. Fioretto[3], A. Gottardo[1,3,§], L. Grente[15], H. Hess[11], Tz. Kokalova[5], W. Korten[15], A. Kuşoğlu[16,17], S. Lenzi[1,2], S. Leoni[9,10], J. Ljungvall[18], R. Menegazzo[1,2], C. Michelagnoli[1,2,‖], T. Mijatović[19], G. Montagnoli[1,2], D. Montanari[1,2,¶], D. R. Napoli[3], Zs. Podolyák[8], G. Pollarolo[20,21], F. Recchia[1,2], P. Reiter[11], O. J. Roberts[14,**], E. Şahin[3,†], M.-D. Salsac[15], F. Scarlassara[1,2], M. Sferrazza[22], P.-A. Söderström[23,††], A. M. Stefanini[3], S. Szilner[18], C. A. Ur[2,‡‡], A. Vogt[11], and J. Walshe[5]
Published 22 June 2017

Phys. Rev. C 95, 064322 (2017) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.95.064322
β-decay half-lives and β-delayed neutron emission probabilities for several isotopes of Au, Hg, Tl, Pb, and Bi, beyond N=126
R. Caballero-Folch[1,2,*], C. Domingo-Pardo[3], J. Agramunt[3], A. Algora[3,4], F. Ameil[5], Y. Ayyad[6], J. Benlliure[6], M. Bowry[7], F. Calviño[1], D. Cano-Ott[8], G. Cortès[1], T. Davinson[9], I. Dillmann[2,5,10], A. Estrade[5,11], A. Evdokimov[5,10], T. Faestermann[12], F. Farinon[5], D. Galaviz[13], A. R. García[8], H. Geissel[5,10], W. Gelletly[7], R. Gernhäuser[12], M. B. Gómez-Hornillos[1], C. Guerrero[14,15], M. Heil[5], C. Hinke[12], R. Knöbel[5], I. Kojouharov[5], J. Kurcewicz[5], N. Kurz[5], Yu. A. Litvinov[5], L. Maier[12], J. Marganiec[16], M. Marta[5,10], T. Martínez[8], F. Montes[17,18], I. Mukha[5], D. R. Napoli[19], C. Nociforo[5], C. Paradela[6], S. Pietri[5], Zs. Podolyák[7], A. Prochazka[5], S. Rice[7], A. Riego[1], B. Rubio[3], H. Schaffner[5], Ch. Scheidenberger[5,10], K. Smith[5,17,18,20,21], E. Sokol[22], K. Steiger[12], B. Sun[5], J. L. Taín[3], M. Takechi[5], D. Testov[22,23], H. Weick[5], E. Wilson[7], J. S. Winfield[5], R. Wood[7], P. J. Woods[9], and A. Yeremin[22]
Published 23 June 2017

Phys. Educ. 52, 054001 (2017) http://iopscience.iop.org/article/10.1088/1361-6552/aa76d5
The implementation of binding blocks in the classroom
A J Wright[1], H V Willett[1,3], S R Beanland[1], M Carson[2], R A Davies[1], G Duffett[1] and A Pastore[1]
Published 29 June 2017

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2. News to Report

a. NuPECC, 16&17 June 2017, Lisbon

The 89th meeting of the Nuclear Physics European Collaboration Committee (NuPECC) took place on the 16th and 17th of June in a sunny Lisbon. The first item of business was a presentation of Portuguese nuclear physics research. Effort is concentrated in Lisbon and Coimbra, with activity highlighted in hadrons and fundamental interactions, theory developments in spectroscopy and structure of hadrons, nuclear reactions, instrumentation, astrophysics, and other topics on the interface of nuclear and particle physics. This was followed by a brief visit to the local laboratory facilities, which feature a number of low energy accelerators and radioactive sources are used for research and materials science.

The main business of NuPECC followed, with presentations from ANPhA (the Asian Nuclear Physics Association) and an overview of on-going activities in South Africa, together with updates from the Horizon 2020 projects ENSAR2 and Hadron Physics Horizon, from ECT*, the European Physics Society, and Nuclear Physics News. On the last point, Rodi Herzberg was confirmed as a new member of the Editorial Board. From FAIR, it was announced that the pre-construction activities are completing and a formal ground breaking ceremony, marking the start of major construction, will take place on July 4 2018.

The two main items on this meeting's agenda were the completion of the Long Range Plan, and the election of a new chair. Strong contributions to the Long Range Plan were made by a number of UK based researchers, including Carlo Barbieri, Alison Bruce, Martin Freer, Laura Harkness-Brennan, Alison Laird, Alex Murphy, Paul Nolan, Paddy Regan, and John Simpson. The Plan will be formally announced at a meeting to be held in Brussels, Belgium, at 1pm on 27 November 2017, and while all are welcome, formal

invitations will be extended to senior figures from European and national governments and funding organisations, professional bodies, members of the nuclear physics community, and the press. Printed copies of both the full document and a leaflet-style summary will be distributed over the next few months.
Angela Bracco retires after two terms as chair of NuPECC. Over the past few months an extensive search led to a number of excellent candidates being considered. A final vote by the members of NuPECC resulted in Marek Lewitowicz being elected as the new chair. Formally, Marek takes over after the next meeting, on January 1st 2018.
The next NuPECC meeting is scheduled to take place at Saclay, 6 & 7 October.
Contribution by Rodi Herzberg r.herzberg@liverpool.ac.uk (Liverpool) and Alex Murphy a.s.murphy@ed.ac.uk (Edinburgh)

b. PET in the Future

On the 9th of June the Nuclear Physics Group at the University of Edinburgh held a meeting on the physics of Positron Emission Tomography (PET) and related topics. There were speakers and participants from across many PET (and other medical physics) disciplines including: clinical and preclinical imaging, detector technologies, industry, image reconstruction and processing, data analysis and simulations. Keynote presentations were given by Dr Gillian Macnaught, the lead MR-PET physicist from the University of Edinburgh's Clinical Imaging facility at the Queen's Medical Research Institute (QMRI); and Professor Paul Marsden, the head of the PET physics group at Kings College London.

The aim of the meeting was to provide the opportunity to exchange ideas, foster discussions, and learn in a cross-disciplinary environment. The half-day cross-disciplinary format ensured that the content was accessible, with each talk a flavour of one PET research area to an audience with a mixed background of experience. More information on the meeting, including a full list of speakers can be found at the Eventbrite web page. The event was sponsored by the IOP's Nuclear Physics Group's half-day meeting fund.
Contribution by Gary Smith gsmith23@staffmail.ed.ac.uk (Edinburgh)

c. PINE 2017

An event for post-docs or equivalent researchers working in nuclear energy fields shall take place on September 6th-7th at the University of Manchester. Post-Docs in Nuclear Energy (PINE) 2017 offers the opportunity for researchers from a range of diverse fields to get together and share their research and possibly discover shared interests and techniques. There will be presentations from a variety of invited speakers ranging from post-docs to representatives from industry covering the current and future status of research into nuclear energy. The presentations will cover not just technical research topics but also the funding of research and the nuclear industry. Furthermore, the role of post-doctoral level researchers and industry will be explored within this framework. Professor Robin Grimes will open the event and the keynote presentation shall be from Professor Juan Matthews on "The main technical challenges for developing the next generation of reactors".
PINE 2017 is funded by the EPSRC nuclear champion grant and the STFC Global Challenge Network+ the UK Nuclear Data Network (UKNDN: http://www.ukndn.ac.uk) and lunch, coffee and an evening social will be provided free of charge for registered participants. Attendees shall be expected to bring a poster giving an overview of their research.
Registration shall open on July 3rd; for more information please see the website http://www.ukndn.ac.uk/pine or email pine2017@manchester.ac.uk.
Contribution by Tobias Wright tobias.wright@manchester.ac.uk (Manchester)

3. Outreach Activity

Careers talk at the Davison High School for Girls

On the 14th June Chantal was invited to present a career talk for girls in Years 7-10 at the Davison High School for Girls. Chantal shared her journey into physics from GCSEs through to her current position at the Culham Centre for Fusion Energy (CCFE), and discussed the project she is currently working on at CCFE.

Contribution by Chantal Nobs
chantal.nobs@ukaea.uk
(Culham Centre for Fusion Energy)

Binding Blocks June Update

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.

Summary of events this month:

2/6/17 and 3/6/17, Festival of ideas "Science out of the lab":

Public event in Parliament Square, York city centre. The event took place over the two days with hundreds of guests coming in to view and help build the Binding Blocks chart and other science stands in the tent from an array of ages and backgrounds. The event ran from 11am to 4pm both days with nearly a thousand people entering the tent and getting involved.

5/6/17 and 6/6/17, Binding Blocks training days:

Over the course of these two days, 16 more undergraduates and postgraduates were trained on how to build and teach the Binding Blocks nuclear chart to an array of different ages, the group built the chart in its entirety and answered Nuclear Physics related questions on decay.

8/6/17, Binding Blocks Teachers Day:

During this event over 30 teachers from various different schools and colleges across the country attended a STEM session at the National STEM Learning Centre on York university campus. As part of this event the teachers were shown multiple presentations on the advancements in Nuclear Physics currently occurring in the world, for example ITER was talked about in depth. The teachers as a group completed two plates of the nuclear chart. They then went on to complete nuclear physics energy release and decay worksheets.

22/6/17, York Nuclear Physics Masterclass:

During this event, students from York College, St Peters, Ashville, St John Fisher's, Ermysted, Harrogate Ladies and South Craven attended the university. The event catered for 139 students and involved activities such as teaching of the hot CNO cycle and Neutron star physics through the students conducting calculations on the fundamental forces inside a star. Some students also visited the York Plasma Institute for talks and attended some fusion workshops. Mainly, every group conducted the building of the nuclear chart, answered questions and delivered short presentations based upon the allocation of a particular medical isotope to each group (researched and presented).

27/6/17, Surrey Nuclear Physics Masterclass

A Nuclear Physics Masterclass was held at the University of Surrey, utilising the University of York's Binding Blocks Iron+ chart. Thomas Sanders gave an introduction to the session, consisting of the Binding Blocks promotional video, what the chart is and the decays on the chart, as well as some astrophysical explanations of element/isotope formation. In total 2 groups of 20 A-Level students attended and assisted the building of the chart. This was followed by the students completing worksheets designed for use with the chart. These included binding energy calculations, using the chart to follow decay pathways and researching particular isotopes.

Paper progression

The Binding Blocks team have successfully completed a paper on activities aimed at A-level students, this paper has been formally accepted for publication in the Physics Education Journal. Conducted by Alex Wright and Hannah Willett. This paper follows our recently published paper in the IOP Journal of

Physics Education's Special Issue: Focus on Nuclear and Particle Physics (viewable here: http://iopscience.iop.org/journal/0031-9120/page/Focus-on-Nuclear-and-Particle-Physics), entitled "Binding blocks: building the Universe one nucleus at a time".

Future Events:

The Binding Blocks team have an event taking place at Elvington Airfield on the 29/6/17, and have two events taking place down in Daresbury in Cheshire for the Daresbury Nuclear Masterclass days, for this the full nuclear chart will be taken down. We will also be attending the National Astronomy Meeting at the University of Hull from 2nd – 6th July, amongst many more planned and spontaneous events later in July.

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/

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4. Media Interactions