

July 2009

Dear HMC Physicists:

It has been four years since I last wrote to many of you, so I want to bring you up to date on what has happened in the Department of Physics in the intervening period. I prefer to send these updates a little more frequently, but I was on sabbatical leave in 2006-2007 and, as I will explain in more detail below, have been absorbed with completing work on a new textbook since my return.

During the past four years, we have averaged 22 graduating physics majors each year, with 50% going on to graduate school and 50% going directly to work (not that the ones going to graduate school will not be working, too). Graduate programs that have attracted two or more of our majors in this period include Chicago, Colorado, Cornell, Harvard, Illinois, Princeton, UCLA, UCSD, and UT Austin. Companies and institutions that have hired our graduates include Carnegie Observatory, International Solar Electric Technology, NIH, Optical Research Associates, SAIC, Southwest Research Institute, and Sandia National Laboratories.

Some of our graduates have already achieved some notable successes. Andrew Higginbotham, one of this year's graduates, was awarded a Churchill Scholarship at Cambridge University in England, following which he will pursue a Ph.D. at Harvard University. Andrew did his research with Professor Tom Donnelly on nuclear fusion produced by Coulomb explosions of micron-sized droplets (yes, they did detect the resulting neutrons) as well as on the generation of surface harmonic waves. In 2008 Peter Scherpelz, one of those graduates pursuing a Ph.D. at the University of Chicago, was one of sixteen students nationwide to be awarded a Hertz Fellowship. These fellowships cover all fields of applied science, mathematics, and engineering. Peter carried out research in quantum optics on quantum secret sharing with entangled photons under the direction of Professor Theresa Lynn. One of the other Hertz winners in 2008 was Greg Minton, a math major who took a lot of physics courses and did research with Professor Vatche Sahakian on the potential effects of string theory on the cosmic microwave background radiation. Greg was also a finalist for the Leroy Apker Award, an award that Stephanie Moyerman '06 won. Stephanie did her research with Professors James Eckert and Patti Sparks on giant magnetoresistance effects in thin films layered with ferromagnetic and antiferromagnetic materials. The Apker Award is given by the American Physical Society for outstanding achievement in physics research by an undergraduate. Typically, two awards are given annually. In the past eleven years, we have had three Apker Award winners and two finalists, not that we are counting. This is clearly not an exhaustive list of the research accomplishments by our students, but it should give you a sense of the quality of research going on in the Department.

While most of our students participate in individual research projects, we also have an active clinic program, with typically one or two physics clinics per year, under the direction of Professor Richard Haskell. In this past year, for example, we had a joint physics/engineering clinic sponsored by Lawrence Livermore National Laboratory that designed and constructed a

waterproof, tagged-neutron source for the purpose of calibrating a new type of neutron detector for detecting fissile material at major ports of entry. Another physics/engineering clinic team in 2006-07 designed a thermal link for an optical refrigerator at the request of a research group at Los Alamos National Laboratory. The scientists at Los Alamos urged the team to present their work at the 2008 Photonics West conference. The team also wrote an article that was published this year in the Journal of Applied Physics. As I said in my last letter, we are always on the lookout for good clinic projects, so if you see a potentially interesting opportunity, perhaps with a company for which you work, please don't hesitate to let us know.

On the faculty side, I should note the retirement of Professor Daniel Petersen in 2007. Dan, a biophysicist, has been teaching at HMC since 1974. Even though Dan has retired, we are fortunate that he is continuing to teach a course on architecture in Los Angeles with Professor Jeffrey Groves of the Humanities, Social Sciences, and the Arts Department (and yes, that is their new name). In his place, we have hired Adam Edwards, who works in experimental particle physics, an area of much current interest with the Large Hadron Collider coming on line at CERN. Adam did his undergraduate work in physics at UC Berkeley and his Ph.D. at Stanford. In addition to Adam, I should also note the 2006 addition of Theresa Lynn, whom I mentioned earlier, to the full-time physics faculty. Theresa did her undergraduate work at Harvard and received her Ph.D. from Caltech. Other current members of the department whom I have not mentioned already include Chih-Yung Chen, who is now collaborating with Jim Eckert and Patti Sparks in research, Ann Esin, our astrophysicist, Greg Lyzenga '75, our geophysicist, and Peter Saeta, whose research interests are moving toward energy and environmental issues, an area in which Dick Haskell is also quite active. Ann and Peter are returning this coming year from productive sabbatical leaves, while Chih-Yung and Greg are starting to look forward to their upcoming sabbaticals in the next couple of years.

I am also very pleased to report that Jim Eckert was awarded the American Physical Society's 2009 Prize for a Faculty Member for Research in an Undergraduate Institution at the APS March Meeting. His citation reads: "For the significant contributions he has made to the understanding of the complex exchange biasing mechanism crucial to spin-valve sensors used in the read-write heads of hard disks and for his skilled and enthusiastic inclusion of undergraduates in physics research." For the sake of completeness, I should also note that I was surprised and honored to receive the Henry T. Mudd Prize for service to the College from President Klawe at the last faculty meeting of the spring semester this year. This award is normally announced at commencement, but I could not attend the commencement ceremony since one of my daughters was graduating from college that weekend.

One of the more significant upcoming changes at the College is the new core curriculum, tentatively slated to start in the fall of 2010. One of the impacts of this new curriculum for physics will be the shift of the first-semester course, Physics 23, to a focus solely on special relativity. I anticipate that the quantum mechanics portion of the current version of Physics 23, which focuses to a large extent on the quantum mechanics of light through the Feynman sum-over-paths approach to quantum mechanics, will be absorbed into the optics portion of the first-semester sophomore course, Physics 51.

The other changes in the core curriculum as regards physics will involve the core labs. The first-year physics laboratory course will be taught in both the fall and spring semesters during the first year, with half the students taking it in the fall and half in the spring. Professors Lynn, Lyzenga, and Sparks are busy this summer redesigning this course. The required chemistry laboratory course will also become a one-semester lab, with half the students taking it in the fall and half in the spring, alternating with physics. Thus students will not be required to take both the physics and chemistry laboratory courses together in the spring semester of the first year, as is the case in the current core curriculum. The third semester laboratory course will become a “choice lab” with a number of different options available to the students. I expect that we will work toward designing at least one of these choice labs next summer. Presumably, this course should be of particular interest to potential engineering and physics majors. If you have suggestions for topics that you think would fit well in such a course, don’t hesitate to pass them on to me.

Another change in the new core will be a special writing course taught by faculty members from all the departments in the college during half of the fall semester of the first year. Quite a few of the physics faculty have expressed an interest in contributing to this course. In order to facilitate our contributions to the new core we anticipate hiring an additional tenure-track faculty member in experimental physics next year. If you know someone who would make an outstanding faculty member, please point that person in our direction.

Finally, I can’t resist a little shameless advertising. Professor Helliwell and I have recently each completed new books. Helliwell’s *Special Relativity* is a new edition of the relativity text that you used as a student. It has been published by University Science Books, the publisher of my *A Modern Approach to Quantum Mechanics*, the text that we use in our junior-level quantum mechanics course, Physics 116. I have now written *the* text for a sophomore-level quantum physics course, such as Physics 52. This book, titled *Quantum Physics: A Fundamental Approach to Modern Physics*, will be available later this summer, also from University Science Books. The first chapter of this book, devoted to the quantum mechanics of light, is the basis for the discussion of quantum mechanics that is part of the core curriculum. If you want to see how Physics 52 has evolved since your student days, check out *Quantum Physics*.

I hope you get a sense from this letter that, despite the tough economic times, things are overall going well at the College. We very much enjoy seeing you when you return for a visit and we certainly hope that things are progressing well for you in your life after Mudd. I want to stress how much we value hearing from you. If you send an e-mail with any news, comments, or feedback, I will forward it to the rest of the physics faculty here.

Sincerely,

John S. Townsend  
Susan and Bruce Worster Professor of Physics  
Chair, Department of Physics  
Harvey Mudd College