Canadian Institute of Nuclear Physics
Institut canadien de physique nucléaire

Newsletter #24, May 2024

The Canadian Institute of Nuclear Physics (CINP) is a formal organization of the Canadian nuclear physics research community to promote excellence in nuclear research and education, and to advocate the interests and goals of the community both domestically and abroad.

1. Upcoming CINP Sessions at CAP Congress

The CINP and IPP are once again hosting a joint session at the CAP Congress, being held in person at the University of Western Ontario, in London ON.

Tuesday, May 28, 2024	
18:30	**CINP Board Meeting** (by invitation only)
Thursday, May 30, 2024	
12:30	**CINP Annual General Meeting** (be sure to select your lunch option)
	CINP+IPP Joint Session
13:30	NSERC SAPES Report (20+5)
13:55	CFI Report (10+5)
14:10	TRIUMF Report (15+3)
14:28	SNOLab Report (10+2)
14:40	McDonald Institute Report (10+2)
14:52	Strategizing about upcoming LRP and discussion about HQP support (38)

2. Welcome to our New Institutional Member!

The CINP is pleased to announce the addition of a new institutional member. The Institutional Members are the owners of the CINP and their Delegates are solely responsible for the nomination and election of the Board of Directors. Faculty and Associate Membership in the CINP is free. Institutional Members pay annual dues levied by the Board, which are used to support the operation of the CINP.

UNIVERSITY OF CALGARY

Dr. William A. Ghali, the Vice-President (Research) of the University of Calgary, applied for membership on December 4, 2023. Timothy Friesen has been named by the UofC as their official Delegate. The University of Calgary has 11 individual members, including five faculty (Donev, Friesen, Ouyed, Thompson, Wieser), and six associate members.

3. CINP Individual Membership

CINP membership is up modestly from last year. Through to May 10, there were 8 new faculty members and 7 new associates. This was partly offset by a loss of 2 faculty and 6 associate members (as part of our regular review process to ensure the roster remains up-to-date). The net membership gain is 7.

Please encourage your colleagues, grad students and PDFs to join and contribute to the activities of the Scientific Working Groups (SWGs). The membership form and introduction letter are posted at:
http://cinp.ca/membership

CINP Individual Membership – May 10, 2024			
Total Membership	180 (+7)	Nuclear Astrophysics SWG	72 (+2)
Faculty-class Members	93 (+6)	Nuclear Structure SWG	76 (+1)
Associate Members	87 (+1)	Fundamental Symmetries SWG	85 (+6)
Experimentalists	132 (+5)	Hadronic Physics/QCD SWG	55 (-3)
Theorists	46 (+2)	Nuclear Theory SWG	36 (+3)
		Education & Training SWG	60 (+6)

4. NSERC Support for CINP

NSERC provides funding for many CINP activities through the Subatomic Physics Major Resources Support (SAP-MRS) program. The installment for 2024-25 is $75,000.

CINP's NSERC grant expires next March, and a major activity in the next few months will be to prepare the renewal grant application.

5. Junior Scientist Travel Support Program (JSci)

The goal of the JSci program is to allow graduate students and PDFs to broaden their research horizons and become more mature scientists. Two types of expenditures are supported:

1) Funding to allow graduate students and PDFs to attend specialized workshops and schools not directly related to their research project, such as workshops or training opportunities on the practical applications of subatomic physics detector techniques, new computer or digitization technologies, advanced computation techniques, or technology transfer training.

2) Funding to enable PDFs to present their work at conferences or workshops. Conferences and workshops already receiving funds from CINP will not be eligible. Preference will be given to international meetings held either in Canada or abroad.

How to Apply:

The application form can be obtained from the CINP website at: https://cinp.ca/junior-scientist-travel-support-program-jsci

Applications are accepted on a continuing basis. A standing committee consisting of: CINP Executive Director, Chair of the Education & Training SWG, and one representative of the CINP Board will evaluate applications as they are submitted and provide prompt feedback or decision to the applicant (typically within 2 weeks).

The total program funds available for 2024-25 are $7000.

6. Scientific Working Group Review

The CINP bylaws require that the activities and leadership of every Scientific Working Group (SWG) be reviewed by the Board of Directors every 5 years. A key part of this is the renewal of the Chairs of the SWGs. On Nov 20/23, the Board passed a resolution to limit the terms of the chairs for a maximum of two consecutive 5-year terms as chairs of the SWG, which required the recruitment of four new Chairs for those whose terms were expiring in 2024. The Nuclear Theory SWG was created more recently, with Chair term expiring in 2026.

The followed process was:

a) contact members to see if their SWG memberships are up to date
b) review Terms of Reference (ToR) of SWGs, get input from current Chairs
c) solicit nominations for SWG Chair
d) hold elections Mar-April 2024
e) Board approval of new Chairs and ToR

The leadership portion of this review is now completed, and are pleased to report the new slate of SWG Chairs:

Working Group	Chair	Email	Term Expires
Education & Training	Ruben Sandapen (Acadia)	ruben.sandapen @ acadiau.ca	2029
Fundamental Symmetries	Jeff Martin (Winnipeg)	jmartin @ nuclear.uwinnipeg.ca	2029
Hadrons /QCD	Svetlana Barkanova (Memorial)	sbarkanova @ grenfell. mun.ca	2029
Nuclear Astrophysics	Nicole Vassh (TRIUMF)	nvassh @ triumf.ca	2029
Nuclear Structure	Paul Garrett (Guelph)	pgarrett @ physics.uoguelph.ca	2029
Nuclear Theory	Alexandros Gezerlis (Guelph)	gezerlis @ uoguelph.ca	2026

We thank to all outgoing SWG Chairs for their tremendous service to CINP. The CINP would have been very much poorer without their work!

Juliette Mammei (Manitoba) served as Chair of the Nuclear Education & Training SWG since 2014. Her work for the 2015 and 2020 CINP LRP planning briefs included surveys of HQP graduates who have found employment in non-traditional fields. She also spearheaded the addition of EDI components to the ToR of the working group.

Gerald Gwinner (Manitoba) served as the Chair of the Fundamental Symmetries SWG since the inception of the CINP in 2007, and has been vital to the growth of the CINP since then, including the organization of the *CINP Workshop on Fundamental Symmetries: Searching for "New Physics" in Canada and Beyond*, in July 2010.

Iris Dillmann (TRIUMF) served as Chair of the Nuclear Astrophysics SWG since 2014, and contributed to the CINP LRP planning briefs in 2015 and 2020. She also served as CINP Treasurer from 2017-2019.

Adam Garnsworthy (TRIUMF) was first elected as Chair of the Nuclear Structure SWG in 2014, and helped put together large sections of the 2015 and 2020 CINP LRP planning briefs.

We are pleased with the renewed committee of SWG Chairs and we look forward to working closely with them on important tasks, such as the new NSERC MRS grant application this fall, and the next CINP Brief to the Canadian Subatomic Physics Long Range Planning Committee in 2025.

7. Representation and Input to Various Agencies

The CINP is an advocate and representative of the Canadian nuclear physics community and is asked to attend various meetings or make presentations on its behalf. Some recent and forthcoming activities include:

- The CINP presentation to SAPES took place at their Fall Context Session on Dec 15/23. Thanks to those CINP members who provided scientific updates that were shown there. GH also attended the virtual SAPES Large Projects Day as an observer on Sunday Feb 18/24. This meeting is now entirely in-camera, upon request of the international SAPES members. We hope that SAPES competition week will return to an in-person format soon, but discussions with NSERC on this are not encouraging.

- Every spring, the CINP Executive Director is asked to suggest new members of the NSERC Subatomic Physics Evaluation Section (SAPES), to replace the specific expertise of outgoing members. **If you have suggestions for the following six members for the 2024-25 competition, please respond to GH ASAP.**

Retiring Members:
Nikolina Ilic, University of Toronto, Exp Particle Phys

David Morrissey, TRIUMF, Theor Particle Phys

Matthias Schindler, University of South Carolina, Theor Nuclear Phys

Albert Young, North Carolina State University, Exp Nuclear Phys, Strongly Interacting Matter (IEP)

Members who are stepping down for a year:
Thomas Brunner, McGill University, Exp Neutrino & Particle Phys

Rituparna Kanungo, Saint Mary's University, Exp Nuclear Phys, Nuclear Reactions

General Future Recruitment:
Exp High Energy Phys

Exp Astroparticle Phys, Dark Matter

Exp Nuclear Phys, Low and Intermediate Energies

Exp Accelerator R&D

Theor Quantum Field Theory, High Energy Particle Phys, Dark Matter & Cosmology

Theor Nuclear Astrophysics

- GH also represents CINP on the Pan-Canadian MRS Coordination Board, which is a new national oversight board for all SAP-MRS resources. A decision was made to have CINP and IPP Executive Directors join as co-applicants on the Victoria MRS grant application in the 2024 competition, to demonstrate their openness to supporting national infrastructure that is not part of the hosting university. For more information on the available MRS resources, please visit the CINP website https://cinp.ca/subatomic-physics-major-resources-support-facilities

- The Advisory Committee on TRIUMF (ACOT) is a panel of international experts that meets and reports to the NRC twice a year. GH represents the CINP as a "community observer". Dec 5-6/23 meeting was held virtually, but the June 10-12/24 meeting will be in person.

- Nigel Smith, TRIUMF Director, has instituted a regular set of meetings between senior TRIUMF leadership and the Directors of CINP, IPP and McDonald Institute. This is a very positive development, which has considerably improved the communication between TRIUMF and the institutes. We are trying to meet prior to every ACOT meeting.

8. 2023 WNPPC Graduate Student Travel Awards

The 2024 WNPPC was held at Chateau Bromont, Quebec. CINP offered $750 travel awards to qualified graduate students. The awards were evaluated by a committee: GH, Chair, Chris Ruiz (TRIUMF). 9 applications were received, of which 6 were funded.

Student	Supervisor	WNPPC Talk Title
Nikhil Bhati (Saint Mary's)	Rituparna Kanungo (Saint Mary's)	Measurement of ^{59}Cu(p,α)^{56}Ni reaction rate to constrain the flow of nu p-process
Noel Cruz (Manitoba)	Juliette Mammei (Manitoba)	Commissioning of commercial GEM for position calib of MOLLER HVMAP using cosmic-rays
Annabelle Czihaly (Victora)	Ania Kwiatkowski (TRIUMF)	Through thick and tin: investigating tin isotopes approaching N=Z nuclei
Paul Deguire (Guelph)	Liliana Caballero (Guelph)	Ultra-dense matter in binary neutron star mergers
Hussain Rasiwala (McGill)	Thomas Brunner (McGill)	Unraveling secrets of the universe, one Barium ion at at time, nEXO
Jay Hyung Suh (Calgary)	Timothy Friesen (Calgary)	Precision measurement of hyperfine splitting in anti-hydrogen

9. WNPPC Student Prizes

The recipients of the CINP-sponsored prizes at the 2024 WNPPC were:

Name	Category	Prize
Paul Deguire (Guelph)	1st Place Theory	$500
Annabelle Czihaly (VIctoria)	2nd Experiment	$300
Rene Simpson (UBC)	3rd Experiment	$200

10. Congratulations to new CAP Fellows

Three notable members of the CINP were recently named as Fellows by the Canadian Association of Physicists.

Corina Andreoiu (SFU) In recognition of her influential contributions to subatomic physics, particularly in advancing the understanding of collective behavior and shape co-existence in nuclei, and for dedication to the Canadian physics community through tireless service to the CAP, the CINP, and TRIUMF.

Gwen Grinyer (Regina) In recognition of her outstanding research contributions of ultra-high precision measurements to test the Standard Model description of electroweak interactions and designing of state-of-the-art instrumentation to study the structure of rare isotopes; and for championing equity, diversity and inclusion, and challenging the barriers faced by women and 2SLGBTQ+ people in STEM.

Rituparna Kanungo (Saint Mary's) In recognition of her contributions to experimental subatomic physics and groundbreaking discoveries in rare isotopes and nuclear shells; and for leadership of international collaborations in Japan, Germany, and Canada's TRIUMF, and service to national and international organizations.

11. CINP Conference Support

The CINP extends partial funding to workshops, meetings and conferences of broad relevance to nuclear physics in Canada. Requests are appraised against the mission and goals of the CINP, and funding is contingent upon satisfactorily showing that the event will further the aims of the CINP and be of benefit to its members. Application forms for external conference support are available from https://cinp.ca/conference-support

We hope you will be able to attend one of the following CINP-sponsored conferences:

- **Tri-Institute School on Elementary Particles (TRISEP)** Sudbury ON, July 8-19, 2024. https://www.trisep.ca/
- **TRIUMF Summer Institute (TSI2024): Modern Tools for Nuclear Reactions** Vancouver BC, August 11-17, 2024 https://tsi.triumf.ca/2024/
- **14th International Conference on Nucleus-Nucleus Collisions (NN2024)** Whistler BC, August 18-23, 2024. https://nn2024.triumf.ca/

12. CINP Undergraduate Research Scholarships (URS)

The 2024 competition for the URS was recently completed. The intent of the program is to allow gifted undergraduates to work with a supervisor on nuclear physics research for 16 weeks this summer. Each URS is valued at $5500, which must be supplemented by the supervisor by at least $4000, to a total of not less than $9500. In addition, a $1300 travel award is available to encourage work at a laboratory, or with a collaborator for an extended period in the summer.

The scholarships were evaluated by a committee: Barry Davids (TRIUMF), Chair, Peter Blunden (Manitoba), Greg Christian (Saint Mary's), Zisis Papandreou (Regina). 15 applications were received, and 10 were awarded.

Student	Supervisor	Project Title
Rylen De Vries (Winnipeg)	Russell Mammei (Winnipeg)	First diamond-like-carbon UCN coated guides from the UCN guide coating facility at UofW
Allison Frayne (Calgary)	TImothy Friesen (Calgary)	Microwave spectroscopy of anti-hydrogen
Sarah Littlejohn (Mt Allison)	David Hornidge (Mt Allison)	Analysis of CPP-NPP data from GlueX @ JLab
Karalee Reimer (Manitoba)	Savino Longo (Manitoba)	Neutron-Antineutron production in e^+e^- annihilations at Belle-II
Claire Sauze (Saint Mary's)	Rituparna Kanungo (Saint Mary's)	Determination of neutron skin thickness in neutron-rich Ca isotopes
Benjamin Scully (UBC)	Jason Holt (TRIUMF)	Ab-initio theory for superallowed Fermi transitions and constraints on CKM unitarity
Dhruval Shah (Regina)	Gwen Grinyer (Regina)	Beta-delayed charged particle emission of ^{20}Mg
Zachary Sullivan (Regina)	Garth Huber (Regina)	Probing nuclear matter via Deep Exclusive π^+ production with JLab electron beams
Portia Switzer (Winnipeg)	Ellie Korkmaz UNBC)	Instrumenting a new Pulsed Laser Deposition Vacuum Chamber for UCN Coating Applications
Ethan Taylor (Western Ont)	Ania Kwiatkowski (TRIUMF)	Commissioning of laser ablation ion source for TITAN-TRIUMF

13. CINP posting of Job Opportunities

We regularly post Nuclear Physics Job Opportunities on the CINP website, at:
https://cinp.ca/announcements

- Researchers looking for positions are encouraged to regularly consult this page. Please let GH know if you are recruiting for a position and want your announcement to be distributed.

14. CINP Graduate Fellowship

2024 was the fourth year of the Graduate Fellowship program. We are continuing to re-invest the travel savings due to COVID-19 into additional student scholarships, above our nominal budget of one fellowship. Each fellowship is valued at $13,000, which must be supplemented by the supervisor and/or institution by at least $20,000, to a total of not less than $33,000. The student cannot concurrently hold any other major full-time scholarship or fellowship (defined as $13,000 or higher).

In addition to academic and scientific criteria, the Fellowship award has an EDI component, where applicants had to write a 1 page description of what role a PhD student and CINP Graduate Fellow can play in promoting and advancing EDI in our community.

The applications were evaluated by a committee: Chris Ruiz (TRIUMF), Chair, Sangyong Jeon (McGill), Ruben Sandapen (Acadia), incoming Education SWG Chair, Paul Garrett (Guelph), recused from 1 application in conflict. Nine applications were received, and two fellowships were awarded.

CINP is pleased to announce the two recipients of the 2024 Fellowships:

Zarin Ahmed (Guelph). The Zr isotopic chains show dramatic shape evolution, garnering significant theoretical and experimental interest. Nuclear shapes can vary with nucleon numbers and between states within the same nucleus, known as shape coexistence. This phenomenon challenges nuclear theory and requires advanced experimental techniques. My research on ^{96}Zr aims to provide spectroscopic data and constraints on quadrupole and octupole correlations, crucial for both experimental and theoretical studies. Zarin works under the supervision of Paul Garrett (Guelph).

Nathan Heinrich (Regina). In recent years there has been progress in understanding the internal structure of particles bound by the strong force known as hadrons. The next step is understanding Generalized Parton Distributions (GPDs), which are a cohesive framework for describing quark-gluon structure. My experiment seeks to determine the viability of extracting GPDs via a new method, known as Deep Exclusive Pion Electroproduction. Nathan works under the supervision of Garth Huber (Regina).

CINP is very pleased by the strong response to the Graduate Fellowship program, and we thank the many students who applied for the Fellowship, the many people who wrote letters, and the Selection Committee for their work.

After completion of the Graduate Fellowship, the recipient is asked to provide a short report for the CINP Newsletter summarizing the result of their research. We are pleased to present the articles from the 2023 Graduate Fellowship recipients.

15. Background discrimination for the ALPHA-g anti-hydrogen detectors

Gareth Smith (UBC/TRIUMF)
PhD Supervisor: Makoto Fujiwara (TRIUMF)

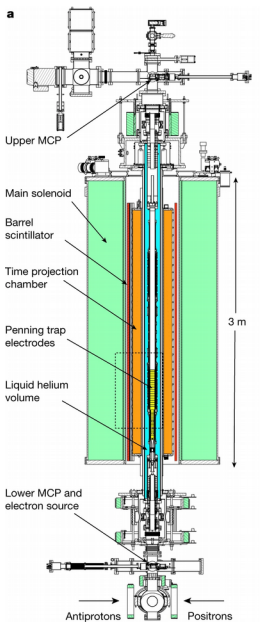

Figure 15-1: Cross-section of the ALPHA-g apparatus [Nature 621 (2023) 716-722]

The imbalance between matter and antimatter in the observed universe, coupled with our lack of a quantum theory of gravity and the unexplained nature of dark matter and dark energy, creates a strong incentive to explore the intersection of antimatter and gravity. One idea to shed light on this area is to look for differences in the gravitational behavior of matter and antimatter.

The ALPHA-g experiment, recently commissioned at CERN, was designed to directly measure the gravitational free fall of anti-hydrogen, the simplest neutral antimatter atom. Anti-atoms are created and magnetically confined, then slowly released to measure

their annihilation positions. The first measurements from ALPHA-g were published last year [Nature 621 (2023) 716–722] and demonstrate gravitational acceleration consistent with hydrogen. The ALPHA-g apparatus is shown in Fig. 15-1.

ALPHA-g employs two detectors to observe anti-hydrogen annihilations. A time projection chamber (TPC) tracks the trajectory of charged pions produced in annihilations, and traces them back to a common annihilation vertex. Simultaneously, a barrel scintillator (BSC) detector measures the time-of-flight of these annihilation products. Consisting of 64 thin scintillator bars concentrically surrounding the TPC, each bar is read out by 6 silicon photomultipliers at both ends. A machine learning analysis combines time-of-flight information from the BSC with tracking information from the TPC, to discriminate a few hundred anti-hydrogen annihilations per run out of a constant background of cosmic rays.

My research over the past year as a CINP graduate fellow has been on preparing the BSC for time-of-flight measurements in the upcoming ALPHA-g run. In particular, my focus has been on developing a time-of-flight calibration algorithm. My scheme requires around 3 hours of cosmic ray background-only data; by parasitically using data already taken while waiting for anti-proton delivery from ELENA, time-of-flight calibration can be performed continuously on a run-to-run basis.

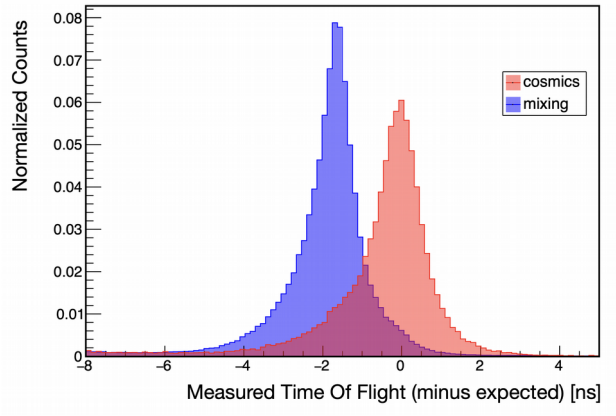

Figure 15-2: Measured time-of-flight distributions for annihilations (blue) and cosmic ray background (red). Expected time-of-flight based on a cosmic ray at the speed of light has been subtracted.

I perform a series of calibrations sequentially. First, each scintillator bar is treated individually; the end-to-end time difference is compared to the expected hit position based on a matched TPC track, and the end-to-end time offset and effective refractive index is found. Secondly, the "time-walk" effect is calibrated by assuming an inverse square root relationship between time delay and pulse amplitude, which is measured using an analog-to-digital converter. The coefficient is found independently for each bar via a grid search to minimize the width of the time-of-flight distribution for cosmic rays travelling to the bar directly opposite. Finally, bar-to-bar time offsets are measured for every pair of bars using cosmic rays. These offsets are then combined to find a characteristic time delay for each bar.

Using this calibration, I have reached the target time-of-flight resolution of 500 ps required for background rejection. Fig. 15-2 shows the time-of-flight for cosmic ray background and annihilation. I have added time-of-flight variables to the background rejection machine learning analysis and have already seen some improvement. I look forward to using time-of-flight-based background rejection for the first time in the ALPHA-g run this year. This work will improve a systematic uncertainty in the current gravity measurement, and open the door to future possible measurements which would yield slower annihilation rates.

16. Beam Spin Asymmetry of Exclusive Pion Production in the KaonLT Experiment

Alicia Postuma (Regina)
PhD Supervisor: Garth Huber (Regina)

The strong force is well understood in the high energy limit, where asymptotic freedom applies, and somewhat in the low energy limit, where colour confinement dominates. In the transition regime between these extremes, however, the strong force remains poorly understood. The KaonLT experiment at Jefferson Lab (JLab) Hall C measured deep exclusive meson production (DEMP) reactions to study quark-gluon interactions in the transition regime. My work measured the beam spin asymmetry of the p(e, e′π^+)n data collected in the KaonLT

experiment.

The beam spin asymmetry is defined as the fractional difference in events caused by incident electrons of positive or negative helicity, and it is proportional to the structure function $\sigma_{LT'}/\sigma_0$. In this work, the extracted values for $\sigma_{LT'}/\sigma_0$ are compared to three theoretical models: the GPD-based Goloskokov-Kroll (GK) model [1], the Regge-based Vrancx-Ryckebusch (VR) model [2], and the Regge-based Choi-Kong-Yu (CKY) model [3].

Scattered electrons were detected in the High Momentum Spectrometer (HMS) in coincidence with mesons in the Super High Momentum Spectrometer (SHMS). Particle identification relied on binary Čerenkovs, in combination with a lead glass calorimeter in the HMS. Background from aluminum target cell walls and random coincidences were subtracted from charge normalized yields. The exclusive neutron final state was selected with a cut on the reconstructed missing mass, which in the case of the p(e, e′π^+)n reaction should be close to the free neutron mass. As the detector inefficiencies and data acquisition livetimes are uncorrelated with the electron beam helicity, they cancel in the calculation of the BSA.

The data are binned in the kinematic variables $Q^2=-(\mathbf{p}_e-\mathbf{p}_{e'})^2$, $-t=-(\mathbf{p}_{\gamma^*}-\mathbf{p}_\pi)^2$, and center of mass energy W, and the BSA is calculated in each bin (Fig. 16-1). There are two possible ways of determining $\sigma_{LT'}/\sigma_0$: using the full functional fit or an approximation. In this work, the result from the approximation method is used as a systematic error. Other systematic errors result from the uncertainty on the beam polarization, and the cut dependence of $\sigma_{LT'}/\sigma_0$ from the missing mass and coincidence time cuts. Once $\sigma_{LT'}/\sigma_0$ was determined, The $-t$ dependence was studied at fixed Q^2 and W. Final results are not shown here, but it was found that the CKY model gave the best fit to the data, although features of the data were reproduced by both GK and VR.

Results from this work are in good agreement with recent results from CLAS12 [4], showing a similar magnitude and $-t$ dependence of $\sigma_{LT'}/\sigma_0$. Between these results and CLAS, there is a substantial overlap in kinematics. By comparing data between CLAS6 [45, CLAS12, and this work, two points were identified for a Q^2 scan, at which x_B and $-t$ were held constant, and $\sigma_{LT'}/\sigma_0$ was plotted as a function of Q^2 (Fig. 16-2). It was found that at the two points investigated, Q^2 had no measurable effect on the magnitude of $\sigma_{LT'}/\sigma_0$.

This work will be submitted to Physical Review Letters shortly. I thank the CINP for their generous support of my research work.

[1] S. V. Goloskokov and P. Kroll. Eur. Phys. J. C (2009) 65, 10.1140/epjc/s10052-009-1178-9
[2] T. Vrancx and J. Ryckebusch. Phys. Rev. C 89 (2014) 025203
[3] T.K. Choi, K.J. Kong, B.G. Yu, Korean Phys. Soc. 67 (2015) L1089-L1094
[4] S. Diehl et al (The CLAS Collaboration). Phys. Lett. B 839, 1(2023) 37761
[5] S. Diehl et al (The CLAS Collaboration), Phys. Rev. Lett. 125 (2020) 182001

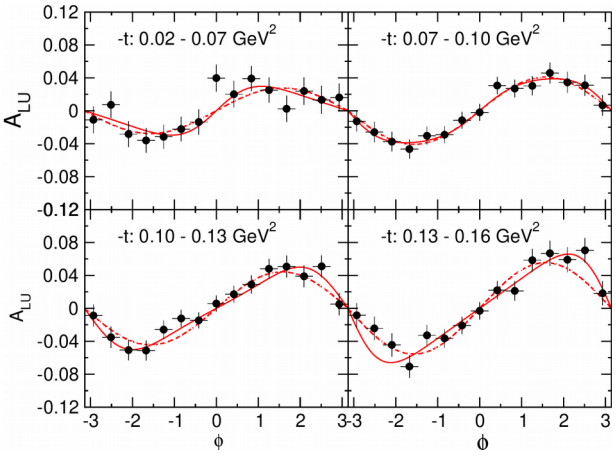

Figure 16-1: BSA for Q^2=3.0 GeV^2, W =3.14 GeV. The solid red line shows the fit of the functional form of the BSA to the data, and the dashed line shows an approximated sinϕ fit.

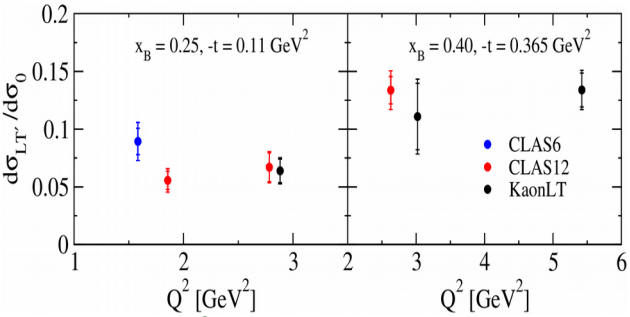

Figure 16-2: Q^2-dependence of $\sigma_{LT'}/\sigma_0$. Note that in each bin, all points agree within error.

17. Unprecedented $399.8M federal investment in TRIUMF advances Canadian science (submitted by Stuart Shepherd, TRIUMF)

The Canadian government is sending a strong signal of support for Canadian science with an unprecedented $399.8M in funding for TRIUMF, Canada's particle accelerator center as announced in federal Budget 2024. The funding, which represents the largest investment in the laboratory to date, will enable TRIUMF's national and international research communities to advance critical research and innovation, including the development of isotope-based cures for cancer and illuminating the form and function of our Universe using accelerator-produced isotopes.

The funding supports TRIUMF operations through 2030 and will significantly fortify the laboratory's world-leading science programs, including in the areas of nuclear and particle physics, life sciences, and materials sciences. The funding will also allow TRIUMF to continue expanding its research and production capacity for actinium-225 (the 'rarest drug on earth'), a short-lived radioactive isotope with tremendous promise for treating cancer. TRIUMF will also bring online a new, flagship multidisciplinary research facility, the Advanced Rare Isotope Laboratory, which will triple TRIUMF's rare isotope production capacity and shift the landscape of global isotope beam science in Canada's favor through increased academic and international partner collaborations, industry partnerships, and technology transfer.

"We are tremendously pleased and grateful for this historic investment into Canadian science," said Nigel Smith, TRIUMF Executive Director and CEO. "The federal government has recognized the immense value of TRIUMF's world-leading accelerator infrastructure, our community's contributions to the national academic ecosystem and in training the next generation of STEM leaders, and the leadership we enable for Canada within international Big Science."

"With today's budget results, the federal government is setting a strong vision for science in Canada, and for our major science facilities and the invaluable national community of researchers who need this infrastructure to do their work," said Angus Livingstone, Chair, TRIUMF Board of Governors. "TRIUMF is well-positioned to continue to driving impact for Canadians for years and decades to come."

More information will be shared as it becomes available.

18. TRIUMF Science Week (submitted by Chloe Malbrunot, TRIUMF)

TRIUMF Science Week returns this year with bright tones!

Join us for recent science highlights, community engagement regarding the upcoming TRIUMF Five-Year Plan 2025-2030, keynote talks on broad-ranging topics, discussions and networking opportunities.

A public lecture and many social gatherings are part of the event including a BBQ and the now infamous soccer tournament.

Registration is now open!
Info available at https://indico.triumf.ca/event/509/
Deadline for early registration: 09th of June

We look forward to seeing you at TRIUMF!

19. Grad classes offered by TRIUMF
(submitted by Marcello Pavan, TRIUMF)

TRIUMF periodically offers a few graduate-level courses, usually in the fall and winter terms, which could be of interest to your students. The courses are run online through UBC or UVic. Typically students would register at their local department in a 'directed studies' or 'special topics' course, though students in western Canada could take advantage of the Western Dean's Agreement to transfer course credit directly.

In Winter 2025, the following courses are planned. Students are asked to contact the lecturer directly is they are interesting in taking, or want more information about, the course.

UBC PHYS 505 — Nuclear Physics

Nucleons and their structure, hadrons and isospin, two-nucleon systems, the *NN* interaction; bulk properties of nuclei, nuclear excitations and radioactivity, nuclear models; strong and electromagnetic decay, symmetries and weak interaction; nuclear reactions, nuclear astrophysics.

In 2021 and 2023, Phys 505 was taken by an average of 5 UBC students and 10 from other Canadian universities (several under Western Deans' Agreement). It will again be taught entirely remotely.

Prerequisites: PHYS 500 Quantum Mechanics I or equivalent (one semester of grad QM)

More details at:
https://phas.ubc.ca/~behr/phys505/

Contacts: John Behr <behr@triumf.ca>, Barry Davids <davids@triumf.ca>

UBC PHYS 560 / UVic PHYS 522 Physics and Engineering of Particle Accelerators

The course will provide an introduction to the physics and technology of particle accelerators concentrating particularly on proton and ion accelerator technology. The course will include a survey of existing accelerator types and an introduction to transverse and longitudinal beam optics. The course will also include an introduction to the physics and technology of ion sources, will give an overview of radioactive ion beam production, of accelerator radio-frequency principles and more detailed aspects of room temperature and superconducting linear accelerators, as well as high energy circular machines. The course should appeal to students of Accelerator Physics, as well as to students of Experimental Nuclear and Particle Physics and other students interested in Particle Accelerators.

Pre-requisites: Classical Mechanics, Classical Electro-dynamics

Contact: Dr. Oliver Kester <okester@triumf.ca> or Dr. Bob Laxdal <lax@triumf.ca>

20. Research Update: A uniquely clean test of an elegant model of isospin symmetry breaking (submitted by John Behr, TRIUMF)

This experiment provides a uniquely clean test of a particular mechanism of isospin symmetry breaking that occurs in the beta decay of most nuclei having an excess of neutrons or protons. Isospin, a symmetry treating protons and neutrons as identical particles, is well-preserved in strong interactions but is obviously broken by electromagnetism, since the proton has an electric charge.

Unlike beta decay of the neutron and tritium, most beta minus decay in heavier nuclei is forbidden by energy conservation to decay to a state with same nuclear structure, the well-known isobaric analog state. Such isospin-suppressed beta decay can still occur by the Gamow-Teller operator, but the Fermi operator can only contribute if a progeny state has an isospin-breaking admixture with the isobaric analog. Such progeny states typically contain the anti-analog configuration, which has space and spin composition similar to the analog, but with quite different anti-symmetry under exchange and thus

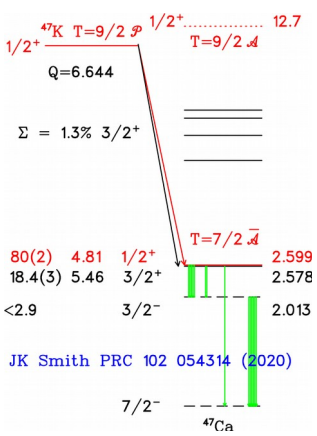

*Figure 20-1: $^{47}_{20}Ca^{27}$'s single 1/2⁺ state contains most of the **A** config.*

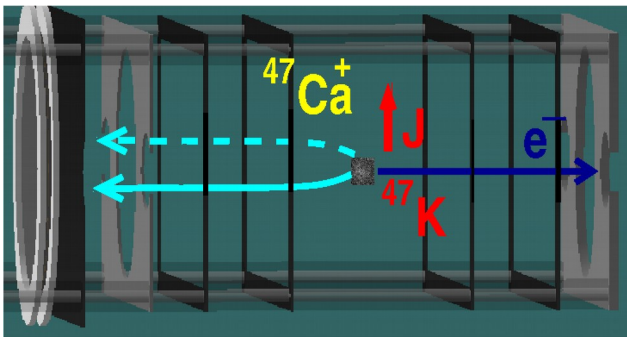

Figure 20-2: TRIUMF neutral atom trap for beta decay

different total isospin.

Nearly all beta decays show much less isospin breaking than predicted by elegant phenomenology of analog-antianalog mixing [N. Auerbach and M.-L. Bui, Nucl. Phys A 1027 (2022) 122521], while the amount measured here in ^{47}Ca is both large and a

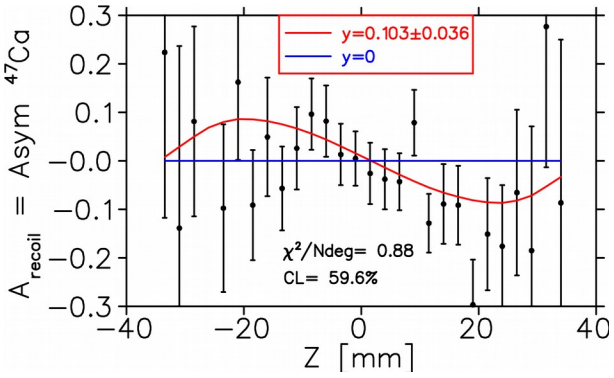

Figure 20-3: The nonzero asymmetry of recoils w.r.t. nuclear spin implies a nonzero Fermi component

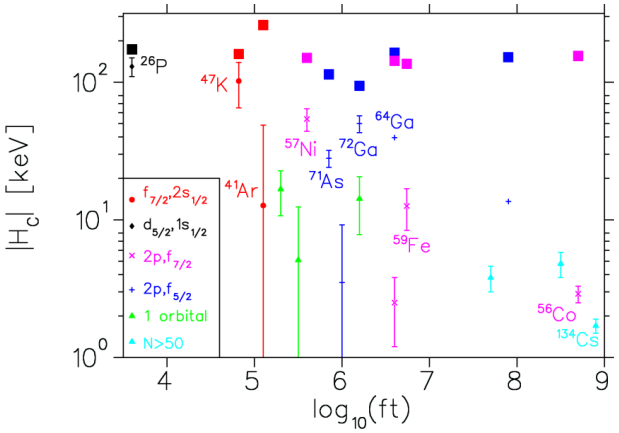

Figure 20-4: Most isospin-suppressed β decay has smaller H_c

large fraction of the prediction. The experimentalist authors attribute this to the existence of just one state in nearly doubly-closed ^{47}Ca of the same spin and parity as the parent ^{47}K, rather than the many such states in most decays that naturally distribute the degree of isospin mixing with the isobaric analog state.

Accepted by Phys Rev C Letters, and arXiv: 2405.02742

21. CINP Board of Directors

The CINP Institutional Members had their annual meeting via Zoom on May 15. One of the agenda items was to elect two Board members, who are listed below. Their assigned duties will be selected at their next meeting on May 28.

Name	Institution	Email	Term Ends
Thomas Brunner	McGill	thomas.brunner @ mcgill.ca	June, 2025
Liliana Caballero	Guelph	ocaballe @ uoguelph.ca	June, 2026
Gwen Grinyer	Regina	gwen.grinyer @ uregina.ca	June, 2027
Rituparna Kanungo	Saint Mary's	ritu @ triumf.ca	June, 2025
Russ Mammei	Winnipeg	r.mammei @ uwinnipeg.ca	June, 2026
Chris Ruiz	TRIUMF	ruiz @ triumf.ca	June, 2027

CINP Executive Director:

If you require information about any CINP programs, please do not hesitate to contact:

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CINP Treasurer:

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CINP Institutional Members:

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Saint Mary's University
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McGill University
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Scientific Working Group Chairs:

Fundamental Symmetries:
Jeff Martin (Winnipeg)
Hadronic Physics/QCD:
Svetlana Barkanova (Memorial)
Nuclear Astrophysics: Nicole Vassh (TRIUMF)
Nuclear Education and Training:
Ruben Sandapen (Acadia)
Nuclear Structure: Paul Garrett (Guelph)
Nuclear Theory: Alexandros Gezerlis (Guelph)

This Newsletter was edited by Garth Huber. Email regarding the content of this newsletter, or suggestions for content in future CINP newsletters should be sent to huberg@cinp.ca