# Subatomic Physics Evaluation Section
# Annual Report

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## I. Introduction

This report summarizes the activities of the Subatomic Physics (SAP) Evaluation Section (SAPES) in fiscal year 2016-17, including the results of the 2017 competition. The report is provided for information to the NSERC Committee on Discovery Research (CDR), and to the Canadian subatomic physics community. The format and content of the report follow the reports from previous years very closely.

The Subatomic Physics Evaluation Section is a standing review committee that oversees a suite of programs. Funding for the Subatomic Physics suite of programs has been made through an independent envelope mechanism since 1991. Subatomic Physics Individual and Project Discovery, Research Tools and Instruments (SAP-RTI), and Major Resources Support (SAP-MRS) grant applications are evaluated together by SAPES. This comprehensive approach is essential given the complexity and inter-dependency of many proposals, which are often and ever-more frequently parts of international programs and collaborations, and involve many universities and national laboratories. This approach is also essential for planning and stability of execution of large-scale and long-term projects, and for maintaining a balance between large projects and the smaller research efforts that are essential to the breadth and future success of the Canadian subatomic physics program. The envelope structure also helps SAPES maintain as appropriate a balance between operations and capital investments as possible. Moreover, the SAP community's five-year Long-Range Plan includes the community's priorities, and provides guidance to SAPES' deliberations. The most recent Long-Range Plan was produced in 2016 and covered the period 2017-2021 with a look ahead to 2016.

Another unique strength of SAPES is the extent to which it solicits reviews by international experts of the highest calibre. All major Project, SAP-RTI and SAP-MRS grants are separately reviewed by *ad hoc* or standing committees of internationally-recognized experts drawn from institutions from around the world. These committees perform exhaustive scientific, technical, and budgetary evaluations, and produce detailed written reports which

provide exceptionally valuable input to SAPES for its assessment of the grant applications. Moreover, SAPES generally selects a substantial proportion of international external reviewers for each proposal, from the smallest individual discovery grant to the largest project proposal. Finally, the membership of SAPES is itself substantially international, with half or more of its members generally coming from institutions in the U.S. and Europe. This level of international review provides an exceptionally high degree of scrutiny and validation of the research funded by the SAP Evaluation Section.

In its report, *The State of Science and Technology in Canada, 2012*, the Council of Canadian Academies identified Nuclear and Particle Physics as one of the sub-fields in which Canada excels and leads the world in terms of scientific impact. Despite the internationally-recognized excellence of Canadian SAP research, and the unique strengths of the SAPES envelope structure and review processes, the past several years have been increasingly difficult for this Evaluation Section to financially support the community's short- and long-term objectives at an appropriate and competitive level to ensure the maximum scientific return on substantial investments already made. Several high-priority research programs are in the ramping-up phase of their activities, while others are at the full scientific exploitation stage. The success of the subatomic community in securing infrastructure funding through CFI has also led to ever-increasing demands on the SAP envelope for operational funds.

Looking back ten years ago (a relatively small window over the typical timescale of SAP projects), the scenario of a flat envelope was thoroughly analyzed in the 2006 LRP report, with the conclusion that it would lead to a curtailing of research operating support and affect growth possibilities in Canadian SAP research activities. In such a scenario, it was recognized that the ability of the Canadian subatomic physics community to exploit the major capital investments of the past decade and to achieve its long-term scientific vision would be jeopardized.

The 2011 LRP report, *The Subatomic Universe: Canada in the Age of Discovery*, describes the constrained support provided to the "flagship research programs" over the past 5 years as they neared the stage of data-taking and science exploitation, with concurrent reductions from elsewhere in the envelope. The report warns that if this trend continues, funding for investment in equipment will suffer as a consequence of increasing needs from small and large projects in an era of decreasing budgets. This concern has proved prescient, as the increasing demands on operational funds have led to pressure on the ability of the envelope to support small-scale "seed funding" for equipment through the RTI program.

There is an urgent need to exploit the considerable investments that have already been made in SAP research. One can justifiably state that the Canadian SAP program has become a victim of its own excellence and successes, and that the currently available operating funds are enough only to maintain existing activities at a constrained level that is not always sufficient to allow Canadian researchers to contribute to the full extent of their potential. Clearly, the internationally-recognized excellence and contributions of the Canadian SAP community, coupled with the unique strengths of the SAPES envelope, ensure that additional investments in this area will yield exceptionally high returns in

cutting-edge knowledge and the training of highly-qualified personnel (HQP). Additional investments are now more needed than ever if the Canadian SAP research program is to continue to produce excellent science both now and in the future.

## II. Update on the Envelope Funding

The pressure on the Section's funding envelope has been building for several years; it has now reached a level that is difficult to manage. In particular, substantial investments by federal and provincial government funding agencies have annually injected non-operational funds into the SAP program in excess of 50% of the entire SAPES envelope, including substantial capital investments from CFI and various provincial government agencies. Other substantial investments by the Canadian government in science and technology, such as the Canada Research Chairs (CRC) program, the Canada Excellence Research Chairs (CERC) program, and now the Canada First Research Excellence Fund have also resulted in, and will continue to enable the fast growth of the number and the quality faculty in SAP at many Canadian institutions. The latter increase has, in turn, been accompanied by a substantial growth in the number and quality of graduate students and other highly qualified personnel.

The SAP community has been very effective in making use of CFI's programs for major capital equipment. This additional source of funding is welcome, but it is important to highlight the fact that it is in turn generating further pressure on the envelope as the latter is the main funding source in support of research-related costs. Up until recently repeated attempts to foster the necessary level of coordination between CFI and NSERC had not succeeded. Last year, SAPES Co-Chair Adam Ritz participated in a meeting of representatives of NSERC, CFI, and members of the Subatomic Physics Long-Range Plan Committee to discuss the issues and propose solutions. This was the start of more frequent interactions between the funding agencies. Starting in competition cycle 2016, CFI presented at Large Project Day as one of the Canadian institutes supporting subatomic physics research in Canada. During the most recent CFI funding competition, SAPES Co-Chair Karsten Heeger was an ex officio member of the Multidisciplinary Assessment Committee which met in Toronto in December 2016, providing input as needed. These latest developments are seen as a very positive sign that more contact between the peer review processes of NSERC and CFI is developing. As stated in the last Long Range Plan (2011-2016), without such coordination there is a risk for research funding to be spread too thin, leading to failure of major parts of the Canadian subatomic physics program. An alternative risk would be for research funding to be focused only on a few state-of-the-art major infrastructures, leaving several others unexploited.

Since the 2006 Long-Range Plan was released, new funds were allocated to NSERC by the federal government in Canada's annual budgets, but were mostly provided for clearly targeted priority areas which did not include SAP. In *Budget 2011,* NSERC received $15M to "support outstanding research in the natural sciences and engineering fields, such as the Strategy for Partnerships and Innovation (SPI)." NSERC devoted half of those funds to enhance the support given to Early Career Researchers (ECRs) across all disciplines in the

form of supplements to their Discovery grants. ECRs with active grants in subatomic physics have received such supplements. Even though this is a welcome development, it has translated into a limited influx of funds into the envelope ($125k). In *Budget 2014*, NSERC received an additional $15M "to support advanced research in the natural sciences and engineering". These funds are being phased into the Discovery grants program over the five-year cycle, with approximately $3M being added to the budget each year starting in 2014-2015. The share of $3M being added to the subatomic physics envelope is approximately $158k. Given that much of the spending in the subatomic physics envelope is directed toward Project Grants of three-year duration, the funds will be phased in over a three year period, with the addition of $474k in FY 2015, $632k in FY 2016 and $790k in FY2017. In *Budget 2016*, the Government announced $30M of "new annual funding for discovery research". Again these funds are being phased into the Discovery grants program over the five-year cycle, with the addition of $772k in FY 2016, $1,152k in FY2017, 1,132k in FY2018, $1,503k in FY2019 and $1,874k in FY2020.

## III. Evaluation Section

This year's SAPES comprised 12 members, including three theorists. Six new members joined for full three-year terms and one returning member joined for a one-year term. Our new members were Alfredo Galindo-Uribarri (Oak Ridge National Laboratory & University of Tennessee - Knoxville), Hans Kraus (University of Oxford), Jeffery Martin (University of Winnipeg), Tor Raubenheimer (Standford Linear Accelerator Center), Niki Saoulidou (University of Athens), Brigitte Vachon (McGill) and our returning member was Marielle Chartier (University of Liverpool). The full SAPES membership is given below.

| **Name** | **Organization** | **Final Year** |
|---|---|---|
| Marielle Chartier | University of Liverpool | (2017) |
| Alfredo Galindo-Uribarri | Oak Ridge National Laboratory | (2019) |
| Karsten Heeger (Co-Chair) | Yale University | (2018) |
| Hans Kraus | University of Oxford | (2019) |
| Heather Logan (Co-Chair) | Carleton University | (2018) |
| Naomi Makins | University of Illinois at Urbana-Champaign | (2017) |
| Jeffery Martin | University of Winnipeg | (2019) |
| Gabriel Martinez Pinedo | Technische Universität Darmstadt | (2018) |
| Tor Raubenheimer | Stanford Linear Accelerator Center | (2019) |
| Adam Ritz | University of Victoria | (2017) |
| Niki Saoulidou | University of Athens | (2019) |
| Brigitte Vachon | McGill University | (2019) |

The Co-Chairs would like to acknowledge the very demanding task faced by SAPES members throughout the year, up to and especially through competition week. Very long hours of deliberations ensured that each proposal was fairly and consistently evaluated according to the selection criteria. The remarkable professionalism and dedication of

SAPES members is manifest in the high quality of the Section's recommendations. The Co-Chairs also wish to sincerely thank SAPES members for their careful and constructive attitude throughout the competition, and for ensuring the conduct of our many discussions in a pleasant atmosphere. Special thanks also go to this year's retiring members, Naomi Makins and Adam Ritz for three years of outstanding service to the Canadian SAP community; it is deeply appreciated. As well, many thanks go to our returning member Marielle Chartier who agreed to return for an additional year.

It is a pleasure for the Co-Chairs to thank NSERC staff for their expert guidance and help in the months leading up to the competition, and during the many long days of competition week: Trevor Rodrigues (Program Assistant), Kim Bonnet and Caroline Bicker (Program Officers), Sarah Overington and Emily Diepenveen (Team Leaders), Elizabeth Boston (Director, Mathematical, Environmental and Physical Sciences), and Pierre Charest (Vice-President, Research Grants and Scholarships).

## IV. Orientation/Policy Meeting and Information Visits

Each year, SAPES launches its operations during an orientation and policy meeting. This is a critical opportunity for the new members to familiarize themselves with NSERC and SAPES operating procedures, to be informed of the process leading to competition week, and to interact with the returning members. News from NSERC, including a detailed review of the competition budget, is also communicated to the members. The orientation and policy meeting for this competition was held on November 2, 2016 via teleconference.

Until the 2011 competition, it had been a tradition, following the policy meeting, for SAPES to visit Canadian institutions with subatomic physics research programs on a 3-year rotation basis. The visits were conducted for informational purposes only and were not a part of the grant evaluation process. Since the 2011 competition, owing to operating budget pressures at NSERC, these information visits are no longer held. With these discontinued visits and the now fully tele-conferenced orientation meeting, competition week is the first and only time per year that Section members meet. This is viewed by much of the SAP community as a negative development.

Again this year SAPES members were given the CINP-IPP jointly prepared document on the context of the Canadian research environment, with the opportunity to ask questions. The document provides an overview of the roles that various Canadian funding agencies play in supporting subatomic physics research and provides details about Canadian subatomic physics research institutes. The document further provides information about the structure and different options for Canadian M.Sc. and Ph.D. programs, followed by details about the regional differences in the training of Highly Qualified Personnel (HQP). An Appendix listing the typical level of graduate student support at different Canadian universities across the country is included as well.

This year a teleconference was held prior to competition week in order to review NSERC's policies and guidelines, and present the most up-to-date budget for the 2017 competition. This pre-competition session is seen as very useful and should continue to be part of the yearly lead-up to competition week.

## V. Pre-Review Process

The review of the Notifications of Intent to Apply (NOI) for a Subatomic Discovery Grant took place in August and September. Those which require NOIs include Individualand Project SAP Discovery, as well as SAP-MRS, and large SAP-RTI (Category 2 and 3) grant applications.

The review of Individual NOIs involved the SAPES Co-Chairs as well as Section Chairs of the Physics Evaluation Group. Its objective was to discuss those applications whose research topics crossed the boundaries of two or more Sections within the Physics Evaluation Group or those which related to a discipline other than physics. For each application, the intent was to identify the Section (or Evaluation Group, if the research topic related to another discipline) that should take the lead for the review and to determine the need for expert input to/from other Evaluation Groups. As a result of this process, one application submitted to the Subatomic Physics Evaluation Section was transferred out; two members from the Physics Evaluation Group and one member of the Mathematics and Statistics Evaluation Group were asked to participate in the SAPES deliberations during competition week. Likewise, a member of SAPES participated in the review of Discovery grant applications.

When the Notifications of Intent to Apply for a SAP-RTI (Category 2 or 3) or SAP-MRS grants are received, NSERC in consultation with the Co-Chairs assigns each application first and second internal reviewers who are SAPES members with the most appropriate expertise, and with careful consideration of balancing the full workload among all of the members. Additionally, a third reviewer is systematically assigned, with special responsibility for budget scrutiny, for SAP Discovery or SAP-MRS grant applications that request funds averaging $500k/year or more. Likewise, a third internal reviewer is systematically assigned to Category-2/3 RTI grant applications.

In the case of SAP Discovery grant applications, the first reviewer is required to recommend five external reviewers for each of his/her assigned proposals. Typically, up to two of the external reviewers could be chosen from the list of suggested reviewers on the Notification of Intent to Apply. It is in the applicant's interest to suggest reviewers who are not in a position of conflict according to NSERC's guidelines. Internal reviewers generally recommend a substantial fraction of external reviewers who are from outside Canada. This year an average of 3.2 external reviewer reports per SAP Discovery grant application were received.

Similarly, once SAP-RTI - Category 1 grant applications are received, NSERC in consultation with the Co-Chairs assigns first and second internal reviewers. External reviewer reports are not sought for SAP-RTI grant applications.

## VI. *Ad hoc* Expert Review Committees

*Ad hoc* expert reviews are typically held for Subatomic Physics Project grant applications requesting more than an average of $1M per year as well as Category-3 SAP-RTI grant applications. During this year's competition cycle six *ad hoc* expert reviews were conducted in-person during November and December 2016. One SAPES member was present for each as ex officio. These reviews were related to the standing review of ATLAS-Canada, and the Discovery Project applications submitted by the DEAP-3600 collaboration, the EXO collaboration, the SNO+ collaboration, the T2K collaboration and the Gamma-Ray Spectroscopy at the Isotope Separator and Accelerator (ISAC) collaboration.

The reviews were carried out by *ad hoc* or standing Committees of experts. Full reports with recommendations, including budget recommendations, were prepared for SAPES. The reports, without the budget recommendations, were sent by NSERC to the applicants prior to Large Project Day. The reports *with* the budget recommendations were sent to the applicants after the results of the competition are announced.

Finally, Co-Chair Heather Logan attended the meetings of the Advisory Committee on TRIUMF (ACOT) held on October 28-29 2016; Emily Diepeveen attended on April 21-22, 2017.

## VII. Large Project Day

It has proved extremely useful to devote one day prior to the beginning of the competition to hearing presentations by applicants of Discovery and MRS grant applications requesting an average of $500k per year or more, as well as applicants of Category-2 or Category-3 RTI grant proposals. This is referred to as Large Project Day (LPD). These large proposals are typically complex, with extensive budgets, international commitments and project planning timelines which go far beyond those of smaller scale grant applications. The success or failure of a scientific program can depend on factors beyond the control of the Canadian research team. There have been notable examples in recent years in which the funding decisions in a host country forced changes in the scientific direction of the Canadian team between time of grant submission and assessment by SAPES. The opportunity to question the applicants in writing and in-person in advance of the SAPES deliberations is critical to a thorough evaluation and a judicious recommendation to NSERC.

The focus of LPD is to meet with representatives of large Canadian projects and with management representatives from the Canada Foundation for Innovation (CFI), the Canadian Institute of Nuclear Physics (CINP), the Institute of Particle Physics (IPP), the Perimeter Institute, SNOLAB, and TRIUMF. In addition, this year SAPES also heard from a representative of the Canadian Particle Astrophysics Research Centre (CPARC). LPD was held this year in Ottawa on Sunday, February 26, 2017. The agenda is attached as Appendix 1.

The day began with *in camera* presentations from representatives of Canadian institutes. They provided the SAPES with the perspective of the communities served by their organizations and answered questions previously submitted by the members. Applicants then made presentations and answered the questions submitted by the SAPES; this was done in an open session that was attended by all applicants in attendance. The invited grant proposals were, in order of presentation, the projects ALPHA, IceCube, Gamma-Ray Spectroscopy at the Isotope Separator and Accelerator (ISAC), T2K, ATLAS, SuperCDMS, SNO+, EXO, and DEAP-3600.

## VIII. Beginning of the Competition

The funds available to the Section at the beginning of the competition are shown in Table 1.

Taking into account on-going commitments from previous competitions, $9.2M was available for the 2017 competition (37% of the envelope). This year, SAPES received 51 applications. At the start of competition, the total funds requested for fiscal year 2017 amounted to $15.9M. Consequently, at that point in the competition, the projected average funding rate for fiscal year 2017 was 57%. For comparison, the funding rates for the years 2007 to 2016 were 55%, 66%, 66%, 46% (57% without SNOLAB operations), 61%, 69%, 53%, 52%, 64%, and 55% (50% without the Federal Budget 2016 increase) respectively.

**SUBATOMIC PHYSICS ENVELOPE**
**MULTI-YEAR COMMITMENTS BY CATEGORY**
**Beginning of 2017 Competition**

| | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|
| RTI - COMMITTED | $85,000 | $35,000 | $0 | $0 | $0 |
| RTI - 2016 Competition | $479,875 | $0 | $0 | $0 | $0 |
| **RTI - TOTAL** | **$564,875** | **$35,000** | **$0** | **$0** | **$0** |
| | | | | | |
| THEORY - COMMITTED | $2,692,800 | $2,081,300 | $1,520,100 | $949,100 | $38,000 |
| THEORY - 2016 Competition | $693,000 | $703,000 | $703,000 | $618,000 | $618,000 |
| **THEORY - TOTAL** | **$3,385,800** | **$2,784,300** | **$2,223,100** | **$1,567,100** | **$656,000** |
| | | | | | |
| EXP OPS** - COMMITTED | $12,570,370 | $7,854,420 | $261,370 | $144,957 | $0 |
| EXP OPS - 2016 Competition | $5,368,400 | $2,780,200 | $2,638,600 | $388,000 | $388,000 |
| **EXP OPS - TOTAL** | **$17,938,770** | **$10,634,620** | **$2,899,970** | **$532,957** | **$388,000** |
| | | | | | |
| MRS - COMMITTED | $539,000 | $484,173 | $46,000 | $48,000 | $0 |
| MRS - 2016 Competition | $1,741,000 | $1,741,000 | $1,411,000 | $0 | $0 |
| **MRS - TOTAL** | **$2,280,000** | **$2,225,173** | **$1,457,000** | **$48,000** | **$0** |
| | | | | | |
| **TOTAL - COMMITTED** | $15,887,170 | $10,454,893 | $1,827,470 | $1,142,057 | $38,000 |
| **TOTAL - 2016 Competition** | $8,282,275 | $5,224,200 | $4,752,600 | $1,006,000 | $1,006,000 |
| **GRAND TOTAL** | **$24,169,445** | **$15,679,093** | **$6,580,070** | **$2,148,057** | **$1,044,000** |
| | | | | | |
| **TOTAL ENVELOPE** | **$24,169,445** | **$24,820,511** | **$24,833,911** | **$25,036,331** | **$25,407,251** |
| **AVAILABLE** | **$0** | **$9,141,418** | **$18,253,841** | **$22,888,274** | **$24,363,251** |

*Table 1. Overall budget available as presented at Pre-Competition teleconference, Feb. 15, 2017.*

## IX. The 2017 Competition

On February 15 and 16, 2017, the Section held teleconferences in order to prepare for the competition. During these teleconferences, members were reminded of policies and procedures, and the competition budget was presented.

The competition was held in Ottawa over a period of five days, from Monday, February 27 to Friday, March 3, 2017. The first day started with a review of the logistics. The Evaluation Section then started Round 1, and proceeded with the review of the applications.

The format of the discussions followed NSERC's guidelines and SAPES internal procedures. For each application, the first internal reviewer presented all aspects of the proposal and made his/her recommendations (ratings, funding, duration). This was followed by additional comments and/or a presentation by the second internal reviewer, who also made recommendations. For grant applications requesting support in excess of an average of $500k per year, or for Category-3 RTI grant applications, a third presentation, concentrating on budget matters, was made. These in-depth assessments were carried out independently by the internal reviewers (who were not aware of the other's identity before the first reviewer's presentation), and took into account the reports received from external reviewers, as well as reports from *ad hoc* expert committees where applicable. Each application was then thoroughly discussed by all SAPES members. At the end of the discussion, each member was asked to rate the application against NSERC's selection criteria: (i) Excellence of the Researcher(s), (ii) Merit of the Proposal, (iii) Plan for and Record of training Highly Qualified Personnel (HQP), and (iv) Need for Funds. Guided by the results of the selection criteria, SAPES then determined whether to recommend funding the application, the level of support, and the duration. Any recommendation was determined through secret electronic voting. The median vote was selected as the final SAPES recommendation. Members in conflict with any particular application left the meeting room in advance of the identification of internal reviewers and discussion; those in conflict were not informed of the reviewer assignments or the result, even by the end of the competition.

The entire Evaluation Section reviewed experimental Individual and Project Subatomic Physics Discovery grant applications as well as any Category-2 and Category-3 SAP-RTI proposals. The entire Evaluation Section also reviewed Category-1 SAP-RTI proposals that were linked to large Project grant applications. Once these reviews were completed, SAPES members were divided into two Sub-Sections: the Theory and RTI-1/MRS Sub-Sections. The Theory Sub-Section reviewed all the theory Individual grant applications. The RTI-1/MRS Sub-Section reviewed the Category-1 SAP-RTI grant requests (up to $150k) and SAP-MRS grants requesting < $500k per year.

SAPES members were asked not to keep a cumulative total of the recommended awards, in order not to bias the review of applications discussed towards the end of the round, and to ensure that all applications were treated consistently and fairly.

Moreover, in order to ensure the integrity of the review process, applications could be flagged by any SAPES member, the Program Officer, or the Team Leader at any time, if he/she felt that some aspects of the discussion or the recommendation necessitated further deliberations. Flagged applications are re-discussed before the budget balancing discussion that concludes the deliberations of a given round.

The Round 1 deliberations concluded around lunch on Wednesday, March 1. The Team Leader made a presentation on the budget, taking into account the sum of the recommended awards for all the applications. The result was that a sum of $10.621M had been recommended from the envelope, to be compared to a total of $9.205M that was available to SAPES, and $15.925M in requested funds.

Prior to the start of Round 2, a thorough discussion took place to establish the guiding principles for the re-evaluation of all proposals in an attempt to balance the budget. The principles were applied to all proposals; all proposals were assessed on their merits, taking into account the Section's evaluations of the four criteria for each proposal, which had been recorded in Round 1. All proposals were reviewed and revised funding recommendations made (up or down), again using secret electronic vote. As in Round 1, any application could be flagged if a member or NSERC staff felt that some aspect of the revised recommendation necessitated further deliberations.

Round 2 was completed in two stages. The first was a review of all proposals and revised funding recommendation was made based on the merit indicators. The second stage was a re-visit of project applications to ensure consistency, with respect to the recommended level of support and the ratings according to merit indicators. The Round 2 deliberations concluded in the evening of Thursday, March 2. During the competition $52k in post-award adjustments was confirmed for the SAP envelope, bringing the available sum to $9.269M. The Team Leader presented the results: the revised recommendation by the Section was for $9.257M from the envelope, compared again with the available sum of $9.269M.

At that point, the SAPES members carefully reviewed the allocated funding for future years and the distribution of the recommended budget amongst the various categories of grant applications assessed within the envelope: research operating grants (Individual and Project SAP Discovery; SAP-MRS); Category 2 and 3 SAP-RTI grants; and Category-1 SAP-RTI grants.

With recommended total funding of $9.257M from the envelope, and a total request for $15.925M, the funding rate for this year's competition is 58%.

## X. End of Competition Results

The Section's final multiyear budget, broken down into equipment, theory, experimental operating, and MRS allocations is shown in Table 2, while Table 3 gives the percentage

share of the envelope in theory, equipment, and operations over the period from 2010 through 2017.

As forecast in the 2006 Long-Range Plan and confirmed in the 2011 Long-Range Plan, these figures provide quantitative measures of the increasing budget pressure that continues to build within the subatomic physics envelope. Year after year, the share of the envelope committed to the support of research operations is at a record high, with little room for small-scale capital investments that are critical for emerging research endeavours.

Small-scale capital investments by SAPES, mostly for proposals that fall outside the mandate of the CFI, are needed for R&D efforts that are crucial for the future of Canadian SAP, and to satisfy the capital needs of the smaller programs that are essential to the breadth of the community. Due to the long cradle-to-grave time scale of subatomic physics research programs, some overlap between current and next-generation discovery endeavours is unavoidable if Canada is to continue to play a leading scientific role in next-generation forefront research projects. At a time when Canadian researchers are actively and fruitfully exploiting the public investments made to date in leading endeavours, it would not be opportune to consider re-allocating a substantial part of the support to these efforts towards small-scale capital investments.

## XI. Recommendations to the DAS Program

This is the tenth year of the Discovery Accelerator Supplements (DAS) program. The present objective of this program is to provide substantial and timely additional resources to researchers who have a superior research program that is highly rated in terms of originality and innovation, and who show strong potential to become international leaders within their field. SAPES directly allocates one DAS award. During regular deliberations SAPES members may nominate Individual Discovery grant applicants for a DAS Supplement following the assessment of the merit criteria. Following the final round, once the competition budget is balanced, all the potential candidates are discussed in detail against the DAS selection criteria and objectives. The members rate each nomination according to how well it meets the objections of the program on a scale of 1 (very well) to 4 (No Support) through a secret vote, and the nominee(s) are selected by numerical tally of the Section's votes. This year, the Section quota for DAS nominees was one (1), as in recent years.

The DAS program is not aimed at Project grant applications. As indicated in the 2009 annual report, a procedure is available for any member of a Collaboration submitting a Project grant application to be considered by SAPES for the DAS program; however this option has not been exercised to date.

## XII. Policy Matters

At the end of the competition, the Evaluation Section and NSERC representatives came together for a session devoted to policy matters. B. Mario Pinto (President), Pierre Charest (Vice-President, Research Grants & Scholarships), and Elizabeth Boston (Director, Mathematical, Environmental and Physical Sciences) attended this session in whole or in part.

Topics discussed during the policy meeting included: update on unconscious bias and gender equity from NSERC; calibration of the SAPES; the format and quality of the Expert Review Reports; the week's deliberations; meeting logistics; the format of Large Project Day.

Expert Reviews:
SAPES recommended that NSERC staff or the Chair of the Expert Review Committee present the terms of reference in advance of Expert Reviews to ensure committees have a clear understanding of the budget pressure faced by the SAP envelope, as well as the level of detail required for the funding recommendation.
SAPES recommended that more detailed instructions, and possibly a template, be provided to large Project applicants when asking for reduced budget scenarios, in an effort to obtain a consistent level of detail from all applicants.

Application Material:
Again this year members discussed the need for clear information related to the time devoted to research. Members suggested that a table with all co-applicants and the number of hours devoted to the research proposed within the budget justification, and that this also be expressed as a percentage of their total time committee through all projects. This format would be very useful in assessing the FTE effort across all applications.

Large Project Day:
SAPES discussed the possibility of having *in camera* time with applicants at Large Project Day, in order to facilitate the frank discussion needed for an informed update from applicants.

| SUBATOMIC PHYSICS ENVELOPE<br>MULTI-YEAR COMMITMENTS BY CATEGORY<br>End of Round 2 | | | | | |
|---|---|---|---|---|---|
| | 2017 | 2018 | 2019 | 2020 | 2021 |
| RTI - COMMITTED | $35,000 | $0 | $0 | $0 | |
| RTI - 2017 Competition | $390,003 | $0 | $0 | $0 | $0 |
| **RTI - TOTAL** | **$425,003** | **$0** | **$0** | **$0** | **$0** |
| | | | | | |
| THEORY - COMMITTED | $2,784,300 | $2,223,100 | $1,567,100 | $656,000 | |
| THEORY - 2017 Competition | $636,000 | $590,000 | $600,000 | $480,000 | $480,000 |
| **THEORY - TOTAL** | **$3,420,300** | **$2,813,100** | **$2,167,100** | **$1,136,000** | **$480,000** |
| | | | | | |
| EXP OPS** - COMMITTED | $10,634,620 | $2,899,970 | $532,957 | $388,000 | |
| EXP OPS - 2017 Competition | $8,012,500 | $8,052,500 | $3,521,000 | $1,867,000 | $1,867,000 |
| **EXP OPS - TOTAL** | **$18,647,120** | **$10,952,470** | **$4,053,957** | **$2,255,000** | **$1,867,000** |
| | | | | | |
| MRS - COMMITTED | $2,161,000 | $1,457,000 | $48,000 | $0 | $0 |
| MRS - 2017 Competition | $219,000 | $216,000 | $217,500 | $0 | $0 |
| **MRS - TOTAL** | **$2,380,000** | **$1,673,000** | **$265,500** | **$0** | **$0** |
| | | | | | |
| **TOTAL - COMMITTED** | $15,614,920 | $6,580,070 | $2,148,057 | $1,044,000 | $0 |
| **TOTAL - 2017 Competition** | $9,257,503 | $8,858,500 | $4,338,500 | $2,347,000 | $2,347,000 |
| **GRAND TOTAL** | **$24,872,423** | **$15,438,570** | **$6,486,557** | **$3,391,000** | **$2,347,000** |
| | | | | | |
| **TOTAL ENVELOPE** | **$24,884,684** | **$24,833,911** | **$25,036,331** | **$25,407,251** | **$25,407,251** |
| **AVAILABLE** | **$12,261** | **$9,395,341** | **$18,549,774** | **$22,016,251** | **$23,060,251** |

*Table 2. Breakdown of multiyear commitments at the end of the 2017 competition.*

| Subatomic Physics Evaluation Section<br>Evolution of Envelope's Shares | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010 |
| **Theory** | 13.8% | 14.0% | 14.9% | 14.0% | 14.3% | 14.2% | 14.2% | 14.2% |
| **RTI** | 1.7% | 2.3% | 1.2% | 4.7% | 2.7% | 2.6% | 5.5% | 3.8% |
| **Total Research Ops** | 84.5% | 83.7% | 83.8% | 81.4% | 82.9% | 83.3% | 80.3% | 82.0% |
| **Exp. Ops** | **75.0%** | **74.2%** | 73.5% | 71.3% | 72.8% | 71.9% | 67.7% | 68.9% |
| **MRS** | **9.6%** | **9.4%** | 10.3% | 10.1% | 10.2% | 11.3% | 12.5% | 13.0% |

*Table 3. Envelope share in theory, experimental operations, and equipment, from 2010 to 2017.*

# Appendix 1

NSERC CRSNG

*Investing in people, discovery and innovation*
*Investir dans les gens, la découverte et l'innovation*

# SUBATOMIC PHYSICS EVALUATION SECTION - 2017 COMPETITION

## LARGE PROJECT DAY

**Sunday February 26, 2017**
**Constitutions Square**
**350 Albert Street, Ottawa, Ontario**
**Room 11-250**

| | | |
|---|---|---|
| 8:00 – 8:15 | ***Committee meets in camera*** | |
| 8:15 – 8:30 | Meeting with Perimeter Institute – *in camera* | *C. Burgess* |
| 8:30 – 8:50 | Meeting with SNOLAB – *in camera* | *N. Smith* |
| 8:50 – 9:15 | Meeting with TRIUMF – *in camera* | *R. Kruecken* |
| 9:15 – 9:30 | Meeting with CINP – *in camera* | *G. Huber* |
| 9:30 – 9:45 | Meeting with IPP – *in camera* | *M. Roney* |
| 9:45 –10:05 | Meeting with CFI – *in camera* | *M. Nasser-Eddine* |
| 10:05–10:25 | Canadian Particle Astrophysics Research Centre (CPARC) – *in camera* | *A. Noble* |
| 10:25–10:40 | ***Coffee Break*** | |
| 10:40 –11:10 | Fundamental Symmetry Tests with Trapped Antihydrogen: ALPHA at CERN/AD | *M. Fujiwara* |
| 11:10 –11:40 | IceCube data analysis and detector upgrade developments | *D. Grant* |
| 11:40 – 12:45 | ***Lunch*** | |
| 12:45 – 13:15 | Gamma-Ray Spectroscopy @ ISAC | *C. Svensson* |
| 13:15 – 13:45 | Canadian Participation in the T2K Long Baseline Neutrino Experiment | *H. Tanaka* |
| 13:45 – 14:15 | Upgrades to the ATLAS Detector at the LHC | *P. Krieger* |
| 14:15 – 14:45 | ***Coffee Break*** | |
| 14:45 –15:15 | SuperCDMS SNOLAB continued construction | *W. Rau* |
| 15:15 – 15:45 | SNO+ Data Taking, Analysis and Operations | *M. Chen* |
| 15:45 – 16:15 | The EXO search for Neutrino-less Double Beta Decay | *D. Sinclair* |
| 16:15 – 16:45 | DEAP-3600 Operation and Analysis | *M. Boulay* |
| 17:00 | ***Committee meets in camera*** | |

Canada

*Last updated: Jan 10, 2017*