



Status of the McDonald Institute and role in the Canadian Astroparticle Physics Landscape

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The current role of the McDonald Institute

A partnership of 8 Universities and 5 institutes, the McDonald Institute is a globally recognized centre for research and learning, coalescing Canadian and international 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.



The 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.
- **\$4,65 M\$** in the form of 11 successful CFI-JELF Awards to date

Period of grant, nominally Sept 2016 – August 2023. Just over 1 year to go !

- one extra year to spend down residual funds. → Aug 2024. No significant spending anticipated thereafter. Aug 24 is when our funding to the community winds down.
- possibility of “no cost extension” of up to two years due to Covid-19 delays. Likely will not be used as our grant is heavily dominated by personnel salaries, who are already in place. No obvious need or mechanism for a long extension. And, as we position ourselves for a new CFREF application we don't want to have left over funds from the first round.

Annual science budget now about 10 M\$

Some elements of the Ongoing support the McDonald Institute provides to the community

Base Research Support at Partner Institutions:

- 15 new faculty members across Canada (7 already transitioned onto NSERC funding)
- 15 research projects supported and strong support for theory
- 101 HQP Positions supported on **base** program

Competitive Research Support supporting Astroparticle Physics across Canada

- 77 HQP Positions supported through pooled funding competition
- 7 FRVF awards (Frontier Research Venture Fund)
- PhD/Visitor exchanges 14
- Cross Disciplinary Internships 8

(And, we are currently opening up more opportunities to support research collaboration building /networking as we break out of the covid pandemic, hopefully.)

Research Outputs the past fiscal year:

- 101 Peer reviewed papers by members supported by MI
- Over 400 total papers/presentations/proceedings/other scholarly works
- Significantly advanced progress in experimental program – MI has been instrumental in accelerating progress

A feeling for the personnel numbers:

47



	2016 non-MI	2020 non-MI	2020 "MI Supported"
University Faculty	22	33	14

Research Scientists	10	14	3
RA and PDF	16	14	35
Grad Students	34	42	42
Engineers and Tech	10	14	17
Total HQP	70	84	97



181

In Astroparticle Physics, MI is supporting slightly more than ½ of the community HQP.

Which experimental programs are supported ?

One of our main roles of the McDonald Institute is to **add value to existing programs already supported by NSERC** and featured in the Long Range Plan for subatomic physics.

This was a way to leverage more funding to make those programs more successful and to help deliver on the suite of experiments at SNOLAB.

Project support is very significant for: [DEAP-3600/DarkSide](#), [SNO+](#), [nEXO](#), [SuperCDMS](#), [PICO](#), [SBC](#), [NEWS-G](#)

Project support is ramping up for: [P-ONE](#),

Project support is modest for: [HALO](#), [IceCube](#), [Legend](#)

(not because of lack of interest, but HALO has had rather steady operations, IceCube was not as well aligned with original mandate, and Legend currently has a very small footprint)

Plus: support for basic R&D: SiPM, ultrapure crystal growth, LoLA, LoLX, paleo-detectors...

The MI is also active in:

- HPQ training,
- supporting recruitment and retention,
- visiting scientist/HQP exchanges,
- fostering collaborative research and cross disciplinary research.
- MI also provides seed funding for new “high risk high gain” research initiatives.
- Education (2 summer schools CAPSS and GRIDS),
- supporting implementation of best practices in EDII,
- Outreach (school curriculum, lecture series, camps, visitor centre, ...)
- Innovation/knowledge translation

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

A few Upcoming events of potential interest:

- GRIDS – GRaduate Instrumentation & Detector School (June 13-24)
- MI National Meeting, Aug 4th and 5th
- TeVPA, Aug. 8-12 - international astroparticle physics conference in Kingston, ON, led by Queen's, co-sponsored by McDonald Institute
- DRIFT: Art and Dark Matter exhibit. Arriving at University of Toronto, Justina M. Barnicke Gallery (July 11 – Oct 8)

Summary thoughts on current CFREF:

- The McDonald Institute plays 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.
- Whereas SNOLAB is funded to support the infrastructure, and integration of international projects into the lab, the McDonald Institute is providing support for the initial development and science delivery, primarily at the Universities.
- 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.
- This institute, funded through the current round of CFREF, will end in August 2023. It has been a great success in increasing the intellectual capacity within Canada, and this capacity is being sustained at the Universities as they assume responsibility for the faculty members.
- We are also embarking on a bold new vision in a new CFREF application

A new CFREF

Some main elements:

- Enabling Canadian researchers to take substantial roles in global scale experiments delivering dark matter and neutrino physics results by providing the necessary engineering, project management and technical support positions.
- Expanding the scope of the science to include SNOLAB type programs (nEXO and/or Legend ($0\nu\beta\beta$), Darwin, P_ONE and multi-messenger physics (GW), Neutrino Oscillations (HyperK) which benefit from world class Canadian infrastructure and leadership and which have realistic chances of delivering early science within the 7 year period of the CFREF.
- Advancing the technologies that will be required for future generation detectors (Digital SiPM, low background technologies, data science...)
- Create a centre in the Sudbury region that will be the hub for researchers visiting SNOLAB, providing intellectual “buzz” and logistic support.



Other Important Pieces:

- Theory Initiative (CRC at Queen's, new partnership with CITA, CIFAR, PI)
- Cross-disciplinary research positions (radio-chemistry, STEM education, EDII, Data Science, Electrical Engineering (in support of SiPM development at Sherbrooke), P-ONE ...)
- Technical Research Thrusts: SiPM Digital photon sensors, Low Background Radioactivity, Data Science
- Administration and Program delivery (Education/outreach, HQP training, communications, GR, etc on behalf of the community.
- International early Career Research support initiatives, IBIS program (to support Black and Indigenous scholars in pan Canadian program), Engineer in training program,
- Strategic Base program support (can't pull out rug from underneath currently supported programs, but not the flagship of the new CFREF)
- Pooled funding (reserve of funding for HQP/new initiatives that develop)

A new CFREF

Universities and Institutions expressing an interest in partnering with Queen's and contributing to this new initiative include:

- Queen's
 - Alberta
 - UBC
 - Carleton
 - McGill
 - Montreal
 - Sherbrooke
 - Simon Fraser
 - Toronto
 - Victoria
- CIFAR
 - CITA
 - IPP
 - PI
 - SNOLAB
 - TRIUMF

And there are opportunities for this to grow yet as we continue to define the program with colleagues across Canada.



CFREF Process:

- Lots of consultation currently underway with meetings at Carleton, Alberta, SFU, UBC, UVic, TRIUMF, Sherbrooke, Montreal and McGill, Toronto to date. Opportunities still being developed but overall strategy now well developed.
- The astroparticle research framework is shaping up and consultations/initial plan are essentially complete but still a lot of work to do.
- Budget detail with partner commitments needs to be sorted.
- First rough draft of overall concept anticipated by June 17th for internal review
- This will define things well enough that we can begin getting letters of support and defined commitments from the partner institutions. Anticipate 4-6 weeks to collect these.
- End of June we will know if LOI was successful. Hopefully all this effort not wasted!
- Full proposal submission deadline Aug 31, 2022, but we plan for completion early August



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Thank-You
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