UK Nuclear Activity

March 2021 Issue 93

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1. Nuclear Physics Publications for March (also includes missed publications from previous months)

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.

The editors at Nature Communications have put together an Editors' Highlights webpage of recent research called "Nuclear and particle physics". A paper from this collection with UK-based authors is included below.

Phys. Rev. C **103**, 035805 **(Editor's Pick)**
https://journals.aps.org/prc/abstract/10.1103/PhysRevC.103.035805
Level structure of the T_z=−1 nucleus ^{34}Ar and its relevance for nucleosynthesis in ONe novae
A. R. L. Kennington1, G. Lotay1, D. T. Doherty1, D. Seweryniak2, C. Andreoiu3, K. Auranen2,*, M. P. Carpenter2, W. N. Catford1, C. M. Deibel4, K. Hadyńska-Klęk1,†, S. Hallam1, D. Hoff5, T. Huang2, R. V. F. Janssens6,7, S. Jazrawi1, J. José8,9, F. G. Kondev2, T. Lauritsen2, J. Li2, A. M. Rogers5, J. Saiz10, G. Savard2, S. Stolze2, G. L. Wilson2,4, and S. Zhu2,‡
Published 8 March 2021

Phys. Rev. Lett. **126**, 102501
https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.126.102501
Role of Chiral Two-Body Currents in ^{6}Li Magnetic Properties in Light of a New Precision Measurement with the Relative Self-Absorption Technique
U. Friman-Gayer1,2,3,*, C. Romig1,†, T. Hüther1, K. Albe4, S. Bacca5,6, T. Beck1, M. Berger1, J. Birkhan1, K. Hebeler1,7, O. J. Hernandez8,5, J. Isaak1, S. König1,7,9, N. Pietralla1, P. C. Ries1, J. Rohrer4, R. Roth1, D. Savran10, M. Scheck1,11,12, A. Schwenk1,7,13, R. Seutin13,1,7, and V. Werner1
Published 12 March 2021

Phys. Rev. Lett. **126**, 122301
https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.126.122301
Longitudinal Flow Decorrelations in Xe+Xe Collisions at $\sqrt{s_{NN}}$=5.44 TeV with the ATLAS Detector
G. Aad et al. (ATLAS Collaboration)
Published 24 March 2021

Phys. Rev. C **103**, 034303
https://journals.aps.org/prc/abstract/10.1103/PhysRevC.103.034303
Microscopic origin of reflection-asymmetric nuclear shapes
Mengzhi Chen (陈孟之)1,2, Tong Li (李通)1,2, Jacek Dobaczewski3,4, and Witold Nazarewicz5,1
Published 3 March 2021

Phys. Rev. C **103**, 034317
https://journals.aps.org/prc/abstract/10.1103/PhysRevC.103.034317
Spectroscopy and lifetime measurements in ^{134,136,138}Te isotopes and implications for the nuclear structure beyond N=82
G. Häfner1,2, R. Lozeva1,*, H. Naïdja3, M. Lebois1, N. Jovančević1, D. Thisse1, D. Etasse4, R. L. Canavan5,6, M. Rudigier5,7, J. N. Wilson1, E. Adamska8, P. Adsley5, M. Babo1, K. Belvedere5, J. Benito9, G. Benzoni10, A. Blazhev2, A. Boso6, S. Bottoni10,11, M. Bunce6, R. Chakma1, N. Cieplicka-Oryńczak12, S. M. Collins6, M. L. Cortés13,14, P. J. Davies15, C. Delafosse1, M. Fallot16, B. Fornal12, L. M. Fraile9, R.-B. Gerst2, D. Gjestvang17, V. Guadilla16, K. Hauschild1, C. Henrich7, I. Homm7, F. Ibrahim1, Ł. W. Iskra10,12, S. Jazwari5,6, J. Jolie2, A. Korgul8, P. Koseoglou7, Th. Kröll7, T. Kurtukian-Nieto18, L. Le-meur16, J. Ljungvall1, A. Lopez-Martens1, I. Matea1, L. Matthieu18, K. Miernik8, J. Nemer1, S. Oberstedt19, W. Paulsen17, M. Piersa8, Y. Popovitch1, C. Porzio10,11,20, L. Qi1, D. Ralet21,1, P. H. Regan5,6, D. Reygadas Tello22,23, K. Rezynkina24,25, V. Sanchez9, C. Schmitt25, P.-A. Söderström7,26, C. Sürder7, G. Tocabens1, V. Vedia9, D. Verney1, N. Warr2, B. Wasilewska12, J. Wiederhold7, M. S. Yavahchova27, F. Zeiser17, and S. Ziliani10,11
Published 22 March 2021

Phys. Rev. C **103**, 034318
https://journals.aps.org/prc/abstract/10.1103/PhysRevC.103.034318
Various collective states in the ^{124}I nucleus
C.-B. Moon, B. Moon, J. Park, G. D. Dracoulis, T. Kibédi, R. A. Bark, A. P. Byrne, P. A. Davidson, G. J. Lane, and A. N. Wilson
Published 22 March 2021

Phys. Rev. C **103**, 034319
https://journals.aps.org/prc/abstract/10.1103/PhysRevC.103.034319
Mass measurements of As, Se, and Br nuclei, and their implication on the proton-neutron interaction strength toward the N=Z line
I. Mardor1,2,*, S. Ayet San Andrés3, T. Dickel3,4, D. Amanbayev4, S. Beck3,4, J. Bergmann4, H. Geissel3,4, L. Gröf4, E. Haettner3, C. Hornung4, N. Kalantar-Nayestanaki5, G. Kripko-Koncz4, I. Miskun4, A. Mollaebrahimi5,4, W. R. Plaß3,4, C. Scheidenberger3,4, H. Weick3, Soumya Bagchi6,3,4,†, D. L. Balabanski7, A. A. Bezbakh8,9, Z. Brencic10, O. Charviakova11, V. Chudoba8,9, Paul Constantin7, M. Dehghan3, A. S. Fomichev8, L. V. Grigorenko8,12,13, O. Hall14, M. N. Harakeh5, J.-P. Hucka3,15, A. Kankainen16,17, O. Kiselev3, R. Knöbel3, D. A. Kostyleva3,4, S. A. Krupko8,9, N. Kurkova8, N. Kuzminchuk3, I. Mukha3, I. A. Muzalevskii8,9, D. Nichita7,18, C. Nociforo3, Z. Patyk11, M. Pfützner19, S. Pietri3, S. Purushothaman3, M. P. Reiter14, H. Roesch3,15, F. Schirru3, P. G. Sharov8,9, A. Spătaru7,18, G. Stanic20, A. State7,18, Y. K. Tanaka21, M. Vencelj10, M. I. Yavor22, and J. Zhao3
Published 23 March 2021

Phys. Rev. C **103**, 034320
https://journals.aps.org/prc/abstract/10.1103/PhysRevC.103.034320
Nuclear structure of Te isotopes beyond neutron magic number N=82
B. Moon1,2, A. Jungclaus3,*, H. Naïdja4, A. Gargano5, R. Lozeva6,7, C.-B. Moon1,†, A. Odahara8, G. S. Simpson9, S. Nishimura2, F. Browne2,10, P. Doornenbal2, G. Gey9,11,2, J. Keatings12, G. Lorusso2, Z. Patel2,13, S. Rice2,13, M. Si7, L. Sinclair2,14, P.-A. Söderström15,2, T. Sumikama2, J. Taprogge3,16,2, H. Watanabe2, J. Wu2,17, Z. Y. Xu18, A. Yagi8, D. S. Ahn2,19, H. Baba2, F. L. Bello Garrote20, S. Bönig21, R. Daido8, J. M. Daugas22, F. Didierjean6, F. Drouet9, Y. Fang8, N. Fukuda2, R. Gernhäuser23, B. Hong24,25, E. Ideguchi26, S. Ilieva21, N. Inabe2, T. Ishigaki8, T. Isobe2, H. S. Jung27, D. Kameda2, I. Kojouharov28, T. Komatsubara2, T. Kröll21, T. Kubo2, N. Kurz28, Y. K. Kwon29, C. S. Lee27, P. Lee27, Z. Li17, A. Montaner-Pizá30, S. Morimoto8, K. Moschner31, D. Mücher23, D. Murai32, M. Niikura2,18, H. Nishibata8, I. Nishizuka33, R. Orlandi34,35, H. Sakurai2,18, H. Schaffner28, Y. Shimizu2, K. Steiger23, H. Suzuki2, H. Takeda2, K. Tshoo29, Zs. Vajta36, A. Wendt31, R. Yokoyama37, and K. Yoshinaga38
Published 25 March 2021

Phys. Rev. C **103**, 034322
https://journals.aps.org/prc/abstract/10.1103/PhysRevC.103.034322
Possible quenching of static neutron pairing near the N=98 deformed shell gap: Rotational structures in ^{160,161}Gd
D. J. Hartley1, K. Villafana2,*, F. G. Kondev3, M. A. Riley2, R. V. F. Janssens4,5, K. Auranen3, A. D. Ayangeakaa1,†, J. S. Baron2, A. J. Boston6, M. P. Carpenter3, J. A. Clark3, J. P. Greene3, J. Heery6, C. R. Hoffman3, P. Jackson1, T. Lauritsen3, J. Li3,‡, D. Little4, E. S. Paul6, G. Savard3, D. Seweryniak3, J. Simpson7, S. Stolze3, G. L. Wilson8, J. Wu3, S. Zhu3,§, and S. Frauendorf9
Published 25 March 2021

Phys. Rev. C **103**, 035804
https://journals.aps.org/prc/abstract/10.1103/PhysRevC.103.035804
Charged-particle branching ratios above the neutron threshold in ^{19}F: Constraining ^{15}N production in core-collapse supernovae
P. Adsley1,*, F. Hammache1,†, N. de Séréville1, V. Alcindor1,2, M. Assié1, D. Beaumel1, M. Chabot1, M. Degerlier1, C. Delafosse1, T. Faestermann3, F. Flavigny1, S. P. Fox4, R. Garg4,5, A. Georgiadou1, S. A. Gillespie4, J. Guillot1, V. Guimarães6,1, A. Gottardo1, R. Hertenberger7, J. Kiener1, A. M. Laird4, A. Lefebvre-Schuhl1, I. Matea1, A. Meyer1, M. Mahgoub8,9, L. Olivier1, L. Perrot1, J. Riley4, I. Sivacek10, I. Stefan1, V. Tatischeff1, and H.-F. Wirth7
Published 8 March 2021

Phys. Rev. C **103**, 035807
https://journals.aps.org/prc/abstract/10.1103/PhysRevC.103.035807
Systematic analysis of inner crust composition using the extended Thomas-Fermi approximation with pairing correlations
Matthew Shelley* and Alessandro Pastore†
Published 10 March 2021

2. News to Report

a. Winner of the IOP Nuclear Physics Group's Early Career Researcher Award

It is our pleasure to announce the winner of the 2020 Nuclear Physics Group Early Career Award as Dr Jack Henderson from the University of Surrey. Jack has recently been awarded a Future Leaders Fellowship by UKRI and was nominated for "*Developing experimental ways to test the long-standing problem of charge symmetry in nuclear structure via electromagnetic probes".*

Jack will be presenting his work at the upcoming Joint meeting of the HEPP, APP and NP IOP Groups taking place 12th-15th August: http://appheppnp2021.iopconfs.org/964716

Photo: 2020 Award Winner Jack Henderson

Contribution by David Sharp
(Chair of the IOP Nuclear Physics Group)

b. PhD Opportunity: University of Birmingham in conjunction with the Culham Centre for Fusion Energy

Title: Implementation of a novel nuclear-astrophysics technique for measuring difficult to reach nuclei for fusion

Description:
As steel is used as one of the main construction materials for magnetic confinement fusion devices, like ITER and most likely DEMO, impurities will undergo reactions to produce problematic long-lived products including Nb-94 and Nb-94m, Mo-93, Ni-59, Ag-108m and Ni-63. The reaction cross-sections for isotopes including Nb-94 and Mo-93 are lacking in nuclear data libraries, libraries do not contain any data to separate (n,gamma) and (n,2n) reactions into different isomeric state daughters, possibly because the half-lives of the ground states are so long making this a difficult measurement. This is a more significant issue for Nb-94 because it is likely to provide a much larger contribution to the overall activity of the long-term waste. Therefore, we need to devise experiments which can measure the cross-sections for these isotopes, and other similarly difficult to reach nuclei.

The focus of this PhD would be to devise, test and validate a new technique for measuring the cross-section of very long-lived nuclei which could use the Trojan Horse Method (THM) employed in nuclear astrophysics measurements. This technique is well understood but has not yet been exploited for (n,gamma) reactions, though the required framework is established. This project will involve a mixture of detailed and complex nuclear modelling and the opportunity to perform activation experiments. The PhD student may choose to be based at the UKAEA fusion research centre at CCFE Culham, near Oxford, from the second year onwards.

Application:
We welcome informal enquiries to t.wheldon@bham.ac.uk and chantal.nobs@ukaea.uk and encourage full applications through the Birmingham University portal: https://www.birmingham.ac.uk/postgraduate/courses/research/physics/physics-astronomy-phd.aspx (please put Tzany Kokalova Wheldon as the supervisor and the title as the research topic – for any further clarifications on the application process please contact t.wheldon@bham.ac.uk and chantal.nobs@ukaea.uk directly).

Funding:
This project is fully funded for UK students (42 months). Students outside the UK will need to seek financial support from scholarship programmes.

Contribution by Chantal Nobs (UKAEA)

c. NuSec Science Network Summer 2021 Pilot Project Applications

Following on from the success of previous NuSec funded Summer Student pilot projects, applications are being sought for Summer 2021 pilot projects from UK universities, companies or government laboratories researchers.

Projects must be from the Natural Sciences and show the potential to enhance the field of nuclear security.

Projects could involve the development of an early research idea, a small proof of concept or a feasibility study undertaken by an Undergraduate or Post Graduate and supervised by a Univeristy Academic or Industrial Scientist.

Applications are welcomed from collaborations between UK Universities, companies or government laboratories and must be submitted by **Midday 26th April 2021.**
Funding is available for 5 Summer Pilot Projects Up to a maximum of **£4,000 each**
For further details please visit the NuSec Science Network website

Contribution by Lisa Fletcher (University of Surrey)

d. UK-US Academic Network in Nuclear Security and Non-Proliferation Skills

The **NuSec Science Network** are launching a new UK-US Academic Network in Nuclear Security and Non-Proliferation Skills in Partnership with the NNSA ETI, MTV and NSSC consortia.

NuSec will offer grants to support mobility and training activities to develop collaboration between UK and US researchers working in nuclear security and non-proliferation technologies.

NuSec-NNSA collaboration grants are available to UK researchers wishing to collaborate with the NNSA consortia on the following activities:

- Short term postdoctoral research projects (up to 3 months), up to £15,000
- Undergraduate student interns/summer research projects, up to £2,000
- Research visits, up to £5,000
- Conferences, training and collaboration visits, up to £2,000.

A workshop will be held on **27-28 April 2021** to formally launch the call for UK applications and provide opportunities for US and UK researchers to connect. The main objective of the workshop will be to showcase the current research in nuclear security and non-proliferation from the UK and from the three NNSA consortia. The program will consist of invited presentations from UK and US researchers, and will include an overview of research activities carried out in the NNSA consortia.

The workshop will be run as a Zoom meeting over 2 consecutive afternoons 3-6.45pm (UK time). Attendance at both afternoon sessions is advised and workshop pre-registration is required.

Please visit this NuSec Website Events Web page for further details of the **Workshop Program** and **How to Register**.

Contribution by Lisa Fletcher (University of Surrey)

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3. Outreach Activity

a. Outreach Seminar: "Six quarks for Muster Mark?"

Nuclear physicists from the York group (Bashkanov, Pastore and Watts) were invited to give an EU-Horizon2020 public seminar on the exciting new candidate for a hexaquark in the light quark sector - the d*. They presented an outline of the underlying theory, current evidence and potential impacts for our understanding of neutron stars and dark matter. The YouTube podcast is already approaching 1000 views!

"Six quarks for Muster Mark?"

https://www.youtube.com/watch?v=x4SYzSaOVCE

Contribution by Dan Watts
(University of York)

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4. Media Interactions

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