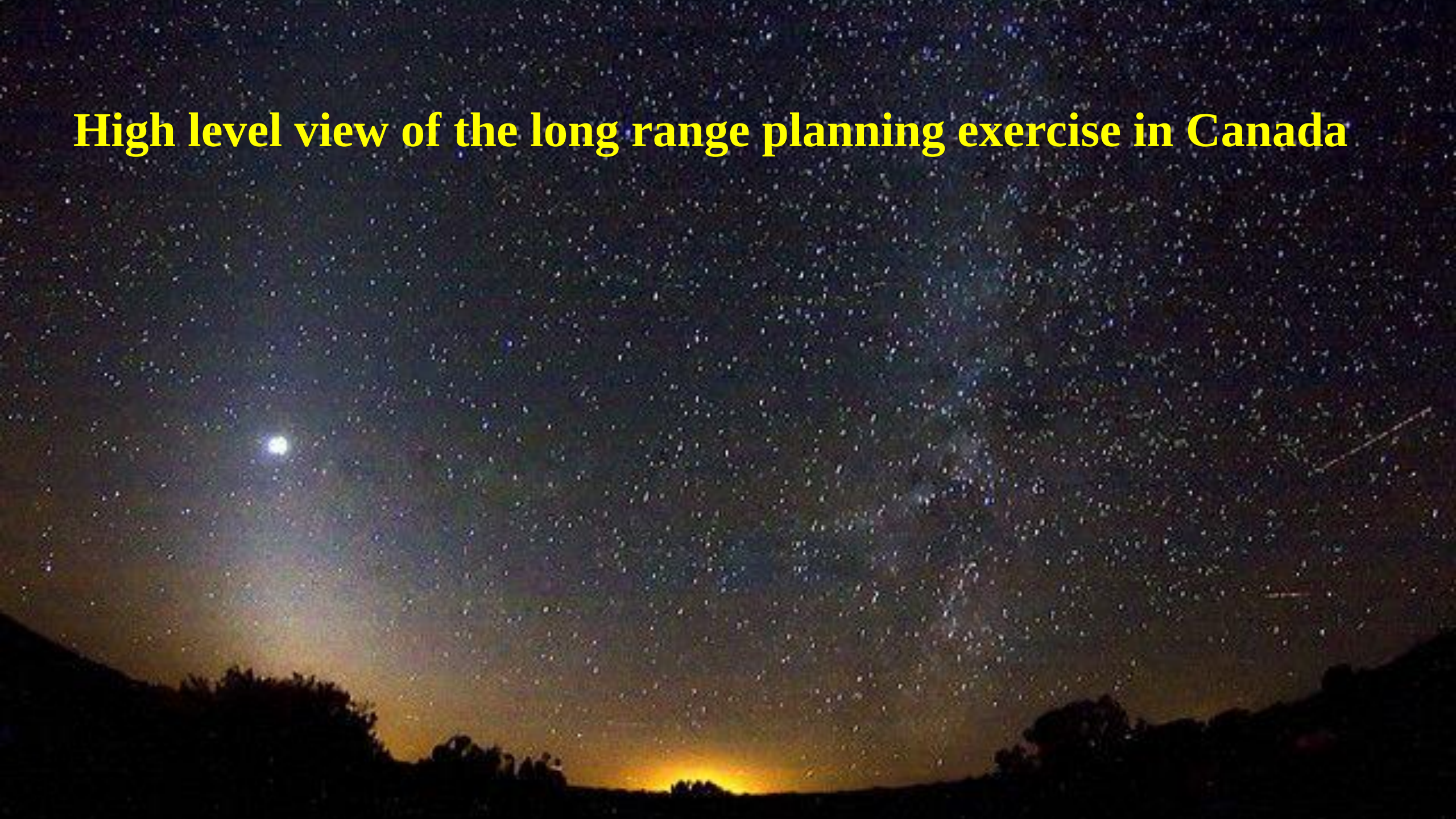
Long Range Planning for Astroparticle Physics: As facilitated by the McDonald Institute and SNOLAB

Tony Noble
Queen's University Physics

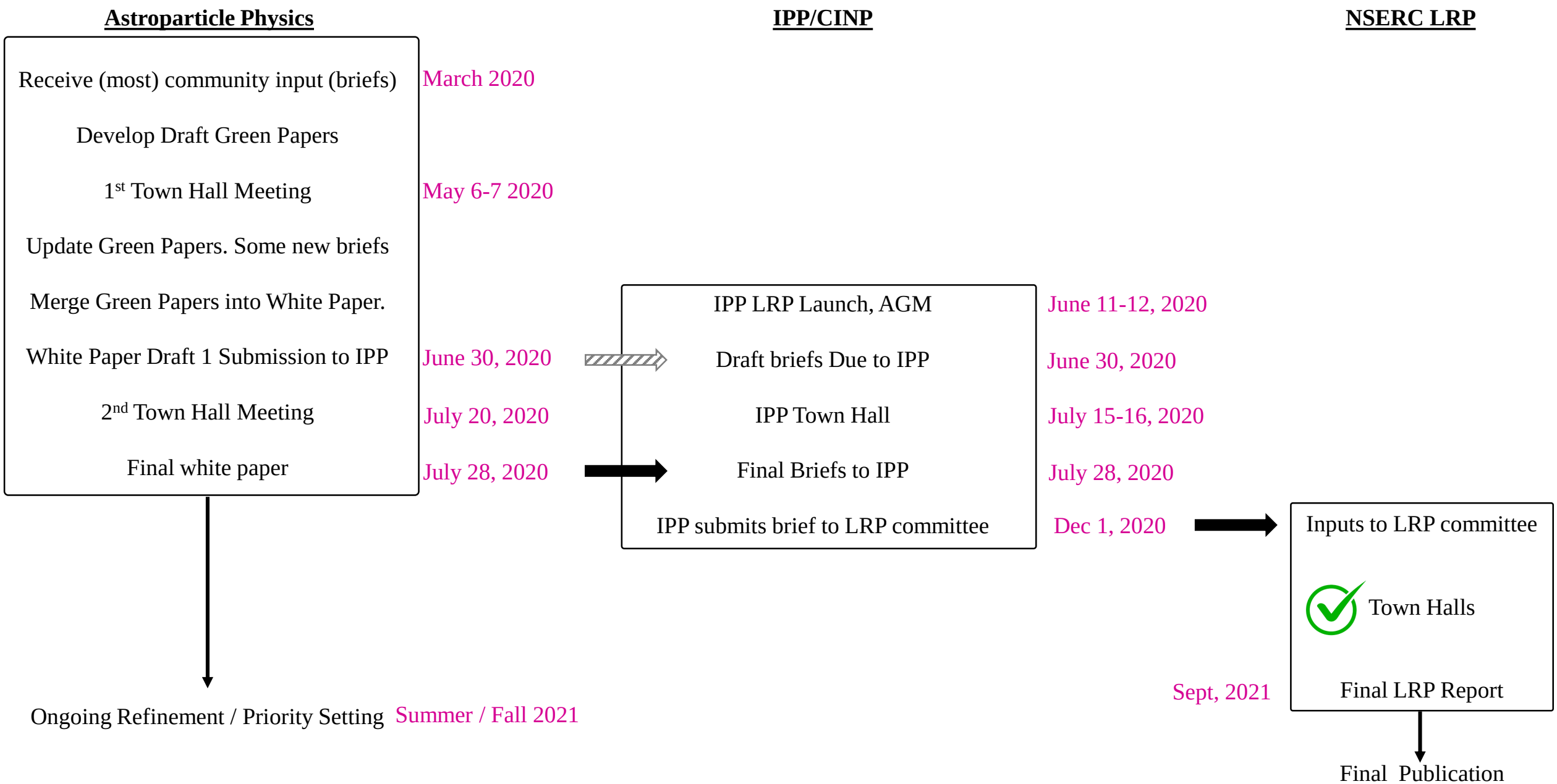
Arthur B. McDonald
Canadian Astroparticle Physics Research Institute

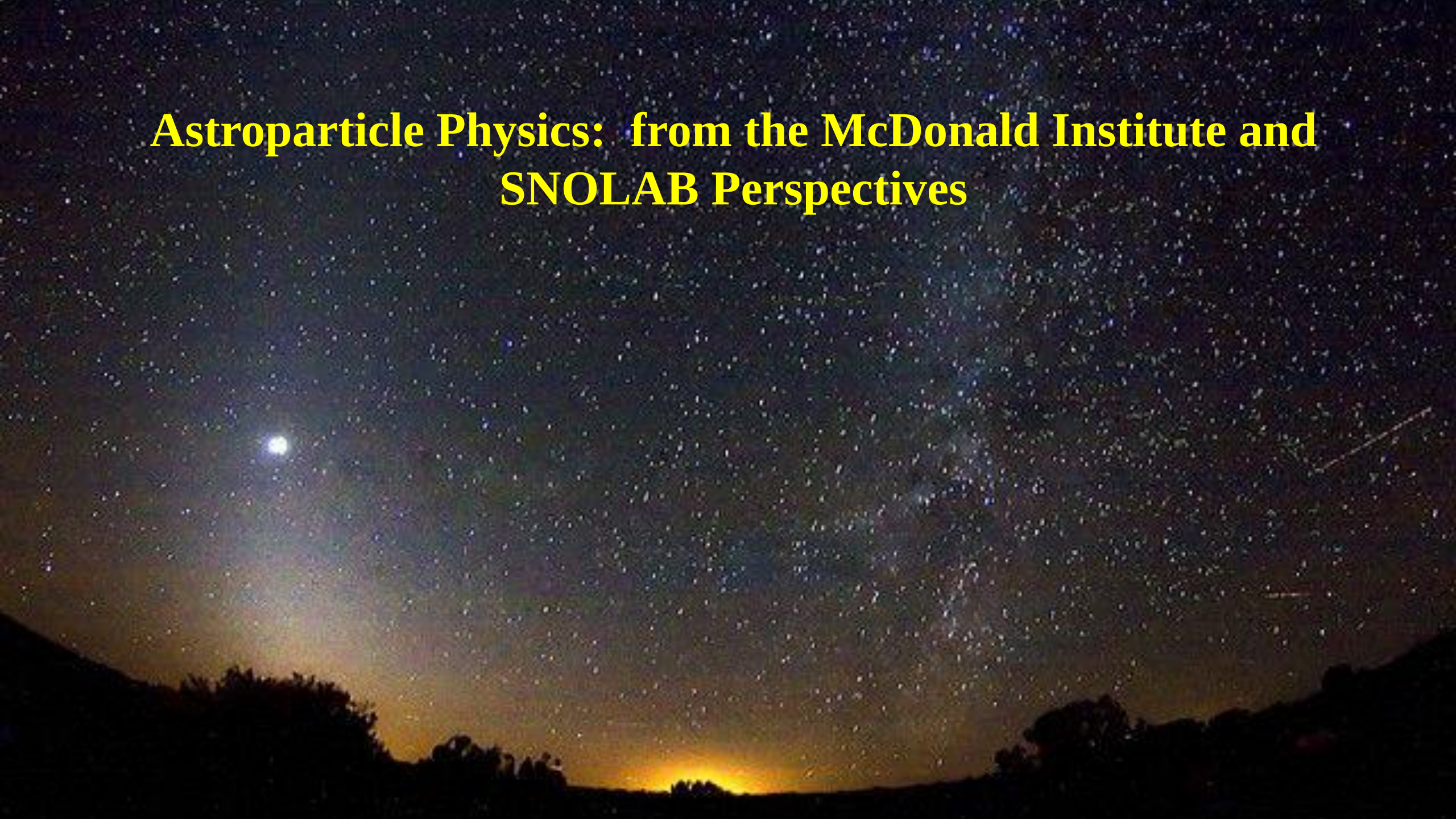
Situated on traditional Anishinaabe and Haudenosaunee territory.

- The high level view of LRP in Canada
- Astroparticle Physics and the McDonald Institute
- Where we are in the process
- The future of the McDonald Institute


High level view of the long range planning exercise in Canada

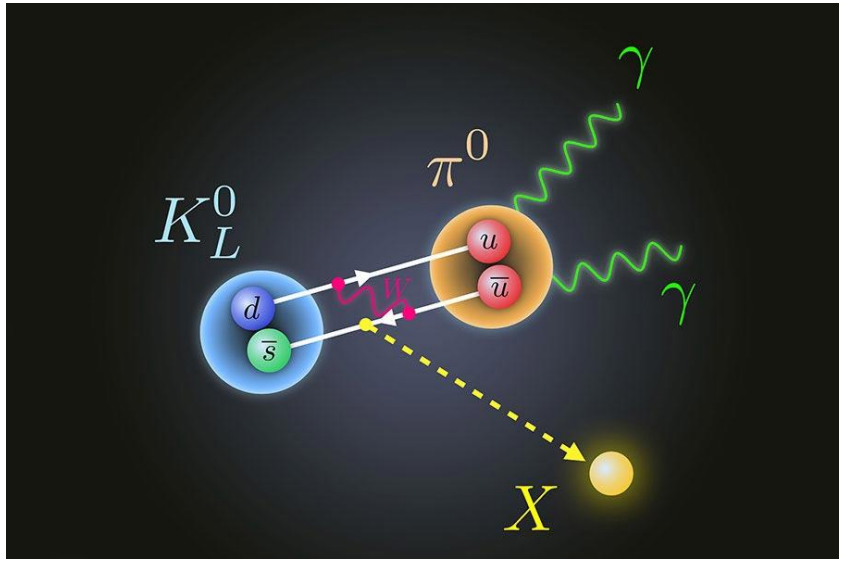
Overall high level view of the Canadian Process from the astroparticle physics perspective.



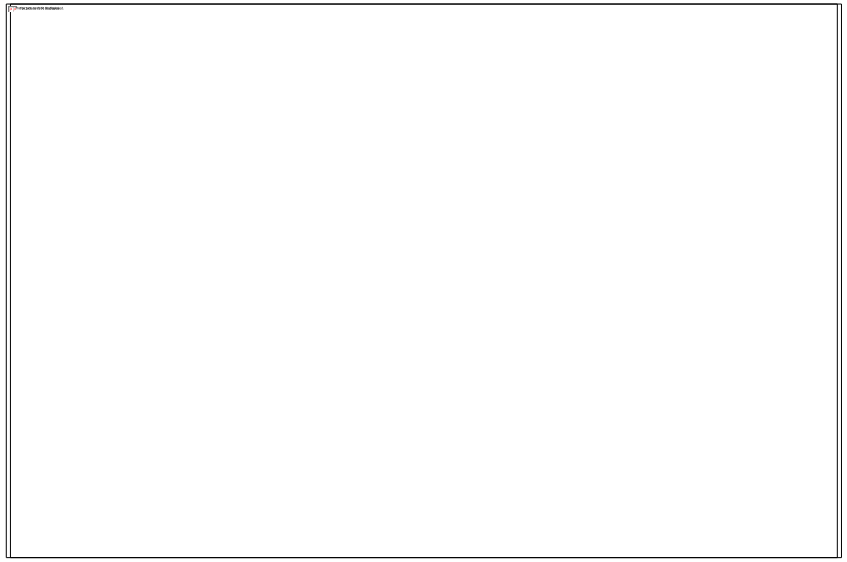

Astroparticle Physics: from the McDonald Institute and SNOLAB Perspectives

Astroparticle Physics in the McDonald Institute and SNOLAB context

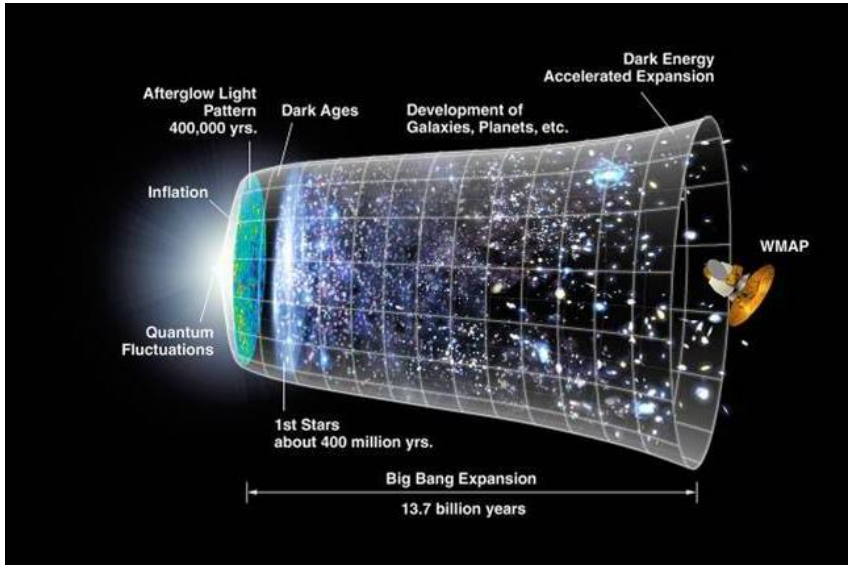
Astroparticle Physics lies at the intersection of particle physics, astronomy, and cosmology.



Particle Physics:
Properties of the fundamental particles that constitute nature.
Credit: Florida State University



Astronomy:
Physics and properties of celestial objects
Credit: BBC Sky at Night



Cosmology:
Origin and evolution of the Universe.

Credit: UniverseToday.com

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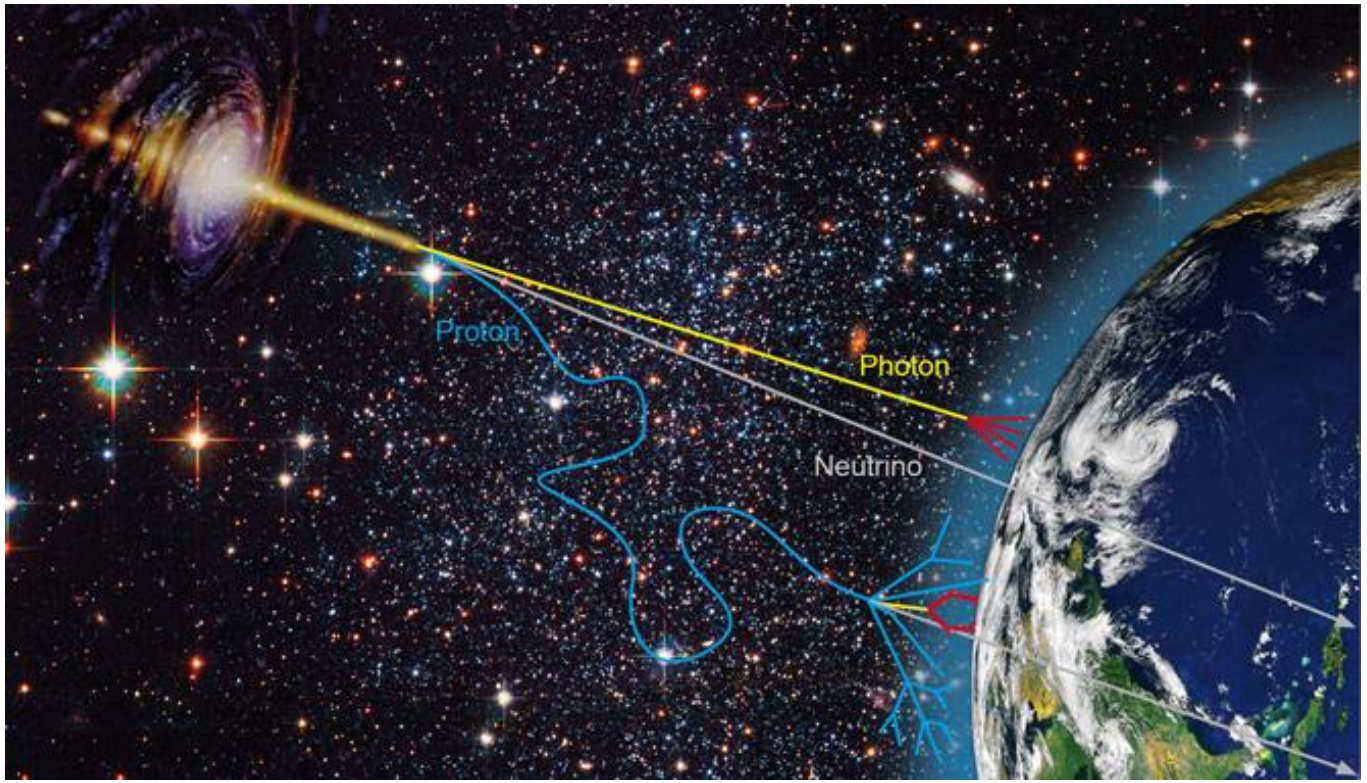
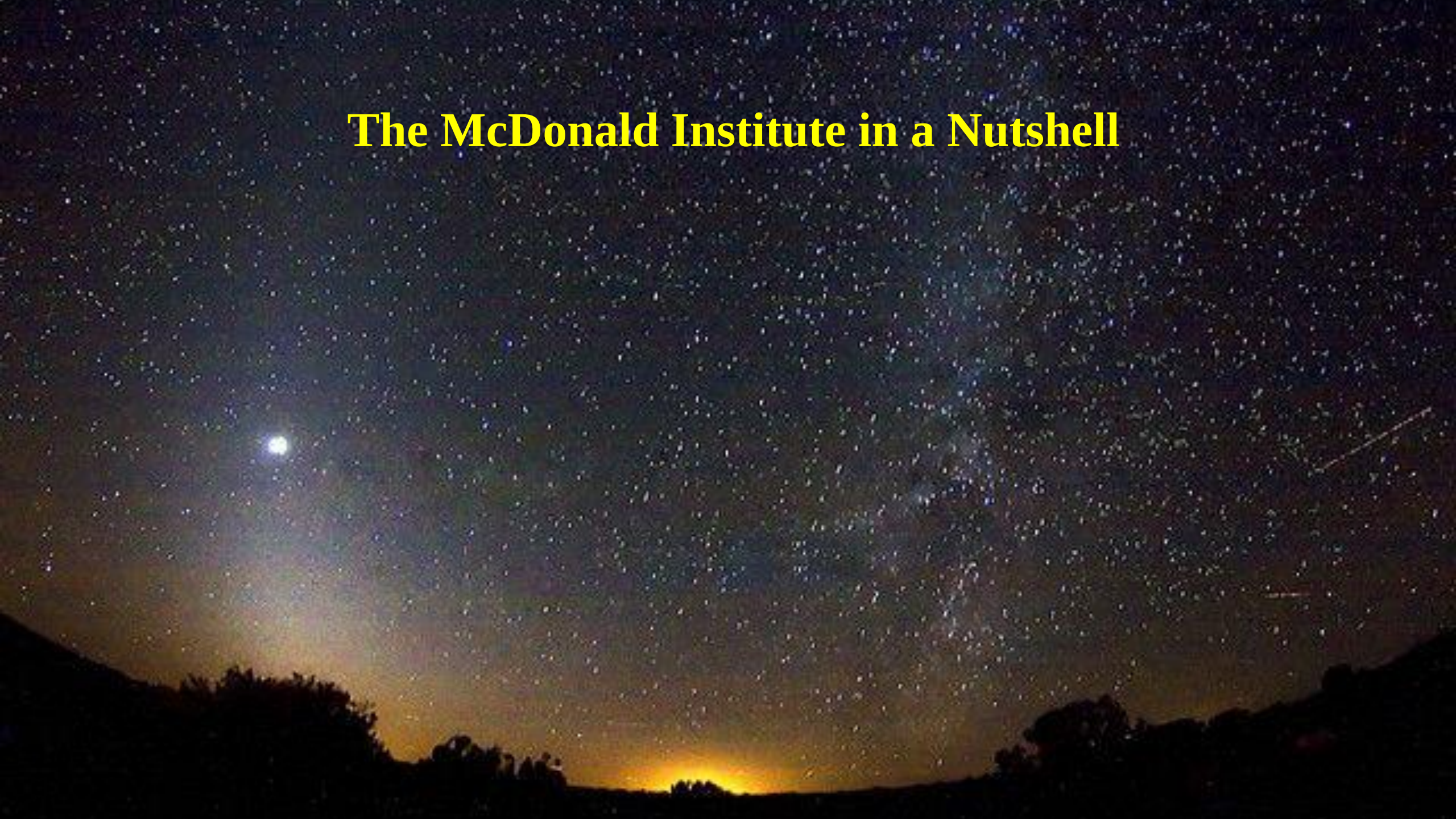


At SNOLAB and within the McDonald Institute, the focus is on programs that benefit greatly from community efforts toward the ultra-low backgrounds possible deep underground (or below surface) and the challenges of working in those remote environments. Hence we refer to our long range planning in this special niche area of astroparticle physics as

ACP-NAS ….. Astroparticlephysics Community Planning – Non-Accelerator - Subsurface

The McDonald Institute in a Nutshell



Arthur B. McDonald
Canadian Astroparticle Physics Research 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.

Supported by a $64M Canada First Research Excellence Fund 2016 - 2023

Queen's University
SNOLAB
CIFAR CANADIAN INSTITUTE FOR ADVANCED RESEARCH
Carleton UNIVERSITY
INSTITUTE OF PARTICLE PHYSICS
Laurentian University Université Laurentienne
McGill
PERIMETER INSTITUTE
THE UNIVERSITY OF BRITISH COLUMBIA
TRIUMF
UNIVERSITY OF ALBERTA
Université de Montréal
UNIVERSITY OF TORONTO
CANADA FIRST RESEARCH EXCELLENCE FUND

MI is Supporting scientists, technicians, students, in a complete scientific environment.

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	2016 "Base"	2020 "Base"	2020 "MI Supported"
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:

- **The HQP community size has more than doubled since the start of MI (70 → 181)**
- **MI is currently supporting more than ½ of the community HQP. (97 vs 84)**
- **Faculty base in this field has doubled. MI faculty plus other new hires, research pivots (22 → 47)**

Synopsis of what the MI currently supports

- Education and Outreach
- Knowledge Translation/Mobilization
- HQP Training – Professional Development
- Gov Relations
- HQP recruitment/retention
- Communication
- Networking and Connections
- EDII Best practices support

- These are time intensive programs.
- They need significant administrative support
- Enables big science by creating “the full package”
- Creates highly skilled, deeply connected, community
- Relatively inexpensive, but beyond scope of most individual projects

- Faculty Salaries
- Student Salaries
- Engineering and Technical Support Salaries
- Seed funding for novel R&D

- Dominates overall costs to MI.
- Less overhead required to manage
- Builds capacity in community and research potential


Where we are in long range planning

ACP - NAS

Receive (most) community input (briefs)

Develop Draft Green Papers

1st Town Hall Meeting

Update Green Papers. Some new briefs

Merge Green Papers into White Paper.

White Paper Draft 1 Submission to IPP

2nd Town Hall Meeting

Final white paper

Ongoing Refinement / Priority Setting

- We originally received 17 briefs from the community.
- Many were cross-disciplinary.
- Some related to theory, others experimental.

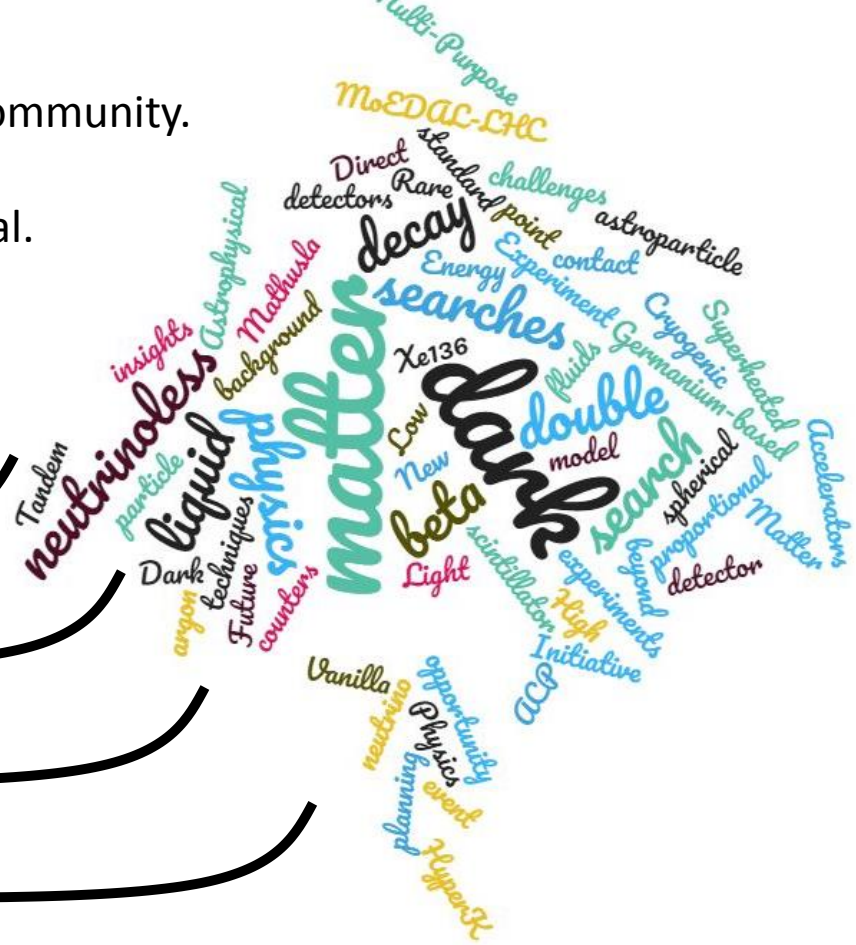
Convenor co-chairs digesting briefs according to themes

Dark Matter

Neutrino Messenger

Neutrino Properties

Technologies



Prepared for the Town Hall meeting of May 6th and 7th

Draft Dark Matter Green Paper

Draft Neutrino Green Paper

Draft Technology Green Paper

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Green Paper Thematic Discussions		
Wednesday "Morning"	Dark Matter	David Morrissey Simon Viel
Wednesday "Afternoon"	Technology	Fabrice Retiere Silvia Scorza
Thursday "Morning"	Neutrino	Erica Caden, Ken Clark Carsten Krauss, Alex Wright
Community Strategy Discussion		
Thursday "Afternoon"	20 year vision	Panel discussion

Thematic Green Papers collected into Overall White Paper describing the aspirations of the community: Authors were:

- Erica Caden
- Ken Clark
- Fouad Elgindy
- David Morrissey
- Tony Noble
- Fabrice Retiere
- Silvia Scorza
- Nigel Smith

This is the effort for this summer and on-going. How do we as a community accomplish the aspirations we have with the resources available?

Community Aspirations

The community aspires to be a global leader in astroparticle physics with a view to the **discovery** of new particles to explain the galactic **dark matter**, an **understanding of the intrinsic properties and nature of the neutrino**, and the **opening-up of new windows** of intersectional astronomy and cosmology studying the **sources of these particles** and their influence on the evolution of the universe.

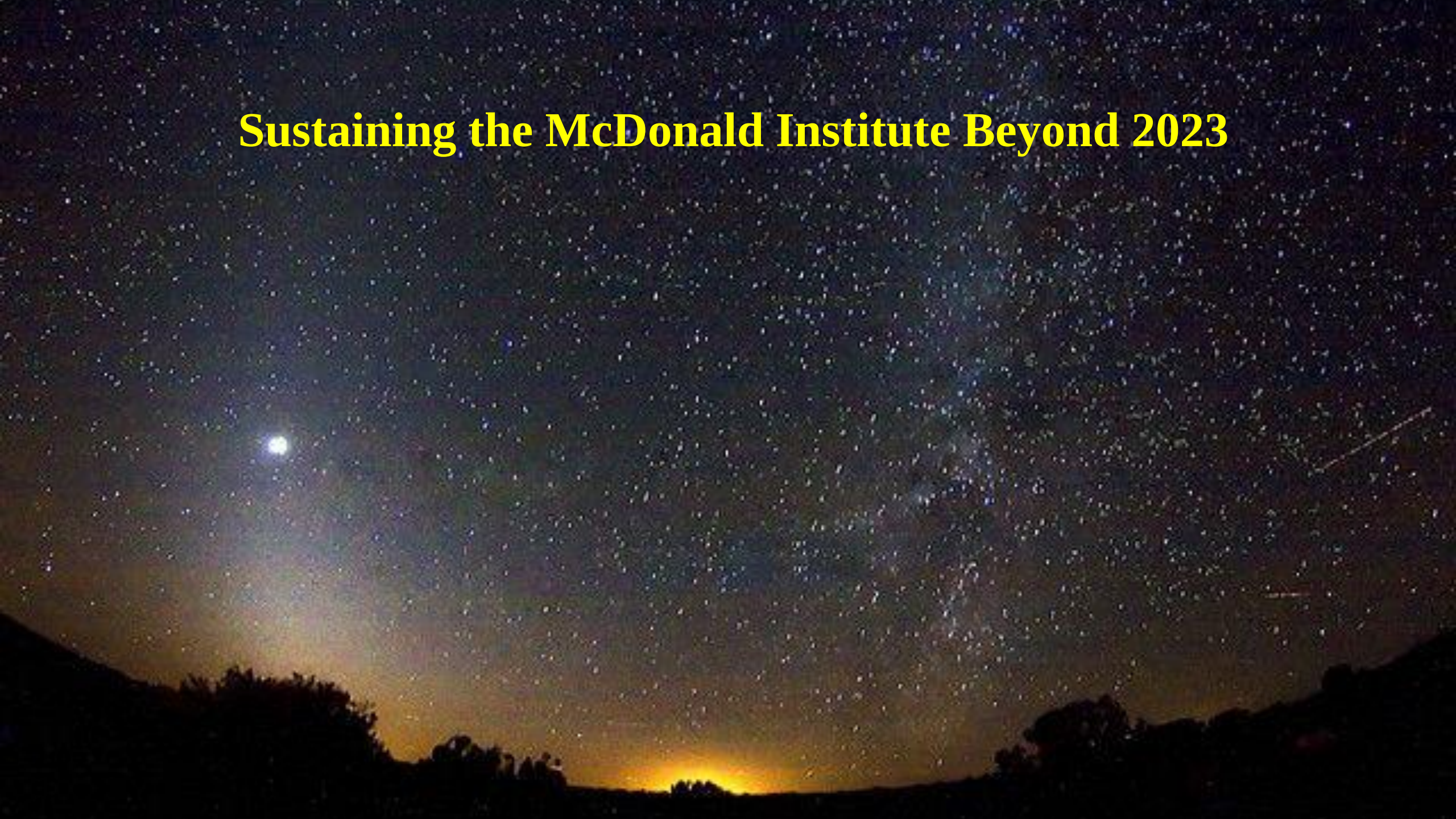
Fundamental science program focused on high priorities in physics today:

- Origins of dark matter
- Properties of neutrinos
- Understanding of neutrino sources

In the last decade this field has evolved into a major research field. In Canada, increased capacity and capability as a consequence of significant investments:

- **SNOLAB**: Deepest clean International facility for underground science
- **McDonald Institute**: Centre for Astroparticle Physics building intellectual capacity across Canada.

Canada is well placed to capitalise on investments to this research field.


Sustaining the McDonald Institute Beyond 2023

Potential Model for a Sustained MI at Queen's University Post CFREF

- Education and Outreach ++
- Knowledge Translation/Mobilization ++
- HQP Training – Professional Development ++
- Gov Relations ++
- HQP recruitment/retention ++
- Communication ++
- Networking and Connections ++
- EDII Best practices support ++

- These are time intensive programs.
- They need significant administrative support
- Enables big science by creating "the full package"
- Creates highly skilled, deeply connected, community
- Relatively inexpensive, but beyond scope of most individual projects
- New MI Research Centre at Queen's 1 – 1.5 M$/a

Centre at Queen's tentatively approved !

- ~~Faculty Salaries~~

- Subsumed by universities.

- ~~Student Salaries~~

- Picked up by NSERC

- Engineering and Technical Support Salaries
- Seed funding for novel R&D
- Novel/targeted positions

- To be funded through new MI grant to MSI, MRS, CFREF', SNOLAB MSI', Gov…
- Ball Park: Funded externally 3 – 4 M$/a

Grass –roots effort to define what is needed in Canada, coming to your in-box soon. Expect funding program launches this summer.