July 22, 1996.

Dear Colleague:

We need your help. As you know, most of the Physics allocations from NSERC suffered in the 1994 grant re-allocation exercise, and the next round is scheduled for 1998. Based on a detailed proposal by CAP, NSERC has provided funds for a thorough independent review of physics research in Canada. The reports resulting from this review will provide input to the preparation of the various GSC submissions to the 1998 NSERC Re-allocation Committee. Each GSC has the right to prepare its own submission. It goes without saying that it is very important to prepare the best possible submissions.

The Main Committee charged with the task of undertaking a review of physics research in Canada has been divided into the following subcommittees:

1. Condensed Matter
2. General/Atmospheric/Space Physics and General Relativity
3. Subatomic Physics
4. Highly Qualified Personnel/Economic Aspects

This letter and questionnaire is addressed to researchers in the above three subfields of physics. The membership and chairs of each subcommittee are listed at the end of the questionnaire. Note that this division into subcommittees is only for purposes of undertaking a survey of physics as broadly defined, and it does not imply a similar grouping for purposes of preparing final submissions to the NSERC Re-allocation Committee. The intent is for each GSC to prepare its own final submission, using the results of this survey as input.

Please give some time and thought to the enclosed questionnaire. Your answers will form an important part of the review process, and all members of the research community are expected to reply. Although many of the questions are directed to NSERC grant holders, responses from other faculty, postdoctoral fellows and research associates are also encouraged. The questionnaire is divided into the following sections:

I. Personal Statistical Information
II. Personal Research Contributions
III Canadian Strengths and Weaknesses in Physics Research
IV. Selectivity and the Use of Available Funding
V. Vision for the Future
VI. Physics Students and Graduates
VII. Other Comments and Recommendations

Please answer all of Sections I and II, fill out the table on physics graduates in Section VI, and complete those parts of the rest as applicable for which you have comments to make. Use additional sheets of paper if there is not sufficient space on the form. Alternatively, replies can be entered directly into the LaTeX file for the questionnaire. It can be obtained by downloading it by anonymous ftp from cepheid.physics.utoronto.ca (see pub/physics), or http://cepheid.physics.utoronto.ca/Review.

INITIAL REPLIES ARE REQUESTED BY AUGUST 16, 1996. Current grant holders who do not reply by then will be contacted by a member of the Review Committee. For this reason, and for purposes of obtaining follow-up information, respondents are asked to identify themselves. However, replies will be held in confidence, and only reported in a way that does not reveal the identities of individuals to NSERC or others. Respondents who do not wish to have their name on the form may leave this part blank, and supply the requested contact information on a separate sheet of paper.

While NSERC is providing valuable logistical and financial assistance in conducting the review, it does not wish to influence the outcome, nor does it necessarily endorse it. Similarly, while CAP was directly involved in setting up the process and selecting the Canadian subcommittee members, it has no control of the process beyond that stage. Direct CAP participation will be limited to a subcommittee collecting data on the training of highly qualified personnel, chaired by Bev Robertson, the current President of CAP. Thus CAP also does not necessarily endorse the outcome of the research review process.

Finally, if you are not already a member of the Canadian Association of Physicists (CAP), then **please join** (phone 613-562-5614, fax 613-562-5615). It is becoming increasingly clear that research in physics, and in science generally, will only thrive in the present climate if we have strong and united representation at the political level. Paul Vincett, past president of CAP, has done a phenomenal job over the past year in lobbying the federal government on crucial funding issues, such as adequate funding to NSERC and the growing crisis in infrastructure support, but we need your backing as a member of CAP to strengthen these efforts.

Replies should be sent to the appropriate committee chair, as listed at the end of the questionnaire. Many thanks for your co-operation.

Yours sincerely,

Michael Thewalt,
Chair,
Condensed Matter Committee

Gordon W. F. Drake,
Chair,
General/Atmospheric/Space Physics and General Relativity Committee

Faqir Khanna and Pekka Sinervo
Chair and Vice Chair,
Subatomic Physics Committee.

P.S. This version of the covering letter is for purposes of general distribution only, and it does not replace the one sent directly by mail from NSERC to NSERC grantholders. If you received a direct mailing, please refer to it for additional information. The questionnaire is otherwise identical.

SURVEY OF PHYSICS AND SPACE SCIENCE RESEARCH IN CANADA

David P. Steele	Professional Research Associate / Adjunct Professor
Name	Position
I S A S / University of Saskatchewan	
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Saskatoon, SK S7N 5E2	306-966-6400
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I. PERSONAL STATISTICAL INFORMATION

1. Please identify yourself as one of the following:

   ☒ NSERC funded faculty ☐ non-NSERC funded faculty ☐ RA ☐ PDF
   ☐ other ____________

2. Please identify below ONE of the three major areas which best encompasses your research, together with as many subtopics within that group as are applicable.

   ☐ CONDENSED MATTER PHYSICS

   - ☐ materials science
   - ☐ surface science
   - ☐ biophysics
   - ☐ soft materials
   - ☐ pattern formation
   - ☐ magnetic properties
   - ☐ electronic properties
   - ☐ phase transitions
   - ☐ semiconductors
   - ☐ photonic materials
   - ☐ neutron scattering
   - ☐ x-ray and synchrotron
   - ☐ materials growth
   - ☐ materials modification
   - ☐ materials characterization
   - ☐ computational materials science
   - ☐ superconductivity (normal)
   - ☐ superconductivity (high T_c)
   - ☐ mesoscopic properties
   - ☐ highly correlated electron systems
   - ☐ other ____________

   ☒ GENERAL/ATMOSPHERIC/SPACE PHYSICS AND GENERAL RELATIVITY

   - ☐ spectroscopy, atomic and molecular
   - ☐ collisions, atomic and molecular
   - ☐ other atomic & molecular properties
   - ☐ optical physics
   - ☐ laser physics
   - ☐ plasma physics
   - ☐ controlled fusion
   - ☐ surface interactions
   - ☐ photonics
   - ☐ materials science
   - ☒ atmospheric physics
   - ☒ space science
   - ☐ astrophysics
   - ☐ general relativity
   - ☐ fundamental physics and QED
   - ☐ subatomic physics
   - ☐ other ____________

☐ SUBATOMIC PHYSICS

3. Is your research primarily experimental or theoretical?

   ☒ experimental ☐ theoretical

4. What is the current size of your NSERC research grant? $ 10000 /annum.

5. If you receive other forms of NSERC support (excluding equipment grants), please complete the following:

   (a) Type of grant ______
   (b) Project title ______
   (c) Principal investigator ______
   (d) Number of participants ______
   (e) Annual budget $ ______

6. Please list any other sources of research funding and the amounts.

   Canadian:

   source CSA CNSR Transition Program contract $ 65000 /annum

   source ______ $ ______ /annum

   Foreign:

   source ______ $ ______ /annum

   source ______ $ ______ /annum

7. Please provide information on the following statistical indicators of impact.

   (a) Number of refereed journal publications:

   Total 6 Last five years 3

   (b) Total number of citations for your top five papers for each of the last five years:

   1995 ______ 1994 ______ 1993 ______ 1992 ______ 1991 ______

   (note that the Citations Index is by first author only).

   (c) Number of invited conference papers in the last five years:
      i. Canadian conference 0
      ii. International conference 0

   (d) Number of review articles in the last five years 0

   (e) Honours and awards:

   none

   (f) Other forms of recognition:

   none

II. PERSONAL RESEARCH CONTRIBUTIONS

1. Briefly describe your research in nontechnical terms.

   I acquire and analyze optical images of polar-latitude upper atmospheric emissions from neutral and ionized species, to gain information on (a) waves and tides at the mesopause (87 km), and their seasonal and solar-cycle variation; (b) high-latitude auroral phenomena and their relation to the structure of the magnetospheric electric field; and (c) the dynamics of the polar electric field as revealed by the motions of F-region ionization patches. These are collaborative activities which also use data from other optical instruments as well as radiowave and magnetic sensors on the ground and satellite-borne sensors.

2. What opportunities do you see for the future development of your research?

   Recent observations have revealed an emission morphology, possibly of auroral origin, that has not been seen before. The nature of this emission has yet to be determined. If an auroral source is confirmed, it will add a new perspective on the linkage between the boundary regions of the magnetosphere and Earth's upper atmosphere/ionosphere. If the emission is not of auroral origin, it implies fairly rapid changes in the temperature and/or composition of the polar upper atmosphere, that have not previously been observed.

3. Why are these developments important to the advancement of the field?

   The major current challenge in space physics is the development of a working model of space weather. This requires an understanding of all the important modes of interaction between the solar wind and interplanetary magnetic field, on the one hand, and Earth's magnetosphere, ionosphere, and upper atmosphere, on the other. The discovery of an novel emission morphology implies the existence of a mode of interaction that is either entirely new or at least active in a previously unknown way. It is important to assess the significance of such a discovery.

4. Describe the impact that your work has had on, for example, (a) your particular field of specialization, (b) physics in general, (c) science in general, and/or (d) technological applications.

   Too new to assess.

5. Describe the anticipated impact that proposed future work could have on, for example, (a) your particular field of specialization, (b) physics in general, (c) science in general, and/or (d) technological applications.

   Described above.

6. Describe the impact that you foresee for your subfield on the development of physics in general and/or technological applications.

   The development of space weather prediction as an operational technology will significantly increase the reliability of all services delivered using space platforms, including communications, terrestrial weather prediction, and all forms of space-borne remote sensing.

7. Are you involved in collaborative projects? ☐ YES ☒ NO

   If you answered YES, please answer the following questions:

   (a) Describe the nature of university-based collaborations, including those with other disciplines.

   (b) Describe the nature of collaborations with industry etc.

   (c) Describe the nature of other collaborations (e.g. with NRC)

8. What additional initiatives and progress could you make if your NSERC operating grant were doubled? Include examples of opportunities lost due to underfunding.

   I could advertise for a graduate student to study the novel emission morphology described above.

9. What would be the adverse effects if your NSERC operating grant were halved? Consider here questions of urgency and priorities.

   I would have poor prospects, if any, for co-supervising a graduate student, as my ability to support the student and the research would be very limited.

10. What is the role and importance of university infrastructure (e.g. machine shops, technical support) to your research?

    My experiment requires electronics maintenance periodically, and the cost of contracting these services at commercial rates would be difficult to bear.

11. Do large central facilities such as synchrotrons play an important role in your research? If so, please outline

(a) the facilities used

N/A

(b) problems or difficulties

N/A

(c) desirable improvements or enhancements

N/A

12. Could your research benefit from large scale computing facilities? If so, please outline.

N/A

13. Are there other areas of research that you draw upon in your work? If so, please describe.

N/A

III. CANADIAN STRENGTHS AND WEAKNESSES IN PHYSICS RESEARCH

1. What do you believe are the current areas of strength in Canada for physics research, rated on an international scale? Please elaborate.

2. What do you believe are the current areas of weakness in Canada for physics research, rated on an international scale? Please elaborate.

3. Weaknesses might include important new or emerging areas. Should these be strengthened? If so, at the expense of what?

4. In view of the above, should there be particular areas of focus for Canada in the future, and if so, which?

5. What steps should be taken by NSERC or the research community to ensure that a defined area of focus does not unduly diminish research diversity and risk-taking?

6. Describe any anecdotal "success stories" you might know involving industrial or interdisciplinary applications of Canadian physics in either your own area of research, or in other areas.

IV. SELECTIVITY AND THE USE OF AVAILABLE FUNDING

In order to accomplish best the objectives for physics research in Canada within the available funding, the Grant Selection Committees (GSCs) must decide how selective to be in awarding grants. Should the most productive researchers be supported at an internationally competitive level? If so, at whose expense? Are there other special concerns to be taken into account?

1. With these considerations in mind, do you think that the Physics GSC's should be
   - ☐ more selective
   - ☐ about the same
   - ☐ less selective
   - ☐ other, see rationale below

   Outline the rationale for your recommendation.

2. Are there special considerations that should be taken into account regarding

   (a) regional and geographical distribution?

(b) support of researchers in smaller universities?

(c) risk-taking and diversity of research?

3. Do you believe in the concept of a minimum useful grant, and if so what level(s) would be appropriate?

4. Do you believe that there should be some maximum level(s) for the funding of an individual in the research grants program, and if so what should it(they) be?

5. Do you have any comments on the present situation regarding startup grants for new researchers? If you propose increased funding, where should it come from?

6. Do you have any comments on the NSERC equipment and major equipment funding programs?

7. Given the growing emphasis on research partnerships, particularly with industry, should those in less industrially developed parts of Canada be helped in their participation? If so, can you suggest mechanisms?

8. What strategies should NSERC adopt regarding:

(a) risk-taking (i.e. the support of speculative proposals with with limited chances of success, but large potential pay-offs)

(b) encouragement of spin-off activities and ventures

(c) better communication of research results to other disciplines and to the public

(d) greater participation of physicists in interdisciplinary research

9. How can the impact of Canadian physics research on other disciplines be enhanced?

10. Could the overall health of Canadian physics (or a particular subdiscipline) be enhanced by a major collaborative effort across physics boundaries and/or across other disciplines? If so, please elaborate.

V. VISION FOR THE FUTURE

The areas of research covered by the various Physics GSC's are diverse. Nevertheless, one of the strengths of physics lies in its search for the principles underlying diverse phenomena, and the unification of understanding. Physicists have a long history of recognizing the importance of new phenomena and developing new applications. Within this context, please consider the following questions:

1. What exciting themes do you see emerging (or already exist) in your own area of research, and its relationship to others?

2. What themes should be encouraged in the broader context of physics research in Canada? Are there particular areas of research that should be emphasized?

3. Do you see opportunities for new or continuing interdisciplinary research?

4. What should be the attitude of our community to the role of applied research?

VI. PHYSICS STUDENTS AND GRADUATES

1. How many students have graduated from your research group in the last five years?

   M.Sc. number N/A　　　Ph.D. number N/A

2. How many of these are currently employed as physicists, or in closely related disciplines?

   M.Sc. number in Canada _____　　　Ph.D. number in Canada _____

   M.Sc. number elsewhere _____　　　Ph.D. number elsewhere _____

3. Can you cite examples of graduate students carrying technological skills or innovations from their research into industry?

4. How might technological transfer by students from universities to industry be improved?

5. Do you feel that student training and/or employment prospects can be enhanced by direct contact with industrial research or collaboration with industry? Has this played any part in your research program?

6. Does physics research play a role in your undergraduate program (e.g. honours thesis projects), or do you hire undergraduate students as research assistants? If so, please elaborate.

7. Do you think that your involvement in research makes your teaching

   ☐ much better ☐ better ☐ the same ☐ worse ☐ much worse.

8. What do you perceive are the unique benefits that a student should obtain from a physics education (especially undergraduate)?

9. Please fill in the following table with the names of your M.Sc. or Ph.D. students who have graduated over the past six years (July 1990 to July 1996), and also postdoctoral fellows

(PDF) or research associates (RA) who left your group during this period. Include their current occupation, or indicate their position if currently a PDF, RA, or technician (T).

Name	Position or Degree	Year	Current Occupation or Position	Employer/Location

VII. OTHER COMMENTS OR RECOMMENDATIONS

Depending on the major area of research selected in Question I.2, please return to one of:

CONDENSED MATTER PHYSICS	Prof. Michael Thewalt Department of Physics Simon Fraser University Burnaby, BC V5A 1S6	e-mail: Fax: Tel:	Thewalt@sfu.ca (604) 291-3592 (604) 291-3384
GENERAL/ATMOS./ SPACE PHYSICS AND GENERAL RELATIVITY	Prof. Gordon Drake Department of Physics University of Windsor Windsor, ON N9B 3P4	e-mail: Fax: Tel:	A36@server.uwindsor.ca (519) 973-7075 (519) 253-4232 Ext. 2656.
SUBATOMIC PHYSICS	Prof. Pekka K. Sinervo Department of Physics University of Toronto Toronto, ON M5S 1A7	e-mail: Fax: Tel:	pekka@physics.utoronto.ca (416) 978-8221 (416) 978-5270

Main Committee

Bill Halperin (Northwestern Univ.) Chair Halperin@casbah.acns.nwu.edu.

Condensed Matter

Mike Thewalt (SFU)	Chair	Thewalt@sfu.ca
John Berlinsky (McMaster)	High T_c superconductors, theoretical aspects of electronic states/magnetism	Berlinsk@mcmail.CIS .mcmaster.ca
Martin Grant (McGill)	Soft condensed matter, statistical mechanics, polymers	Grant@physics.mcgill.ca
Thom Mason (U. of Toronto)	Neutron/synchrotron scattering, experimental aspects of magnetism, heavy fermion systems	Mason@physics.utoronto.ca
Sjoerd Roorda (U. Montreal)	Surface and applied physics, ions beams for CM research	Roorda@LPS.umontreal.ca
Jeff Young (UBC)	Semiconductors, heterostructures, nanostructures, mesoscopic systems	Young@physics.ubc.ca

General/Space/Atmospheric Physics/General Relativity

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Ted Llewellyn (U. Sask)	Atmospheric and Space	Llewellyn@skisas.usask.ca

SubAtomic Physics

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HQP / Economic Aspects (CAP Committee)

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John de la Mothe (U. Ottawa)	
George Beer (U. Victoria)	Beer@uvphs.uvic.ca