Arthur B. McDonald

Canadian Astroparticle Physics Research Institute

Strategic Plan

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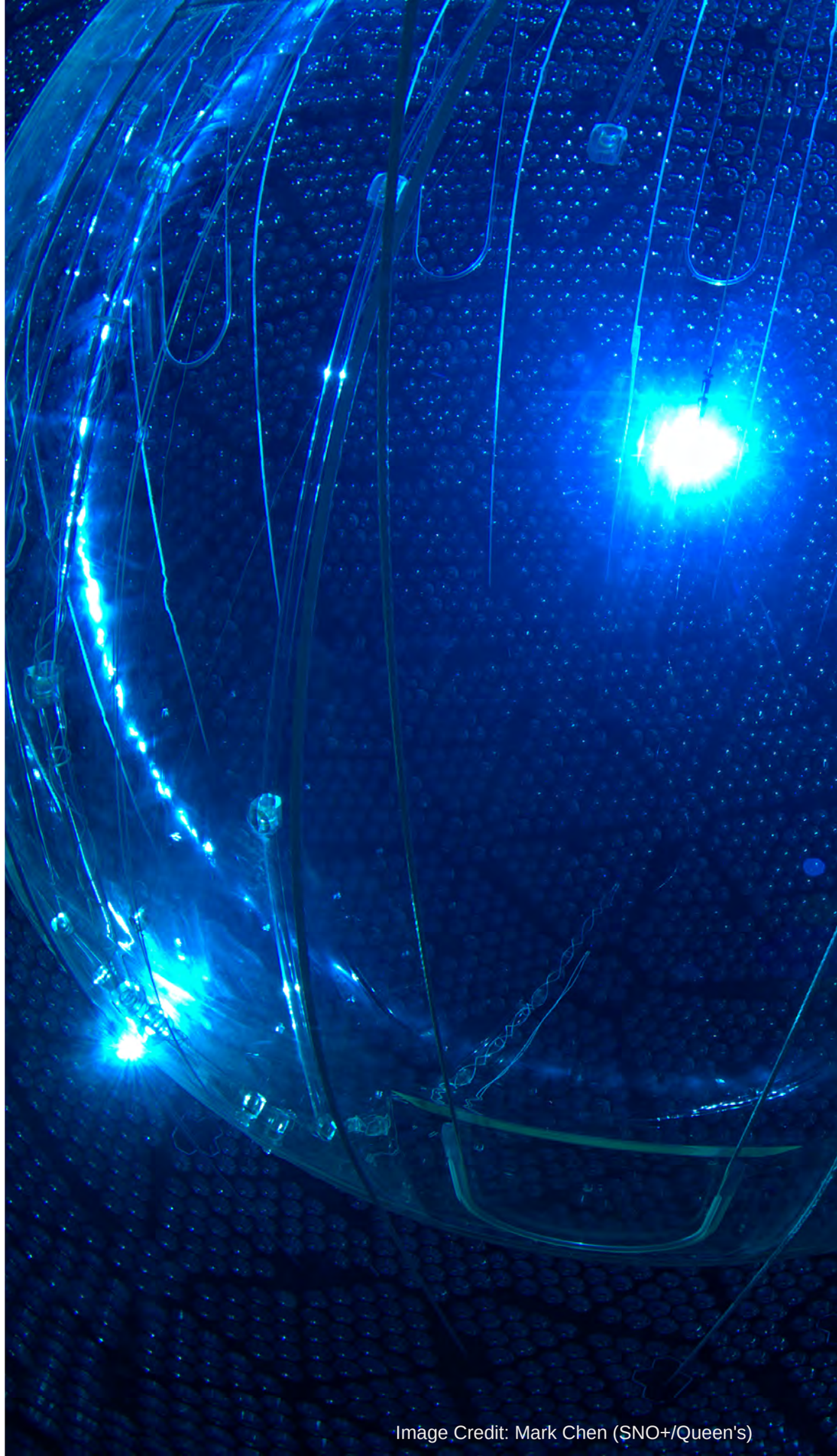


Image Credit: Mark Chen (SNO+/Queen's)

Image Credit: SNOLAB/PICO Collaboration

EXECUTIVE SUMMARY

In the last 20 years, Canadian astroparticle physicists have delivered world-leading results that expand our collective understanding of fundamental particles and the composition of our universe. The Sudbury Neutrino Observatory (SNO) experiment transformed the landscape for Canadian astroparticle physics research and brought global acclaim to its contributors. The SNO experiment's accomplishments go beyond research achievement. It helped the Canadian scientific community focus its purposes; forged deep collaboration between researchers, funders, institutions and private sector entities; and it laid the groundwork for, SNOLAB, a globally important underground research facility drawing the world's best minds to Canada.

The Canada First Excellence Research Fund recognized astroparticle physics as a national science priority area with $63.7 million funding aimed at elevating the Canadian research position among its international peers. The funds were awarded to Queen's University and its seven institutional partners (including University of Alberta, University of British Columbia, Carleton University, Laurentian University, McGill University, Université de Montréal, and the University of Toronto). They were mandated to create a Canadian network of astroparticle physics research talent and catalyse the integration of this scientific community with the broader research and innovation ecosystem. The academic institutions aim to do just that in

close collaboration with their major research facilities partners (SNOLAB and TRIUMF). They are collectively delivering on this mandate as the Arthur B. McDonald Canadian Astroparticle Physics Research Institute (McDonald Institute).

Over the next five years, the McDonald Institute will focus its efforts into five key objectives. Scientifically, it is essential to our mandate to: 1) Create a globally competitive community of astroparticle physics in Canada; 2) Attract and retain talent; 3) Facilitate discussion to further align the strategy for astroparticle physics development in Canada. Efforts 1-3 focus on enhancing and promoting Canada's research excellence by leveraging the substantial science legacy built from federal and provincial government investments over the past two decades. We will also: 4) Focus on generating benefits for society and the economy; 5) Champion diversity, management and governance throughout our activities. Efforts 4-5 reflect the necessity of driving broader applications from research knowledge and mobilizing a broader range of communities to more effectively harnessing scientific knowledge creation for even greater impact. Underlying these efforts is a strong governance structure with mandate to maintain fiscal responsibility as well as timely delivery on our objectives.

Through this plan we are committed to deliver value for the Canadian astroparticle physics community, its institutional and research partners, funders and the public. Canadian astroparticle physicists and their trainees are well positioned to play major roles in global science over the next several decades. The McDonald Institute will be the catalyst to ensure that it happens.

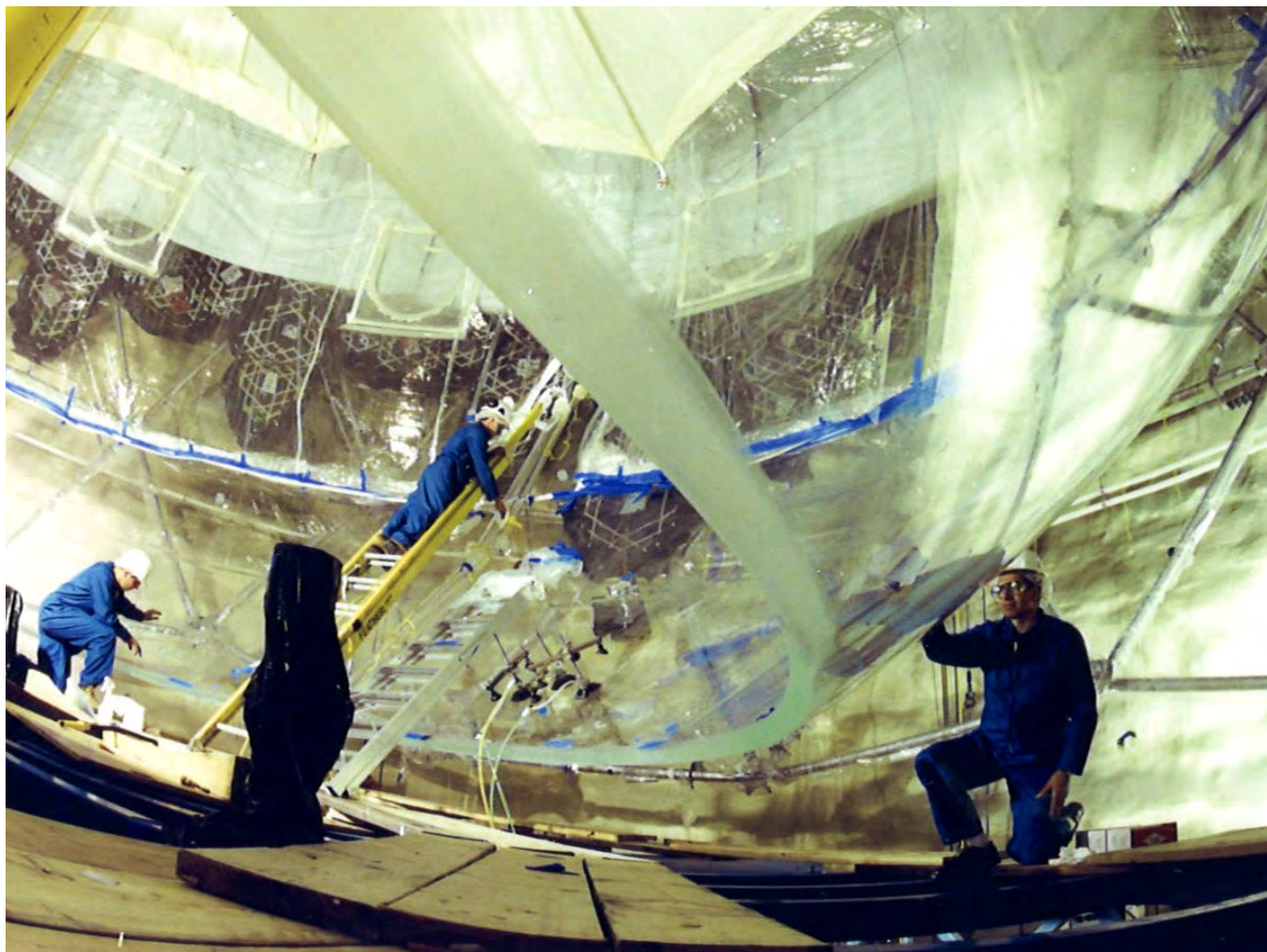
Image Credit: UBC

BUILDING MOMENTUM: OUR LAST 20 YEARS

Canadian astroparticle physics research rose to global prominence in 2002 when extraordinary results from the Sudbury Neutrino Observatory (SNO) were published in Physical Review Letters. After several decades of conceptualization, development, construction and careful analysis, the SNO collaboration findings provided a solution to the decades-old Solar Neutrino Problem. It discovered critically important properties of neutrinos that had not been predicted by the Standard Model of particle physics. Recognition of these important results was swift and propagated through the international scientific community. The success was marked by numerous awards to the Director of SNO, Arthur B. McDonald, and the SNO collaboration, culminating in a share of the 2015 Nobel Prize, and the 2016 Breakthrough Prize.

The neutrino anomaly and the SNO experiment

Prior to SNO, several decades of careful experimentation measuring the flux of neutrinos from the sun could not be reconciled with detailed theoretical calculations predicting the neutrino flux from solar fusion reactions. All prior experiments measured a flux of about 1/3 the expected number of neutrinos. Either the experiments were flawed, the calculations were wrong, or the neutrinos had an



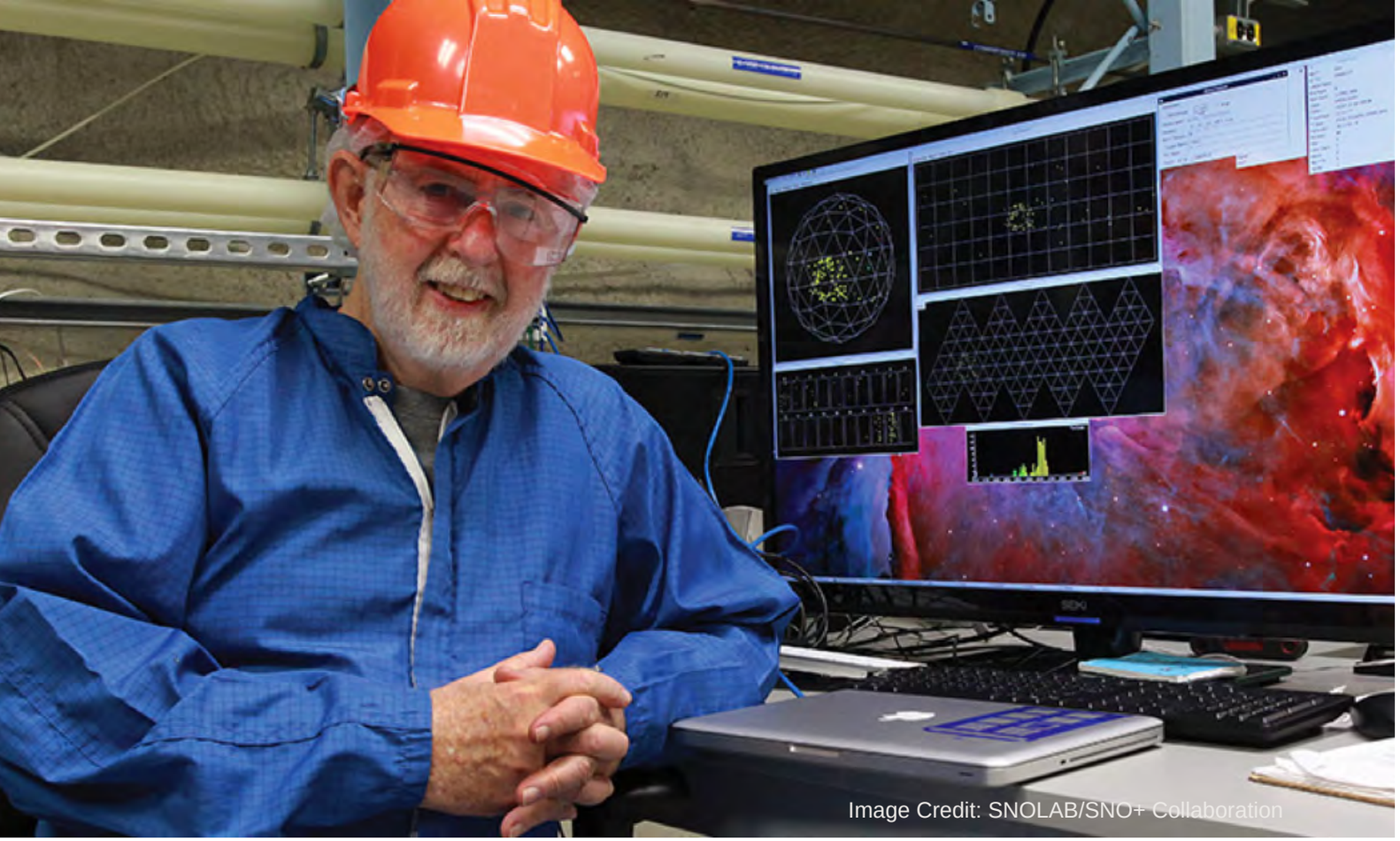


Image Credit: SNOLAB/SNO+ Collaboration

The legacy of SNO has expanded into much broader range of astroparticle physics experimentation in Canada.

unexpected new property that allowed neutrinos born in the sun as one flavour, to arrive at the earth in another, in a form that that was undetectable by early experiments.

The SNO experiment was unique, and only possible in Canada due to the availability of a huge supply of heavy water from reserves established for the CANDU nuclear reactor program. The use of heavy water allowed astroparticle physicists to simultaneously measure the flux of neutrinos of the type born in the sun through one reaction, and to measure the total flux of neutrinos independent of flavour, in another. The experiment required exquisite control over naturally occurring radioactive backgrounds that could mimic neutrino signals. On the surface of the earth these backgrounds would mask any neutrino signal detected and the rate needed to be significantly reduced by going deep underground. The experiment was brought to life through a partnership that provided access to one of the deepest active mines on earth, in Sudbury Ontario, and a willingness on the part of the mining company – INCO, now Vale - to host the experiment facility.

The results from SNO demonstrated that the neutrinos from the sun were indeed oscillating from flavour to flavour as they travelled through the sun and on to the earth. This is only allowed quantum mechanically for particles with mass, indicating that neutrinos must have some mass. Despite the smallness of the particle, the impact was far reaching, modifying our understanding of the fundamental nature of the neutrino, impacting the models for galaxy and structure formation in the early universe, and contributing an unknown fraction to the total mass budget of the universe. The standard model of physics still requires alteration, as the mechanism whereby massive neutrinos arise in the theory is not known. There is still much to discover about neutrinos, and neutrinos are powerful probes into the inner workings of astronomical objects.

SNO storms the international stage

The success of SNO went well beyond the physics results. By the end of the experiment over 200 students and postdoctoral fellows had been trained in the science, the underground lab had become known internationally as a world-class astroparticle physics facility enabling this science, and the research team in Canada became recognized as world leaders in astroparticle physics and low background technologies. These credentials led to the expansion of the lab from a single cavern hosting SNO, to a much larger facility, SNOLAB, with the capability of hosting numerous large international scale experiments.

Universities across Canada prioritized

astroparticle physics research, and increased intellectual capacity through new faculty positions, the appointment of a Canada Excellence Research Chair at Queen's, and nine Canada Research Chairs (seven at Tier 2, and two at Tier 1). The new SNOLAB facility, and the associated scientific community, focused on the highest priority physics questions of the day, the nature of dark matter, furthering our understanding of the neutrino, and the impact of both of these on the structure and evolution of the Universe.

The changing Canadian research landscape

Buoyed by the success of SNO, the SNOLAB facility and the progress of cutting-edge sub-surface experiments, a momentum was building in the Canadian community as sights were set on deeper and more challenging scientific questions. A variety of astrophysical observations provide compelling evidence for the existence of dark matter throughout the universe (accounting for 85% of the mass of the universe), but it has never been directly detected on earth. The current suite of experiments at SNOLAB is pushing the frontiers of technology and developing the techniques to make unprecedented measurements on the nature of dark matter and neutrinos, but it is quite likely that the technology limitations and background radiation make it impossible to further our understanding at the present. What is needed is the next generation of technologies and researchers in Canada to lead new experiments to develop a global understanding of these fundamental particles. Conversely the research funding landscape was centred around research equipment purchased through universities, and small incremental increases to growing the community which limited the speed of progress as we competed internationally to host future experiments.

Arthur B. McDonald's 2015 Nobel Prize for physics with Takaaki Kajita recognized their contribution to solving the Solar Neutrino Problem.

Recognizing the funding challenges of supporting internationally leading-edge sciences, the Government of Canada launched the Canada First Research Excellence Fund (CFREF) to propel Canadian research and scientists across many different areas, to be international leaders in their respective spaces. The timing of this program aligned precisely with the needs of the Canadian astroparticle physics community to capitalize on the momentum created to maintain and enhance this field as a national research strength. This was recognized by the Canadian government in 2016 with the $63.7 million grant to the consortium of astroparticle physics institutions in Canada that

would be hosted at Queen's University. The Arthur B. McDonald Canadian Astroparticle Physics Research Institute (McDonald Institute) was created to accelerate Canadian research in astroparticle physics and named in honour of the efforts by the SNO collaboration to accelerate Canadian research in astroparticle physics.

The McDonald Institute

Astroparticle physics experiments require unprecedented levels of sensitivity and isolation from backgrounds to conclusively observe the scientific properties of these fundamental particles. While these experiments can cost in the hundreds of millions or fractions of a billion dollars, the CFREF award of $63.7 million will have a significant and critical impact on our national ability to lead future experiments in astroparticle physics. The key is creating, growing and supporting the astroparticle physics community across Canada which is the focus of the McDonald Institute.

Early in the SNO collaboration, a challenge was tabled to solve the 30-year-old neutrino problem. It required a national effort and an aligned vision. Creating connections between scientists and their institutions across the country and around the world with policy makers, government funders, and private sector organizations all working towards the specific goal of achieving a new scientific result was essential. The result was phenomenal and fundamentally changed our understanding of the invisible universe, but the result was only achieved (first in Canada) because of the dedication and collaboration by all the above groups. Consciously or not the sum of the parts enabled unfathomed success in astroparticle physics and there is much more to be discovered. Building on the momentum of the SNO collaboration, the McDonald Institute will forge these linkages across sectors, geographies and disciplines, to tackle greater questions about the nature of neutrinos and align focus on the discovery of dark matter. As an inspiration, the SNO collaboration showed us what can be achieved when we connect the research community and align our vision, the McDonald Institute will demonstrate what happens when we amplify the collaborations.

Image Credit: TRIUMF/UBC

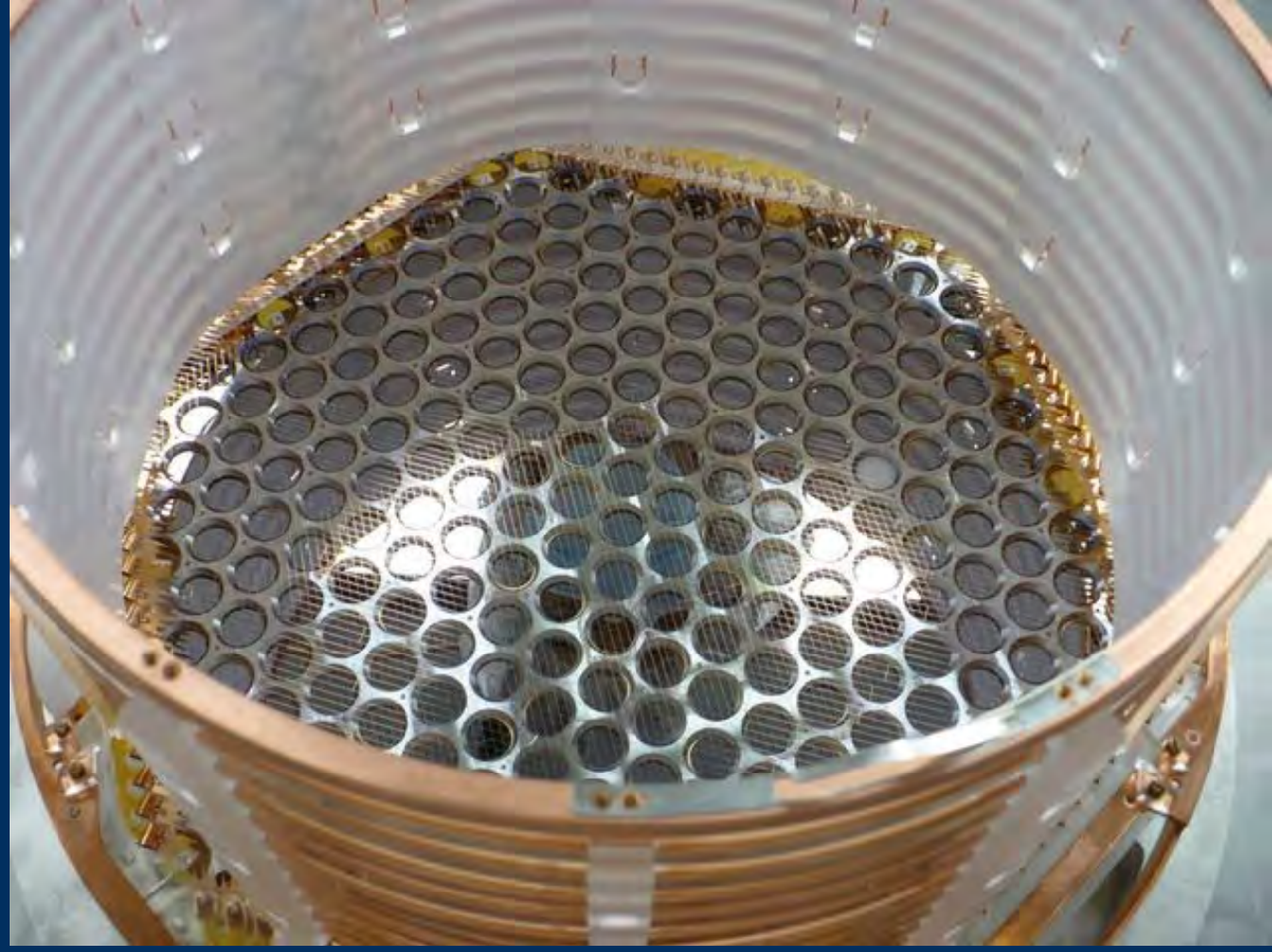
OUR MANDATE

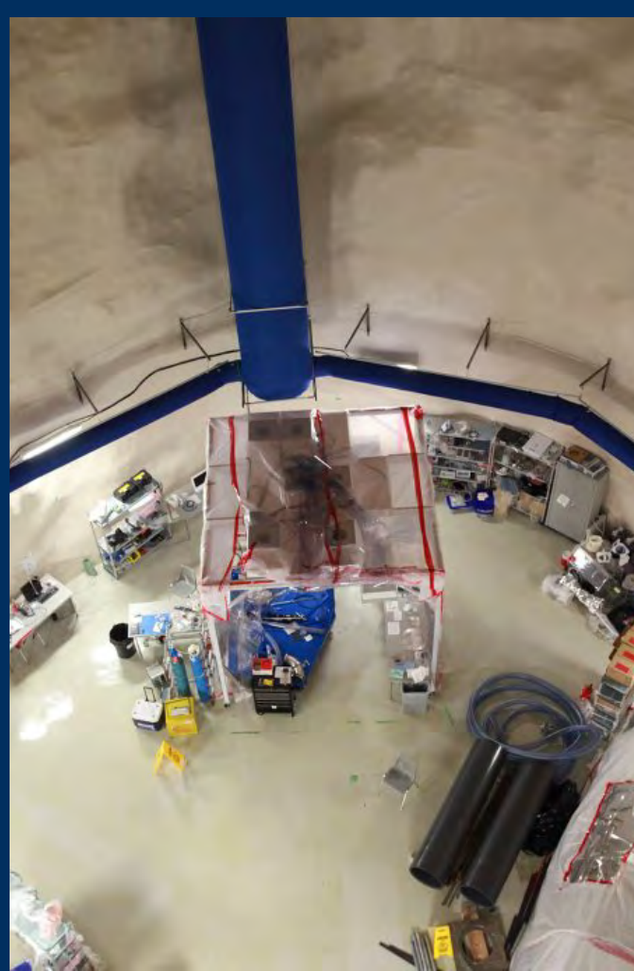
The base funding for the McDonald Institute was provided by CFREF at the level of $63.7 million over seven years ending in 2023. This seed funding is growing the community in unprecedented ways, like the recruitment of 15 new faculty position across the country in under two years. As we continue growing to over 100 new scientific, technical, student and administrative positions focused on astroparticle physics, we are dedicated to connecting the dots and bringing value to those connections. You will see that our five-year plan focuses on research excellence, talent growth, community coordination, and knowledge translation to achieve our vision. Each of these areas requires close consultation to meet the needs of the community through the realization of collaborative and sustainable programming.

OUR NEXT 5 YEARS

VISION

Enable the Canadian astroparticle physics community to excel nationally and compete internationally with our world-leading scientific capabilities.





MISSION

- Invest in growing the Canadian community of astroparticle physics to catalyze vibrant international research programs

- Create an institute that brings together the scientific and technical expertise in particle astrophysics, cosmology, astronomy, detector development and low background techniques to fuel the next generation of experiments with international collaborations.

- Innovate research to translate technologies in solving challenges within and beyond astroparticle physics to impact other disciplines, businesses and the Canadian public.

- Grow the connections across the collaboration and with new disciplines to create relationships that communicate and mobilize knowledge throughout different regions, demographics and disciplines, nationally and internationally.

- Inspire students and the general public in Canadian astroparticle physics through dynamic educational programs and captivating outreach activities.

Objective 1: Global Excellence for Canada

Grow and focus the scientific capacity in Canada to have strong measurable impact on existing astroparticle physics research and shape the vision of future world-leading astroparticle physics experiments in Canada

The global astroparticle physics community progresses towards discovery via large detectors that are developed over decade-length timespans, from theory driven experimental concepts to the small-lab proofs of concept, technology integrations across multiple labs and finally to construction of large-scale instruments in special low-background radiation environments. The community does not pre-specify the locations of large-scale detectors. Those decisions are made in stages, as confidence increases in the scientific potential of a new experimental method. The decision to locate a new full-scale detector is typically addressed only after the underlying technology has already been demonstrated in small university laboratories or government research centres. The three competitive decision factors in this escalation-model of detector location includes: i) the ability to nationally support world class experiments, ii) the size and calibre of the scientific community and iii) the track record of implementing world-leading novel techniques/approaches to scientific discovery and collaboration.

Presently, Canada is in a strong position in each of the above areas. We have a world-leading low-background radiation facility at SNOLAB. We have world leading academic institutions growing their investments and focus in astroparticle physics research. We are building on the success of the Sudbury Neutrino Observatory (SNO) collaboration, as we continue to lead several international experiments to advance the science. Internationally there is a race among researchers and labs to achieve global leadership in specific research areas. The SNO collaboration taught us much about the three components of world-beating excellence in astroparticle physics. With planning having just begun for the next generation of large-scale astroparticle detectors, we have an excellent, if time-limited, opportunity to exceed that legacy.

Nationally, we need to maintain increased support of all three competitive decision factors. Doing so adds value not only to the ambitions of the astroparticle physics community, but also to the innovation ecosystem in Canada as the community of “Big Science” researchers engages with its network of private sector suppliers, technology innovators and the science-engaged public at large. The McDonald Institute aims to leverage the current suite of astroparticle physics experiments operating at SNOLAB to bolster Canada’s research and innovation capacity for world-beating excellence. Our goal is to demonstrate the merit for the international community to locate much larger, next-generation astroparticle experiments in Canada.

We will begin by building a critical mass of astroparticle physics talent within Canada using the federal funds awarded to us in 2016. These investments will increase the scientific output of SNOLAB and secure a significant footprint of intellectual and facilities contributions to next-generation detector development. This, in turn, will position SNOLAB and


Image Credit:SNOLAB/DEAP-3600 Collaboration

Installation of photo-multiplier tubes (PMTs) on the recently commissioned DEAP 3600 experiment at SNOLAB. DEAP uses liquid argon as a scintillator for dark matter detection.

Canada as a desirable location for this large-scale future work.

The McDonald Institute will:

- Fund the creation of of more than 100 new faculty, research, engineering and HQP positions across Canada to expand on the regional astroparticle physics capabilities.
- Work with the experimental and theoretical astroparticle physics communities to co-develop novel approaches needed to resolve barriers to existing and future experiments and undertake key responsibilities on the existing suite of experiments.
- Provide further resources to promising detector technologies to support their scale-up.
- Create opportunities to bring the community together to establish a clear direction for scientific efforts, to co-create programming that contributes to talent recruitment and retention, to develop scientific discussion platforms to collaborate on high-priority topics, and to contribute funding to explore new high-risk research areas with potential to stimulate the research focus along new directions.

Objective 2: Attraction and retention of talent

Integrate learning for highly qualified people and students in all initiatives through novel and interactive education, training and social mediums.

Research would not be possible without the knowledge, skills and dedication of engineers, technicians, research assistants, post-doctoral fellows, support staff, graduate and undergraduate students. Canada's community of Highly Qualified People (HQP) traverse knowledge creation, knowledge translation and knowledge application. They possess the skills and aspirations to expand the boundaries of astroparticle physics or mobilize their knowledge to advance emerging technologies in engineering, data science, medicine, mining and finance, among other fields.

The absence of a national astroparticle physics community for HQP is a lost opportunity for both the HQP and astroparticle physics ecosystem. Their co-creation and engagement in such a community can diversify their skill set and prepare them as top-quality candidates in careers beyond physics (engineers, information technology professionals, entrepreneurs, medical doctors, financial strategists, etc.).

Their successes will in turn fuel demand for future training opportunities in astroparticle physics. This sustainment of interest among HQP – to build viable scientific and professional futures with astroparticle physics

Image Credit:SNOLAB/DEAP-3600 Collaboration

as a cornerstone – is a key to sustaining Canadian critical mass (and leadership) in the field.
We will assemble and engage HQP across Canada to connect with their peers and provide opportunities to direct and expand their understanding of astroparticle physics while exploring complementary career pathways enabled by their training. The McDonald Institute commits to enable HQP success and promote their contributions to global astroparticle physics and beyond. We know from international cases such as Berkeley ALS, the CERN LHC, and the European XFEL that Big Science facilities and robust talent/innovation ecosystems complement each other.

The McDonald Institute will:

- In collaboration with our partners create linkages that enable global connections between HQP and industry/companies for skills development, internships/co-ops, knowledge transfer, entrepreneurial ventures and research application.
- Develop a robust educational program to complement the technical knowledge gained through research positions and provide a diverse skill set for different career trajectories.
- Create tools to help HQP realize the opportunities available to them, become ambassadors for Canadian astroparticle physics and promote their skill sets to various employers.
- Supplement existing efforts to create new learning opportunities for students and teachers in breakthrough astroparticle physics research.
- Target training opportunities to these students to foster an entrepreneurial savviness as they move through astroparticle physics research positions to better identify opportunities for knowledge translation.
- Create funding opportunities to seed the advancement of these areas with appropriate guidance and mentorship.

Objective 3: Facilitate discussion and align the vision across Canada


Image Credit: TRIUMF/UBC

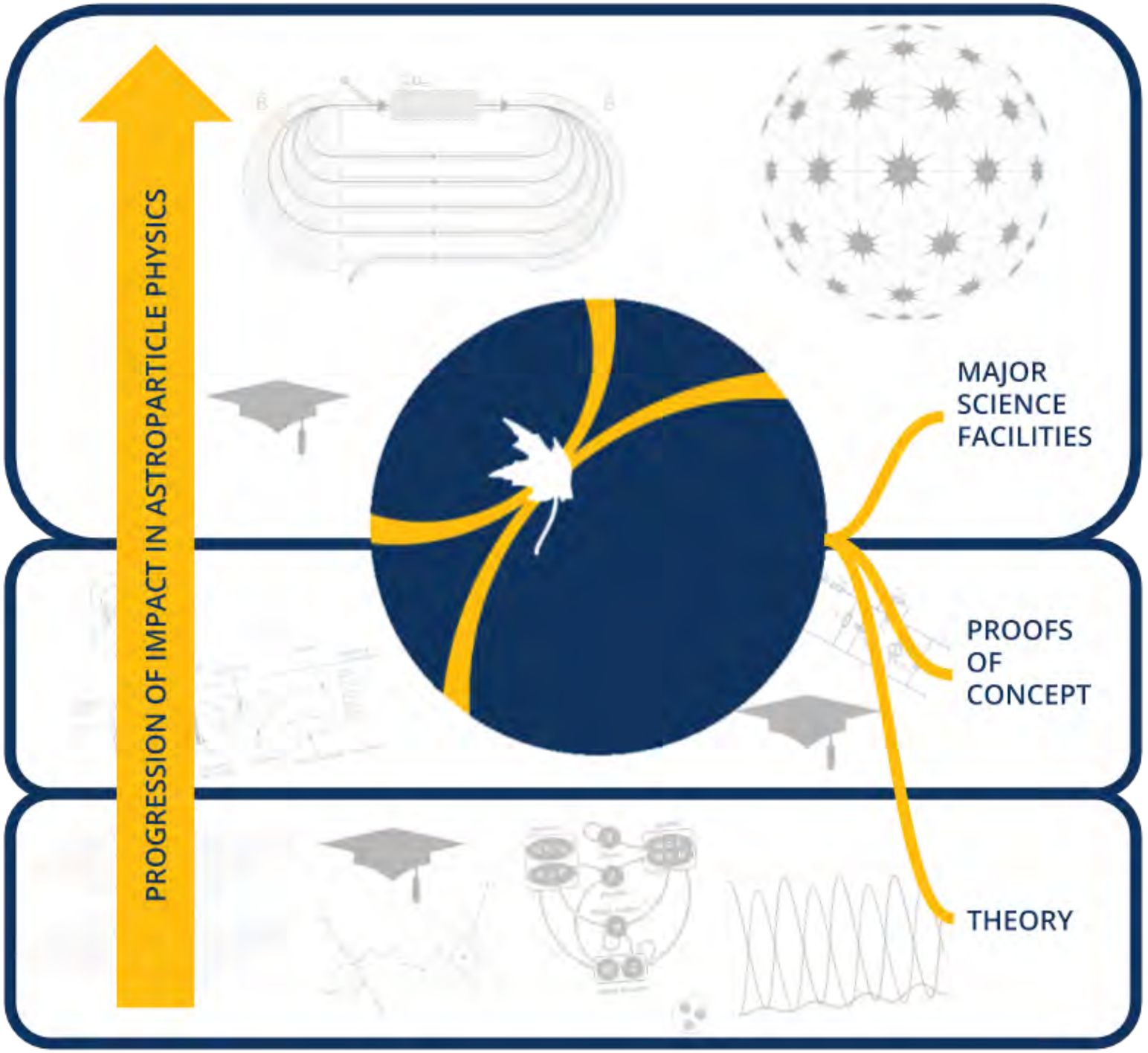
Create an astroparticle physics ecosystem linking researchers, facilities, industry and funders to align the national vision and pursue significant opportunities in astroparticle physics research.

The scale of experiments in next-generation astroparticle physics research will require monumental efforts, large investments, and massive coordination. Major discoveries in this field are not possible without extensive collaboration – The major SNO physics paper describing neutrino-oscillation included 274 authors.

Since the SNO collaboration, many astroparticle physics researchers across Canada have turned their attention to a variety of experiments further exploring neutrinos and laying the groundwork for discovery of dark matter. The broadening of focus is connecting the Canadian astroparticle physics community to many leading-edge research areas – but it is also spreading out the nation's research capacity. While much of the community recognizes the need to consolidate efforts around fewer experimental areas, there is little national dialogue about making choices. The Canadian funding model further exacerbates our divided attentions by parsing resources toward individual and incremental projects rather than large-scale multi-institutional efforts.

Increasing the scale and frequency of the dialogue across the community is the first step forward towards understanding the scope of current experimental efforts across the country and the scaling thresholds we must reach to continue global leadership in the field. A broader road mapping of the community's efforts, resources and funding will help us build a consensus around priorities and targets for the years to come, which will help focus Canada efforts towards the magnitude of collaboration we need to accomplish.

The McDonald Institute and its partner organizations will lead the effort to establish a coherent long-term strategy for Canadian astroparticle physics. While these discussions are critical to prioritizing Canadian efforts, their outcomes will also provide funders (domestic and international) with a long-term strategy and timeline to secure and invest resources into experimental development. These strategies are urgently needed due to the long lead-time to design and build experiments. The critical decisions to continue or stop developing most next-generation candidate detectors will occur during the next five years.



The McDonald Institute is the coordinating centre between academics, university labs and major science facilities that are engaged with astroparticle physics research.

The McDonald Institute will:

- Coordinate frequent opportunities for engaged dialogue across the Canadian astroparticle physics community and to strengthen ties between individual research groups.
- Work closely with university government relations, federal and provincial departments and funding agencies to inform their policy and planning discussions supporting international competitiveness – and ensure that base funding keeps pace with the growing Canadian community.
- Grow the partnership to include all astroparticle physics research hubs across Canada who will enhance the existing network with their own resources and investments.
- Work with stakeholders to sustain investments by the McDonald Institute and align future contributions with a consolidated view of the community.
- In collaboration with the broad Canadian community, initiate a consultative process with the research community, research organizations, academic and private stakeholders, and funders to discuss future areas of focus with the understanding that such priorities will be set by the community.
- Host forums for discussion and facilitate sharing of various ideas while developing and supporting a steering committee. The outcomes of the consultative process will be to develop a community consensus on priorities and the best opportunities that will inform future national strategies surrounding astroparticle physics investments.

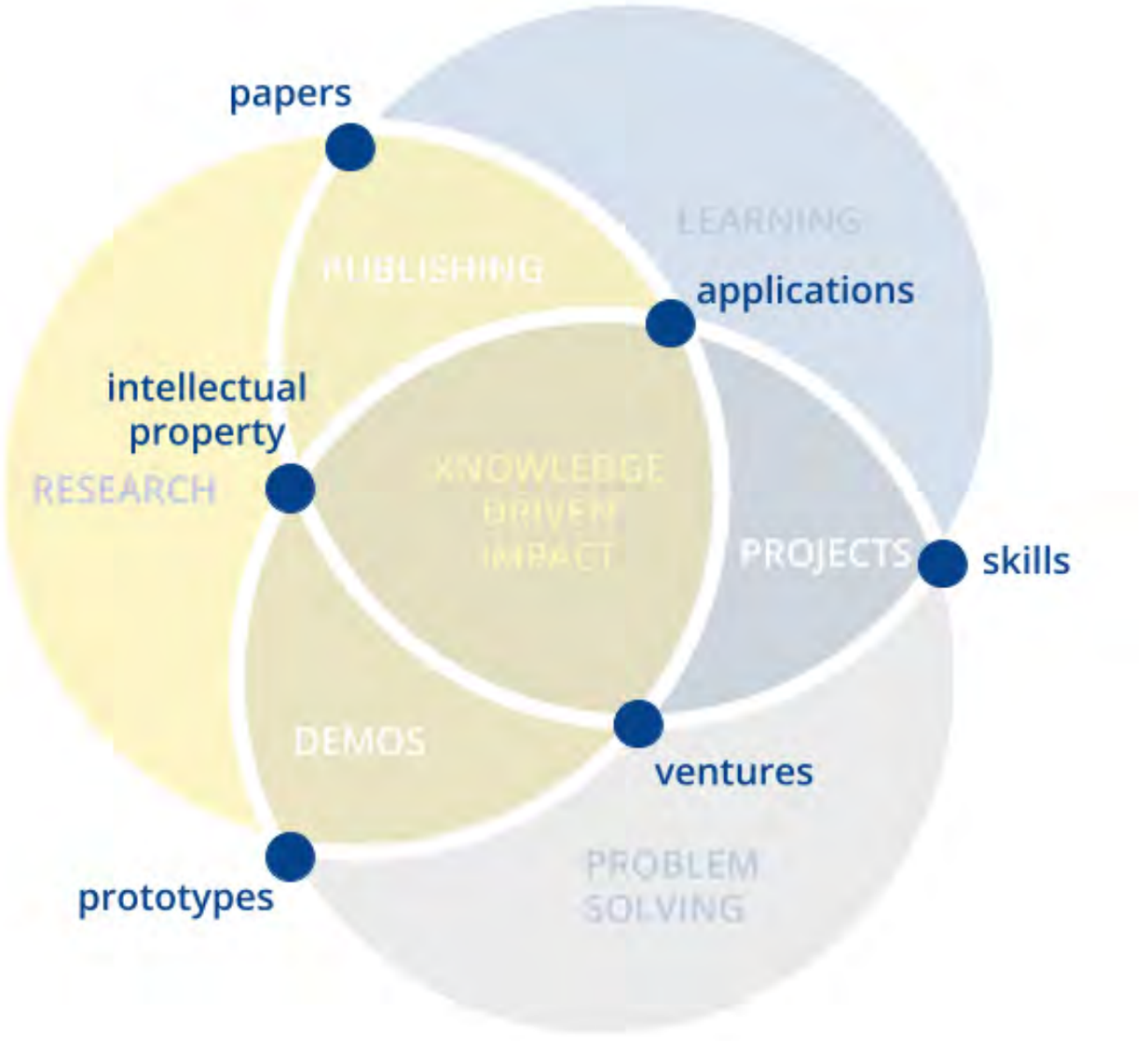
Objective 4: Benefit society and the economy

Elevate the conversation around the impacts of the Canadian astroparticle physics research and the community to be recognized as world class nationally and internationally.

Astroparticle physics is an awe-inspiring branch of scientific discovery. Incremental discoveries emerging from the research are publicized extensively in national and international media. The field, along with astronomy & cosmology, captures the public imagination and speaks to its demand for answers to existential questions about humanity's place in the universe. This attention capital is invaluable and can translate to greater public investment both intellectually and financially. These effects can be challenging to measure, but they are very real. We appreciate that our field's grip on the public attention can catalyze society's broader engagements with science generally, which in turn, supports advances in other branches of research, education and innovation. Science fiction authors may speculate what the plausible could make possible, but it is our research that confirms what is fundamentally plausible in our universe. If the writers can engage our knowledge to expand cultural opportunity, we should likewise engage entrepreneurs, the general public, funders and highly qualified personnel to expand innovation, science-engagement, research impact and excellence.

Central to the sustainment of Canadian astroparticle physics is the ability to break man-made barriers across geographies, politics and technology to create the largest global experiments. Other branches of science have emulated the early collaboration model of physics and adapted it to interconnect and grow networks of researchers in their fields (e.g., Human Genome Project). Where these models exceed the astroparticle physics community is their ability to mobilize knowledge within and outside of their community. This mobilization does not end with the stimulation of the public's imagination with new knowledge. It must also transform technological invention into value-generating innovation. It must inspire new curiosity driven generations to persevere through the intellectual

preparation needed to contribute their own discoveries. It must acculturate the broader community of stakeholders – beyond the researchers themselves – to use knowledge to create new opportunities.
Developing a national and international dialogue around Canadian astroparticle physics outside of our immediate research network is one of the top priorities for the McDonald Institute. We will mobilize knowledge from the research community to increase the impact of the science for those outside of the research community. We will leverage existing and new channels to attract inquisitive minds to engage the science that will define our universe. We will promote why Canada is the place where the next global discovery will take place and how we will do our part to get there faster.



The McDonald Institute will:

- Enable dialogue between our partners and investors looking for promising technologies to address economically important problems, or recruit talented HQP who can contribute to developing such innovations.

- Capitalize on and supplement resources to evaluate and promote the community's novel research technologies wherever they may have innovation potential outside of research.

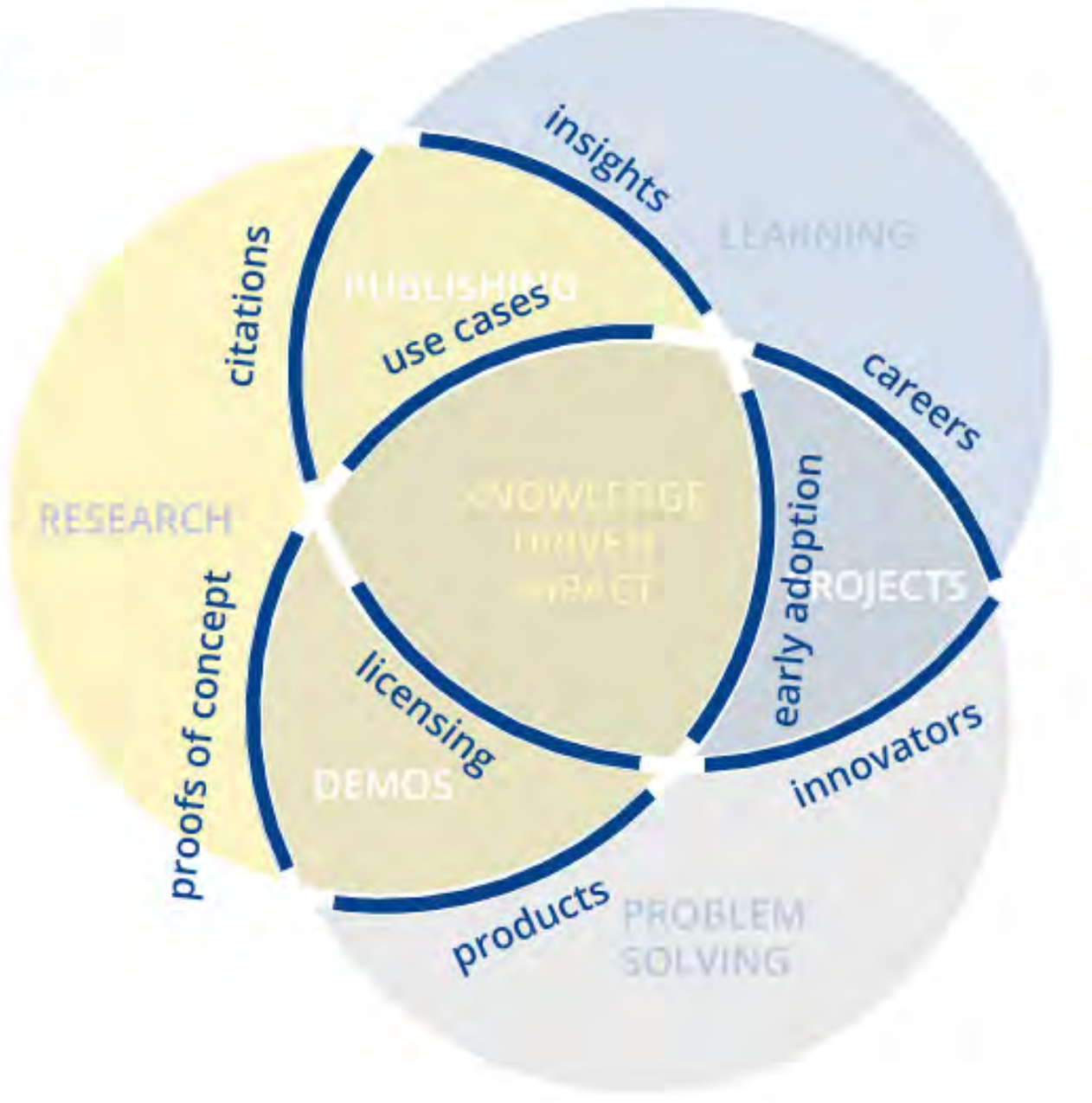
- Connect the scientific community more closely with young scientific minds, interested cutting edge businesses, and the inquisitive public through new vectors of education, technology transfer and outreach

- Develop opportunities for the international community to see the Canadian landscape as ready to excel future international astroparticle research and lead equity and inclusion efforts to increase the diversity of the astroparticle physics community.

- Play an active role in marketing Canada as the destination for the future of astroparticle physics.

- Engage with researchers, universities, stakeholders, government and the international community to promote the ease of mobility and linkages between Canadian labs, the available capacity at Canadian world class research facilities.

- Conduct a thorough analysis of completed research programs in Canada (i.e. SNO) and explore the direct economic impacts from technological advancements that can be credited back to Canadian astroparticle physics investments.



Objective 5: Champion diversity, management and governance


Image Credit: TRIUMF/UBC

To create a culture of equity, integrity and excellence in the science, administration and governance through partnership, engagement, participation and outreach.

Equity, diversity and inclusion (EDI) has been an ongoing challenge in science, technology, engineering and mathematics (STEM) where progress has been slow in relation to societal demands for equity. Many companies, academic institutions and governments are changing their systems, approaches and activities to tackle barriers that exacerbate systemic disparities in opportunity and attainment. The field of physics remains among the least diverse of the STEM disciplines. Although major barriers stand in the way of progress for the larger physics community, a narrower focus on the subset of astroparticle physics – pursuing a concerted effort to close systemic barriers related to gender, visible identity, disability or indigeneity – will better demonstrate the potential of various EDI supports and their impacts to the broader Canadian physics community. In our efforts to achieve international excellence in the research, it is our duty to contribute to solutions to EDI problems in astroparticle physics and physics in general. The McDonald institute will prioritize EDI through partnerships with key EDI organizations and lead novel approaches to tracking and assessing EDI progress and opportunities across our activities.

- The McDonald Institute has been entrusted with public funds to raise the bar of excellence across the Canadian astroparticle physics ecosystem. We are responsible to the Canadian public, our host Queen’s University, the community of partners and our namesake to maintain appropriate stewardship of all funding, fair access and inclusion in activities and continuous engagement on best practices for EDI with all astroparticle physics groups across Canada and globally.

- Fund research and analysis to better understand the barriers of EDI in the Canadian context and direct funding to create new opportunities as we strive to set a global example for EDI.

The McDonald Institute is delivering multiple events, like the IGnite series, to expose a broader range of young scientists to the work and opportunities in astroparticle physics

We believe that achieving a more equitable, diverse and inclusive research network is essential to the creation of rigorous, innovative and impactful research necessary to collectively tackle the frontier questions in astroparticle physics. The recruitment efforts of our research personnel are reflective of our desire to further strengthen our network by actively seeking diversity of skills, identities, experiences, and perspectives. We welcome and strongly encourage participation from individuals and organizations who will contribute to the further diversification of the McDonald Institute network. Come work with us to further uncover the secrets of our universe.

The McDonald Institute will:

- Track our performance in diversifying our leadership, research community, and opportunities and create regular checkpoints to thoroughly evaluate our progress.
- Create a robust data collection and reporting program to validate the achievement of key performance indicators and will publish those results on our website and report them to our funders.
- Represent the interest of the consortia partnership by establishing channels for direct communication with our governance branches and encouraging their involvement in these bodies.
- Maintain a dynamic management team to prioritize the advancement of the science, operations, and knowledge translation portfolios as we strive to realize the goals of this strategic plan.

DELIVERING THE PLAN

We are committed to our vision:

Enable the Canadian astroparticle physics community to excel nationally and compete internationally with our world leading-scientific capabilities.

We will implement this strategic plan to realize our vision. The ambitious targets set in this plan map the course for the McDonald Institute and will be realized through the commitment of the governance and management team. Our governance model reflects the best practices of not for profit research organizations to ensure effective oversight and accountability to our research community, partners, funders and the public.

The Board of Management for the McDonald Institute is built from prominent leaders from our partner institutions, research organizations and private sector membership. Our Board members are committed to delivering on the McDonald Institute mission and provide direction and insight that will lead us to success. The Board has created subcommittees to focus specifically on the financial, scientific and EDI progress of the Institute and has positioned a strong management team with experience directing large international research programs, establishing and delivering large-scale research funding initiatives, and creating and fostering national and international partnerships.

CORE VALUES

We are driven to realize our vision and mission by championing our core values in all we do:

1. Research excellence,
2. The capacity to learn is unbounded,
3. Engagement with academics, business persons and the general-public,
4. Vibrant research ecosystems are essential to creativity, ingenuity and innovation, and
5. Science goes further, faster when it encounters and includes a diversity of people and their ideas.

RESOURCES

Talent

Funds

Partners

Arthur B. McDonald Institute

Core Values

Vision

Momentum

CONTEXTS

GOALS

Canadian Excellence in Astroparticle Physics

OBJECTIVES

Science Excellence

Attract & Retain Talent

Align the Vision Across Canada

Social & Economic Benefit

Diversity, Management, Governance

ACTIVITIES

Governance

Science Portfolios

Admin. Portfolios

Project Portfolios

Projects

Projects

OUTPUTS

Data

Info.

Metrics

Data

Info.

Metrics

Performance Measures

OUTCOMES

Exper. Results

Science Insights

Skills for HQP

Public Interest

Tech. Transfer

More Diverse Particip.

IMPACTS

Scientific Leadership in Global Astroparticle Physics

Integration of APP community Into Innovation Ecosystem

Easy attraction, Retention and Promotion of Physics Talent

Social elevation & sustainment of fundamental science in Canada

Appendix A: BUILDING THE STRATEGIC PLAN

The Canada First Research Excellence Fund (CFREF) was awarded to Queen's university and the consortium of partners focused on astroparticle physics in September 2016. The award initiated a flurry of activity in the first year among the collaboration focused on the recruitment of 15 astroparticle physics faculty across Canada and the establishment of the administrative and governance bodies overseeing the award. In the fall of 2017, the management and governance identified gaps in the original application and initiated a strategic planning process to clearly articulate the goals and what actions would be taken to realize success before the conclusion of the CFREF funding in August 2023.

Between September 2017 and April 2018, stakeholders were contacted for input on rebranding the consortium (previously called the Canadian Particle Astrophysics Research Centre) to become the Arthur B. McDonald Canadian Astroparticle Physics Research Institute (McDonald Institute). These consultations sought input from the research community, administrators at the partner institutions, and the public on what the McDonald Institute could accomplish and provided valuable insight into the focus areas of the Canadian astroparticle physics community. Concurrently the McDonald Institute reassessed the original CFREF application to extrapolate the goals and activities into a strategic plan format. Both efforts culminated into the first draft of the strategic plan that was presented to the Board of Management in June 2018. The McDonald Institute Board held a retreat to review the draft and address key questions that would guide the focus of the McDonald Institutes investments and activities.

Following the Board consultation, the McDonald Institute management initiated an online survey and one-on-one interviews to reach the broader scientific community, students and research administrators who could provide unique insights on key questions. These responses by the community reflected gaps where the McDonald Institute would be strategically positioned to address the community needs. These inputs were included in the redrafted plan that was shared within the governance and administrative community of the McDonald Institute. The McDonald Institute Board reviewed and accepted the plan in January 2019. The public plan was published on the McDonald Institute website February 2019.

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Appendix B:
KEY PERFORMANCE INDICATORS 2018-2023

Objective 1: Globally competitive community of astroparticle physics in Canada

Grow and focus the scientific capacity in Canada to have strong measurable impact on existing astroparticle physics research and shape the vision of future world-leading astroparticle physics experiments in Canada.

Moving the Scientific Goalpost: a) Total # of leadership-role hours per researcher per year b) Total score of all publications per year

HQP Recruitment: Total increase of international and domestic HQP per year

Objective 2: Attraction and retention of talent

Integrate learning of highly qualified people and students in all initiatives through novel and interactive education, training and social mediums.

Enabling HQP Excellence: Total # of HQP participating, per term, in streams 1) non-research career-building 2) research training 3) MI networking opportunities

Objective 3: Facilitate discussion and align the vision across Canada

Create an astroparticle physics ecosystem linking researchers, industry and funders to align the national vision and pursue significant opportunities in astroparticle physics research.

National Community Cohesiveness: % increase in participation at MI-hosted national community meetings per year

MI Partnership Growth: # of new partnerships brokered per year

Objective 4: Benefit society and the economy

Elevate the conversation around the impacts of the Canadian astroparticle physics research and the community to be recognized as world class nationally and internationally

MI Affect: # of identified changes in attitude/behaviours towards APP, driven by MI interactions

Objective 5: Champion diversity, management and governance

To create a culture of equity, integrity and excellence in the science, administration and governance through partnership, engagement, participation and outreach

MI Partner EDI Engagement: Total # of DEAP Tool goals met bi-annually

HQP from ESG: % increase of new ESG recruitments and participants per year

MI Budget Efficiency : a) Total amount of variance between spends and forecasts of CFREF funds on a quarterly basis b) Total $ spent as planned per institution commitments year over year

Network Partner Reporting: % of partners reporting completely and on time per quarter

Governance Oversight Score: Total # of risks registered and/or downgraded annually

Arthur B. McDonald

Canadian Astroparticle Physics Research Institute