The role of the McDonald Institute in the Canadian Astroparticle Physics Landscape

SNOLAB Future Projects Workshop

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Arthur B. McDonald
Canadian Astroparticle Physics Research Institute

CANADA FIRST RESEARCH EXCELLENCE FUND

Arthur B. McDonald
Canadian Astroparticle Physics Research Institute

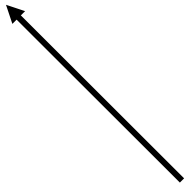
A partnership of 11 Universities and 6 institutes

The McDonald Institute is a globally recognized centre for research, coalescing expertise in **underground particle astrophysics** and benefitting from the unique SNOLAB facility **to deliver world-leading science** focused on the big questions in particle astrophysics, cosmology and astronomy.

Queen's University
SNOLAB
Carleton University
CIFAR Canadian Institute for Advanced Research
Institute of Particle Physics
Université de Sherbrooke
CITA | ICAT Canadian Institute for Theoretical Astrophysics / L'institut Canadien d'astrophysique théorique
University of Victoria
Laurentian University / Université Laurentienne
McGill
Perimeter Institute
UBC The University of British Columbia
TRIUMF
University of Alberta
Université de Montréal
University of Toronto
SFU Simon Fraser University

The Original CFREF Grant and leveraging support:

- **~$64 M$** in direct and indirect support (3:1) from CFREF
- **>$10 M$** in cash contributions from the partners to spend on direct costs.
- **~ 5 M$** in the form of successful CFI-JELF Awards



Very important

Status of grant: (Nominally Sept 2016 – August 2023).

- All funds now received from CFREF
- One extra year to spend down residual funds at partner institutions. → Aug 2024 for completion
- All partner institutions have now completed their spending
- Winding up of the CFREF supported institute at Queen's in the current year. Mainly administrative costs. Minimal resources to support direct costs of research now. Working hard to finalize/close out this grant, tapering to zero while slowly ramping up the new funding.

As the community developed, the MI annual science budget grew to about 10 M$/a by the end of the program

- Mainly in support of growing the community. **15 new faculty** brought into the field. Supported research through HQP and some engineering/technical support for the experimental program.

- >85% of the direct costs to research went into personnel salaries. **Over 200 HQP** supported through pooled funding awards and contributions to the partner institutions according to priority needs.

- All faculty have now transitioned to being fully supported by their respective Universities.

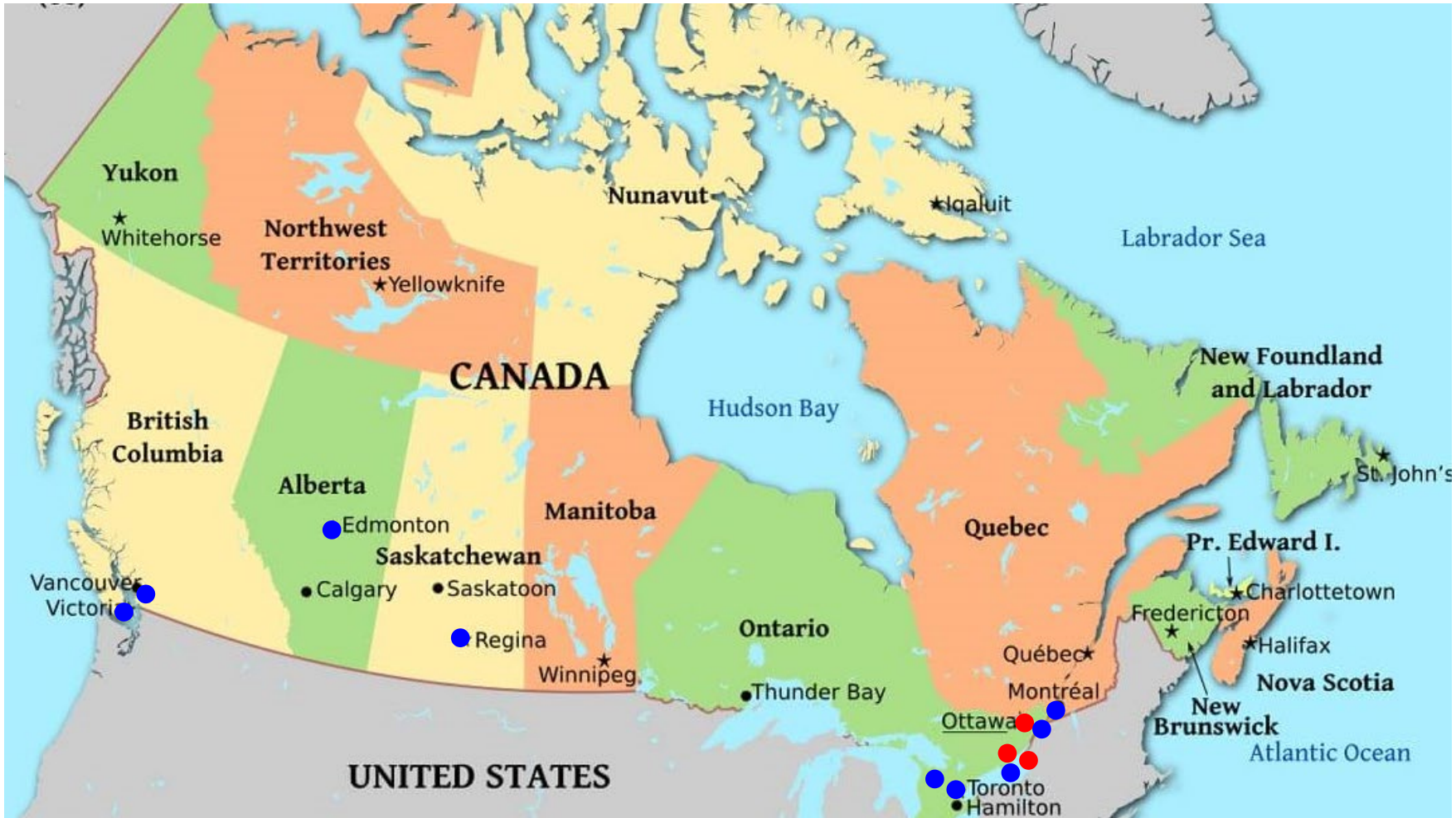
One of our main roles of the McDonald Institute was to **add value to existing programs already supported by NSERC** and/or CFI and featured in the Long Range Plan for subatomic physics. This was a way to augment and accelerate these programs to help deliver on the suite of experiments at SNOLAB.

Growth of the Theory Community;

- Joe Bramante Queen's
- Aaron Vincent Queen's
- Yue Zhang Carleton

MI initially established 3 new faculty positions in astroparticle physics theory:

Somewhat absent in our Universities before.



Plus: HQP support for:

- Theorists at Institutions all across Canada

Summary thoughts on the CFREF award:

- The McDonald Institute played a very important role in the SAP ecosystem, with a mandate to connect and support astroparticle physics research at the Universities at a scale that will maintain this as a world leading research priority. The institute was successful in creating substantial growth in the community across Canada.

- Whereas SNOLAB is funded to support and operate the infrastructure and facilitate the integration of international projects into the lab, the McDonald Institute is providing support for the research and development and science delivery, primarily at the Universities. Both aspects are critical to a rich program with Canadian leadership.

- The Institute provides the community with professional and administrative support with expertise in education/outreach, communications, hqp recruitment, retention and training, EDII best practices etc …. All important aspects of big science that are difficult to include at the individual project level. A small fraction of the budget, but very important.

MI ISED NSERC

Tier 1 Research Institute at Queen's:

- The McDonald Institute has been designated a Tier 1 Research Centre at Queen's University with a mandate to support astroparticle physics across Canada by managing grants on behalf of the community. The Institute will be supporting the community through support for direct costs of research and our programming and networking efforts (professional and administrative support, education/outreach, communications, hqp recruitment, retention and training, EDII best practices).

New funding:

- We have received **new funding, 45.5 M$ over 5 years** announced in the 2024 Federal budget.
  - The first 2 years of this was recently officially awarded, and the money was received in October 2024. We have been slowly ramping up the spending here, hoping to stretch the funds a much as possible.
  - We are hoping the final 3 years will be awarded soon as well, as on a budget which supports personnel, the longer the runway one can provide the better the odds of recruiting strong candidates.

- The funding has been made available through the NSERC MRS program. (But is not part of the SAP envelope in any way), this was the convenient way to flow the funds with agency oversight. New eligibility requirements to be navigated.

- The focus of these funds are on the necessary engineering and technical resources that support astroparticle physics community broadly. These resources are to be distributed on a priority basis through a pan Canadian prioritization panel currently being established.

New Funding

We are working with the partner institutions to finalize how the money will be distributed. There will be a gradual ramp over the 5 years as recruitment happens, and taking into account inflation on personnel salaries.

Not allocated a priori to specific projects

Roughly speaking, the amounts earmarked per year are:

- Engineering and Technical Resources, operated like a distributed MRS (Integrated Project Delivery Office): **3.3 M$/a**
- Pooled funding allocation for new HQP, frontier research venture funds (new research initiatives), cross-disciplinary internships, theory postdoc program, etc. **1.5 M$/a**
- Support for R&D at 13 partner institutions (additional HQP, focused engineering and technical support…) **2.5 M$/a**
- Programming elements (summer schools, EDII initiatives, visiting scientist programs HQP Training and recruitment, professional development …STEM Education) **0.9 M$/a**
- Administrative and Program staff (Finance, admin, education and outreach…) **0.9 M$/a**

Funding of Astroparticle Physics in Canada

It is very important to recognize that MI is **not** another funding agency.

Funds for the MI come from a grant to support Astroparticle Physics as laid out in the application to ISED which assumed that strong contributions from funding agencies like NSERC and CFI will persist.

Despite the pressures due to the lower than anticipated NSERC funding, we cannot be deviating significantly from our original grant proposal …. All the funds are earmarked for various programs already.

MI provides the means of augmenting and enhancing the existing astroparticle physics program through the creation of a highly skilled pool of engineers and technical resources, and support for some direct costs of research where we can enhance existing funds.

Supporting “big international science” at the scale required for large complex international experimental programs enables Canadian participation in this field, at a level which would not be possible through the existing subatomic physics envelope.

Providing engineering and technical resources enables these academics to take major responsibilities for aspects of the experimental program, thus enabling their leadership in this area.

Sustainability

We are hoping to continue conversations with ISED, CFI, and NSERC around:

- How to optimize the community support to advance the highest priority projects expeditiously
- How to include the MI (or a similar body) into the Major Research Facility Framework to ensure that the facilities, the projects, and the R&D advance in a coordinated way.

Succession Planning

Much of this work, and future planning will be the purview of a new Scientific Director for the McDonald Institute at Queen’s University.

News/Comments

- New positions: CERC at Queen's and at Carleton. Most prestigious chair positions. Unusual to go to a person already in Canada. Aimed at renowned researchers eligible to be appointed as full professors.

- New positions at Queen's (Michela), Montreal, and hopefully a few in Atlantic Canada

- MI will coordinate the generation of a whitepaper on astroparticle physics in Canada as an input to the IPP/CINP long range planning exercise. Capture strategic plan for the community. Individual projects also required/encouraged to submit individual briefs.

- Currently without a finance officer …. At a critical time we are winding down CFREF and ramping up the NSERC funding. Patience please. I am covering this with help from VPRs office.

- National Meeting in Ottawa: Aug 6 – 8

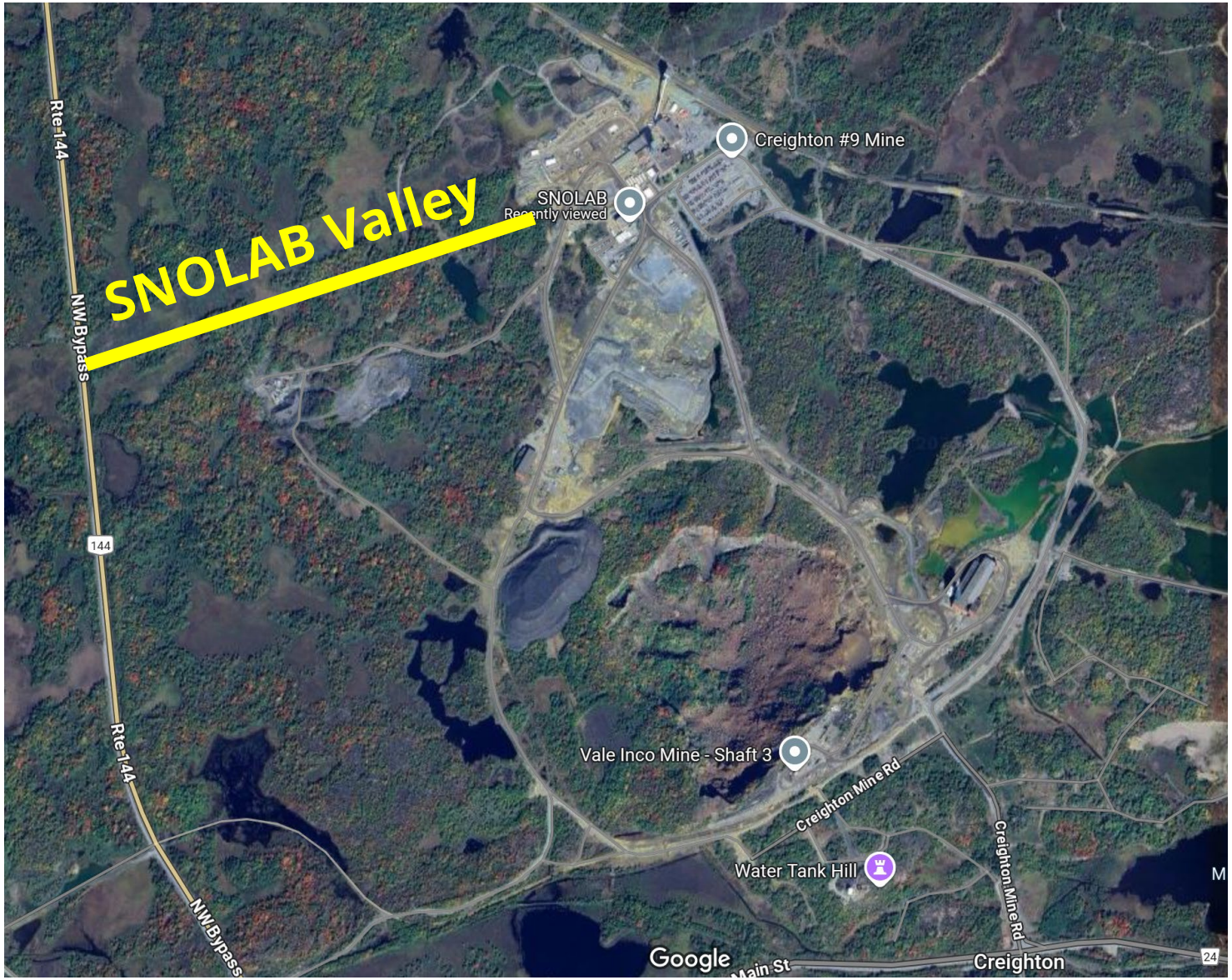
- New programs already in the works:
  - Cross-Disciplinary Internships (awarded)
  - Theory postdocs (awarded)
  - Graduate students (closed, under adjudication) 40+ applications
  - Experimental postdocs (coming soon)

SNOLAB 15 year plan and MI

- MI see's itself as a long term partner of SNOLAB ….. Providing some of the resources that feed the Research and Development programs that will help deliver the current programs, and nurture the ideas that are generating the next generation of projects.

- Success in the future depends on:
  - A full and vibrant research program at SNOLAB
  - A culture shift in the funding model with a cradle to grave overview of major facilities and institutes, like SNOLAB and MI, that gives the stability and confidence necessary for major international investment
  - Eligible use of funds that are matched to the needs of project to advance the program in the most efficient way.

- The white paper we will produce as part of the LRP underway will capture the community's ambitions for the science, and the implications for the future SNOLAB program

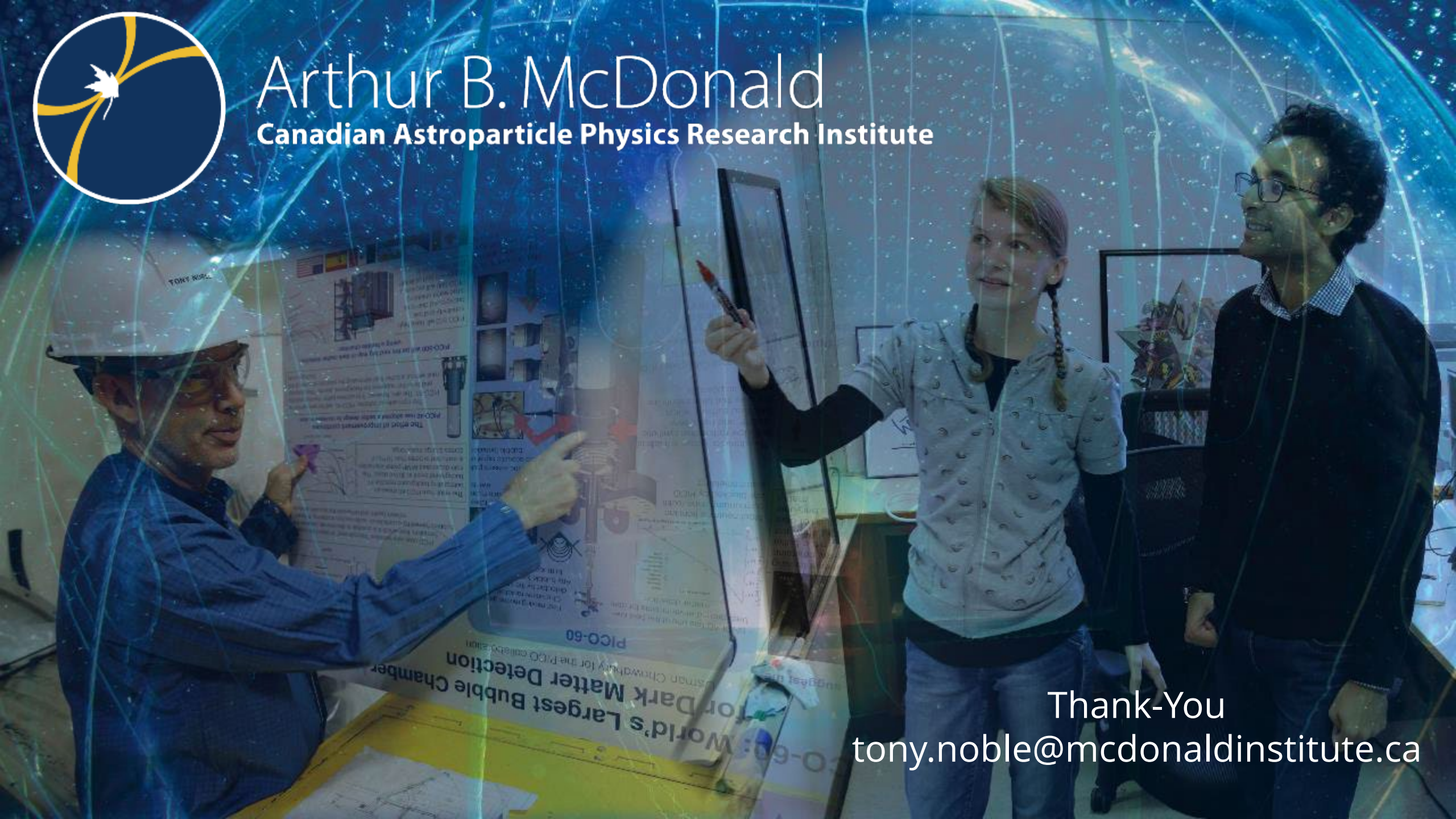


A pet idea of mine .....

Decouple SNOLAB surface activities from the mine with separate access gate to get into active area.

Allows the building of new facilities on surface in very close proximity, but outside the gate

Keeps scientists and staff close.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PICO-60
Thank-You
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Some of the main elements of the **CFREF** funded McDonald Institute were:

Scientific Faculty Support:

We support people. Through the CFREF funds we hired 14 new faculty members at partner universities, and 1 “equivalent to faculty” research scientist at TRIUMF. We also supported their research programs during the period they were ineligible to apply for NSERC funding as PI’s.

Direct Research Support:

MI provided essential research support to each of the partner institutions (HQP, engineering, technical support…) in support of programs already endorsed through NSERC and CFI. This accelerated that research substantially and allowed Canadians to contribute more significantly to flagship research programs.

Pooled funding HQP Support:

The McDonald Institute also had a reserve fund of ~$6.3 M direct costs to support HQP positions on a competitive basis to any research program in Canada aligned with the physics goals of MI. (114 HQP were supported to date. For example:

- 28 postdocs, 33 graduate students and 53 undergraduate students to date.
- over 200 HQP years were supported in this way through this fund alone.

Faculty profiles:

M.-C. Piro	Alberta	Expt: News-G, SBC, ++
J.P. Yanez	Alberta	Expt: SNO+, P-ONE. +
S. Viel	Carlton	Expt: DEAP/Darkside
Y. Zhang	Carlton	Theory:
C. Licciardi	Laurentian/Windsor	Expt: nEXO
A. Robinson	Montreal	Expt: SuperCDMS, PICO
M. Diamond	Toronto	Expt: SuperCDMS
L. Balogh	Queen's	Expt: Material Engineering. Additive manufacturing ++
J. Bramante	Queen's	Theory:
K. Clark	Queen's	Expt: SBC, PICO, ++
G. Giroux	Queen's	Expt: News-G, PICO
M. Leybourne	Queen's	Expt: Geochemistry. Low Backgrounds
A. Vincent	Queen's	Theory:
P. Wang	Queen's	Expt: Chemistry. New detectors
W. Rau	TRIUMF	Expt: SuperCDMS

Transition of University faculty from CFREF support into "normal" faculty positions is complete.

What are other elements of the McDonald Institute

The MI is also active in:

- HPQ training, supporting recruitment and retention, visiting scientist/HQP exchanges,
- Fostering collaborative research and cross disciplinary research.
- Seed funding for new “high risk high gain” research initiatives,
- Education & outreach (including 2 summer schools),
- Supporting implementation of best practices in EDII, outreach ….

We try to provide the “**complete package**” in support of all necessary ingredients for big science campaigns.

This was largely supported with the use of indirect funds.