UK Nuclear Activity

July 2022 Issue 109

In this issue,

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

Nuclear Physics Public Engagement Website: NuclearPhysicsForYou

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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.

Nature **607** 260 (2022) (https://doi.org/10.1038/s41586-022-04818-7)
Nuclear moments of indium isotopes reveal abrupt change at magic number 82
A. R. Vernon *et al.*
Published 13 July 2022

Phys. Rev. C **106** 014306 (2022) (https://doi.org/10.1103/PhysRevC.106.014306)
Total absorption γ-ray spectroscopy of the β decays of ^{96gs,m}Y
V. Guadilla *et al.*
Published 13 July 2022

Phys. Rev. C **106** 014312 (2022) (https://doi.org/10.1103/PhysRevC.106.014312)
Improved measurement of the $0_2^+ \rightarrow 0_1^+$ E0 transition strength for ^{72}Se using the SPICE spectrometer
J. Smallcombe *et al.*
Published 19 July 2022

Phys. Rev. C **106** 015502 (2022) (https://doi.org/10.1103/PhysRevC.106.015502)
Direct determination of the atomic mass difference of the pairs ^{76}As–^{76}Se and ^{155}Tb–^{155}Gd rules out ^{76}As and ^{155}Tb as possible candidates for electron (anti)neutrino mass measurements
Z. Ge *et al.*
Published 13 July 2022

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2. News to Report

a. Professor Philip Walker awarded Lise Meitner Prize

The 2022 Lise Meitner Prize of the European Physical Society, Nuclear Physics Division, has been awarded to Phil Walker, University of Surrey. The prize is given every two years for outstanding work in the fields of experimental, theoretical or applied nuclear science. Phil Walker has been awarded the prize for seminal contributions to the understanding of long-lived nuclear excited "isomeric" states and the factors determining their half-lives, that range from nanoseconds to years.

More information can be found here

Contribution by Prof. Phil Walker, University of Surrey

b. Indium gets a new spin

In a recent article published in Nature 607 (2022) 260, an international team of scientists led by Vernon and Garcia Ruiz (MIT) reported that the "Nuclear moments of indium isotopes reveal abrupt change at magic number 82". The paper shows that the almost constant value of nuclear magnetic moments measured in the past in the indium isotopes with neutron numbers from N=64 to 78 continues until N=80, but then jumps to a much larger value at N=82. Such a jump is a surprise and does not support the earlier assumptions of an effective g-factor but, rather, calls for invoking specific nuclear-structure effects.

Advanced calculations, reported on in the same Nature article provide a quantitative description of the measured effect. Bonnard and Dobaczewski (York), Holt and Miyagi (Vancouver), and Stroberg (Seattle) performed theoretical analyses within the nuclear DFT and in-medium similarity normalization group. They showed that the magnetic moments of the indium isotopes (proton number Z=49) are generated not only by the single odd-proton hole in the magic proton closed-shell corresponding to Z=50 but also by self-consistently polarised states of the entire Z=50 core. Indeed, properties of the polarised doubly magic closed core at N=82 and Z=50 are different from those of the lighter isotopes and lead at N=82 to a markedly different value of the magnetic moment.

Following the publication of this exciting discovery, there were a number of interactions with the media, a selection of which are listed below:

University of York press release

MIT News: "A new spin on nuclear magnetic moments"

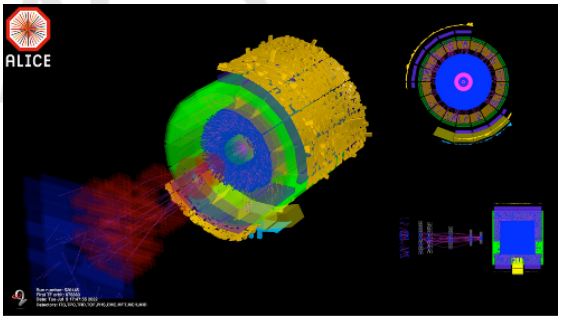
Phys.org: "New technique allows physicists to study interactions of neutrons inside of an atom"

Mirage News: "New spin on nuclear magnetic moments"

Contribution by Prof. Jacek Dobaczewski, University of York

c. ALICE starts data taking in LHC run 3

After a long shutdown of more than three years, the LHC recently reached the top energy for proton-proton collisions, marking officially the start of RUN 3. The upgraded ALICE detector started taking data at 16:45 on July 5th with the first proton physics fill at 13.6 TeV.



Upgrades were completed for ALICE during the LHC Long Shutdown 2 in order to fulfill the goals of Run 3. The UK-ALICE collaboration plays a leading role for the upgrades of the

Central Trigger Processor (CTP) and the Inner Tracking System (ITS). The new CTP, led by the University of Birmingham, has been designed, installed and commissioned at the experiment, which can support different sub-detectors running in continuous and triggered readout simultaneously and can receive and deliver trigger signals with precision to 25 ns. The upgraded ITS is the largest pixel silicon tracking system built so far. The reduced material budget in combination with smaller pixel size will offer a significant improvement of impact parameter resolution and tracking efficiency, especially for particles with low transverse momenta. The University of Liverpool and STFC Daresbury Laboratory made leading contributions in the detector module/stave assembly and commissioning.

The interaction rate is being ramped up and the upgraded ALICE detector can reach 500 kHz at the moment, which is already 500 times higher than for RUN 2. The detector will be tested at an interaction rate of 5 MHz in early August to investigate the system with a comparable track load from Pb-Pb collisions. The detector alignment is now progressing as well as analyses of the data taken with first beams, to benchmark the detector performances and software systems. Data taking will be continuously consolidated with proton-proton collisions over the next months before the first Pb-Pb collision data taking campaign, scheduled in November 2022.

Contribution by Dr. Jian Liu, University of Liverpool

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3. Outreach Activity

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4. Media Interactions

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