UK Nuclear Activity

April 2018 Issue 58

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

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1. Nuclear Physics Publications for April*

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. C 97, 035801 (2018) https://journals.aps.org/prc/abstract/10.1103/PhysRevC.97.035801
Direct measurement of resonance strengths in $^{34}S(\alpha,\gamma)^{38}Ar$ at astrophysically relevant energies using the DRAGON recoil separator
D. Connolly[1,*], P. D. O'Malley[1,†], C. Akers[2,3,‡], A. A. Chen[4], G. Christian[3,§], B. Davids[3], L. Erikson[5], J. Fallis[3,‖], B. R. Fulton[2], U. Greife[1], U. Hager[1], D. A. Hutcheon[3], S. Ilyushkin[1], A. M. Laird[2], A. Mahl[1], and C. Ruiz[3]
*Published 7 March 2018

Phys. Lett. B 779, 124 (2018) https://www.sciencedirect.com/science/article/pii/S037026931830100X
Re-examining the transition into the N = 20 island of inversion: Structure of ^{30}Mg
B.Fernández-Domínguez[abc], B.Pietras[a], W.N.Catford[d], N.A.Orr[b], M.Petri[aef], M.Chartier[a], S.Paschalis[af], N.Patterson[d], J.S.Thomas[d], M.Caamaño[c], T.Otsuka[g], A.Poves[h], N.Tsunoda[g], N.L.Achouri[b], J.-C.Angélique[b], N.I.Ashwood[i], A.Banu[j1], B.Bastin[b], R.Borcea[l], J.Brown[f], F.Delaunay[b], S.Franchoo[m], M.Freer[i], L.Gaudefroy[n], S.Heil[e], M.Labiche[o], B.Laurent[b], R.C.Lemmon[o], A.O.Macchiavelli[k], F.Negoita[l], E.S.Paul[a], C.Rodríguez-Tajes[n], P.Roussel-Chomaz[n], M.Staniou[l], M.J.Taylor[f2], L.Trache[jl], G.L.Wilson[d]
Published 10 April 2018

Phys. Rev. Lett. 120, 152504 (2018) https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.120.152504
Strong Neutron Pairing in core+4n Nuclei
A. Revel et al. (R^3B Collaboration)
Published 12 April 2018

*Also including missed publications from previous months.

Phys. Rev. A 97, 042504 (2018) https://journals.aps.org/pra/abstract/10.1103/PhysRevA.97.042504
Isotope shifts from collinear laser spectroscopy of doubly charged yttrium isotopes
L. J. Vormawah[1], M. Vilén[2], R. Beerwerth[3,4], P. Campbell[5], B. Cheal[1,*], A. Dicker[5], T. Eronen[2], S. Fritzsche[3,4], S. Geldhof[2], A. Jokinen[2], S. Kelly[5], I. D. Moore[2], M. Reponen[2], S. Rinta-Antila[2], S. O. Stock[3,4], and A. Voss[2]
Published 16 April 2018

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2. News to Report

a. The *d(2380) in Neutron Stars — A New Degree of Freedom?**

Nuclear scientists at Edinburgh and York (Bashkanov, Pastore, Watts) and a theoretical astrophysicict from Catania (Vidana) have teamed up to explore the role of a recently discovered 6-quark particle, named the d*, to neutron stars.

The new results (recently published in Physics Letters B) indicate the d* particle could form copiously within neutron stars, providing a new phenomena occurring within these intriguing objects. Up to 20% of the matter in the core of stable neutron stars is predicted to be d*, with major consequences for our understanding of neutron star properties. For example, the d* is predicted to significantly reduce the maximum stable neutron star mass - and our predicted value of around 2.1 solar masses is in excellent agreement with experimental constraints extracted from recent gravitational wave observation of neutron star mergers and from the many astrophysical observations of binary neutron star pairs obtained using space based telescopes. The d* also offers new unanticipated mechanisms for neutron star cooling and gamma ray emissions.

Ongoing UK led experiments using intense photon beams at MAMI and Jefferson Lab in the USA will better establish the properties and nature of the d* and its interaction within neutron stars and nuclei. The role of the d* in neutron star mergers and neutron star-black hole mergers is an exciting future research direction, as even higher matter densities and d* fractions could be reached. First calculations to explore the role of the d* in neutron star-black hole mergers are underway, using computer modelling of the merger process.

Contribution by Dan Watts
Daniel.Watts@ed.ac.uk (Edinburgh)

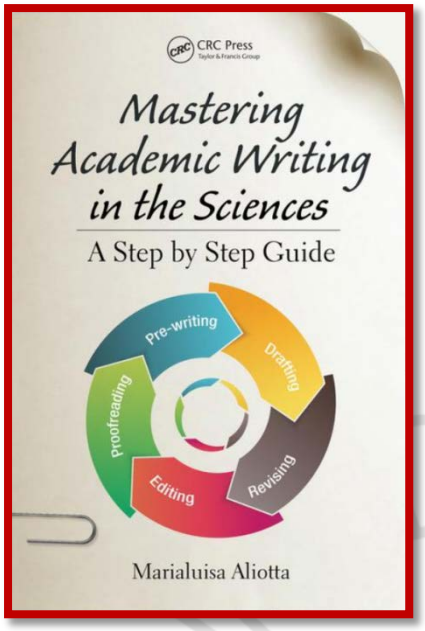
b. Electrons are Front Page News

The new SPEDE electron spectrometer made the front page in the European Journal of Physics A: Philippos Papadakis *et al*. Eur. Phys. J. A (2018) 54: 42.

The SPEDE spectrometer for internal conversion electron detection has been constructed by a collaboration of the University of Liverpool and the University of Jyväskylä, Finland. The spectrometer will be primarily employed in the study of octupole collectivity and shape coexistence in Coulomb excitation experiments at the HIE-ISOLDE facility, CERN, using radioactive ion beams. SPEDE will be combined with the Miniball γ-ray spectrometer to allow for simultaneous detection of electrons and γ rays, which is essential for the proposed studies. In the novel design of SPEDE, no magnetic fields are employed for electron transportation to the detector and thus electron trajectories can be determined accurately allowing for the kinematic correction of their velocities and a significant improvement on spectral quality. Many of the nuclei which exhibit octupole collectivity or shape coexistence have highly converted low energy transitions, transitions with enhanced E0 strength or $0^+ \rightarrow 0^+$ transitions which can only proceed via internal conversion electron emission. The simultaneous observation of both electrons and γ-rays provided by SPEDE and Miniball is especially important for the analysis of the multi-step Coulomb excitation data, which will become possible through the higher beam energies and intensities provided by the upgraded HIE-ISOLDE facility.

Contribution by Rodi Herzberg
R.Herzberg@liverpool.ac.uk (Liverpool)

c. Mastering Academic Writing in the Sciences



This book provides a comprehensive and coherent step-by-step guide to writing in scientific academic disciplines. It is an invaluable resource for those working on a PhD thesis, research paper, dissertation, or report. Writing these documents can be a long and arduous experience for students and their supervisors, and even for experienced researchers. However, this book can hold the key to success. Mapping the steps involved in the writing process - from acquiring and organizing sources of information, to revising early drafts, to proofreading the final product - it provides clear guidance on what to write and how best to write it.
The book is available on Amazon or directly from CRC Press.
Marialuisa Aliotta
maliotta@staffmail.ed.ac.uk (Edinburgh)

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3. Outreach Activity

Keynote talk at Worthing College's Cracking the Code Festival
On 20th April Worthing College held a "Cracking the Code Festival", a STEM festival which invited a total of approximately 100 students from local schools to listen to talks and participate in hands-on activities. The annual event aims to provide students with a better understanding of STEM careers and to inspire students to consider a STEM subject at A-level and beyond. Chantal Nobs, who currently works at the Culham Centre for Fusion Energy, was invited to provide the keynote talk for the festival, titled "From A-levels to Fusion Researcher".
Contribution by Chantal Nobs
chantal.nobs@ukaea.uk (Culham Centre for Fusion Energy)

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4. Media Interactions

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