



UNIVERSITY OF WASHINGTON

DEPARTMENT OF CHEMICAL ENGINEERING

July 29, 1997

Marsha L. Landolt, Dean
The Graduate School, UW

John B. Simpson, Dean
College of Arts and Sciences, UW

Frederick L. Campbell, Dean
Office of Undergraduate Education, UW

Dear Deans Landolt, Simpson, and Campbell,

Enclosed is the report of the Ten-Year Review Committee for the Department of Physics. This is an excellent Department, and the University should strive to maintain the excellence. Our major recommendation is that the Department retain its present size in the long run, but start to replace forthcoming retirees in an orderly fashion. Five people in the age group 60-65 are expected to retire as they approach 70, and approximately one hire per year is recommended over the next five years.

Please feel free to call on us for clarification or support for the committee report.

Sincerely,

A handwritten signature in cursive script that reads "Bruce A. Finlayson".

Bruce A. Finlayson
Rehnberg Professor and Chairman

BAF:sr
Enclosures: 1

cc: Dr. Merrill
Dr. Segal
Dr. Kleppner
Dr. Peccei

Ten-Year Review of the Department of Physics
University of Washington
June, 1997

1. PROCEDURE

A review committee was appointed by Marsha L. Landolt, Dean, The Graduate School; John B. Simpson, Dean, College of Arts and Sciences; and Frederick L. Campbell, Dean, Office of Undergraduate Education; to conduct the 10-year review of the Physics Department. The members of the committee were:

Bruce A. Finlayson, Professor and Chair, Chemical Engineering, University of Washington
(Committee Chair)

Daniel Kleppner, Professor, Department of Physics, Massachusetts Institute of Technology

Roberto Peccei, Dean, College of Letters and Science, University of California, Los Angeles

Ronald T. Merrill, Professor, Geophysics Program, University of Washington

Jack Segal, Professor, Department of Mathematics, University of Washington

The Committee was provided with the Ten Year Self-Study Report from the Department of Physics, a copy of the last review in 1986, and surveys of graduate students obtained through the Graduate School. The University of Washington members of the Committee met with the three deans prior to the Review to discuss objectives and methods. The University of Washington members also met with Professor Mike Heinekey, Vice Chair for Undergraduate Programs, Chemistry Department, and Dorothy Reed, Associate Dean for Academic Affairs, College of Engineering. The complete committee met on April 28-29 with faculty, staff, and students from the Department of Physics. The complete schedule is given in Appendix A.

2. MAJOR ISSUES

The Physics Department is excellent, currently rated 14th in the nation in the National Research Council surveys of Ph.D. programs. It has made a number of very strong appointments in the past few years and the Physics-Astronomy Building has turned out to be a great success, further increasing the Department's momentum. The Department can realistically aspire to move into the top 10. However, the Department is fragile because of its faculty age profile, and there is a real possibility of it seriously slipping in the coming decade. The fundamental problem is that 16 faculty out of 42 are between 55 and 65 years of age and their positions will need to be filled if the Department is to fulfill its teaching role and maintain its strength in research. However, the Department is seriously hampered in hiring new faculty over the next few years. An untimely delay

in appointing new faculty would inevitably put the Department in a "catch up" posture a few years hence. It is extremely difficult to develop first rate new faculty in a rush. Such a situation can be expected to adversely effect the intellectual life of the Department, to aggravate the problem of providing startup costs, and to cause disruptions in teaching.

The need for sustaining the size and strength of the faculty is particularly urgent because the undergraduate enrollment of the University of Washington is expected to increase about 20% due to the bulge in students that are already in K-12. Neither the Tacoma nor Bothell campuses will have laboratories and they will not teach the freshman laboratory course such as Physics 121-2-3 (lecture) or Physics 131-2-3 (laboratory). Consequently, the new students interested in medicine, engineering and science will all come to the University of Washington. Thus the undergraduate enrollment in Physics can be expected to jump more than 20%, possibly as high as 60%. Handling such a big increases would be a formidable task under any circumstance, but doing it while the faculty size is shrinking, even temporarily, would be impossible.

Currently there are several mortgaged positions, positions that were filled before a retirement took place and which are funded now with soft or flexible money, not as state positions. Under current agreements with the Dean of Arts and Science, seven retirements will take place and only three positions will be converted from soft or flexible money to state funds. This would result in a decrease of seven positions compared with the current situation, or four positions compared with the situation if a hire had been made after each retirement. The problems of making a series of rapid appointments starting five years from now, and functioning with a decreased faculty size in the interim, would be, in our view, a serious threat to the vitality of the Department. While we do not recommend an increase in the average size of the Department, the University needs to recognize the need for a temporary bulge to see it through the coming period of high retirement rate.

We have a further concern for the Department's future: the salaries are abysmal. Data provided in the self-study document indicates that the average salary of full professors in physics at four peer institutions is \$88,000 per year while the University of Washington it is only \$64,400, a full 27% below its peers.

Although new faculty--Assistant Professors and Professors hired at senior levels--have been paid market rates, the ongoing faculty have seen their salaries erode due to the minimal increases provided by the State Legislature over the past ten years. Such a two-tier system must inevitably erode faculty morale, particularly when the discrepancies are obviously unfair, and can hinder the retention of outstanding young faculty.

The Department is facing pressure on its research activities because the National Science Foundation and Department of Energy (the agencies that support most of the Department's

research) have limited funds. Several faculty mentioned that the agencies were going to phase out the support of senior Research Professors (although this was not confirmed by NSF except for a general belt-tightening). Losing those positions will decrease the amount of research carried out in the Department and will curtail options for students.

In summary, the future holds increased teaching demands and extraordinary pressures on research budgets. In addition, the Department suffers from salaries that are seriously low, and faces the possibility of a precipitous turnover in faculty a few years hence under the present hiring plan. These issues need to be addressed if the Department is to maintain its standing, much less move up in its standing.

MAJOR RECOMMENDATION. The committee recommends that the Department retain its present size in the long run, but start to replace forthcoming retirees in an orderly fashion. Five people in the age group 60-65 are expected to retire as they approach 70, and approximately one hire per year is recommended over the next five years.

3. TEACHING PROGRAM

INTRODUCTORY COURSES

There are two components to the undergraduate teaching mission: service courses taken by students from throughout the University, and courses for Physics majors. About 75% of the student credit hours generated by the Department are generated in the 100-level courses. These courses are taught by the regular faculty, with the assistance of the Physics Education Group.

The Physics Education Group (PEG) at the University of Washington is unique. It develops course material which it tests and refines in a major tutorial program for the basic introductory physics courses: Physics 121-2-3 and 131-2-3. PEG trains the tutors, supervises the tutorials, and administers the tutorials' complex schedule. Consequently, it is a major teaching resource for the Department.

On the whole, the work done by the Physics Education Group in the tutorials is well received in the Department, though there are a number of problems. Some of the faculty do not like the rigidity of the tutorial syllabus, which essentially steers and sets the pace for the course. Many of the physics majors do not like the tutorials and would prefer more emphasis on mathematical reasoning and problem solving. However, the introductory classes are for students predominantly outside of physics, and for those students the tutorials seem to be working reasonably well. Although not all faculty agree with the tutorial concept, many faculty spoke out strongly in favor of it. The College of Engineering would like a more formal assessment procedure to validate the improvement in concepts taught to students who become engineers. The faculty are actively

involved in the tutorials and service courses, and this impressed the committee. The Physics Education Group has national resources which are helping the State of Washington, and this fact should be made known to legislators.

A concern for the future is that although PEG is supported by the NSF for educational research, a major portion of its activities is operational. We recognize that educational research requires teaching, so the arrangement is fundamentally sound. However, NSF cannot be expected to sustain operational programs in education indefinitely. The Department needs to have contingency plans should the NSF support decrease.

PHYSICS MAJORS

The undergraduates have a wide selection of good courses to choose from, and they are well prepared when they graduate. The undergraduate program is excellent and draws excellent students from throughout the Northwest, many of whom go on to pursue graduate work at top universities. The faculty are actively involved with undergraduates, from teaching courses to advising to involving them in independent research projects. Many of the undergraduates we talked with would have liked to take the Honors section of freshman physics because it was more mathematically based, but were not aware it was available to them without being enrolled in the Honors College.

GRADUATE PROGRAM.

The graduate program is strong and draws good students. However, students with even better qualifications would come to UW if the Department had more fellowships to offer first-year students. Currently, the Department can offer only teaching assistantships, but the students they are competing for are offered fellowships at other Universities, and often go elsewhere. The Department has an excellent Research Program for Undergraduates during the summer which permits them to identify outstanding prospects. Having a few fellowships to offer the cream of the crop would make an important difference in attracting the top students. The graduate students generally were enthusiastic about their education. Issues they raised with us included the problems of a few students who took a long time to get a degree or who had problems with their research advisor. Furthermore, they claimed that there is no formal mechanism (or at least none that they believed mattered) to resolve their disputes. Students talked with the review committee of the Nuclear Physics Laboratory a couple of years ago, but nothing was done. The Committee encourages the Chair to keep up his efforts with faculty and students to shorten the time to degree. The students are very appreciative of the Friday Flings that allow informal contact between faculty, graduate students, and undergraduate students.

The graduate students are not discouraged about their job prospects, and have organized a seminar series given by past graduates that describe the type of jobs they got. The graduate students in the

Physics Education Group seem to have excellent employment history and prospects.

WOMEN AND MINORITY RECORD

The record with respect to attracting women and minority students to physics at the University of Washington is comparable to that of the physics community as a whole. The National Research Council report evaluating Graduate Programs in Physics provides data on graduate programs. Among the top quartile, 13% of the graduate students are women, and that is the figure listed in the report for the University of Washington, too. The same report indicates that 9% of the Ph.D. degrees in Physics were awarded to women (for schools in the top quartile), and lists the number 5% for the University of Washington. For minorities, only 3% of the Ph.D. degrees in Physics were awarded to minorities (for schools in the top quartile), and 2% is the figure for the University of Washington. The fact that the percentage of women graduate students now is higher than the percentage of women obtaining Ph.D.s in the past can be due to several factors: the situation is improving and the students haven't graduated yet, or the women stop at a M.S. degree more often. The committee talked with a number of women undergraduates and graduate students, and they seem pleased with their education for the most part.

For undergraduates, we have no comparable national statistics. The percentage of Caucasians getting B.S. degrees is 70%, which is the same figure for the University of Washington undergraduate population. The percentage of B.S. degrees going to women is 15%.

4. DIRECTIONS FOR THE FUTURE

Atomic Physics is a traditional strength of the Physics Department, which is recognized as one of the top departments in the nation in this area. The group is particularly known for studying fundamental problems using innovative atomic techniques. However, none of the faculty are young and its senior member can be expected to retire in the coming years. To maintain its leading position in Atomic Physics, the Department should give top priority to making an appointment in this area.

Substantial resources will be needed for the Department to maintain an Experimental Particle Physics group because of the age distribution of the current members of the group. The Department will need to examine carefully whether it can provide the resources needed for excellence and for having a real presence in this field. In this regard, we note that no Department in the top 30 lacks a presence in Experimental Particle Physics.

In addressing such problems, the Department needs a vision of what it would like to be in 10 years. Areas that were presented to the Committee as possibilities for expansion or introduction

include Astrophysics (expansion) and Biophysics (introduction). This latter field resonates with other biological departments on campus which are excellent. However, this is also a field where the competition for top talent nationally is very heated.

The University of Washington Physics Department has established a reputation for excellence in pursuing fundamental measurements in a number of fields. Examples include setting the most stringent limits on composition-dependent forces of gravitational strength (fifth forces) and the pioneering experiments searching for parity violation in atoms. This tradition remains strong in the Department now and is well worth preserving. In many respects, the facilities provided by the Nuclear Physics Laboratory, as well as the existence of the excellent group in atomic physics, have served as catalysts for these kinds of endeavors. A very beneficial effect is also played here (and in furthering the overall international reputation of the Department) by the strong faculty group working in theory. Theoretical Physics in the Department is uniformly strong - be it in condensed matter, gravitation, elementary particles or nuclear theory. In particular, the DOE supported Institute for Nuclear Theory is an important intellectual magnet and helps the Department on a broad front, well beyond Nuclear Theory.

The Sudbury Neutrino Observatory is an important new development done through the Nuclear Physics Laboratory. Since the tandem accelerator is quite old already (the last reviews said it would no longer be in use in 1997!), it is important for the Laboratory to establish new goals so that it can redefine its mission, build on its strengths, and create a new identity. The infrastructure in the Laboratory is very important, as is the excellent Machine Shop. However, ultimately such facilities can only be retained if the faculty and the Laboratory develop new programs that can be funded at the national level. SNO is one such example, but other possibilities must be identified for the future.

Currently the Physics Education Group depends heavily on the stature of one person. If the Department decides that it wishes to maintain as a permanent feature its Ph.D. in physics for research in physics education, then it will have to provide the faculty resources. The committee understands that one position is being recruited right now, but feels that two positions are probably necessary ultimately to maintain momentum.

The Committee notes that, although there are isolated instances of funding difficulties now, most of the research groups in the Department are competing well in the national arena.

UNIVERSITY OF WASHINGTON
The Graduate School

AGENDA

Department of Physics Program Review
C520 Physics-Astronomy Building
April 27, 28 and 29, 1997

Sunday, April 27

7:30 p m

Dinner/Meeting - Review Committee
Ray's Boathouse Restaurant

Monday, April 28

8.45 - 9:00 a.m

Oscar Vilches, Professor

9.00 - 9 15

SNO Group
Hamish Robertson, Professor
Steven Elliott, Research Assistant Professor

9.15 - 9:30

Gerald Seidler, Assistant Professor

9 30 - 10.00

Steve Ellis, Professor and Chair

10:00-10 45

Atomic Physics Research Group
Norval Fortson, Blayne Heckel and Robert Van Dyck, Professors

10 45 - 10:55

Research Associates

10:55 - 11 15

Bruce Warrington

11:15 - 11.30

Steven Penn

Paula Heron

11.30-12:00 p m

Astrophysics Research Group
Craig Hogan, Professor; Christopher Stubbs, Associate Professor

12:00 - 12 30

Nuclear Theory Research
Lawrence Wilets, Eminentus Professor; Gerald Miller, Professor
Aurel Bulgac and Martin Savage Assistant Professors

12 30 - 1:30

Lunch-Review Committee/Faculty Club (South Dining Room West)

1:30-2.30

Open to Physics visitors

2 45 - 3 00

Chris McDermott will take Committee to C211 -- meet with TA's

3:00 - 3:15

Edward Stern, Professor

3:15 - 3.30

Stamatis Vokos and Peter Shaffer, Research Assistant Professors

Staff

3:30 - 3.40

Petra Lopez, Fiscal Specialist Supervisor

3 40 - 3:50

Karen Liebert, Administrative Assistant A

3:50 - 4.05

Michael Schick, Professor

4:05 - 4 20

Lillian C. McDermott, Professor

4:20 - 4 30

John Stoltenberg, Engineering Technician 3

AGENDA
Department of Physics Program Review

Monday, April 28 (cont'd)

4:30 - 4:40 Christian D'Urso, Graduate Student

4:40 - 4:55 Mark McDermott, Professor

4:55 - 5:10 Paul Mockett, Research Professor

5:00 Graduate Students at the College Inn

7:30 Dinner - Review Committee
La Buca Restaurant

Tuesday, April 29

8:30 - 9:10 a.m. Undergraduate Students
Shanti Rao, John O'Meara, Allison Stangel, Amy Goff,
Marcus Collins, Valerie Peyton, Sean Jensen-Gray

9:10 - 9:20 Gregory Smith, Research Associate

9:20 - 9:30 William Hazelton and Bradley Ambrose, Graduate Students

9:30-10:00 High Energy Research Group
Victor Cook, Joseph Rothberg, Henry Lubatti, Professors

10:00 - 10:30 Condensed Matter Experiment
Oscar Vilches, Edward Stern, Marjorie Olmstead, Professors
Gerald Seidler, Assistant Professor

10:30 - 11:00 Particle Theory Research Group
Lowell Brown, Stephen Sharpe, Laurence Yaffe, Samuel Fain,
and Michael Schick, Professors; Ann Nelson, Associate Professor

11:00-11:15 Wick Haxton, Director of the Institute for Nuclear Theory

11:15 - 11:25 Hans Dahmelt, Professor

11:25 - 11:45 Gerald Miller and Larry Sorensen, Professors

11:45 - 12:00 p.m. Stephen Sharpe, Professor

12:00 - 12:10 Jeffrey Wilkes, Research Professor

12:10 - 1:00 Lunch - Review Committee / Faculty Club (Music Room)

1:00 - 2:00 Exit Interviews
Steve Ellis, Professor and Chair, Department of Physics
Marsha Landolt, Dean, Graduate School
John Simpson, Dean, and Gary Christian, Divisional Dean,
College of Arts and Sciences
Frederick Campbell, Dean, Undergraduate Education

2:00 - 3:00 Marsha Landolt, Dean, Graduate School
John Simpson, Dean, Gary Christian, Divisional Dean,
College of Arts and Sciences
Frederick Campbell, Dean, Undergraduate Education

3:00 - 5:00 Review Committee - Executive Session