Proposal for TRIUMF Commitment (5YP 2015-2020)

Date:
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PROJECT/COMMITMENT TITLE: Theory Group Expansion

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PROJECT DESCRIPTION:

The Theory Group (TG) at TRIUMF was formed in 1975 and currently has five staff members and seven postdoctoral research associates. The TG is engaged in research in two core areas: nuclear physics and particle physics. The research is focused on nuclear structure and reactions from first principles, nuclear astrophysics, baryon and meson masses and excited hadronic states, elementary particles at colliders, neutrino masses and mixing and particle cosmology. The TG is aligned with TRIUMF main experimental programs, the ISAC facility and the ATLAS group.

The recommendation of the 2002 NRC External Review was to increase the size of the Theory Group to nine members. In the 2010-2015 Five-Year Plan, a growth of the TG to ten permanent members was discussed and justified. To fulfill partially the 2010-2015 Five-Year Plan concerning the growth of the TG, a new nuclear theory staff member should be hired as soon as the fiscal situation permits.

The goal for 2015-2020 is to have the Theory Group expand to 10 Research Scientists with increased coverage in the core areas, Nuclear and Particle Physics, and a moderate diversification into a third area, for example, astrophysics.

SCIENTIFIC JUSTIFICATION:

Having in mind the TRIUMF expansion by building the ARIEL facility that will, among other scientific goals, shed light on the r-process and other major physics issues relevant to astrophysics, the new discoveries at the LHC, its upgrade together with the ATLAS upgrade, the intensive neutrino research pursued, e.g., by the T2K collaboration, and starting of the UCN program, we propose an expansion of the TG by four new staff members. The new staff members will strengthen the TG in the core areas of nuclear and particle physics and cover new areas, such as astrophysics. Optimally, we envision that the new members will have partly overlapping interests with the current staff, but, also, they will pursue research in areas not currently covered. Depending on availability of suitable candidates, these areas may include astrophysics and/or neutrino physics with the focus on synergy between nuclear and particle physics.

RELATIONSHIP TO BROADER CANADIAN RESEARCH COMMUNITY:

The TG is on a forefront of Canadian theoretical nuclear and particle physics research with frequent publications in the most prestigious physics journals such as Physical Review Letters. Still, the current size of five is substantially smaller than major university groups in particle and nuclear theory. The TG is aligned with the TRIUMF experimental programs more closely than other Canadian theory groups. This alignment should be maintained as the TRIUMF experimental program expands but at the same time the theory program needs additional flexibility and diversity to strengthen connection with the Canadian university community.

BROADER IMPACTS:

Nuclear physics has entered an exciting era with advances in effective field theory, ab initio methods for nuclear structure and reactions, the effort to develop a universal density functional based on microscopic nuclear interactions and the application of large-scale computing resources. These theoretical advances are accompanied by construction and operation of radioactive beam facilities such as the ISAC and ARIEL at TRIUMF that provide and will provide wealth of new nuclear data.

Particle physics now entered the most exciting era in decades by the discovery of the Higgs boson at the LHC. TRIUMF ATLAS group is directly involved in this and other discoveries. The next five to ten years will provide breakthroughs in our understanding of fundamental physics.

The TRIUMF Theory Group is actively involved in these exciting new developments. The TG is internationally recognized, with many international collaborators and visitors. It is engaged in organizing international workshops locally and abroad. It is crucial to maintain and grow the TRIUMF Theory Group to augment on the theory side the world's leadership position of TRIUMF in experimental nuclear and particle physics.

MAJOR MILESTONES:

Description	Date
Hiring of a new TG staff member	2016
Hiring of a new TG staff member	2017
Hiring of a new TG staff member	2018
Hiring of a new TG staff member	2019

RESOURCE REQUIRMENTS:

CASH FLOW REQUIREMENTS						
\YEAR SOURCE \	ONE	TWO	THREE	FOUR	FIVE	TOTAL
TRIUMF	10k	20k	30k	40k	40k	140k
EXTERNAL						
TOTAL	10k	20k	30k	40k	40k	140k
TRIUMF NON-CASH RESOURCES						
\YEAR RESOURCE\	ONE	TWO	THREE	FOUR	FIVE	TOTAL
Research Scientist FTE	1	2	3	4	4	14

EXTERNAL FUNDING INFORMATION:
Newly hired Research Scientists are expected to receive NSERC funding and bring additional resources to TRIUMF in this way.

ONGOING OPERATIONAL REQUIREMENTS:
Additional office space will be needed: 6 offices

DECOMMISSIONING REQUIREMENT:

Accepted: Date: