

Winter 2008 Physics Staffing Committee Report

Department of Physics University of Washington

February 4, 2008

EXECUTIVE SUMMARY

The Physics Department at the University of Washington (UW) is recognized as one of the premier physics programs in the nation. This strength stems in part from the Department's success in recruiting faculty who emerge as leaders in their fields. It is our common goal to support and improve the strength, vitality, and intellectual diversity of our Department. A first-rate Physics Department should be recognized as being leaders in some disciplines and should also include a sufficient breadth of activities to provide educational opportunities for students and to contribute to areas where new discoveries are being made.

The following is the report of the Physics Department Staffing Committee. The Committee is charged with recommending the Department's strategic faculty-hiring goals over the next five years. Choosing those areas to which resources and hires should be applied is a balance between responding to the immediate needs of the Department, the Department's long-range strategy, and special opportunities that may arise. Alongside strategic searches are targets-of-opportunity and searches coupled to initiatives. Targets-of-opportunity are difficult to anticipate and are therefore largely outside this report. Initiatives (e.g., Experimental Gravity and Tera-Scale Physics) are usually, but not always, generated by groups of individuals within the Department and are likewise largely outside this report. Although outside this report, the Staffing Committee feels that targets-of-opportunity and initiatives are an important source of outstanding faculty and programs and are important components of hiring. The full charge to the Staffing Committee includes encouraging and evaluating targets-of-opportunities and initiatives.

Per the discussion below, we anticipate approximately ten hires over five years (two per year), and this is our target number of recommendations. This report is organized for convenience by subfields, but we recognize that this organization is somewhat arbitrary and good programs and candidates can and will overlap existing subgroups or be in new directions. Our overall strategy for recommending searches was to assemble information to aid us in making the difficult determination as to whether a search should be a priority. Factors in this determination are the direction the subfield is heading—here we were aided particularly by Department and National Research Council (NRC) studies—and whether staffing in that subfield is adequate, projected over five years. We further considered whether a subfield was a “pillar” of the Department's research, representing a significant source of intellectual activity and graduate education. We did not give great weight to arguments based on maintaining head count. We were asked to make a five-year recommendation, and found we had clarity on Department priorities for the near term, but our vision was hazy for the out years. We note that Staffing recommendations are revisited each year, and therefore these recommendations, especially for the out years, are not static. Finally, other Committees within the Department provide useful information for staffing. In particular, the Graduate Committee reports on graduate student enrollments, their research subfields, and sources of funding. Unfortunately, we do not have this report at the time of writing this document.

In the near term, we envision a major initiative in Condensed Matter Experiment, supported by perhaps three hires. Condensed Matter is the largest subfield of Physics, and lends itself to the kind of innovative experiments our Department does best. We feel the Department is underrepresented in this area and that there are opportunities we can exploit. Also, in the near term, we envision increasing our activity in Experimental Astrophysics, broadly defined. This is another subfield that is of growing importance and lends itself to innovative, UW style experiments. Also in the near term, we advocate filling out a three-

person group in experimental Large Hadron Collider (LHC) science. We find the Department split on whether LHC science should be a near-term recommendation. However, the Committee feels that the LHC, which is scheduled to start operation this year, has a high likelihood of discovering important new science. We note the Department has a large investment in the LHC experiment through the ATLAS muon detector system. The Committee certainly recognizes the challenges a university group faces in such a large and remote research enterprise, but we expect the LHC theorists and experimenters will be able to fully participate while maintaining their intellectual center at the University of Washington.

Also in the near term, we recommend building up Astrophysics Theory. The likely loss of Craig Hogan is a serious setback to the Department's Astrophysics initiative and should be addressed at very high priority.

BACKGROUND

In 2004, a five-year Staffing Plan was approved by the Department. The 2005 Staffing Plan Update provided a progress report and outlined the remaining staffing priorities. In the 2006-07 academic year, the Staffing Committee met with representatives of various groups in the Department to assess continuing needs and evaluate priorities for faculty hiring. In early 2007 another Staffing Plan Update summarized the information presented to the Staffing Committee and included a first response of the Committee to the presentations. Since that early 2007 update, the Staffing Committee has solicited short updates from the various groups and individuals within the Department. We also listen to the vigorous discussion of staffing issues among the faculty.

The original 2004 Plan highlighted staffing priorities in five areas: Astrophysics, Atomic Physics/Quantum Manipulation, Experimental Neutrino Physics, Experimental High-Energy Physics and Theoretical Physics. Since then, substantial progress has been made towards fulfilling the plan. An appointment has been made in Experimental Neutrino Physics (Tolich). Two appointments have been made in Atomic Physics/Quantum Manipulation (Blinov and Gupta). An appointment has been made in Experimental High Energy Physics (Goussiou). Two appointments have been made in Experimental Astrophysics (Morales and Rosenberg).

Since the priorities in the 2004 Plan are well on the way to being satisfied, this is a good opportunity to reevaluate our staffing recommendations. If we assume that faculty searches will be authorized one-to-one as people retire (at the estimated age of 70), then we plan on filling ten positions over the next five years. We may be surprised, pleasantly or unpleasantly, by the number of authorized searches; two per year over five years is our present working number.

There are several Department commitments that affect hiring plans over the next several years. These include: A Department vote that a search in LHC Theory be included as part of a broad theory search should Nelson et al.'s "Tera-Scale" funding request be supported; a Department vote to include Particle Experiment in the next broad search in Experimental Physics (the "Goussiou commitment"); and a similar commitment for Astrophysics Experiment (the "Morales commitment").

CHARGE TO THE COMMITTEE

The present Staffing Committee was constituted by the Department Chair in July 2007. Pursuant to this report, our charge is:

Identify areas of physics in which staffing is a priority based upon consideration of anticipated developments in physics. Recommend the broadly defined areas in which the Department should seek to search during the following year, such as 'theory', 'experiment' or 'education', and what emphases in these areas should be.

The summary of the Committee's findings and recommendations are given below. Since the motivations and plans for hiring in Astrophysics and Experimental Particle Physics are already well documented in Department reports and the reports are still relevant (the 2004 and 2005 Staffing Committee reports, the Astrophysics Strategic Plan, and the Experimental Particle Physics vision document), these subfields are only briefly addressed below. Two new reports since the 2004 plan, one reviewing CENPA (Hogan et al.), the other evaluating opportunities in Biological Physics (Kaplan et al.), are summarized below. The Committee recognizes that the Department Chair, in consultation with the faculty and Dean, "packages" search priorities into search requests to the UW Administration. The sense of the Committee is that, for strategic searches, in general the Department is better served by broad searches.

FINDINGS AND RECOMMENDATIONS

Condensed Matter Experiment (CME)

The Committee feels that CME is our Department's area in most urgent need of strengthening. CME is the largest area of physics and is highly diverse, interdisciplinary, and technologically relevant. Further, much of this experimental activity is of the type that fits into our Department's tradition of innovative basement-scale experiments. These science opportunities are described in the recent NRC Condensed Matter Decadal Survey "CMPP2010". Recent searches have demonstrated that outstanding candidates interested in coming to the UW can be identified.

The Physics Chair floated several ideas for assisting this strengthening process, including an "external & internal" review or perhaps a purely "internal-to-UW" review. He also encouraged the CME group to align with UW's increased interest in interdisciplinary programs and consider a center-like proposal with connections to other units within the University. These discussions are ongoing and are outside of this report. We note, however, that the potential of three hires in CME represents an opportunity to launch a high-profile, high-impact CME initiative.

Within the context of a CME plan, at co-highest priority, we recommend a junior-level search. We also recommend the Department be aggressive in identifying targets of opportunity; for this, we note the interdisciplinary nature of condensed matter experiment makes it a natural partner in University initiatives. Further, partnership in an interdisciplinary initiative and the recommendation of three hires may allow hiring at the senior level, or a "cluster hire", and may provide access to facilities attractive to condensed matter experimenters. Such joint initiatives have been encouraged by the University administration, especially over the last two years. We therefore recommend exploring joint opportunities for multi-college initiatives with other units on campus.

Although the exact nature of the strengthening plan for Condensed Matter Experiment remains to be established, *we envision that an effective plan could include a total of three hires in this subfield over five years.* Given the diversity of CME, these hires could overlap with Atomic Physics and/or BioPhysics.

Particle Experiment

The Large Hadron Collider at CERN in Geneva, Switzerland, is designed to explore particle physics at the TeV scale. It is scheduled to start operation this year, and the Committee feels that it has a high likelihood of discovering dramatic new TeV-scale science; here supersymmetry comes to mind, but other, even more dramatic discoveries are certainly possible. The Department is invested in the LHC through the ATLAS muon detector system. We therefore advocate filling out to a three-person group in experimental LHC science. We recognize that some faculty in the Department do not support such a recommendation. The main objections are that the UW shouldn't increase its participation in a distant and huge research enterprise where it's not clear we would have a significant identifiable impact, and that the future of accelerator-based particle physics is in danger. Regarding the first objection, the Committee certainly recognizes the challenges of a university group in such a large and remote research enterprise and this is a *bona fide* concern. The majority of the Committee feels, however, that the likely science payoff is sufficiently great to override this concern. We do expect, moreover, that UW theorists and experimenters will be able to fully participate in the LHC while maintaining the intellectual center at the UW. Regarding

the second objection, we feel accelerator-based particle physics, in the scenario where the LHC finds dramatic new science, is likely to be interesting at least through the 10—20 years of LHC operations. Whether or not this leads to a beyond-LHC accelerator is unknown for now. There is a risk that LHC science is barren with a shorter lifetime for the LHC, but the majority of the Committee believes this is a small risk. *The Committee therefore recommends at co-highest priority, a junior-level search in Particle Experiment.* This recommendation is consistent with the “Goussiou Commitment”.

Astrophysics Experiment

A Department study, Adelberger et al., (June, 2004) identified Astrophysics as a key Department area for expansion. This study mirrored the NRC “Connecting Quarks with the Cosmos” report (Turner et al., 2003) in concluding that Astrophysics is key, along with particle physics, nuclear physics and gravitational physics in understanding the universe and its contents. Likely, the quality of UW’s activities in astrophysics and cosmology will be increasingly important to the stature of our Department. Astrophysics is also a popular choice for those entering graduate students who declare a field of preference. The Department recently brought Rosenberg and Morales into the Astrophysics program. Rosenberg is in the process of bringing a large axion-search experiment to CENPA. He is also interested in large optical surveys to map dark matter and energy in the universe. The axion search experiment directly addresses the question of the nature of dark matter, and it will be a significant addition to the UW on-site experimental program. Morales, who will join the faculty fall 2008, is a principal in the Mileura Widefield Array, sited in Australia, a large antenna array designed to find the signature of the epoch of reionization in the microwave background. Recently Eric Adelberger retired, and this is a substantial loss across a broad range of activities in the Department, including Astrophysics. The likely departure of Craig Hogan is also a very serious blow to Astrophysics at UW, since he is the only theorist at the UW with a thorough grasp of the astrophysical and astronomical observations and surveys. The Department voted for the “Morales commitment”, that astrophysics experiment be included in the next broad experiment search. However, since Morales won’t arrive at the UW until fall 2008, the UW Astrophysics group will likely defer this search for a year. *The Committee therefore recommends continuing the astrophysics initiative with a junior-level 2009-2010 search in Astrophysics Experiment.*

Theoretical Physics

Theoretical Physics is a particular strength of our Department. In addition to outstanding programs in individual subfields, the Department fosters connections between Particle, Nuclear, Astrophysics, and Condensed Matter Theory, as well as the Institute for Nuclear Theory (INT) and connections to our programs in experimental physics. However, the aging of the faculty is of growing concern, particularly in Nuclear Theory. There is some concern that there are large and very active areas of Theoretical Astrophysics, Cosmology and Condensed Matter Theory in which the Department does not significantly participate. Particle Theory has recently lost two people (Aganagic and Strassler). More positively, the Department recently voted to promote string-theorist Andreas Karch.

Astrophysics will likely lose Craig Hogan. Hogan is the only Astrophysicist within Physics and Astronomy who integrates theory with the huge number of astrophysical surveys and observations. His loss is therefore a significant blow to our growing Astrophysics initiative. The Committee feels that hiring in Astrophysics Theory therefore has a very high priority.

A major strength of the UW Particle Theory group is the unusual breadth of activities, covering the range of intellectual interests from a close connection with experimental particle physics to a close connection with string theorists in the Mathematics Department. At the same time, the members of the group overlap enough in their interests to allow significant cross-fertilization. An example of this is string theorist Matt Strassler evolving into a bona-fide LHC phenomenologist while working with Ellis. Another example is Karch and Yaffe employing string-inspired field theory for describing relativistic heavy-ion collisions. These activities are significantly compromised by the departure of Strassler.

Strength in Condensed Matter Theory will aid in building Condensed Matter experiment within the Department. Also, BioPhysics experiment would be strengthened by a strong BioPhysics concentration

within Condensed Matter Theory. Within five years, Condensed Matter Theory will likely have a retirement (Schick). Although the majority of the Committee feels hiring in Condensed Matter Theory is not an immediate priority, the growth of Condensed Matter Experiment and BioPhysics within the Department would increase the urgency for a Condensed Matter Theory hire.

Nuclear Theory is a pillar in our Department. The strength comes in part from the DOE/Nuclear Physics supported group plus research within the INT, as well as the overlap with other groups within the Department. Although we do not consider Nuclear Theory an immediate staffing priority, we do recommend including this field in broad searches in the out years.

At co-highest priority, we recommend a junior-level search in Astrophysics, broadly construed. We envision this as a broad search with emphasis in Astrophysics/Cosmology. Should the Tera-Scale initiative be funded, we recommend this search be broadened to include LHC phenomenology.

A reasonable plan to maintain the Theory program could include a total of four hires over five years. These positions could come from a broad set of subfields, including Astrophysics & Cosmology, Particle Theory, Nuclear Theory or Condensed Matter Theory. Since the Committee lacks clarity for these out-year priorities, this report has no recommendations as to the emphasis subfield for the out-year searches. However, we recommend that after the successful Astrophysics search, the next theory search be a broad search across subfields.

Physics Education Group (PEG)

Physics Education Research is a small but growing field in which the UW has attained national prominence, recently recognized by the PEG Group receiving the APS Excellence in Education Award. PEG argues that a faculty hire will be required, for instance, to maintain existing programs in K-12 teacher preparation and curriculum development.

There was significant disagreement within the Staffing Committee on whether a hire should support ongoing programs or support new programs, whether a faculty hire is the appropriate type of hire to support the proposed programs, and the priority of this hire relative to other Department needs. The Committee considered recommending that a PEG search be included within broad searches in Experimental Physics, but unfortunately did not reach broad agreement and therefore makes no recommendation in this report.

Nuclear Experiment

The Center for Experimental Nuclear Physics and Astrophysics (CENPA) is a DOE Nuclear Physics “University Center for Excellence” and is a highly visible and successful component in experimental physics at the UW. This was noted in a recent report, Craig Hogan et al., responding to a charge by the Department Chair to review CENPA. The report concludes that CENPA is the engine of much important experimental work within the Department and educates a large number of graduate students. In recent years, activity at CENPA has broadened to include gravity and dark-matter research, but the core of CENPA’s infrastructure is supported by DOE Nuclear Physics (the “core program”). A recent hire in neutrino physics (Tolich) strengthened this program, but CENPA had a recent retirement (Adelberger) and further retirements are likely within the next five years (Cramer and Robertson). These retirements will reduce the number of faculty at CENPA and will diminish the core nuclear science program. The most serious consequences will be in CENPA’s research in Relativistic Heavy Ion Collisions, one of the core programs; this will likely shrink substantially with Cramer’s retirement. To maintain the vitality of CENPA, and by extension, the vitality of experimental physics within the Department, the Department should support initiatives in important scientific areas where UW Nuclear Experiment/CENPA can play a leading role, for example the “DUSEL” or “RIBF” projects. These new initiatives can replace the nuclear physics efforts that will be lost through retirements and ramp-down of programs (e.g., SNO and RHIC).

Although the plan for nuclear physics initiatives remains to be established, we envision that supporting opportunities in the Experimental Nuclear Physics core program will at minimum include a junior-level search within the next five years.

Biological Physics

In 2006, the Department Chair charged a Biological Physics study committee, chaired by David Kaplan, with making recommendations on BioPhysics opportunities in our Department. Paraphrasing, the main report conclusions are: (1) BioPhysics is a highly interdisciplinary and growing field that many in the Department believe should be part of our program; (2) Efforts to hire in this area may require collaboration and joint initiatives with other units within the UW in order to create new positions within the Department; (3) Physics hires should closely overlap with our Department's other research to maximize the positive impact within our Department of the BioPhysics activity.

The Staffing Committee accepts the main recommendations of the Kaplan report: we therefore recommend that the Department identify promising candidates through broad searches in experimental condensed matter physics. We also note that the current NanoTechnology Director search has considered candidates with interest in nanomedicine. If such a center were to be established at UW, there will likely be opportunities to pursue positions related to this new area of research. We recommend that if this occurs, the Department should explore potential positions in this area that might have ties to a broader interdisciplinary initiative.

Atomic Physics

The Atomic Physics group recently added Boris Blinov and Subhadeep Gupta and has hired Tom Loftus as a Research Scientist. However Norval Fortson retired. In addition, Bob Van Dyck is ending his research. The new hires (Blinov and Gupta) have provided renewed vitality to the group as evidenced by their NSF/MRI proposal with Markus Raschke and Munira Khalil from Chemistry to acquire a "frequency comb", enabling extremely high precision frequency measurements and tracking of high speed chemical reactions. It is likely that this activity will lead to new opportunities within the next few years.

The Staffing Committee recommends that, should the renewed activity lead to new opportunities, there should be a junior-level hire supporting this area.

The Atomic Physics group asked the Staffing Committee to consider hiring in Atomic Theory. The Staffing Committee considers this by itself a lower priority than the experimental search, but *the Committee recommends overlaps with Atomic Theory should be considered in future Theory searches.*

SUMMARY OF SEARCH RECOMMENDATIONS

It is important that this summary should not be read in isolation, but should be considered in the context of the above discussion.

Near Term Priorities

For 2008-2009, the majority of the Staffing Committee has a common set of clear priorities. The most urgent experimental priorities are strengthening Condensed Matter Experiment, continuing to pursue the Astrophysics initiative, and addressing the Department's commitment to Particle Experiment. Since the experimental Astrophysics search will be deferred for a year, in the near term, therefore, these priorities translate into a recommendation for a broad search in experimental physics with emphasis in Condensed Matter Experiment and Experimental Particle Physics. By "emphasis", we envision, e.g., the job posting reading "UW seeks applications in all areas of experimental physics, particularly in the subfields of Condensed Matter and Particle Physics ...". We also expect the Search Committee and faculty to solicit and be attentive to applications from good candidates in all sub-fields. We encourage faculty to participate in searches by scanning on-line applications for promising candidates: this is especially important for broad searches. The most urgent theory priority is rebuilding Astrophysics Theory, and so we recommend a search in this area.

Five-Year Priorities

Our projections of priorities over the out years are less clear. Assuming that the faculty size stays approximately constant, there will be a need for ten successful searches over the next five years, or about two hires per year. Consistent with the above discussion, a majority of the Committee sees a potential

sensible scenario of hires for the ten positions could be as follows: seven in experimental physics (three in condensed matter, one in astrophysics, one in particle, one in nuclear and one in atomic), and four in theoretical physics (one in astrophysics, and three across all theory subfields). This scenario includes the 2008-2009 searches. It is likely that in practice these searches will include broad searches emphasizing particular areas, as well as targets of opportunity tied to new initiatives.

These recommendations call for eleven hires over the next five years, to be compared to our estimate of ten for the number of searches at our assumed replacement rate.

CLOSING THOUGHTS

Overall, the Physics Department has made good progress towards meeting its staffing goals. However, it could well happen that the number of pressing staffing searches will outnumber the number of allowed searches over the next five years. Through strategic hires, targets-of-opportunity and initiatives, we therefore need to remain imaginative, aggressive, and willing to make hard decisions in our staffing to ensure the continued strength of our Department.

Leslie Rosenberg (Chair)
David Boulware
David Cobden
Steve Ellis
Blayne Heckel
Dam Son
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