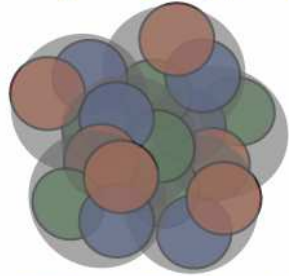


C I N P



I C P N

**Canadian Institute of
Nuclear Physics**

**Institut canadien de
physique nucléaire**

Major Issues for CINP Brief

Garth Huber

CINP Executive Director

Canadian Subatomic Physics Long Range Plan

Town Hall Meeting

June 13, 2025

University of Saskatchewan and on Zoom

LRP 2027–34 Terms of Reference

- There are significant changes to LRP mandate compared to the one 5 years ago. These reflect input received in our Nov/24 Ottawa visit
 - NSERC:** *We are asked to have a more selective LRP process that defined actual priorities, and be more useful to peer reviewers*
 - CFI:** *“Needs to set some priorities to be useful.” Last one didn’t set clear enough priorities*
- **The new LRP is asked to take into account :**
 - i. the optimization of the human and financial resources of the Canadian subatomic physics community in terms of research excellence and impact
 - ii. the alignment of research endeavors with the established expertise and strengths of the Canadian community
- **Budgetary Scenarios for Prioritized Endeavours:**
 - Need to address the intellectual capacity available in the community
 - The overarching goal needs to be to facilitate coalescence around the most impactful projects
- **i.e. The LRP should be realistic in terms of the community’s human capacity and expertise, and avoid undue duplication of effort**

More Ottawa LRP suggestions

- **ISED:** Broad themes the LRP should highlight:
 - Subatomic Physics (SAP) is international by nature
 - SAP contributions to Government’s “Mission Oriented” Efforts
 - Aspects of research security and sensitive technologies, Intellectual Property (IP). How are they relevant to our world?
- **NSERC:** need to focus on the impact of SAP, and what difference our HQP makes to society and the economy. Be punchy.
 - “SAP research pushes the frontiers of human knowledge”. This is good, lead with this and its impact to society
 - “SAP trains HQP”. What differences have they made to society? Government likes to hear success stories
 - Be bold. Physics should not be afraid to take ownership of AI in its arguments, given the awarding of the Physics Nobel for AI
 - What computational capability does Subatomic Physics need? What is the future role of AI in our field?
- **OCSA:** LRP should look at international view, what does SAP need and push for?
 - Prioritization process is science based, but politicians decide whether to fund, so you need to make arguments accordingly
 - The square kilometer array (SKA) played the digital card as part of their funding case, infrastructure upgrade within Canada

Ottawa feedback summary

- The Federal scientific leadership (ISED, OCSA, NSERC, CFI) is very supportive of subatomic physics
 - We have an international reputation for excellence and impact that has not gone unnoticed
 - They recognize that our LRP have historically provided good stewardship of our resources, and have contributed to our scientific excellence and impact
- They want us to be bold in our vision, linking it to broader themes within government (e.g. Digital Future, AI) as part of making case for funds
 - At the same time, we need to realistic in terms of available manpower and expertise, so that probability of future success is high
- Government never doubts the quality of hard science, it's the broader impacts that they want to hear about
 - New initiatives are possible if arguments can be made in a compelling way to government
 - House of Commons S&T Committee has been critical of research that serves little or no apprenticeship benefit to Canada (particularly certain SSHRC disciplines)
- **Making these arguments effectively is easier said than done. But we should try to make these points in the best way we can**

Previous CINP LRP Brief Contents

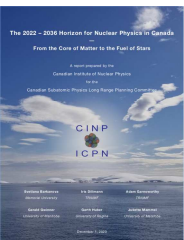


- **2020 CINP LRP report was 187 pages**

- While this provided a very nice summary of Canadian nuclear physics research, a shorter document might be more helpful in making the case for resources

- **Table of Contents:**

1. The Key Questions in Nuclear Physics and Benefits of Nuclear Physics Research to Society	(8p)
2. Executive Summary of Recommendations	(4p)
3. Physics Case	(5 thematic sections, 104p)
4. Opportunities Enabled by New Facilities	(25p)
5. The Human Element: Positive Impacts on Canadian Society	(17p)
6. Recommendations and Budget Estimates	(8p)



2020 CINP Recommendations

1. Enhance Nuclear Theory Support

Recommend increased support at a level to allow travel and support postdocs, graduate students

2. Maintain a diverse program of excellence in experimental and theoretical nuclear physics

Strongly recommend that a diverse nuclear physics program addressing all of the key questions be maintained in all funding scenarios

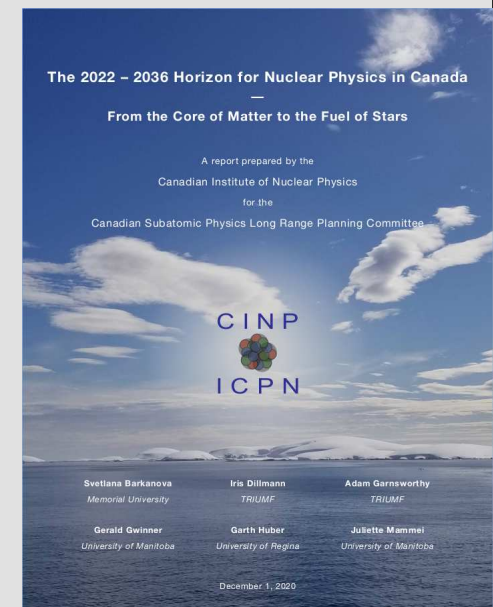


How do quarks and gluons give rise to the properties of strongly interacting particles?



Canadians have made substantive detector contributions to the JLab 12 GeV Upgrade, and have moved to data collection and analysis mode.

- **GlueX (exotic hybrid mesons) Hall D.**
- **Pion and Kaon Form Factors Hall C.**
- **Medium term (2022–26): Canadians involved in data taking and analysis of data. JLab Eta Factory (JEF) is planned with upgraded GlueX equipment for 2021–26.**
- **Longer term (2027-36): SoLID experiment at JLab**
- **Canadian participation at Electron–Ion Collider will uniquely address profound questions about nucleons, including the origin of hadronic mass, the origin of nucleon spin, and the emergent properties of dense systems of gluons.**

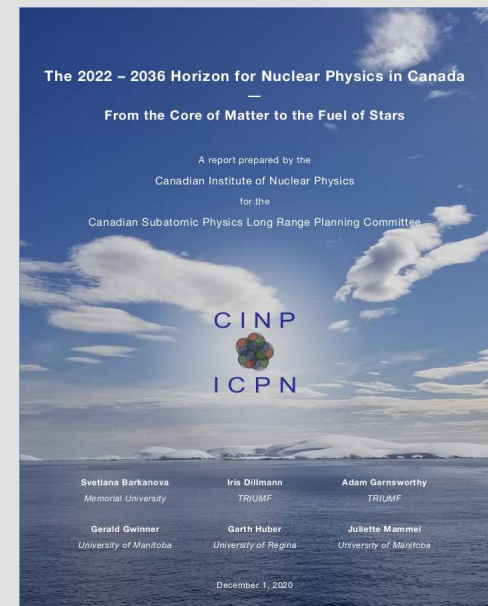


How does the structure of nuclei emerge from nuclear forces?

Medium term (2022–26): Highest priority is to capitalize on the recent investments in new world–class detector infrastructure at ISAC. New detector systems, such as EXACT-TPC and RCMP, will begin physics programs at ISAC.

Longer term (2027-36): ARIEL will be a next generation rare–isotope beam facility, new beam species, higher intensities, cleaner beams, longer beam periods.

- High quality work off–shore at GSI/FAIR, GANIL, RIKEN, FRIB, JLab
- Global ab–initio calculations of all nuclei may become possible in next 5-15 years, making statistical analyses of properties and limits of nuclei from first principles a reality.
- Nuclear structure investigations relevant to $0\nu\beta\beta$ may become a future direction.



What is the role of radioactive nuclei in shaping the visible matter in the universe?

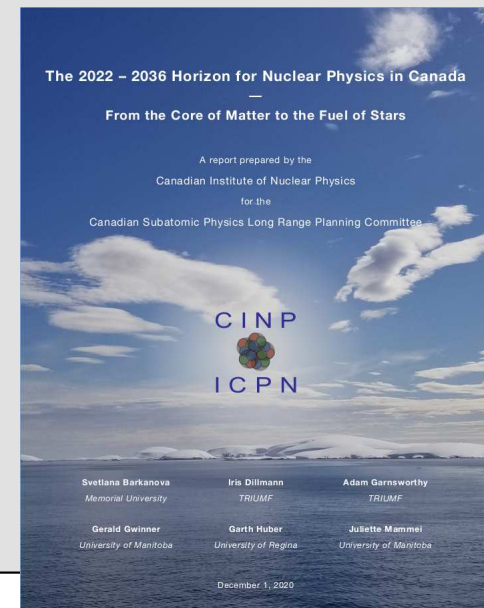


Medium term (2022–26): Majority of domestic program is carried out at ISAC, complemented with off-shore activities at GSI, GANIL, RIKEN, FRIB

- The flexibility of several ISAC detectors to be combined allows a wide coverage of experiments that are not easily possible elsewhere, e.g. EMMA + TIGRESS, GRIFFIN + DESCANT, TITAN EBIT + 8π , etc. detectors.

Longer term (2027-36): Canadian program will profit from full implementation of ARIEL facility at TRIUMF

- New detectors planned to take full advantage of upcoming photofission beams and intense re-accelerated heavy nuclear beams from ARIEL, e.g. EXACT–TPC
- TRIUMF Storage Ring (TRISR) Proposal for a low–energy storage ring with a neutron generator at ISAC is underway



What Physics Lies Beyond the Standard Model?

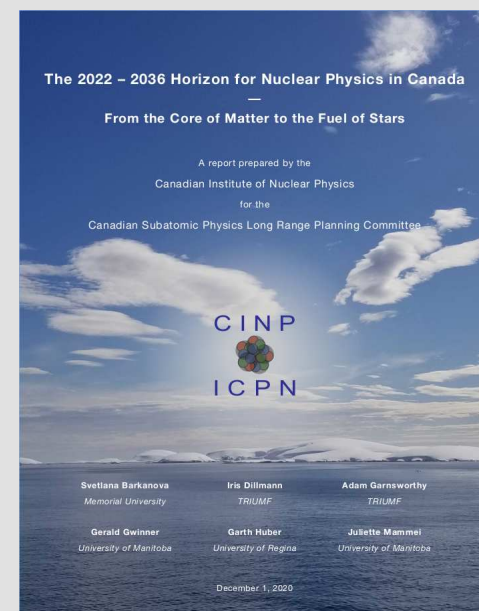


Medium term (2022–26):

- Active ISAC program: Laser–trapped Francium, GRIFFIN β –decay, TRINAT, TITAN
- TUCAN and ALPHA–g CFI–funded upgrades completed
- NaB, nPDGamma, nHe3 cold neutron experiments underway
- MOLLER @ JLab will be commissioned ~2025, run to ~2030
- Positive funding decision awaited on nEXO 5 tonne detector

Longer term (2027-36):

- Precision spectroscopy with radioactive molecules will be major new effort @ ISAC
- FrPNC to start atomic PV run @ ISAC
 - Possible extension to cold Fr, Ag molecules
- Deployment of HAICU by ALPHA Collaboration
- Fundamental Symmetries @ EIC



3. Fund the additional HQP needed to capitalize on new or recently-upgraded facilities

It is essential that a corresponding increase be made in the NSERC SAP envelope to support the research teams that will drive the scientific output from these new facilities

4. Leverage the scientific opportunities enabled by the completion of ARIEL

Government of Canada support for TRIUMF to allow for operational support necessary to fully exploit the science opportunities of ARIEL (9000 hr of RIB/yr) is essential



5. Position Canada for Leadership in Future International Nuclear Physics Research

A major new project on horizon is the Electron-Ion Collider, a substantial involvement will confirm Canada's leadership role in scientific research and development

6. Grow the Nuclear Physics Community

We encourage our community to seek innovative sources of funds for bridge faculty positions, so that the substantial scientific opportunities we see in the next 15 years can be best taken advantage of



2020 CINP Recommendations

7. Foster a funding environment which enables Canadian Researchers to lead in science and discovery

- a) Sufficient and versatile funding opportunities for both capital equipment and operational funding is essential. The interplay between NSERC, CFI and the new Computing Agency needs to be strengthened, so that capital, operating fund and high performance computing resource decisions are coordinated and streamlined
- b) NSERC and TRIUMF should continue to provide technical resources and capabilities for construction of experiments
- c) Ongoing investments in detector and accelerator R&D are needed



Important issues for new LRP

- **Highlights of key past accomplishments**
- **Mid-term vision: 2027–34**
- **Longer term vision: 2034–41**
- **Optimization of human and financial resources**
- **Alignment of research endeavors with expertise and strengths**
- **Coordination of Canadian program within international context to maximize our excellence and impact**
- **Broader Impacts: HQP, IP, spinoffs, EDI**
- **High Performance Computing needs, Accelerators, Emerging Technologies**
- **Current and projected industrial connections**
- **Recommendations on how to lessen any negative impacts or enhance positive ones**

Town Hall Meeting Schedule

- **Lunch Break**
- **Plenary II: Selected New Projects**
- **Discussion** *(recorded for committee use)*
- **Breakout Sessions:** Each SWG meets to discuss plans and priority. Scheduled in series. Please be considerate when joining ongoing session
- **Rest Break**
- **Plenary III: SWG Summaries**
- **Final Discussion** *(recorded for committee use)*

Final Discussion Points

- Initial thoughts on scientific opportunities afforded by the presented new projects
 - Highlights of past accomplishments
 - Mid-term vision: 2027–34
 - Longer term vision: 2034–41
 - International context
- Initial thoughts on major challenges to worry about, and opportunities to optimistically present, in CINP Brief
- Broader Impacts? HQP Testimonials?
- Is there anything we missed?
- Please send us pictures!