March 10, 2008

Dear Friends and Alumni,

Greetings! I hope this spring finds you all well and eagerly awaiting news from the physics program. As usual, the past year has been busy, filled with events, student accomplishments, and some significant changes in the program.

Deep Underground Science and Engineering Lab (DUSEL)

The old Homestake mine in Lead, South Dakota, has been a big news story in South Dakota for the past several years, but events in the last several months are starting to have a big impact on the physics program. For those of you who are not familiar with the story, Barrick Mining announced a cessation of their operations at Homestake in 2001. Almost immediately, scientists in the high-energy physics community recognized the potential value of this site as a deep underground laboratory and began to take steps to make this a reality. Running experiments underground at Homestake is not a new idea; Ray Davis won the 2002 Nobel Prize in Physics for an experiment that began in the sixties and was designed to measure the number of neutrinos produced by the Sun. This particular experiment was located at the 4850-foot level. However, in the forty years since that experiment began, excavations at Homestake have increased the depth available for experiments to nearly 8,000 feet. Unfortunately, problems with indemnification led to a delay in further progress on an underground lab in 2001.

These problems have now been solved and, within the last month, South Dakota obtained title to Homestake from Barrick Mining. The process is moving forward along several other paths as well. South Dakota's Homestake, along with the Henderson Mine in Colorado, is one of two finalists in the NSF competition to determine the site of a Deep Underground Science and Engineering Lab. The final Conceptual Design Report is due in late June with an announcement of the chosen site to occur sometime in the Fall of 2006. At the request of Governor Rounds, the South Dakota legislature appropriated an additional $20 million to provide infrastructure support to scientists who wish to locate their experiments in the mine. Physics has certainly been in the news in South Dakota for the past year.

New Faculty Member

As we began the search for a new faculty member, hiring someone with research interests and expertise compatible with DUSEL became a high priority for us. After a very long and competitive search, we hired Dr. Dongming Mei as the third tenure-track physicist in the department. Dr. Mei received his PhD from the University of Alabama in 2003 and a B.S. from Hua Zhong Normal University in 1983. For the past three years, he has been a post-doc at Los Alamos National Lab. He is a participant in numerous collaborations that must be located in a deep underground laboratory, including the Majorana Double-Beta Decay Experiment, the CLEAN Solar Neutrino and Dark Matter Experiment, and the DEAP Dark Matter Experiment. He is widely published with articles appearing in such journals as *Physical Review D* and *Nuclear Instruments and Methods in Physics Research*. He has already begun planning for an Ultra-Low Background Counting Facility to be located at Homestake and his hire essentially doubles the number of Regental faculty with expertise in the type of physics proposed for DUSEL. The Department and, I dare say, the whole physics community in South Dakota enthusiastically welcomes Dr. Mei to our program.

Nobel Conference

As I am sure many of you know, 2005 was the designated as the World Year of Physics by the International Union of Pure and Applied Physics as a way of marking the centennial of Albert Einstein's miraculous year of 1905. In this year, Einstein published three seminal papers, which changed the way physicists and others view the world. These papers developed special relativity, introduced the idea of the photon or quantum of light, and explained Brownian motion. One celebration of the World Year of Physics occurred at the annual Nobel Conference hosted by Gustavus Adolphus College in St. Peter, Minnesota. In cooperation with the Honors program, we took a group of students, both physics majors and non-majors, to one day of this conference. These students heard a number of prominent speakers including Wolfgang Ketterle (Physics Nobel Prize in 2001 "for the achievement of Bose-Einstein condensation in dilute gases"), Kip Thorne of Cal Tech who does research in general relativity, and Thomas Levinson, a historian who has written on Albert Einstein. Some of you former students may remember Kip Thorne as the author of *Black Holes and Time Warps: Einstein's Outrageous Legacy*, which we used in the Space and Time Honors Seminar. It was both an educational and entertaining trip for our students.

Astronomy Day Speaker

On April 11, Dr. Bill Hiscock of Montana State University presented our annual Astronomy Day lecture in Farber Hall. In keeping with the World Year of Physics theme (although we were already in 2006, I blamed it, appropriately enough, on time dilation), Dr. Hiscock presented two lectures on topics related to work originally developed by Albert Einstein. Dr. Hiscock's public lecture was entitled "Black Holes: Mysterious Powerhouses of the Universe." Dr. Hiscock's talk traced the history of the black hole concept from before Einstein through today's incredible astronomical discoveries. Bill also presented a more technical lecture for science students and faculty earlier in the day. This lecture was entitled "Beyond Einstein: Quantum Gravity and Dark Energy." This lecture traced some of the most noteworthy developments in the quest to combine general relativity with quantum mechanics, including the theoretical discovery of black hole evaporation by Hawking in 1974, the ever-growing interest in string theory, and the recent observational evidence showing that the expansion of the universe is accelerating.

Dr. Hiscock is the head of the Department of Physics at Montana State University, where he is a professor of theoretical astrophysics and has been a member of the faculty since 1984. Dr. Hiscock received his B.S. in Physics from the California Institute of Technology, and his M.S. and Ph.D. from the University of Maryland. He held postdoctoral fellowships at Yale University, the University of Texas, and the University of California-Santa Barbara prior to arriving at MSU. His lectures were very well received by the campus community and the general public.

Research Activities

Dr. Yongchen Sun continues to be a very productive researcher. This past year he co-authored four papers including one in *Physical Review B* entitled "Optical decoherence and spectral diffusion at 1.5 mm in Er^{3+}:Y_2SiO_5 versus magnetic field, temperature, and Er^{3+} concentration" and another in *Physical Review Letters* entitled "Optical Decoherence in Er^{3+}-Doped Silicate Fiber: Evidence for Coupled Spin-Elastic

Tunneling Systems." This summer he will be presenting a paper at the 9th International Conference on Hole Burning, Single Molecule and Related Spectrocopies Science and Applications in Centre Paul Langevin, Aussois, France.

Summer Activities

The Lawrence Brothers Science Camp continues into its fifth year this summer, with members of the physics program continuing to contribute activities to the camp. This camp was initially funded through a very generous gift from the Lawrence family and was first announced at the Lawrence Brothers Celebration in 2001. This summer's theme will be a repeat of the second year's theme of "Science and Sports" and will run from July 10-14. If any of you know young people (grades 7-9) who may be interested in attending this camp, you should direct them to www.usd.edu/lbc for more information.

The Masters of Natural Science program continues with modules on thermodynamics and modern physics (you can bet we will spend a great deal of time discussing neutrinos) and an interdisciplinary module focusing on inquiry-based learning.

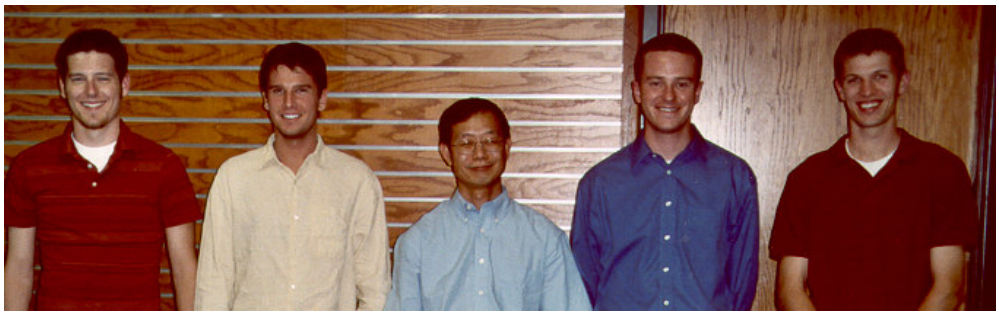
Graduating Seniors

This spring we continued to remain around the national average for students graduating from undergraduate physics departments. Andrew VanOsdol graduated Magna Cum Laude with a double major in physics and history. He has been accepted into the Sanford School of Medicine at the U. and will begin classes this fall. Jamie Weissenfluh joined our program midway through her junior year as a transfer student from the South Dakota School of Mines and Technology. She graduated with a B.S. in physics and will enter the graduate program in medical physics at Purdue University. Eric Omdahl graduated Cum Laude with both a B.S. in Physics and a B.B.A in Economics. He is currently deciding whether he should use his physics degree or business degree as he considers employment opportunities.

Current Students

The Joseph and Margaret Nelson Scholarships were awarded to Phillip Maass, Zach Parsons, and Keenan Thomas. Mike Janssen received the G.I. Moller Scholarship, which is given to an outstanding senior-level student who has been active in departmental activities. Overall, the undergraduate physics majors were a very active bunch this year. As in past years, the physics club held an open house at the Science Olympiad, which features a number of cool (you may interpret cool in several ways, since liquid nitrogen plays a big role in the presentations) physics demonstrations. This series of demonstrations grew into a traveling physics show. The students spent a day at the Vermillion Middle School, during which time they presented their show to every eighth grade science class. They also traveled to Gayville and presented to their entire middle school. The students did a great job putting this together and created a lasting legacy for future undergraduate students. Both schools have already asked the group to come back next year and we expect the roster of school visits will increase as word spreads.

This past year, the Society of Physics Students also updated its charter. Along with that update and after many years of inactivity, we reestablished the Sigma Pi Sigma chapter on our campus. As many of you know, ΣΠΣ is the national honor society for physics majors. We inducted our new ΣΠΣ members at our first annual spring physics banquet, at which we also handed out our scholarship awards. Our new SPS inductees are students: Andrew VanOsdol, Eric Omdahl, Mike Janssen, Phillip Maass, and faculty member: Dr. Sun. I will appreciate having other SPS members on campus next year to help with the selection and initiation processes.



SPS Inductees: (l to r), Phillip Maass, Eric Omdahl, Dr. Yongchen Sun, Mike Janssen, Andrew VanOdsol

Former Students

Tim Margheim (B.S. 2004) completed his first year in the applied physics program at Texas Tech. He was fully supported through an assistantship and will be interning with AMD in Austin, Texas, this summer.

Trevor Anderson (B.S. 2001) is in his final year of medical school and is living in Spearfish with his wife Melissa and son Clark.

Finally, allow me to steal a news story from the USD web site. "*The University of South Dakota is pleased to announce the two recipients of the highest honor bestowed upon teachers at The U. This year's Belbas-Larson Awards for Excellence in Teaching will go to Dr. Christina (Tina) Keller of the Department of Earth Sciences/Physics in the College of Arts and Sciences and Professor Gregory Huckabee of the Division of Business Law, Management and Marketing in the School of Business, and will be presented at the 2006 Spring commencement ceremony on May 13."* I was truly honored to have been chosen as this year's recipient and I thank all of you who have been students in my classes for making my teaching experience at the U. such a pleasant one.

Once again, we enjoy hearing from all of you. Please keep the information coming. Send the information to phys@usd.ed or you may send the information to me via regular mail in care of the physics program at USD. You may also wish to explore our web site at www.usd.edu/phys.

As always, I will end by asking for your help. All of the activities, scholarships, and visiting speakers mentioned above require financial support. As costs increase from year to year, while operating budgets remain static, we depend more and more on friends of the program to help accomplish our goals and support our activities. Our undergraduate majors are some of the very best students at this institution. While they remain successful competing for general scholarship dollars available at our institutions, we think rewarding them with dollars designated specifically for physics majors would help us retain and recruit undergraduate students.

Thank you for all of your support and I look forward to hearing from you.

Best Wishes,

Tina Keller, Director