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MEMORANDUM

ATTENTION	Senate	**DATE**	February 12, 2014
FROM	Jon Driver, Vice-President, Academic and Provost, and Chair, SCUP	**PAGES**	1/1
RE:	Faculty of Science: External Review of the Department of Physics (SCUP 14-01)		

At its February 5, 2014 meeting, SCUP reviewed and approved the Action Plan for the Department of Physics that resulted from its External Review.

Motion:

That Senate approve the Action Plan for the Department of Physics that resulted from its External Review.

c: S. Watkins
C. Cupples

SCUP 14-01

SFU

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MEMORANDUM

ATTENTION	Jon Driver, Chair, SCUP	**DATE**	November 14, 2013
FROM	Gord Myers, Associate Vice President, Academic and Associate Provost	**PAGES**	1/1
RE:	Faculty of Science: External Review of the Department of Physics		

Attached are the External Review Report and the Action Plan for the Department of Physics.

Excerpt from the External Review Report:
"We were impressed by both the broad and substantial strengths of the department and by its potential for further development. The department has a well-earned reputation for its high standards and achievement in research, teaching and outreach."

Motion:

> **That SCUP approve and recommend to Senate the Action Plan for the Department of Physics that resulted from its external review.**

Following the site visit, the Report of the External Review Team* for the Department of Physics was submitted in March 2013. The Reviewers made a number of recommendations based on the Terms of Reference that were provided to them. Subsequently, a meeting was held with the Dean, Faculty of Science, the Chair of the Department of Physics and the Director, Academic Planning and Budgeting (VPA) to consider the recommendations. An Action Plan was prepared taking into consideration the discussion at the meeting and the External Review Report. The Action Plan has been endorsed by the Department and the Dean.

SCUP recommends to Senate that the Department of Physics be advised to pursue the Action Plan.

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*External Review Team:
- Andrew Rutenberg, Department of Physics and Atmospheric Science, Dalhousie University (Chair, Review Team)
- John Martin, Department of Physics, University of Toronto
- Amanda Petford-Long, Department of Materials Science and Engineering, Northwestern University
- David Muraki (internal), Simon Fraser University

Attachments:
1. External Review Report (March 2013)
2. Department of Physics Action Plan

cc Claire Cupples, Dean, Faculty of Science
Simon Watkins, Chair, Department of Physics

Report of the 2013 External Review of the Department of Physics of Simon Fraser University

March 29, 2013

Andrew Rutenberg, chair of external review committee
Dept of Physics and Atmospheric Science, Dalhousie University

John Martin
Dept of Physics, University of Toronto

Amanda Petford-Long
Centre for Nanoscale Materials, Argonne National Lab
Dept of Materials Science and Engineering, Northwestern University

Site visit: March 6-8, 2013
Internal/external: David Muraki, Dept of Mathematics

Sections:

Appendices:

1. Executive Summary

We were impressed by both the broad and substantial strengths of the department and by its potential for further development. The department has a well-earned reputation for its high standards and achievement in research, teaching and outreach. Here, we highlight key recommendations to sustain the excellence of the department.

- The individual and small group research in the department could be significantly enhanced by stronger participation within **larger research themes**. Such coherence would support new funding opportunities, student recruitment and engagement, and industrial collaboration.
- Physics does outstanding **outreach**. We would like to see all research themes of the department participating in a way that enhances student recruitment, student engagement, and public awareness of research activities.
- We encourage the department to pursue a strategic approach to future **hiring**. We found both a strong rationale for, and support within the department for, two approved research faculty hires: a CRC tier II chair in experimental materials synthesis, and a theoretical position in soft matter/biophysics.
- We are very concerned about the **long time to completion** at all of the undergraduate, Masters and PhD degree levels with respect to national norms. The department has started to address these issues positively, but further sustained efforts, with appropriate support of senior administration, will be needed to make further progress. Failure to make continued progress will hinder improvements in student recruiting, student training, and research productivity.
- Echoing the strong recommendation of the last review (see Appendix C) we feel that significant work is still needed to institute and sustain both **mentoring and ongoing strategic planning** involving all parts of the department (students, staff, and faculty). We recommend building upon the best practices of other departments at SFU.
- The **building** needs updating – it is at a stage where it is inhibiting research development, staff productivity, and student outcomes. Given that wholesale renewal may still be 10 years away, and since that renewal will be disruptive in itself, some targeted improvements should be made in the meantime. This will require the support of senior administration.

2. Response to Terms of Reference

In this section we briefly address the itemized terms of reference and refer to sections where more details can be found. The full terms of reference are found in Appendix A.

For the first group of items (a-d), we were asked to assess whether:

a) The quality of the unit's teaching programs is high, and there are measures in place to ensure their evaluation and revision. (see section 3) The quality of the course program is high. We recommend more consistent course content from year to year, particularly in lower division courses. We agree with the changes that are just being implemented in the course requirements for the graduate program. We are very concerned with long time to degree (LTD) at all levels. A curriculum review exercise should take place between external reviews.

b) The quality of faculty research is high and faculty collaboration and interaction provide a stimulating academic environment, and identify new or emerging areas that should be pursued. (see section 4) Faculty research is of outstanding quality across all sub-disciplines. While there are already numerous collaborations among faculty members, more can be achieved. We believe that more industrial collaboration will be necessary for continuing strong financial support of research.

c) The department members participate in the administration of the unit and take an active role in the dissemination of knowledge. (see section 7) There is room for improvement in the administration of the unit, in particular in bringing a more structured approach to operations and planning. The publication, conference and outreach efforts of the department are all impressive, but more of the department's current research activities could be highlighted in outreach activities.

d) The environment is conducive to the attainment of the objectives of the department. (see section 6.3) The age of the building and its inadequate space and physical services for current teaching and research are a serious concern.

We were also asked to consider the following points (1-5):

1) Comment on the department's capacity to increase enrollment of Majors and/or enhance their quality. (see section 3) The department has capacity to increase both numbers and quality. The current initiatives undertaken by the department are appropriate, especially as they engage undergraduates in their first year, but addressing LTD will be necessary to see significant progress.

2) Is it feasible for the department to maintain its current competencies in both theoretical and experimental physics? (see section 4) This is not only feasible, but absolutely necessary for a thriving physics department. We additionally note that a theory/experiment balance is needed in every broad research theme, not just in the department as a whole.

3) Given the research and teaching strengths of the department, how might it enhance its programs by inter-departmental collaborations? Currently there are research collaborations with MBB (Molecular Biology and Biochemistry), Chemistry, and Engineering. These appear to be friendly and productive. We would particularly encourage expanded collaborations that help secure industrial funding from, e.g., NSERC, CIHR, and MITACS (see section 6.4) or that help to enhance the "branding" of research in the department (see section 5). We did not meet with other departments, or have the time to undertake a curriculum review, so cannot offer detailed recommendations on teaching collaborations.

4) Suggest opportunities to improve the department's investment in experimental infrastructure in the current funding climate. This is a tough problem, especially given the woeful state of the building. Improved collaboration, branding, and industrial partners may lead to more external funding, but will have to be imaginatively approached to succeed with emerging funding models (see section 6). More effective use of 4DLABS by physics (see section 6.3) should also make more resources available, but may require the engagement of university administration to lower current barriers to entry.

5) Evaluate the quality of the graduate program from the perspective of student experience, enrollments, completion times/rates, and specialization areas in relation to learning outcomes and student placements. (see section 3) The overall student experience and eventual career opportunities will be enhanced if the long completion times, partly due to the heavy TA load, can be reduced significantly. More students could be attracted by better branding, including highlighting the high quality of departmental research (see section 5). Recent changes towards more effective supervisory committees are worthwhile.

We were also asked to consider many other aspects of the programs, faculty, administration, connections outside the department and future directions. These topics are mentioned, as appropriate, in the following sections together with our recommendations.

3. Teaching and Highly Qualified Personnel (HQP)

Undergraduates, graduate students, and postdocs pass through the department as individuals, but are essential parts of the departmental community that must be systemically cared for. Recruitment and nurturing of each of these groups has its own demands on departmental resources of time, money, and attention.

3.1 Undergraduates

The committee met with the undergraduate program committee chair, with technicians responsible for undergraduate lab upkeep, with senior lecturers responsible for a significant fraction of first year teaching, with co-op coordinators, with the acting undergraduate advisor, and with a group of seven undergraduate physics majors at varying stages of their degrees. A number of faculty also commented on undergraduate issues, and we benefitted from discussions with our "internal/external" member, and with our closing discussions with senior administrators.

The department has notable strengths, including a strong and committed group of lecturers and lab technicians, ongoing teaching innovation, broad faculty engagement with teaching at all levels, and an apparent level of satisfaction with curriculum, teaching assignments, lab and demo support, and TA resources. While we did not undertake an undergraduate curriculum review, or a detailed facilities review with a focus on departmental undergraduates, we did not identify any pressing issues in these aspects of the undergraduate part of the department. We also note that there is a significant component of service teaching in the lower division on the Surrey campus. Teaching at Surrey appears to be done well, with faculty as well as lecturer involvement. Indeed, significant innovations in teaching delivery, such as Studio Physics, have been started at Surrey and may make it back to Burnaby. This is positive, but may be limited by aging teaching infrastructure (space and labs) on the Burnaby campus.

The department has expressed concerns with, and made initial steps towards addressing, 1) issues of standardization in first year content delivery through the appointment of a full-time first year course coordinator, 2) enhancement of the number of physics majors recruited in the lower division and the number of those retained in the upper division, and 3) boosting the "quality" of recruited students. These last two goals are being addressed by the undergraduate program committee, but we feel that they need engagement throughout the department for significant progress to be made.

We did not dig deeply into issues of the service teaching of required courses to non-majors, of the survey teaching of non-required courses to non-majors, of high-school recruitment efforts, or of enhancing the number of lower division students at SFU who declare a physics major. These are each important to the mission of the department and should be a consistent priority. They need to be considered together with a detailed consideration of curriculum -- both within and outside the department. We recommend that the curriculum is regularly reviewed with the particular aim of enhancing the number of students who engage the courses that the department offers, and enhancing the quality of the experience particularly for non-majors. We were not aware of a recent curriculum review.

Elsewhere in this report we have described how existing outreach activities might be better leveraged to brand the department as a strong and unique destination for physics education and how expanded research themes may help to focus and enhance this message. We feel that these suggestions will gradually help to address quality and retention goals. On the basis of curriculum and research excellence alone, we do not see any reason why SFU physics couldn't be the preferred destination for elite undergraduates in the Vancouver area, as well as nationally, especially as contrasted with the relatively large and impersonal UBC undergraduate experience.

However, as a committee we were struck by an **unusually long time to degree (LTD)** by both national and international standards. It is clear that this is a pervasive, recognized, and accepted part of SFU culture, at both undergraduate and graduate levels. It was suggested that reasons for this long time to degree at the undergraduate level might include course load, course scheduling, and the demands of part-time work. We note that these pressures are shared by many undergraduate physics programs in Canada, most of which do not have LTD. In our meeting with undergraduates we explored the possibility that LTD may be a reason students chose SFU. Interestingly, none of that small sample chose SFU *for* LTD, and the lower division students still hoped for a shorter time to degree. The upper division students were more supportive of the flexibility LTD provided them, but had not reflected on the academic and career impacts of LTD. As a committee, **we do not feel that LTD is a selling point or a strength** --- and indeed we feel it will hobble promising departmental initiatives to raise quality and numbers of physics majors, which will in turn limit growth of graduate student quality, and of research productivity.

As a committee, we do not know what the optimal path towards a "normal" 4 year degree is for the department. We did not have time to deeply explore how to address LTD within the SFU or departmental context. We assume that the spectrum of reasons for LTD may vary from department to department. We do have some initial suggestions to be considered:

1) All scheduling barriers should be removed, i.e. all courses that are degree requirements should be offered every year.

2) Appropriate courses should be offered during (or eliminated from, if appropriate) the summer term, with a specific aim of reducing LTD.

3) Undergraduate courses with onerous workloads that preclude a 15 unit (5 course) load per term should be identified and addressed, perhaps by curriculum adjustments or teaching assignments.

4) Lower division content, especially first year content, should be standardized to provide a consistent foundation for upper division courses. Senior lecturers and faculty need to work together on this.

5) "Cohorts", or common groups of students who progress through their degree together should be encouraged. Reducing the number of different types of physics major may be one way of doing this. Scholarships may be another. A curriculum planning exercise will almost certainly be needed.

6) The different points of contact for undergraduates within the department should regularly meet and work together to develop and work towards achievable short-term goals to address LTD. Meetings at the end of every academic term may be appropriate and manageable. Addressing the issue fully and sustainably will eventually require buy in and participation at all levels within the department.

We strongly recommend that the senior administration support departmental initiatives to reduce LTD. This support could include outside consultants, facilitating key multi-department groups to informally problem solve, or undertaking focused reviews of undergraduate programs.

We strongly recommend that the physics department identifies and exploits current best practice within SFU to address LTD. We feel that this is in the best interests of both the students and the department as a whole. This is a long-term issue, and may require continued and sustainable innovation.

3.2 Graduates

The committee met with the Dean of Graduate Studies both individually and in the opening and closing meetings. We also met with the chair of the graduate program committee and separately with a group of approximately six graduate students from a variety of research groups and at a variety of stages along their degree. We also discussed issues hinging on graduate students at various times during our visit. We did not undertake a focused curriculum review, or a facilities review of the graduate program within the department. While we suspect that space issues, discussed elsewhere, already or will soon impinge on graduate studies within the department, we are not aware of any significant problems with the graduate curriculum.

The department has a goal of recruiting more CDN graduate students, both because of their strong experimental training and because of their eligibility for CDN fellowship support. We support this goal, and note that it will also likely enhance the undergraduate experience. The committee was impressed by the absence of differential fees for international students, and note that this has allowed the development of a strong recruiting pipeline of Iranian graduate students. We hope that this can continue.

The department is aware of LTD issues for MSc students and has just adjusted its graduate course requirements and offerings to more flexibly accommodate graduate students, including those who are not continuing on to a PhD. The Graduate Program Chair is also trying to introduce more structured progress reporting and a more regular and consistent series of supervisory committee meetings. We support these initiatives, but caution that they will only be sustainable with broad departmental support and commitment. We understand that the department has also discussed a qualifying exam for PhD students that would examine a thesis proposal and specific background knowledge needed for thesis work, but is divided about its benefits. We feel that while in principle regular and consistent committee meetings can serve some of the roles of a qualifying exam --- it cannot replace them all. In particular oral qualifying exams, tailored to the student, can provide regular feedback on the appropriateness and effectiveness of graduate course offerings; can allow an opportunity for disinterested colleagues to provide feedback on graduate student strengths; and can provide an early opportunity for some students to be removed from the program.

The committee feels that LTD is an issue for PhD students as well as MSc students, in comparison with national norms. While greater structure in the graduate program will help, the greater systemic issues appear to be heavy recurrent TA assignments that are able to provide significant portions of the funding for graduate students. Normal departmental TA assignments of 210 hours per term, considerably higher than physics departments at other universities, together with substantial course work, leave little time for research in the first year of either MSc or PhD. Some students have two such TAs per year for their entire graduate program. This would significantly impact research productivity, and contribute to LTD. We would anticipate that a plot of time-to-degree vs. total number of TA hours would show a strong correlation for graduating PhD students. While some TA roles are beneficial to every graduate student, beyond a certain limit and intensity the benefits dwindle. We note that LTD more broadly negatively impacts research productivity and timeliness, graduate recruitment, and the "vibe" of the department. **We do not see any benefits to LTD at either the MSc or PhD level.**

As with undergraduate LTD, there is probably no simple solution to graduate LTD. We recommend that the department moves to connect all graduate students with supervisors and with supervisory committees as soon as possible. The new graduate skills course should be effectively used towards limiting LTD as well.

The undergraduate tutorial tradition of the department places heavy demands on TA hours, and also provides an attractive financial resource to boost graduate student numbers --- increasingly attractive in the current national funding climate. To substantially address LTD at the graduate level will require alternative funding for graduate students, which is linked back to the goals of increased recruitment of fellowship eligible CDN graduate students, of obtaining CREATE grants, and of developing increasing industrial ties with commensurate funding streams. *Nevertheless, some immediate measures should be taken within the department to lessen the impact of standard TA assignments:*

1) Standardization of first year undergraduate course material, TA material and delivery, together with course-specific training, would decrease the burden of many TA assignments. This also holds for undergraduate courses beyond the first year.

2) Tracking of TA hours, and discussion about their impact on research productivity, should be a regular part of graduate supervisory committee meetings. Some modest and temporary departmental fellowships could be made available to reduce excessive loads when alternative funding is not available. The reduction of the normal departmental 210 hour TA should be seriously considered.

We strongly recommend that the department works to reduce LTD at both the MSc and PhD levels, with a goal of reaching Canadian norms.

3.3 Postdocs

The committee requested that a meeting with postdocs be added to our schedule. We met with 5 of approximately 10 departmental postdocs and research associates. We also discussed postdoc funding issues in various meetings with faculty. As a rule the research faculty in the department are eager to support postdoctoral researchers, as they can provide valuable critical mass and research productivity for smaller research groups. Significant funding barriers limit postdoc numbers in the Canadian system, but we were somewhat surprised at the modest number of postdocs within a physics department of this size and with such research excellence. This may point towards a recruiting issue, which at this level requires SFU physics to regain its reputation as a preferred destination for world-class postdoctoral talent. A greater proportion of postdocs who are aiming to transition towards North American faculty positions would enhance all aspects of the department, including graduate training and engagement.

In discussion with the departmental postdocs, it was not apparent that there was university support and guidance for career training (including practice with innovative teaching methods), health insurance, and housing. We recommend that a postdoctoral society be encouraged at SFU. Within the department, better social facilities (coffee space with windows, for example) would help foster postdoc camaraderie but may await general space refurbishment.

We did notice that several groups of faculty had pooled money to support shared postdocs --- particularly the cosmology group. We saw this as a very positive development; both attesting to the cohesion and collegiality of those groups, but also as a mechanism to bridge research interests, build common directions, and provide the flexible and stimulating environment that postdocs desire.

We recommend that the department encourage postdoc recruiting, pooling of resources to recruit postdocs, and perhaps provide modest departmental contributions towards pooled postdocs as needed.

4. Research

The research in the physics department is very strong, with excellent output from each of the groups. We met with members of following research directions: condensed matter theory, semiconductors and nanomaterials, cosmology, soft matter and biophysics theory and experiment, high energy physics theory, high energy physics experiment, and correlated electron materials. In all cases we were very impressed by the breadth of the research and by the high standing in which the research faculty are held within their disciplines. Overall we believe that the research involves good collaborations within the department, with other departments at SFU, and externally. However as a response to the changes in funding landscape, and to the need to enhance both branding and recruitment (see Section 5), we feel that greater coherence is needed.

We recommend that the department consider grouping its research activities under three over-arching themes: Materials Physics, Soft Matter and Biophysics, and Physics at Extreme Scales.

4.1 Materials Physics Theme

The Materials Physics theme could comprise faculty with research interests in the following areas: semiconductors, magnetism, nanomaterials and correlated electron materials. Traditionally, materials science and condensed matter physics at SFU have been highly regarded and we believe that this grouping would have good visibility. The 'group' spans both experiment and theory, and reflects active collaborations that already exist between faculty in this theme area. Several members of the research faculty with whom we spoke resonated with the idea of an SFU Materials Physics brand, which could even extend beyond the physics department.

We strongly endorse the planned new hire into the experimental crystal growth area at the CRC tier-II level. This position is intended to more strongly connect the semiconductor and the strongly correlated electronic groups, as well as to complement considerable current experimental expertise and capabilities in both thin film synthesis and materials characterization. Materials discovery efforts would be significantly enhanced by a new hire with expertise in crystal growth who could provide correlated electron materials samples.

One of the issues going forward will be how to maintain and enhance the strength of this theme in the light of a number of retirements that will occur in the next 10 years. We would encourage all of the faculty involved in materials physics to think collectively and strategically about how this could be addressed. A further issue of concern is operating and sustaining the substantial equipment investment that has been made in the group. This is not simply addressed, but draws together questions of industrial support, space and building issues, possible future hires, and local facilities such as 4DLABS. The solutions will emerge from the research excellence and broad collegiality of this group.

We strongly encourage the group to strengthen and extend current industrial connections, as an important avenue in the Canadian funding landscape. Senior administration also expressed uniform support for a more entrepreneurial approach to obtaining funding and to stronger interactions with industry. This administrative encouragement should present larger opportunities for Materials Physics, which traditionally has very strong industrial ties. We were pleased to see that several of the faculty in this group already have, or have had, interactions with industry. While several faculty expressed a preference for basic research, we note that industry is often just as interested in supporting "use-inspired" fundamental research as it is in supporting applied research. Departmental strengths, such as photovoltaics, spintronics and oxide-based electronics, are of significant industrial interest. While there can be significant difficulties in finding suitable industrial partners, we would encourage the group to be proactive and creative in this regard. For example, one faculty member is hoping to attract future industrial partners by simply opening access to equipment in his research labs. We encourage the department to provide support where appropriate.

We strongly recommend pursuing the current CRCII hire in crystal growth. We also recommend the development of a strategic plan for future hiring to replace retiring faculty – keeping a good balance between theory and experiment.

We recommend that the departmental increases interactions with industry. This might include partnering for equipment access and attracting industrial support for, e.g., NSERC Strategic Project and Network Grant proposals. Effective groupings within each theme should work together to pursue larger funding opportunities.

4.2 Soft Matter/Biophysics Theme

The physics department at SFU still has an international reputation in soft matter/statistical physics. The group has changed in the last ten years, with the retirements of a number of senior theorists (Boal, Plischke, and Wortis) and the shift towards a stronger focus on soft matter and biological physics. Most of the group are now experimentalists, with only one theorist who is also moving towards experiment. The group is collegial, coherent, and collaborative. Their profile is good, and they have been good at promoting themselves with an annual regional biophysics conference. Group members contribute to teaching at all levels of the undergraduate and graduate program, including lecturing at the Surrey campus. The biological physics undergraduate program has been recently introduced, including dedicated lab courses, and has managed the impressive achievement of attracting majors from the MBB and Biological Science departments.

In terms of facilities, the group is decently supported. Access to nearby labs in Biological Sciences, Chemistry, and MBB --- all within the same building --- provides additional facilities. There is little direct research collaboration with other groups in the department (some with Materials Physics, essentially none with Extreme Scales) and so the coherence of the group is important to maintain. The group is strong, and has already achieved international presence with HFSP awards and participation. No faculty currently hold CIHR funding, and we would encourage collaborations that would lead to, e.g., CHRP funding.

The last external review of the department in 2005 identified the need to hire an additional theorist in this area. Indeed, the group is underserved with theorists. (A physics standard of 33% theorists would indicate two full time theorists in this group.) We are encouraged that the administration has approved a theory hire in the near future. In discussion, the idea arose of directing a CRC tier I or tier II towards this hire. We did not discuss this possibility with the rest of the department or with senior administration. We do believe that a CRC chair at either level would be successful, and may represent a significant opportunity for SFU. Biological physics is competitive, since it is still growing as a field, but the department and group have a strong international profile in this area: we feel that they could successfully make a senior hire in this direction.

We strongly support the hire of a theorist in the area of soft-matter/biological physics/statistical physics, with the goal of contributing towards the critical mass of this group. We encourage the department to explore the possibility of a senior hire in this theory position, through a CRC chair.

4.3 Physics at Extreme Scales Theme

The challenges facing each of the HEP, Cosmology, and AMO groups stem from being relatively small, though excellent. Small size impacts recruitment of world-class graduate students and postdocs, and ultimately can limit funding. New faculty can help to build both critical mass and collaborative connections, and we discuss two potential hiring directions below. We also feel that a more coherent collective identity would make the most of existing strengths.

The disciplines of HEP and Cosmology are of fundamental importance in developing our understanding of the very small scale and very large scale structure of the universe, respectively. These extreme scales have become closely linked in the study of the physics of the early universe, dark matter, dark energy and the Higgs field. AMO includes fundamental studies of particle properties and research on systems at extremely low temperatures. We feel that AMO may be usefully included to give a unique SFU flavor to a larger theme of "Physics at Extreme Scales".

The department has a significant group in HEP and Cosmology, with three theorists and three experimentalists. All six have an impressive record of publication and of graduate student and postdoc training. Funding has been relatively good for the two theoretical cosmologists, but is likely to shrink due to increasing pressures on NSERC. They have already pooled postdoc money, which we encourage as a model to the rest of the department, and have discussed stronger links with cosmologists at UBC. Such regional links could lure more international postdoc talent to SFU. The three experimentalists collaborate closely on the ATLAS experiment at the CERN LHC, and are tightly integrated into the Canadian ATLAS group and the international ATLAS collaboration. They hold many management positions in ATLAS and are highly respected for their physics analysis contributions, and are well funded through the ATLAS-Canada project grant from NSERC. They have also brought massive computing resources to SFU and TRIUMF. The traditional linkage between cosmology and subatomic physics needs strengthening, since the one subatomic theorist has been devoting more of their time towards important outreach activity and less towards subatomic theory. This shift leaves essentially no theorists working with the HEP experimentalists and essentially no experimentalists working with the cosmologists. Both groups suggest that a theorist with strong phenomenological expertise, able to do calculations relevant to both cosmology and the new physics being searched for at the LHC, would address this gap. We agree.

The experimental AMO group is strong but small, though one of the larger Canadian groups. They are doing forefront work in ion trapping and quantum computing, magnetic resonance of gases, Bose-Einstein condensation, and the spectroscopy of anti-hydrogen. The group is somewhat held back by a full teaching load, which emphasizes the need for larger critical mass. Theoretical AMO work is being increasingly done by Malcolm Kennett, and other experimental links with the Materials Physics theme are strong. We feel that the AMO group should more strongly emphasize these departmental links, including a much stronger optics theme. While the AMO group does not currently have strong industrial links, we can see potential for strong support from, e.g., CREATE and even MITACS.

A recent possibility for faculty expansion has arisen in relation to the development of the world's most intense source of ultracold neutrons (UCN) by an international collaboration at TRIUMF. New experiments on the fundamental interactions and properties of the neutron, such as its electric dipole moment (nEDM), will be possible with unprecedented precision. A measurement of nEDM larger than predicted by the Standard Model of particle physics will be a clue to the matter-antimatter asymmetry of the universe. TRIUMF is proposing a joint UCN position with SFU to strengthen the project. We feel that there would be some synergy between this position and both of the AMO and HEP/Cosmology groups.

We support the TRIUMF/UCN position. We also support a theoretical particle phenomenologist to connect the HEP/cosmology groups. Both are positive directions to grow in. The department as a whole should assess their relative strategic priority, and how they relate to the strategic plan of the department, in consultation with senior administration.

The department should be as flexible as possible with teaching assignments in order not to limit research productivity, particularly in groups where significant international travel is an essential part of research. Breaking one-semester courses into shorter teaching units, particularly for first year courses, may be beneficial.

5. Outreach, Branding, and Recruitment

5.1 Outreach

We commend the department for the outstanding level of its outreach activities. While the focus is primarily local to the Vancouver area, outreach activities are among the best in Canada and would stand up well internationally. The department has an active outreach committee, comprised of one research faculty member, three senior lecturers and one technician. Outreach is currently aimed at school-age children, and incidentally at their parents. The intent is to expose children to science, and astronomy appears to be one very successful focus of outreach activities.

We encourage the department to consider how innovative outreach activities could be better exploited to increase both student recruitment and external awareness of research being done within the department. We would like to challenge the department to raise the level of its outreach activities in three ways:

1) Involve all research faculty, and have them include a sample of the research that they do in their outreach. The intent would be to highlight "living science", and show that it is reachable at SFU.

2) Expand the scope of outreach activities to a national or even international scale. This may simply imply a web or social media presence, or could piggy-back on normal seminar travel by department members. We would also like to see SFU-branded initiatives being joined by other departments nationally.

3) Involve more HQP in outreach (undergraduate and graduate students, together with postdocs), and provide certification of participation. This could then be used as a recruiting tool, to draw students to SFU who want to do science outreach during their degree.

5.2 Branding

The Physics department has a very strong research portfolio. However, we feel that external recognition is not yet commensurate with research strengths that have diversified significantly over the last decade. This external awareness is essential for recruiting at all levels, building collaborative partnerships with, e.g., industry, and maintaining strong university and government support.

We suggest that "branding" departmental research in three broad themes, as described in Section 4, would represent an achievable balance between a detailed picture and critical mass. We do not suggest that individual faculty change their research activities, but rather that research is presented within these themes for purposes of outreach and recruitment. Existing strong connections between subfields could then be better highlighted. Individual faculty could also be included in more than one theme: Materials Physics, Soft Matter/Biophysics, and Physics at Extreme Scales.

An important part of this rebranding activity is a compelling website, and we are pleased to see that the department has recently appointed a full-time IT staff member who could build a framework for the website. We note that while a website is a good start, compelling external presence will come from collaborations, collective funding, courses, and recruiting within the larger themes. The themes are suggestions to stimulate discussion; stronger themes may arise over the years as individual faculty research interests continue to evolve.

5.3 Recruitment

A general concern in the department is how to improve recruitment of excellent undergraduates, graduate students and postdocs. We have addressed this to some extent in Section 3. Here we would like to emphasize that critical mass, i.e., lots of like-minded colleagues, is especially important for the strongest students and postdocs. We believe that outreach and branding are important tools with which to emphasize this critical mass and excitement to prospective students and postdocs --- even before they consider SFU as a destination. Fortuitously, the impact of branding and outreach is likely to be highest within Canada --- which is where the department most wants to bolster recruitment. We caution that LTD will hamper recruitment, especially if it affects the strongest students. We also suggest that the unique flavor of SFU Physics should be highlighted: students will find not just research excellence, but small groups with personal mentoring by a professor, tied together within coherent themes with good collaboration between groups.

Social media (e.g. Twitter, Facebook, YouTube, but really the applications that current students actually use) should be exploited for recruitment. Undergraduate and graduate students should be involved in these campaigns. Outreach activities, seminars, social activities, and recent research results are natural ways of keeping content fresh. Recruitment will need to be separately tailored for recruiting high school students into physics, recruiting lower division undergraduates from other departments, and recruiting graduate students.

We recommend that the department increases the participation of faculty in outreach. The department should tailor outreach to enhance both student recruitment and public awareness of departmental research excellence.

We recommend that the department strongly rebrands their research themes, starting with the website.

We recommend that the department leverages outreach and branding to improve student recruitment, particularly nationally. Social media campaigns should be used. Undergraduate recruitment and retention should be a priority with, e.g., the undergraduate program committee and the outreach committee.

6. Resources

The department is a mid-sized physics department in the Canadian university context, highly active in research, teaching and outreach. As such it is a complex operation with 28 FTE faculty members, 4 senior Lecturers, a half-time undergraduate advisor and an administrative and technical support staff. The latter two categories have grown in recent years in response to an increase in the graduate program and research funding, and significant downloading of clerical and IT work from central management.

6.1 Faculty Resources

A lot of the resources that faculty manage are discussed elsewhere in this report. Here we touch on faculty as resources for teaching, service, and leadership within the departmental community. We were impressed by the general engagement, enthusiasm, and professionalism of the departmental faculty. They provide a tremendous resource, limited only by their time and attention. That said, in discussions with almost all of the departmental faculty, it is clear that faculty (and staff) are already fully engaged.

New initiatives, such as many of those suggested in this report, will need to be engaged carefully so that previous gains are not lost through inattention. These shifts themselves need to be carefully managed. For the department to navigate change effectively, more regular faculty engagement with students, with staff, with administration, and with each other is necessary. This cannot be left to a few committee chairs, however effective they are. We are not advocating simply more meetings. However, regular (semi-annual or more frequently), focused, effective, well-led meetings *are* necessary. Currently, various groups within the department provide service relatively autonomously. Examples include senior lecturers, office staff, technicians, TAs, and the co-op program. These will all benefit from regular faculty engagement, and, again, this should not simply be done by committee and departmental chairs. These issues are discussed more in Section 7.

The department seems to have a collegial and effective approach towards teaching assignments. Teaching loads appear reasonable and under control, helped by strong engagement of senior lecturers. Teaching buyouts due to heavy service loads or external chairs are common, but above-board. The undergraduate coordinator does all undergraduate and graduate teaching assignments, which struck us as sensible and which appears to be done effectively. Many of the graduate classes that received teaching credit have had low enrollment (below five students), which struck us as wasteful -- but a recent initiative aims to regularly survey graduate students and supervisors to better target non-core graduate classes. We heard no complaints of lack of TA support, though this may change if TA hours are reduced to reduce graduate LTD (see Section 3).

We suggest a renewed engagement with more formal service engagement internally – even at the expense of some of the current exemplary engagement of faculty at the national and international level.

6.2 Staff Resources

6.2.1 Technical Staff

There are 8 technical staff members, two of them half-time. They support the teaching labs at Burnaby and Surrey and help develop new experiments. They also support the research activities and the IT infrastructure and manage a machine shop used by faculty, postdocs and graduate students. They also help with outreach. The collegiality among themselves and with the other department members is strong. Nevertheless their working conditions are far from ideal with respect to office space, storage, and even electrical supply.

A great deal of new research instrumentation has been funded in recent years. The research technicians typically maintain equipment without service contracts, and do not have reliable access to technical documentation for the instruments they maintain. It is essential that they are involved with company technicians in setting up all new equipment. The technical staff report to the chair and appear to organize activity happily among themselves. However, it would seem helpful to have a technical services committee in the department with a few faculty and technical staff members to meet about twice a year to review the overall organization of activity and set goals and priorities for future work and new projects. We have not reviewed the details, but the request to replace a retiring technician in a half-time position with a new full-time technician appears to be justified. There is also a desire for a small CNC machine and 3D printer in the student workshop.

We recommend that a technical services committee be formed, and that it meet semi-annually with the chair. One of the topics it should explore is finding ways to provide ongoing professional development for technical staff.

6.2.2 Administrative Staff

The department has a manager, a chair's secretary, a graduate program secretary, an office assistant and a 1/3-time financial assistant funded directly by the Faculty of Science. This is a very lean administrative complement to run such an active department. Staff are engaged and positive, but are noticeably stretched.

There is little in the way of procedures/policies handbooks and training for new people, though the current chair's secretary and the financial assistant have taken the initiative to prepare and improve documentation. Anecdotally it seems that the workload and level of expertise needed in Physics is higher than elsewhere at the university at the same grade level.

Work efficiency is hindered by several factors. The financial software is not optimal; this limits the support available for financial planning of research funds. The physical working environment is poor, with clearly a lack of space in the main office. We heard of the need for both space heaters and sun umbrellas in the office, pointing to the poor state of the building. While staff are available to all members of the department, it is difficult to complete tasks that require a lot of focus. There are also issues of confidentiality with the large flow of traffic through the open office.

Several preliminary ideas came up in our discussions with the staff that address issues of staff turnover, staff training, and work environment. It would help to raise compensation and grade, and also to provide time for more training. More cross-training between the graduate secretary and the office assistant could improve efficiency and cover leave periods. Excessive traffic circulation through the open office and insufficient document storage need to be addressed. The library room space might be used for some office activities or storage, perhaps combining or switching the office and library spaces.

We encourage the department to look for suitable space for file storage so that archival material can be removed from the office, and files that are required frequently can be stored appropriately. We also suggest that changes are made to office access to give the office staff an environment in which tasks requiring a lot of focus can be carried out without constant interruption. A further benefit from limiting access to the departmental office is that it would protect confidentiality when office staff are working on their computers.

We recommend that the department conduct a review of the staff office and its procedures in order to improve its organization and operation, and to regularly reflect on possible improvements. We support the request for more than a 1/3-time financial assistant to take some burden off the manager.

6.3 Building Resources

The space available for research and teaching within the Physics department (Burnaby Campus) was a subject that arose in many of the conversations held with students, postdocs, faculty, staff and senior administrators during the External Review. Indeed, a recent Facility Condition Assessment found that the building had reached the end of its useful life. The quality of the space has deteriorated to a level where it poses significant challenges to the department. Ventilation is poor, heating and cooling are not everywhere adequate, and power usage in parts of the building is at, or above, capacity.

Further challenges relate to the changing usage patterns of the building over its lifetime, since the building is not amenable to easy reconfiguration. For example the teaching laboratory technicians do not have an office, but rather occupy space at the end of a hallway. Low ceiling heights are hampering experimental equipment setups. Insufficient storage space leads to equipment being stored in hallways, and to the departmental office being overrun with files. We note that there may be space concerns at the Surrey campus as well, which hamper delivery of innovative programs such as Studio Physics due to insufficient dedicated lab space.

It is clear that senior administration recognizes that there is a significant deferred maintenance issue, which will be addressed after Biology. This means that Physics is not likely to be renovated within the next 10 years, over which time conditions will continue to degrade. Safety concerns, such as ES&H signage, must be addressed before then. We encourage the university and the department to look for ways in which smaller projects could be undertaken in the shorter term to alleviate some of the more serious problems. We would encourage senior administration to provide greater transparency and departmental engagement with the prioritization, budgeting, and planning process of renovations, since many people expressed frustration with this. The renovations themselves will also be very disruptive, and planning to mitigate this disruption needs to be engaged as early as possible in the process.

On a positive note, we were impressed by the 4DLABS facility and the space that it occupies. We were given a tour of the NanoImaging facility and of the cleanroom facility by the Facility Manager, and discussion of 4DLABS arose in many of the meetings that we held with research faculty. 4DLABS is an outstanding resource for the university and should be a flagship facility that attracts high quality internal and external users, including a large number of researchers from the physics department. The NanoImaging capabilities are of a high standard and are well utilized. The cleanroom capabilities are likewise of a very high standard, but appear to be underutilized, especially by internal faculty and their research groups. This underutilization appears to be a result of high access fees that are not commensurate with the size of single-investigator Discovery grants that fund a large proportion of the research in the physics department. We fully recognize that the operating costs of a NanoImaging facility and of a cleanroom facility are very high, but this barrier to usage by faculty is unfortunate. We believe this leads to significant lost benefits to the faculty, and ultimately to the department and the university. These benefits include research, training, sustainability of 4DLABS in the university context, and more interactions between faculty and industrial users of 4DLABS.

The quality of space in 4DLABS is in marked contrast with that currently available in the physics department. We note that the power and space requirements of the upcoming CRC tier II hire in experimental materials discovery are unlikely to be met within the main physics building. With regard to laboratory space, in particular for the new experimental hire, we would encourage the department to work with senior administration to secure laboratory space in the 4DLABS area.

We recommend that the department work with senior administration to secure single-investigator laboratory space in 4DLABS for the forthcoming CRCII hire in materials synthesis. They should also explore mechanisms by which barriers for access to 4DLABS facilities could be lowered for physics faculty.

The department should consider ways in which small renovation projects could be funded to improve some of the building issues in the physics department, specifically with respect to the departmental office.

6.4 Emerging Funding Opportunities

Departmental faculty are well aware of the shifting funding landscape in Canada. NSERC operating grants are increasingly insufficient on their own to fund a thriving research group, and risky to depend solely upon. At the same time, most faculty are well aware of, and well positioned for, industrial funding in various forms. Industrial ties are strong, and many groups have industrial links or industrially-relevant research. The department has a well-supported, though somewhat undersubscribed, co-op program for undergraduates. Departmental members are actively planning NSERC CREATE applications, and were heartened by the recent success of CREATE at SFU. 4DLABS has strong industrial ties. The SFU IP policy (faculty own their own IP, and retain the larger fraction even with SFU support) encourages collaboration.

However, departmental industrial funding has not been as strong as might be expected. In discussions with faculty about industrial funding two themes emerged. The first is that finding local, or even Canadian, partners with relevant technologies and available matching funds can be challenging. The second is that nurturing industrial links takes time, and will be pursued more aggressively as other funding sources dry up. We believe that the stronger branding discussed in Section 5 will speed this process, and stronger themed research cooperation between faculty may reduce the opportunity cost of nurturing industrial links now --- so that they are stronger when they are needed.

We recommend that the administration leverage current strong industrial ties inherent in, e.g. co-op or 4DLABS, to both match-make and educate faculty about industrial research opportunities and partners. This should not be heavy handed, and could include a sponsored seminar series with a theme of CDN physicists and materials researchers who have thriving industrial connections.

6.5 Library

We met with two of the university library staff, including the physics liaison librarian. We would like to commend the library on its forward-looking approach to electronic resources that support the research and teaching efforts of the university, including the physics department. Comments from research faculty indicated that the library has a very good coverage of physics journals and a large number of e-books in its collection. The library is to be commended for its positive approach to open access journal publishing, where they are able to pay the fees for open access publication as needed. This increases the international recognition of SFU research.

7. Management/mentoring/strategic planning

7.1 Management/Leadership

Traditionally, the department was more coherent around one research direction: condensed matter physics. Accordingly, the department was able to function effectively without a high degree of structure. We observed strong collegial interactions between faculty, however these do not replace the need for more structure within the department. This is particularly true as the department has increased the range of its research activities, as budget constraints have increased, and as the teaching in the department has become more diverse. While staff, technicians, and lecturers provide key support of these increased departmental activities, they too need regular input into departmental planning.

The role of the departmental chair is two-fold, involving both leadership and management, and is critical to the continued success of the physics department. In a leadership capacity the chair is responsible for developing a vision for the department that faculty support and that supports increased external funding, outstanding research, and strong recruiting at all levels. Effective management of the department includes both transparent operations and procedures that structure the department and encourage both consistency and proactive action. The importance of this position should not be underestimated, but we caution that the effectiveness of the chair is reduced by limited teaching relief, a short term of appointment, and shallow levels of departmental governance.

While we recognize that increased committee participation may not be popular with all department members, we believe that it will result in a more effective unit that can respond quickly and effectively to challenges and to opportunities. We would strongly encourage the department to institute more regular faculty meetings, at which day-to-day issues in the department as well as strategic planning can be discussed, and to introduce regular meetings with staff. On the teaching side we would strongly recommend a regular meeting between the senior lecturers, and between the teaching staff and the program committees. Similarly we believe that a more structured approach to faculty-student interactions would be beneficial.

Our external review team met with some committee chairs, but with no committees. This reinforces our perception that the committee culture of the department is too weak, which can threaten both sustainability and effectiveness of initiatives that individuals and individual chairs undertake. We believe that two committees are particularly important:

1) Strategic Planning committee, chaired by the departmental chair, with membership including a few senior members of the faculty appointed by the chair. This committee would identify and propose solutions to issues needing strategic engagement, including the obvious matter of faculty hiring. Proposals would be presented at all-faculty meetings for discussion and decision.

2) Staff integration committee, chaired by the departmental chair, with membership including the graduate and undergraduate coordinators, the departmental manager and representatives from the technical and office staff, senior lecturers and TAs. The purpose of this committee would be to ensure smooth operation of the department by enabling more formal communication and discussion among all stakeholders in the department.

We strongly recommend a more structured and engaged approach to departmental management. This will need to be led by the chair initially, but should become pervasive.

We recommend that the departmental chair be given further reductions in teaching load, but that the standard term be increased to 5 years.

7.2 Mentoring/Training

The department as a whole could greatly benefit from formal mentoring programs at all levels, as was recommended by the previous external review committee. We believe that this would allow the departmental chair to function more effectively. We recognize that formal mentoring programs are not always popular, but they could instituted gradually. The important point is that mentoring and training be done sustainably, and systematically improved with time. We encourage the department to learn from the best practice of other departments within SFU in this regard.

For faculty the mentoring program could include discussions of how to tap novel sources of research funding, effective supervision of graduate students and postdocs, responsibilities to undergraduates and graduate students, and responsibilities regarding appropriate interactions with departmental staff. For staff this could traditional professional development, but also job expectations within the physics department and access to handbooks for the various office positions that would enable cross-training. For postdocs this may be managed at the university level, but could include assisting with issues such as housing and health insurance, and career counseling.

For graduate and undergraduate students we would like to see a more structured approach towards assessment and guidance, with required meetings between faculty and students on a regular basis in which guidance on course selection, research progress, and career development could be provided. The department is already moving in this direction with graduate supervision, which we approve. Training for TAs should also be standardized, which will require consistency of course offerings.

We recommend the institution of formal mentoring/training programs at all levels within the department, for all members of the department.

7.3 Strategic Planning

We greatly appreciated the detail provided in the recent five-year planning exercise by the department, and in its self-study document. However strategic planning could be significantly improved. This was already highlighted in the report of the previous external review, and we are not sure if significant progress has been made. Reduced resources in terms of space, funding and research faculty retirements are potential risks to the international excellence of the department's research portfolio and a strong strategic plan would help the department to address these issues going forward. Strategic planning of the teaching activities is also advisable to support the efforts that the department is making to reduce time to degree completion and we would encourage the department to involve the senior lecturers in any decisions regarding teaching.

We suggest that the department formulate strategic plans for research and teaching that involve all faculty, in consultation with lecturers, staff and students, and that they be revisited annually.

8. Concluding Thoughts

Our review was largely determined by what members of the department brought forward in their meetings with us, and through the self-study document. We thank them for their enthusiasm, thoughtfulness, and openness. We are advocating significant changes. As an analogy, we advocate moving from a machine or production model (of papers, or of students) towards a community model (of engaged mutually-supporting excellence at all levels) at the departmental level. The department has many significant strengths, but also a number of vulnerabilities inherent with being in a smaller university without a guaranteed recruiting or financial pipeline, operating within a shifting and more-centralized national funding model. On the basis of the professional strengths and engagement of essentially everyone we met during our visit, we are confident that the department will be able to smoothly implement and sustain our suggestions. If not, we trust that they will have found even better solutions.

Appendix A (terms of reference)

Department of Physics
Simon Fraser University
External Review Committee 2012/2013 - Terms of Reference

The purpose of the external review process is to assess whether:

a) The quality of the unit's teaching programs is high and there are measures in place to ensure their evaluation and revision.

b) The quality of faculty research is high and faculty collaboration and interaction provides a stimulating academic environment and to identify new or emerging areas that should be pursued.

c) The Department members participate in the administration of the unit and take an active role in the dissemination of knowledge.

d) The environment is conducive to the attainment of the objectives of the Department.

The Review Committee will assess the Department and comment on its strengths and weaknesses, on opportunities for change and/or improvement, and on quality and effectiveness. The Review Committee should make essential, formal prioritized recommendations that address its major concerns, with reference to the resources available to the Department and the objectives described in its three-year plans.

Issues of particular interest to the University and/or the Department that we would like the review team to consider during the review are:

1) **Comment on the Department's capacity to increase enrollment of Majors and/or enhance their quality.**

2) **Is it feasible for the Department to maintain its current competencies in both theoretical and experimental physics?**

3) **Given the research and teaching strengths of the Department, how might it enhance its programs by inter-departmental collaborations?**

4) **Suggest opportunities to improve the Department's investment in experimental infrastructure in the current funding climate.**

5) **Evaluate the quality of the graduate program from the perspective of student experience, enrollments, completion times/rates, and specialization areas in relation to learning outcomes and student placements.**

The review team should also consider:

1. **Programs**
   - structure, breadth, orientation and integration of the undergraduate programs including the cooperative education program
   - structure, breadth, depth and course offering schedule of the graduate programs
   - graduate student progress and completion, and support for graduate students

- enrolment management issues at the undergraduate and graduate levels including, for the former, majors and service teaching

2. **Faculty**
   - size and quality of the faculty complement in relation to the Department's responsibilities and workload
   - teaching, research and service contributions of faculty members, including the level of external research support

3. **Administration**
   - size of the administrative and support staff complement, and the effectiveness of the administration of the Department
   - adequacy of resources and facilities provided to support teaching and research, including library, laboratory, equipment, computing, and office space

4. **Connection of the faculty within and outside the University**
   - the Department's concept and plan for teaching and research and relationship with the other units within the University
   - relationship between the Department and the community
   - relationship with alumni

5. **Future Directions**
   - the plans of the Department are appropriate and manageable.

SIMON FRASER UNIVERSITY
DEPARTMENT OF PHYSICS
ITINERARY FOR EXTERNAL REVIEW SITE VISIT
MARCH 6 – MARCH 8, 2013

Reviewers:	Dr. Andrew Rutenberg, Dalhousie University (Chair of Review Team) Dr. Amanda Petford-Long, Northwestern University Dr. John Martin, University of Toronto Internal – Dr. David Muraki, Simon Fraser University

Wednesday, March 6, 2013

7:15	8:00	Car Service (Pacific Harmony) from Delta Vancouver Suites to SFU Burnaby Campus – Drop off at E Parking Lot by Transit Bus Loop and Blusson Hall	Strand Hall
8:00	9:00	Opening meeting with Senior Administrators: Dr. Gordon Myers, Associate VP Academic (Chair) Dr. Glynn Nicholls, Director Academic Planning Dr. Norbert Haunerland, Associate VP Research Dr. Wade Parkhouse, Dean, Graduate Studies Dr. Claire Cupples, Dean, Faculty of Science	Strand Hall, PCR Room 3187 Continental breakfast served
9:00	9:15	En route to Department - Simon Watkins or designate	
9:15	10:15	Simon Watkins, Chair, Department of Physics	P8468
10:15	10:45	Tour of Physics department (Simon Watkins)	
10:45	11:15	Steve Dodge, Chair, Graduate Program Committee	P8445.1 Coffee served
11:15	11:45	Dugan O'Neil, Chair, Undergraduate Program Committee	P8445.1
11:45	12:15	Meeting with Administrative Staff (Rose Evans, Shawn Li)	P8445.1
12:15	1:45	Lunch break (with faculty)	Club Ilia
1:45	2:15	Malcolm Kennett, George Kirczenow – CM Theory	P8445.1
2:15	2:45	Howard Trottier – Particle Physics Theory and Outreach	P8445.1
2:45	3:15	Patty Gallilee, AUL Collections and Jenna Thomson, Physics Liaison Librarian - SFU Library	P8445.1
3:15	3:45	Erol Girt – Magnetism & nanomaterials	P8445.1
3:45	4:30	Simon Watkins, Karen Kavanagh, Mike Thewalt, Pat Mooney – Semiconductors & nanomaterials	P8445.1
4:45		Return to hotel by car service (Pacific Harmony) – Pick up at B Parking Lot by Applied Sciences	

SIMON FRASER UNIVERSITY
DEPARTMENT OF PHYSICS
ITINERARY FOR EXTERNAL REVIEW SITE VISIT
MARCH 6 – MARCH 8, 2013

Thursday, March 7, 2013

8:15	9:00	Car service (Pacific Harmony) from Delta Vancouver Suites to SFU Burnaby Campus – B Parking Lot by Applied Sciences	
9:00	9:45	Wade Parkhouse, Dean, Graduate Studies	Physics – P8445.1
9:45	10:45	Claire Cupples, Dean, Faculty of Science	Physics – P8445.1
10:45	11:00	Break (tour of 4DLABS)	
11:00	11:30	Levon Pogosian and Andrei Frolov – Cosmology	P8445.1
11:30	12:15	Nancy Forde, Barbara Frisken, Jenifer Thewalt, John Bechhoefer and Eldon Emberly– Soft Matter Theory/Exp	P8445.1
12:15	1:45	Lunch with Outreach Committee – Neil Alberding, Chair and Michael Chen, Sarah Johnson, Howard Trottier, Jeff Rudd	Diamond Alumni Centre
1:45	2:15	Mike Hayden, Jeff McGuirk, Paul Haljan – AMO	P8445.1
2:15	2:45	Meeting with Technicians (Jeff Rudd, Ken Myrtle, Bryan Gormann, Dave Lee, Laura Schmidt, James Lang, Andrew Kurn)	P8445.1
2:45	3:15	Meeting with Post-Docs and Research Associates (Wendell Huttema, Alireza Safferzadeh, Rasoul Narimani, Andrew Wieczorek, Senthil Eswaran)	P8445.1 Coffee served
3:15	3:45	Meeting with Senior Lecturers (Neil Alberding, Andrew DeBenedictis, Michael Chen and Sarah Johnson)	P8445.1
3:30	4:00	Transit to reception at Saywell Atrium	
4:00	5:30	Reception from 4:00 pm to 5:30 pm	Saywell Atrium
5:45		Return to hotel by car service (Pacific Harmony) – Pick up at E Parking Lot by Transit Bus Loop & Blusson Hall	

SIMON FRASER UNIVERSITY
DEPARTMENT OF PHYSICS
ITINERARY FOR EXTERNAL REVIEW SITE VISIT
MARCH 6 – MARCH 8, 2013

Friday, March 8, 2013

8:15	9:00	Car service (Pacific Harmony) from Delta Vancouver Suites to SFU Burnaby Campus – B Parking Lot by Applied Sciences	
9:00	9:45	Norbert Haunerland, Associate VP, Research	Physics – P8445.1
9:45	10:15	Meeting with Gwen Litchfield, Joan Lagman (Science Co-op), Cameron Forde (Acting Undergraduate Advisor – Physics)	P8445.1
10:15	10:30	Break	
10:30	11:15	Mike Vetterli, Dugan O'Neil, Bernd Stelzer – HEP Exp	P8445.1
11:15	11:45	Meeting with Manager, Administrative Services (Jen Chang) and Academic Advisor (Simin Bagheri)	P8445.1
12:00	1:30	Lunch with Emeritus Faculty (David Huntley, Michael Plischke, K.S. Viswanathan, Michael Wortis)	Diamond Alumni Centre
1:30	2:00	Dave Broun, Steve Dodge, Jeff Sonier - Correlated Electron Materials Exp	P8445.1
2:00	2:30	Meeting with Graduate Students (Grad Rep: Natalie Murphy)	P8445.1
2:30	3:00	Meeting with Undergraduate Students (UG Rep, Jeff Bale)	P8445.1
3:00	3:30	Simon Watkins (informal site visit review)	P8468 Coffee served
3:30	4:00	External Review Team – Discussion Time	Strand Hall, PCR, Rm 3187
4:00	5:00	<u>Closing meeting with Senior Administrators</u>: Dr. Gordon Myers, Associate VP Academic (Chair) Dr. Jon Driver, VP Academic Dr. Glynn Nicholls, Director, Academic Planning Dr. Norbert Haunerland, Associate VP Research Dr. Claire Cupples, Dean, Faculty of Science	Strand Hall, PCR Rm 3187
5:00		Return to hotel by car service (Pacific Harmony) Pick up at E Parking Lot by Transit Bus Loop & Blusson Hall	

Executive Summary

The SFU Physics Department has long enjoyed a reputation in North America as a research-oriented department with the strongest soft condensed matter group in Canada and one of Canada's top few groups in condensed matter physics overall. Although some strength has been lost through retirements and, in particular, the international impact of the soft condensed matter/biophysics effort has slipped somewhat, the overall research potential of the Department remains as high as ever through excellent new hires. The research of the Department has broadened over the past decade; it has maintained considerable strength in both soft condensed matter/biophysics and in semiconductor physics, and now includes small groups in particle physics and in atomic physics. Particle physics is an important area for breadth, particularly in the training of theoretical students, and atomic physics has recently undergone a renaissance and is an attractive area to students. In addition to their strength in research, the Department also stands out as a leader in North America in recruiting and retaining excellent women faculty in Physics. The Department deserves to be strongly commended for this initiative which can only result from much effort and attention. The Department also stands out for their friendly and collegial environment which was evident to us and was commented on by numerous faculty, staff and students. This combination of research strength, diversity and collegial environment gives the Department a strong base to further build on.

The Departmental self-study states that almost all of their effort has been focused on hiring in recent years and this is clear both from the very positive outcomes of their hiring and from the weaknesses that are apparent in other areas. Departmental hiring appears to have been largely driven by opportunities and this worked well because there were many opportunities through retirements and growth, and all the research groups benefited from this. However, now that the pace of renewal is slowing and there are more distinct groups, the Department is finding it more difficult to function as smoothly in this opportunistic mode. Although all groups described the environment as friendly and collegial, some individuals expressed concerns that significant rifts could form in the future due to hiring issues and that there was a reluctance to openly discuss contentious issues.

The solution to both these problems – possible discord in hiring and other areas suffering from neglect – is for the Department to pull together and forge a plan and vision for their future. It became clear to us during the interviews that the 5 year plan offered in the Department's submission is not the result of in-depth discussion and planning by the Department. Although we offer some suggestions as to future appointments in the research sections below, we feel strongly that the Department will benefit the most from developing their own plan. We see the lack of a planning process to focus the Department as its greatest shortcoming. Since such a process and its implementation takes significant time, energy and creativity, it will only work if the Department actively chooses to make this commitment. As we see it, the Department can either continue on as it has or it can choose to become more activist and invest in in-depth planning. If it continues on its current course, it will still do quite well; however, if it put in the effort to adopt a more activist planning process, it has the potential to do significantly better and to become an even stronger department.

Another area of concern to us is the Physics undergraduate program. The Department views the undergraduate program as healthy overall because the service teaching load of the Department has increased along with the increase in Science students. However, the number of Physics majors and, in particular, honours students is very small. Although this is not atypical across North America, some Physics Departments have shown that it is possible to increase these numbers with more innovative approaches and we offer several suggestions to the Department in this report.

The graduate program is reasonably healthy, although the overall size is about 25% below what one might expect for such a research-intensive department and the number of students holding external scholarships is also lower than expected. In addition, there is currently a lack of supervisors for students interested in theoretical physics, which should be taken into account when the Department sets its hiring priorities. The difficulty of recruiting excellent graduate students is not surprising, given the generally small size of undergraduate honours Physics programs in North America. Hence, this problem is not completely decoupled from problems in the undergraduate program. More generally, a departmental vision and plan will also help in graduate recruitment, not only for the specific ideas it will generate, but because a well-focused department is also more attractive to students.

Our most important recommendations to the Department are:

Start an in-depth planning exercise which covers all of the Department's major activities and concerns.

Invest more effort and resources in recruiting honours Physics students into the undergraduate program. Suggestions include recruiting from first year Physics classes, developing more flexible physics streams which combine with many other subjects, and developing a direct-entry Physics stream.

In the next section, we list our recommendations, which are then discussed in detail in the following sections.

EXTERNAL REVIEW – ACTION PLAN

Section 1 – To be completed by the Responsible Unit Person e.g. Chair or Director			
Unit under review Physics	**Date of Review Site visit** March 6-8, 2013	**Responsible Unit person,** Simon Watkins	**Faculty Dean** Claire Cupples ....

Note: *It is* ***not*** *expected that every recommendation made by the Review Team be covered by this Action Plan. The major thrusts of the Report should be identified and some consolidation of the recommendations may be possible while other recommendations of lesser importance may be excluded.*
Should an additional response be warranted, it should be attached as a separate document.

1. PROGRAMMING

1.1 Action/s (description what is going to be done):

1.1.1 Undergraduate programming:

- **Improve undergraduate degree completion times:** Below are some proposed action items:
  - **Closely examine the course schedules** to facilitate taking the correct courses in the correct sequence to graduate in 4 years. If there is a problem with getting all the courses they need, we can relax some of the course constraints on the various degree programs. Action item for UG curriculum committee and UG advisor.
  - **Financial incentive to take more courses.** We will urge the administration to provide financial incentives for students to take large course loads. The university can offer 5 courses for the price of 4 or a similar variant to encourage taking a full load. This would require upper administration initiative. Action item for the chair.
  - **Require all students to meet with a program advisor:** Once per year students will meet with a program advisor and show what courses they are taking, etc. They will have a form signed by their advisor or cannot register for next term/year. Action item for UG curriculum committee.
  - **Implement a cohort program (reduce completion times for select students):** We are currently planning an honours cohort proposal through the INSPIRE initiative for very good students. They would be required to take a certain number of courses per year. Co-op terms would only be offered in the summer. If you fail a course, you leave the cohort. Students are guaranteed a department summer job placement in their first year. If successful this can serve as a model for all physics programs.
- **Increase number of physics majors through improved recruiting:** In collaboration with the Dean of Science office, the department will implement a more formalized approach to recruitment. Currently recruitment is a distributed task with no clear leadership. The outreach committee, UGCC and academic advisor all play roles in recruitment. These groups should meet regularly

to coordinate recruitment efforts. If funding permits the undergraduate advisor could be expanded to a full time position responsible for coordination of recruitment. The following is a list of things that should be done on a more regular and coordinated basis:

- Maintain data on where our students get jobs, and make available on the web a list of potential employers. This would make our programs more attractive to students and assist senior students in targeting career searches.
- Contact prospective incoming physics majors every year via email. This needs to be done in concert with recruiting efforts at the faculty level.
- Continue to recruit high school students through programs such as the TRIUMF high school lecture series.
- Liaise with university recruiting groups and contact the right students (e.g. all IB physics students in BC)
- Attend the scholarship dinner (done on an *ad hoc* basis currently).
- Contact alumni and gather testimonials, etc.
- Physics membership on the Dean's recruitment committee.
- Visit schools and/or recruit faculty members to do so (this has been done informally in the past).
- Use the cohort program as a recruiting tool.
- Improved IT services for recruiting (social media, website targeted to high school students...)

- **Standardization of curriculum and delivery in first year:**
  - We have already appointed a 1st-year course coordinator to help with this for the coming fall semester. The first target is PHYS 101/102. The idea is to develop common tutorial materials and to share biology examples and demos for lectures. We will make this a permanent position, assuming resources remain available.
  - Implement a common topics list, ideally one that is shorter than the current one.
  - Develop a standardized delivery to enable us to break courses into 6-week modules, allowing faculty to share courses rather than teach it for the whole term. This also gives us more flexibility in course scheduling.
  - Incorporate standardized TA training into first year courses.
  - Get a wider group of people teaching first-year courses.
  - Ensure consistency of exams, etc. This will be facilitated at the first year level by the new 1st year coordinator but should be expanded to core courses in 2nd and higher years.
  - Eliminate PHYS 130/131 and fold the lab part into a laboratorial component starting with 120/121 but extending to 101/102.

- **Undertake a complete curriculum review:** The department will undertake a complete curriculum review within the next two years. This will be carried out by the undergraduate curriculum committee in consultation with the new Strategic Planning Committee.

Resource implications:
Our suggestion to offer 5 courses for the price of 4 can be done in a revenue neutral way, but would have to have support from the highest levels of the administration. The development of a dedicated recruitment position in the department of physics would require additional resources or elimination of current ones. Our preferred choice would be the conversion an existing ½ time position such as advisor to a full time position with recruitment as an additional task. Central recruitment support through the Dean of Science office would also be needed.

1.1.2 Graduate Programming:

- **Recruit more scholarship eligible graduate students:** The department will develop a recruiting strategy that includes: systematic improvement and maintenance of the department website, recruiting visits to potential feeder universities, recruiting through faculty research networks, and improved methods for collecting and utilizing contact information of potential recruits. The chair and the GPC chair will work with the Dean of Grad studies office on these issues.
- **Improve degree completion times:** We will implement changes to streamline our graduate programs. We have just introduced new graduate program requirements, and currently we are in the process of changing the way supervisory committees assess and report on student progress. Continued attention to recruiting will reduce completion times, by raising the overall preparation of entering students.
- **Limit TA hours per semester:** The External Review Committee asserts, "The reduction of the normal departmental 210 hour TA should seriously be considered." Actually, we have been considering this for some time, but we face significant barriers. The most important one is financial: if we reduce the TA load, then either student stipends must go down commensurately or other forms of support must increase to compensate. With flat or decreasing NSERC budgets, many of our faculty would find it too costly to use RA funds to compensate for a TA reduction from 210 hours to the 120-140 hours per term that many other universities assign. The only other way is to increase our scholarship budget, which we do not control. Our department has worked hard to maintain adequate student stipend levels in the face of increasing tuition, increasing cost of living, and declining federal funding for basic research, but without increased scholarship support we cannot sustain further stipend increases. We will work with the senior administration to increase the scholarship budget for research-based graduate programs, especially PhD programs.
- **Standardized training for TAs:** We will implement improved training for TAs . Our new introductory graduate course devotes a few hours to TA training, and we work with TLC and our first year coordinator to develop more systematic training.
- **Expand funding sources for grad support, e.g. CREATE:** We will strive to increase graduate support through external funding sources such as CREATE. This is a long-term project, especially in the current funding climate, and will require significant administrative support through grant facilitation and support for research networking. The recent Graduate Student Research Award program was widely appreciated in our department, and we will lobby for more support of this nature.

Resource implications (if any):

Closer collaboration between dean's office and department for recruitment. Travel funds for recruitment and prospective graduate student visits to SFU. Increased scholarship budget for research-based graduate programs, especially PhD programs.

1.3 Expected completion date/s:

Most of these items will require ongoing attention throughout the coming review period, although it should be possible to initiate several of them by the end of 2014: improve recruiting and streamline admissions, consolidate changes to program requirements and supervisory committee assessments, standardize TA training.

2. RESEARCH

2.1 Action/s (what is going to be done):

- **Rebranding:** Our website and promotional materials will be "rebranded" to reduce the number of physics research themes for the purposes of recruitment and external profile. The reviewers proposed only three themes, however at our recent post-review retreat there was support for a somewhat larger number, for example (1) Materials Physics, (2) Soft Matter and Biophysics (3) High Energy Physics and Cosmology (4) Atomic, Molecular and Optical Physics, and (5) Theoretical Physics. We note that the Department currently lists 13 groups on its website, so that 4 or 5 will be a significant simplification. The exact formulation of the themes will be worked out by the Strategic Planning Committee in consultation with the department.
- **Strategic Planning Committee:** On the recommendation of the reviewers the Department has formed a Strategic Planning Committee (SPC). Duties will include preparing the 5-year internal SFU planning documents and helping the Chair prepare for future external reviews and will not be just limited to research issues. The committee will focus on both near-term and longer-term planning. The SPC will help to define long term hiring goals as well as evaluating specific opportunities as they arise. On the other hand, another 6-7, plus at least 2 lecturers will be at the retirement age in approximately 10 years, and the SPC will actively plan for

that. The committee will make recommendations to the faculty at large for ratification votes.

- **Postdoc recruitment:** We will encourage faculty members to do outreach to PhD students at other universities when they give seminars or colloquia. Sponsoring summer schools is also a good way to increase Departmental visibility (and was done successfully in the past). The CREATE program (which also directly funds postdocs) is probably the most realistic way to generate funds for such schools. Pooling of funding for postdoc hiring is another way to increase postdoc numbers.
- **Improve industrial interactions for experimental groups:** The department will increase its efforts to foster collaborations with industry through programs such as the NSERC ENGAGE and Research Partnerships programs. We will create a database of local and national companies. We will update and improve the departmental list of specialized equipment. Industries have in the past been users of such equipment, and the Department can increase such collaborations by publicizing better the facilities that we have. Improved industrial interactions will lead to increased funding for postdoctoral fellows.
- **Increased flexibility in teaching assignments:** We propose to restructure the 1st-year courses so that a faculty member could teach 2 sections for ½ a semester. This would be particularly helpful for particle physicists and other users of large facilities who spend a significant fraction of their time off campus.
- **Obtain lab space in 4D labs:** We will lobby the administration for laboratory space in 4D LABs. Through historical accident, the Physics Department has had less presence in 4D Labs than was anticipated when it was set up. Beyond the loss of opportunities for the Department, a broad user base and support group within the University is essential for the long-term success of the facility. Towards that end, the upcoming Tier-II Appointment in Correlated Electron Materials is a natural one to be based (for laboratory facilities) within 4D Labs, and the Department will work hard to ensure that this be arranged.

2.2 Resource implications ((if any):

Securing space in 4D LABS will have some costs especially if some existing faculty need to be relocated to more appropriate facilities however the overall cost should be lower as there will be less need for expensive renovations in the aging Physics building.

2.3 Expected completion date/s:

Formation of a Strategic Planning committee occurred in July 2013. The rebranding initiatives can be rolled out over the next year.
We hope to resolve the 4D LABS situation in the next few months given the time constraints of our pending hire in Correlated Electron Materials.

3. ADMINISTRATION

3.1 Action/s(what is going to be done) :

- **Formation of a strategic planning committee:** As per the reviewers suggestion, the department has formed a strategic planning committee (SPC) consisting of representatives from the various research faculty groups, as well as lecturers, and staff members. A key task of this committee will be to prioritize future hiring strategies. The SPC will be responsible for coordinating the 5 year plan as well as the external review process and as such will consider all aspects of the department's operations, not just research.
- **More regular meetings:** The department will hold more regular meetings in order to address many of the concerns of the external review committee. Meetings are now scheduled for the third Thursday of each month and will be held unless there are insufficient agenda items. In addition at least once a year a true department meeting will be held in which, faculty, and representatives from the staff and student groups will meet to discuss issues affecting the department as a whole.
- **Improved mentoring of all groups**: Specific actions to improve mentoring of all department personnel are listed below:
  - **Improved Mentoring of Research Faculty:** New research faculty will identify a faculty mentor when they are hired who will meet regularly to discuss strategies for the tenure process. This will include discussions of how to acquire research funding, effective supervision of graduate students and postdocs, responsibilities to students, and responsibilities regarding appropriate interactions with departmental staff. The chair will also meet once a semester with new faculty to ensure that they understand the expectations of the tenure process.
  - **Mentoring of Lecturers:** New lecturers will be matched with a mentor when they are hired who will provide advice on strategies for the review and promotion process. This will include discussions of teaching strategies, curriculum development, service duties and opportunities for professional development. The chair will also meet once a semester with new lecturers to ensure that they understand the expectations of the position.
  - **Mentoring of Staff:** All staff will have access to an up to date training manual. More cross training will be implemented to enable flexibility in vacation assignments. Key staff files will be available to other staff members in the case of a sudden illness during peak periods. More opportunities for professional development will be identified for staff.
  - **Mentoring of Students:** Steps will be taken to ensure that students are taking the appropriate courses for their programs. This was discussed earlier. Students also need to be mentored about career options as early as possible. This can include more training on oral presentations, written skills, writing resumes, and preparing for job interviews. We need to develop a stronger presence in the coop program. Coop currently provides many of these skills oriented activities. Mentoring of graduate students is described above.
  - **Mentoring of department chair and committee chairs:** More detailed procedure manuals need to be developed/improved for department chairs, as well as major committee chairs (UGCC, GPC). At present there are varying gaps in these documents. Work on this is under progress and is being archived on a secure website. Procedures for passing on the torch need to be more formalized though the development of detailed job manuals. The next item will also address this issue.

- **Improve documentation and training procedures:** We will continue to develop training manuals and up to date job descriptions for all administrative staff. We are also moving to an online line archive of departmental policies and procedures which should make it easier for future chairs.
- **Improved collegiality:** We will move to improve social interactions in the department. Suggestions for improvements include, regular coffee breaks on a fixed day of the week where staff students and faculty can meet to chat, a summer barbeque open to all department members (offered this summer), regular departmental receptions for physics alumni at convocation (done for the first time this summer), more departmental sports activities (like the annual softball series etc.).
- **Increased financial administrative support:** There has been a significant increase in workload due to the policies for assigning TA stipends in recent years as well as a general downloading of clerical duties to department staff (and faculty). We will work with the Dean to secure an increase in the staff support for financial administration.

3.2 Resource implications(if any):

The creation of an additional ½ time financial services position or centralized support from the Dean of Science office. Minor increase in expenses for departmental activities to promote collegiality. An additional teaching relief for an associate chair should the department decide to go that route.

3.3 Expected completion date/s:

The Strategic Planning Committee was formed in July 2013, and should begin making recommendations in consultation with the department by early fall 2013. The on-line policies and procedures archive should be essentially completed by the end of the current chair's term (fall of 2014).

4. WORKING ENVIRONMENT

4.1 Action/s(what is going to be done) :

- **Urgent building upgrades/repairs:** We will continue to press the administration for urgently needed repairs and code compliant modifications to the physics building. These should be pursued in the short term with funding from outside the department operating budget. Examples include:
  - Urgent seismic upgrades to the department physics office (2 story unreinforced concrete block walls).
  - Urgent modifications to office space for technical staff. Currently two of our teaching staff occupy storage hallways with inadequate fire egress.
  - Modifications to first year physics labs to permit larger numbers of students and flexibility in lab offerings as well as solving

item (2) above.

  - Various modifications to the physics office (some are now underway e.g. sliding security door)
  - Fix water infiltration problems throughout the department.

- **Improved transparency of the renovation resources allocation:** We will continue to press the administration for a more transparent process for allocation of renovation resources. Renovations requests should be solicited from all departments and adjudicated in a transparent fashion.
- **Increased operating budgets to cover continual building repairs items:** We will urge the administration to take into consideration the increased operating costs of departments like physics and biology compared with recently updated facilities like chemistry, MBB, and TASC II (primarily chemistry). Physics is expected to fund a large number of small renovations ($5k or less) and upgrades out of limited operating funds. These expenses occur as a result of the deteriorating condition of the building. As a result the state of the building grows worse each year due to deferred maintenance.
- **Allocate some 4D LAB space to physics researchers:** We will continue to press the administration for access to research lab space in 4D LABS. We completely support the reviewer's suggestions that some space in 4D LABS/TASCII be assigned to the physics department. We urge the administration to conduct an audit of space per experimental research faculty in the primary experimental research departments (physics, chemistry , life sciences) in order to make the case for some redistribution of quality lab space.

4.2 Resource implications(if any):

These modifications will not be cheap but given the fact that a full renovation of the department similar to the recent chemistry renovation is probably at least a decade off, it is no longer an option to defer urgent physical deficiencies. The total cost of these temporary modifications will probably amount to the order of one million dollars spread over a 5 year period. This needs to be placed in the context of a recent million plus dollar renovation of teaching lab space in the department of chemistry which was funded out of university operating funds. We are currently working with facilities to establish estimates for the physics office upgrades. The proposed modifications to the first year lab will be significantly higher. We do not know the cost of fixing the chronic water infiltration problems in our department, but given the long time to renovation of the department this should be an urgent priority. Many parts of the department exhibit a third world appearance that is bad for internal morale and bad for our external image, to say nothing of health and safety issues.

4.3 Expected completion date/s:

The seismic upgrades need to be completed no later than summer 2014. Teaching staff offices can be achieved when the first year office space is completed, hopefully by fall of 2014.

5. Outreach (*OTHER*)

5.1 Action/s:

While Physics Outreach efforts were strongly praised by the external review committee. There is room for improvement. As a whole the department will strive to:

- **Improve research faculty participation in outreach**
- **Increase involvement of HQP by rewarding them for attendance.**
- **Improved web presence for recruitment and outreach (website, social media)**
- **Work with the Dean of Science and other departments to avoid duplication in the area of outreach activities**

5.2 Resource implications(if any):

As a part of the new outreach center and observatory there needs to be a dedicated staff person who would liaise with the individual departments. This will need to be done at the Faculty level.

5.3 Expected completion date/s:

The goals outlined here can be rolled out over the next three years.

The above action plan has been considered by the Unit under review and has been discussed and agreed to by the Dean.

Unit Leader (signed)		**Date**
Name S. Watin	**Title** Department Chair	5 Nov 2013

Section 2 - Dean's comments and endorsement of the Action Plan :

The External Review of the Department of Physics is largely favourable. The reviewers do a solid job of identifying departmental strengths and weaknesses, and have made constructive recommendations for improvement. The Department's response shows that they have given considerable thought to these recommendations; my only concern is that they may have been overly ambitious and too prescriptive in their action plan. Thus, in the paragraphs that follow, I highlight the main issues that reviewers and department have identified and suggest ways that the Faculty can work with the department to resolve them.

Concern about time to degree completion for both undergraduate and graduate students is a recurring theme in departmental appraisals in the Faculty of Science. Thus, while Physics can and should take steps internally towards addressing the problems, such as curriculum reform, better student advising, improved course scheduling, website enhancements, etc., Faculty of Science funds would be better invested in solutions that are not specific to just one department. Degree completion times have also been the subject of recent discussion at the presidential and VP's level, so we can expect university-wide initiatives in the near future.

The Faculty of Science has recently started a variety of new initiatives to coordinate student advising, alumni engagement, student recruitment (both graduate and graduate), IT, and outreach, building on best practices among the eight departments. There are significant cost and time efficiencies to this approach. Physics, as with all departments, will be a vital part of this process. In consultation with all department chairs and managers, we are in the process of altering our budget processes for reporting and administering operating budgets. With advice from individual faculty members, we are starting to provide the same types of services to researchers.

Development of a cohort program to attract top science students, an initiative led by members of the Physics Department, is well underway and is being supported with financial and personnel resources from the Dean's Office as part of the INSPIRE initiative. The Faculty has given approval in principle to a pilot, and has committed to raising funds from donors for research experiences for 1st year students, since they are ineligible for NSERC and VPR research funds.

There is no doubt that the quality of space in the Physics Department is substandard, and that this situation has a detrimental effect on staff and faculty morale, student recruitment, teaching, research, and faculty recruitment. The Faculty of Science has put some funds into upgrading some minor problems (e.g. ventilation and office security), but the financial scope of the problems exceeds our budget by orders of magnitude. In addition, we are reluctant to do extensive, expensive renovations of individual labs only to have those renovations destroyed when the hoped-for department-wide reconstruction occurs. Physics makes the specific case that assignment of space in the 4D LABS to Physics would mitigate some of their problems. However, that can only occur at the expense of other departments. My staff is currently working with leaders in Physics, Chemistry and the 4D LABS Research Institute to develop a comprehensive space plan that is advantageous to all faculty and staff working in the field of materials science.

The Physics Department is highly collegial, and I believe that faculty and staff within the department will do an excellent job of tackling the major projects of curriculum review and strategic planning (particularly around faculty recruitment) recommended by the External Reviewers. However, to avoid burn-out and costly duplication of effort, I urge them to work with the Faculty of Science and their fellow departments to solve the issues that are common to all.

Faculty Dean	Date
...Claire Cupples...	5 Nov 2013.