Canadian Institute of Nuclear Physics
Institut canadien de physique nucléaire

Newsletter #20, May 2022

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

After a long absence due to COVID-19, the CINP and IPP are once again hosting a joint session at the CAP Congress, being held in person at McMaster University in Hamilton, ON.

Thursday, June 6, 2019	
Time	**Event**
7:30	**CINP Breakfast Board Meeting** (by invitation only)
8:45	**Parallel Sessions R1**
10:15	**Health Break**
	CINP+IPP Joint Session
10:45	NSERC SAPES Report -- Jeff Martin (20+5)
11:10	CFI Report -- Olivier Gagnon (10+2)
11:22	TRIUMF Report -- Nigel Smith (15+3)
11:40	SNOLab Report -- Clarence Virtue (10+2)
11:52	McDonald Institute Report -- Tony Noble (10+2)
12:04	General Discussion
12:15	**CINP Annual General Meeting** (be sure to select your lunch option)

2. NSERC Support for CINP

NSERC provides funding for many CINP activities through the Subatomic Physics Major Resources Support (SAP-MRS) program. The installment for 2022-23 is $75,000.

3. CINP Individual Membership

We are pleased to report that CINP membership numbers are up considerably from last year. Through to May 1, there were 2 new faculty members and 26 new associates. This was partly offset by a loss of 3 associate members (as part of our regular review process to ensure the roster remains up-to-date). The net membership gain is 25.

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 1, 2022			
Total Membership	170	Nuclear Astrophysics SWG	72
Faculty-class Members	86	Nuclear Structure SWG	74
Associate Members	84	Fundamental Symmetries SWG	73
Experimentalists	127	Hadronic Physics/QCD SWG	54
Theorists	41	Nuclear Theory SWG	27
		Education & Training SWG	50

4. Scientific Working Groups

The membership for the different SWG are listed above. The new Nuclear Theory SWG is off to a good start, with 27 members. We would like to thank Alexandros Gezerlis for taking on the role of SWG Chair. For more information on the SWGs, please visit: https://cinp.ca/scientific-working-groups

5. 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:

- 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 new members for the 2022-23 competition, please respond to GH ASAP.** CINP's input will be sent to NSERC by June 9.

- The new TRIUMF Director, Nigel Smith, has instituted a regular set of meetings between senior TRIUMF leadership and the Directors of CINP, IPP and McDonald Institute. This is a positive development, which has improved communication between TRIUMF and the institutes. So far, we have met twice, with the expectation of 3 meetings/year.

- The Subatomic Physics Evaluation Section (SAPES) considerably revised their schedule for the 2021-22 competition. The CINP presentation that normally would take place at the beginning of Large Projects Day was moved to the Fall Orientation Session on Dec 17. 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 20. Unlike prior years, where some external representation was allowed, this meeting is now entirely in-camera.

- GH is also representing CINP on the Pan-Canadian MRS Coordination Board, which met 3 times in 2021-22, with the goal of improving access by all CINP members to these resources. A new development is the creation of a national oversight board for all MRS resources, of which GH is an ex-officio member. For more information, 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. Garth Huber represents the CINP as a "community observer". If you have specific information that would be useful to the CINP's input, please let GH know. The fall ACOT meeting is expected to be in-person.

6. Canadian Subatomic Physics Long Range Plan

CINP is one of three commissioning bodies for the LRP, along with IPP and NSERC. GH attended all LRP meetings as an observer, and provided input to the final report. The LRPC has completed their work and their documents, in both French and English, are posted on the CINP website at: https://cinp.ca/subatomic-physics-long-range-plan

The LRPC has produced two documents:

- A 136 page detailed report for scientists and funding agencies.
- A shorter 40 page overview, which is intended for outreach or lobbying issues (such as discussions with your senior administration).

We hope you will find these documents to be useful, in which case we would appreciate receiving anecdotal information on your use of them.

7. COVID-19 Impacts on CINP Programs

Not surprisingly, the travel restrictions in place since March 2020 continue to have an impact upon many CINP programs, and we have had to change plans.

- For the Canadian Undergraduate Physics Conference (CUPC), we upgraded our level of sponsorship and gave a named student prize. For the Winter Nuclear and Particle Physics Conference (WNPPC), we offered enhanced student prizes. These were in place of our usual Student Travel programs, which we plan to resume as soon as circumstances allow.

- Many expenses, such as the Junior Scientist Travel Support program, Conference sponsorships, and representation travel, were greatly reduced. The CINP has a multi-year budget plan, where unexpended funds will be directed to student scholarships. For example, this has allowed CINP to double the number of available Graduate Fellowships.

8. 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 the following CINP-sponsored conference:

CSQCD IX – Compact Stars in the QCD phase diagram, From RHIC to Astrophysics; probing the quark-gluon plasma – brings together QCD physicists (working on phases of quark matter) and Astrophysicists (working on compact stars). The meeting will be held Aug 1-5 in Banff, AB, and will focus on recent explorations of the quark-gluon phase using colliders (e.g. RHIC and LHC) and the renewed interest on neutron and quark matter in astrophysics, particularly in the gravitational wave era. For more information: http://quarknova.ca/CSQCDIX/

9. CINP Undergraduate Research Scholarships (URS)

The 2022 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. The scholarship amount is $5000, which must be supplemented by the supervisor to a total not less than $9000. In addition, if the supervisor intends to send the student to a laboratory or work with a second collaborator for an extended period in the summer, the CINP can contribute up to an additional $1300 to help cover transportation and lodging expenses.

Eight applications were received, which were evaluated by a committee: Juliette Mammei (Manitoba), Chris Ruiz (TRIUMF) and GH. The top six were selected for a scholarship, of which three plan to use the travel supplement.

Student	Supervisor	Project Title
Minya Bai (McGill)	Thomas Brunner (McGill)	Characterization of an in-gas laser-ablation ion source for nEXO's Ba-tagging developments
Vincent Bruening (Mt Allison)	David Hornidge (Mt Allison)	Commissioning of the CATS large NaI detector
Quaid Hawkins (Guelph)	Khashayar Ghandi (Guelph)	Cherenkov radiation in a plasma
August Mendelsohn (Manitoba)	Russ Mammei (Manitoba)	Nab Silicon Characterization with 30 keV protons
Dhruval Shah (Regina)	Gwen Grinyer (Regina)	Beta-delayed charged particle spectroscopy of Si-22,23
Abbygale Swadlinlg (Calgary)	Timothy Friesen (Calgary)	Towards the first direct measurement of the Lamb shift in anti-hydrogen

10. CINP Graduate Fellowship

The Graduate Fellowship is a $12,000 scholarship to a PhD student of high merit. In addition to academic and scientific criteria, the Fellowship award application has an Equity-Diversity-Inclusion (EDI) component, where applicants wrote a 1 page description of what role a PhD student and Graduate Fellow can play in promoting and advancing EDI in our community.

10 applications were received, so the competition was very tight. The applications were reviewed by the committee: Gwen Grinyer (Regina), Gerald Gwinner (Manitoba), Jason Holt (TRIUMF), and David Hornidge (Mount Allison).

CINP is pleased to announce the two recipients of the 2022 Fellowships:

Fatemeh Gorgannejad (Manitoba). She has been designing, developing, constructing, and commissioning the pion detector system for the MOLLER experiment funded by CFI and NSERC.The pion detector system gives us access to the physics of pion production. In addition to providing the experimental input for important background corrections in the Fundamental Symmetries results of the MOLLER experiment, there will be specific physics results out of this pion detector that fits in the Hadronic/QCD field of interest to the CINP. Fatemeh works under the supervision of Wouter Deconinck (Manitoba)

Adam Powell (Calgary). He joined the University of Calgary in early 2019 and has spent most his time at CERN working with the Antihydrogen Laser Physics Apparatus (ALPHA) collaboration. His research is focused on experiments with antihydrogen including microwave spectroscopy and measurements of the gravitational free fall, as well as characterising magnetic fields inside the experiment using electron plasmas. Adam works under the supervision of Timothy Friesen (Calgary).

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 article from the 2021 Graduate Fellowship recipient, Jessica Churchill.

11. Theoretical Investigations of the Quark-Gluon Plasma

Jessica Churchill (McGill)
PhD Supervisor: Charles Gale (McGill)

One of the goals of colliding nuclei at relativistic energies is to create and characterize quark-gluon plasma (QGP), an exotic state of matter that existed a few microseconds after the Big Bang when the universe was in a state of extreme temperature and density -- far too hot and dense for bound states of quarks and gluons to exist. As the universe cooled and expanded, the quarks and gluons from the QGP recombine to form hadrons, creating the building blocks for the universe we know today. Modeling the behavior of this unusual nuclear matter is consequently the subject of vigorous experimental and theoretical programs.

These conditions of the early universe are recreated on a much smaller scale through relativistic collisions of heavy-ions at accelerator facilities such as the Large Hadron Collider (LHC at CERN) and the Relativistic Heavy Ion Collider (RHIC at the Brookhaven National Laboratory) that concentrate so much energy in such a small volume that the colliding nuclei "melt" into QGP. This plasma can be studied through emitted electromagnetic particles such as photons and dileptons (pairs of leptons) which make ideal probes as they are emitted throughout the entire evolution of the system and are penetrating probes that undergo negligible final-state interactions. Calculations of those observables are used to help pin down bulk properties of QGP, such as its temperature.

The evolution of QGP as it cools and expands can be summarized into five main stages shown in Fig. 1: initial state, pre-equilibrium, hydrodynamic QGP, hadronization, and thermal freeze-out. The electromagnetic signal from the pre-equilibrium phase was recently quantified successfully [Churchill et al., Phys. Rev. C **103** (2021) 2, 024904; *ibid*, Nucl. Phys. A **1005** (2021) 121946].

Up to recently, calculations of lepton pair emission from the QGP had been limited to rates obtained in the Born approximation. Within the past year, the enhancement of the dilepton yield due to the contribution from NLO terms in the hydrodynamic phase has been calculated for the first time (see Fig. 2). Much like blackbody radiation, the dilepton (electron and muon) yield has been used by practitioners as a means of determining the temperature of the QGP, therefore, the updated dilepton yield calculations will be used to improve the accuracy of this temperature extraction. Estimates of the dilepton elliptic and triangular flow (v_2 and v_3) are also in progress and will further inform the modeling and interpretation of relativistic heavy-ion experiments.

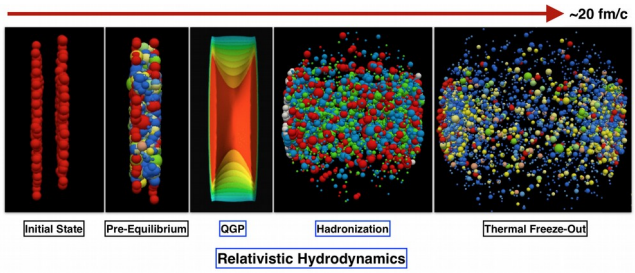


Fig 1: The various stages of the evolution of heavy-ion collisions from the initial state to the freeze-out into hadrons.

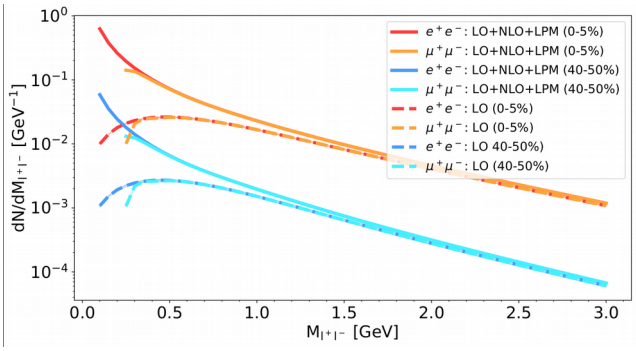


Fig 2: Dilepton spectra for Pb+Pb collisions with centre-of-mass energy 5.02 TeV.

12. 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

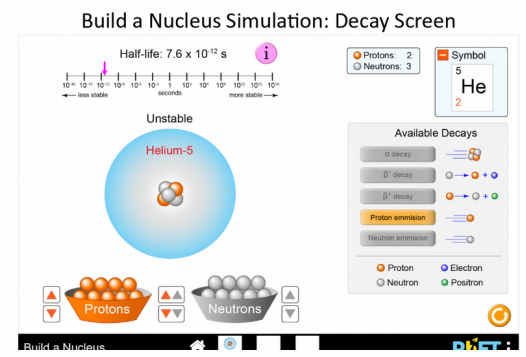
Applications are accepted on a continuing basis. A standing committee consisting of: CINP Executive Director, Chair of the Education & Training SWG, and one representative of the CINP Board will evaluate applications as they are submitted and provide prompt feedback or decision to the applicant (typically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

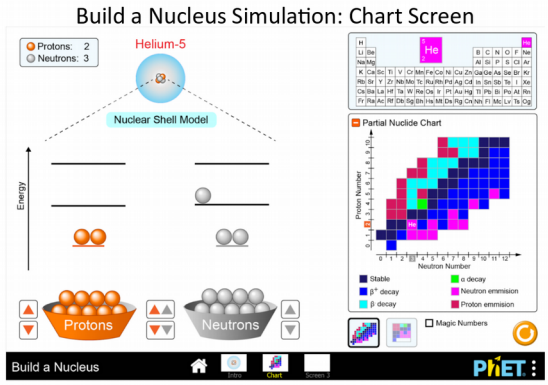
The total program funds available for 2022-23 are $7000.

13. Build a Nucleus Simulation

(Submitted by Luisa Vargas Suarez & Jason Donev, Calgary)

The Chart of the Nuclides and the inner workings of the nucleus are crucial for understanding nuclear science. To encourage non-specialists to become familiar with the chart, the Energy Education team at the University of Calgary designed the Build a Nucleus simulation (currently under development), with the University of Colorado's PhET team, who create engaging educational simulations on math and science concepts. The Build a Nucleus simulation introduces necessary concepts to understand the chart through its connection with the periodic table. The simulation has a total of three screens where the first two build up on the principles of half-life, radioactive decay, and stability, before showing the complete chart on the third screen. The simulation is designed for self-directed learning by users at an undergraduate educational level. The chart in this simulation is colour-coded to show the most likely decay a nuclide would undergo, in addition to showing the half-life and decay arrows for each nuclide. This simulation fosters enthusiasm for learning about nuclear science through an interactive way. Knowledge of this chart can aid in understanding the use of these isotopes in society, not only in generating nuclear power, but also in nuclear medicine and industrial applications.





14. WNPPC Student Prizes

As discussed in Sec 7, CINP offered enhanced student prizes to virtual attendees of the WNPPC in February. The recipients of the CINP prizes were:

Name	Supervisor	Category	Prize
Toogan (Frank) Wu	Krzysztof Starosta (SFU)	Best Overall	$750
Pooja Woosaree	Tim Friesen (Calgary)	2nd Experiment	$300
Alicia Postuma	David Hornidge (Mt. Allison)	Best Undergraduate	$500

Congratulations to the speakers, and thanks to Beatrice Franke for organizing the prizes.

15. CINP Board of Directors

The CINP Institutional Members had their annual meeting via Zoom on May 17. 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 June 9.

Name	Institution	Email	Term Ends
Thomas Brunner	McGill	thomas.brunner @ mcgill.ca	June, 2025
Michael Gericke	Manitoba	mgericke @ physics. umanitoba.ca	June, 2023
Gwen Grinyer	Regina	gwen.grinyer @ uregina.ca	June, 2024
Rituparna Kanungo	Saint Mary's	ritu @ triumf.ca	June, 2025
Jeffery Martin	Winnipeg	j.martin @ uwinnipeg.ca	June, 2023
Chris Ruiz	TRIUMF	ruiz @ triumf.ca	June, 2024

16. CINP Contact Information

CINP Executive Director:

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

Garth Huber, Ph.D.
CINP Executive Director
c/o University of Regina
306-585-4240
huberg@cinp.ca

CINP Treasurer:

Greg Hackman
TRIUMF
treasurer@cinp.ca

CINP Institutional Members:

Memorial University of Newfoundland
Saint Mary's University
Mt. Allison University
McGill University
University of Guelph
University of Manitoba
University of Winnipeg
University of Regina
University of Northern British Columbia
Simon Fraser University
TRIUMF

Scientific Working Group Chairs:

Fundamental Symmetries:
Gerald Gwinner(Manitoba)
Hadronic Physics/QCD:
Svetlana Barkanova (Memorial)
Nuclear Astrophysics: Iris Dillmann (TRIUMF)
Nuclear Education and Training:
Juliette Mammei (Manitoba)
Nuclear Structure: Adam Garnsworthy (TRIUMF)
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