University of Virginia
Physics News
Volume 1, Number 1 Spring 2007

Top Ten Undergraduate Program

Most people are not aware that the Department of Physics ranks in the top ten nationally in the graduation of physics majors. Our annual number of graduating physics majors has consistently been over 30 during the past ten years, and occasionally 40 or more, including 40 last year and 43 to graduate in May 2007. Only UC-Berkeley, U. Washington-Seattle, MIT, Harvard, and Brigham Young regularly produce more physics undergraduates than UVa. Since 2000 an average of 35 students have graduated, many with a double major.

Here are some statistics about our undergraduates:

- 24% were female.
- 54% received the BA in physics.
- 33% received the BS in physics.
- 13% received the BA in astronomy/physics.
- 44% double majored with math, chemistry, economics, environmental science, engineering, and music being the most popular.
- Slightly more than 50% went to graduate or professional schools, with about half of those in physics.

Besides going further in physics, our graduates have done a myriad of things: about 5% went to medical school, 5% became teachers, and 4% were commissioned as military officers. Others went into computers, information technology, law, consulting, flight school, banking, professional basketball, bicycle touring, volunteerism, and many other professions.

Prior to 1995 the physics department graduated an average of 25 undergraduates each year. In 1993 the department began a study under the direction of Professor Bascom Deaver, Associate Chair for Undergraduate Studies, to consider a new less intensive BA degree that would allow students to eventually move to a variety of professions. We expected many of these students to double major. This degree became effective in 1995, and a key component of the new BA degree was the addition of the two-course sequence PHYS 311, 312 Widely Applied Physics, which treat principles of physics from the perspective of modern applications. The flexibility of this degree makes it suitable for pre-professional students. For example, together with PHYS 304 Physics of the Human Body, the BA degree becomes an attractive program for premedical students.

There are presently two special concentrations that can be taken by either BA or BS students. New courses in computational physics (254, 553 and 554) have been developed for the Computational Physics concentration. Similarly, optics (531) and photonics (532) courses have been developed for the Optics concentration.

Honors and Awards

Undergraduate Students

The James W. Elkins, Sr. award is given annually to the most outstanding physics undergraduate major. The recipient in 2005 was **Christopher Noe**, and the award was shared in 2006 by **Jirakan Nunkaew** and **Patipan Uttayarat**.

Graduate Students

The departmental outstanding teaching award for 2005 was given to **Scott Rohrbaugh** and for 2006 to **Melissa Commisso**.

Faculty (since 2004)

Bascom Deaver received the Alumni Distinguished Professor Award.

Robert Hirosky was appointed a University Teaching Fellow and received the Mead Honored Professor Award.

Nilanga Liyanage received a University Teaching Fellowship, an All University Teaching Award, and a Department of Energy Outstanding Junior Investigator in Nuclear Physics Award.

Dinko Počanić and **Stephen Thornton** were elected Fellows of the American Physical Society.

Jongsoo Yoon received an NSF Career Award.

Letter from the Chairman

Dear Alumni & Friends
of the Physics Department,

I am sure that I am not alone in welcoming with great enthusiasm the initiative for a Physics Department Newsletter put forth recently by Steve Thornton. Our department has changed a lot in each of the past two decades during which I've known it. The changes have been overwhelmingly for the better. I am happy to report that since implementing the 1996 reform of our undergraduate program and curriculum, we have dramatically increased the annual number of physics bachelors' degree recipients. The growth and enrichment of our program were noted by the APS in a recent *Physics Today* feature article on the top ten thriving physics programs nationwide. There are many reasons for our alumni and friends to feel good about the department. I hope that over time this Newsletter will succeed in bringing some of them to your attention.

As I was writing these lines, news of the untimely death of our dear colleague Julian Noble reached the department. All of us who have known Julian, his wonderful, gregarious good nature, and his incredibly keen intellect, will miss him very much.

Dinko Počanić

Please send comments and suggestions about the newsletter to
physicsnewsletter@virginia.edu

Faculty News

New Faculty (since 2004)

Stuart Wolf (Professor of Materials Science and Physics) is an experimental condensed matter physicist who joined us in 2004 after a successful career at the Naval Research Laboratory and DARPA. He studies spin dependent phenomena or Spintronics.

Keith Williams (Assistant Professor) is an experimental condensed matter physicist who joined us in 2004. He studies nanodevices.

Kent Paschke (Assistant Professor) is an experimental nuclear physicist in a half-time bridge position at JLAB (Thomas Jefferson National Accelerator Facility in Newport News). He joined the faculty in 2006.

Xiaochao Zheng (Assistant Professor) is an experimental nuclear physicist who is in a half-time bridge position at JLAB She joined the faculty in 2006.

Retired Faculty

A number of faculty have retired over the last decade or so. They include the following with their years of service in parentheses.

Stanley Sobottka (1964-1996) is still active teaching occasional University Seminars.

Arthur Brill (1973-1997) works in his lab most days.

Michael Coopersmith (1969-1998) lives in the Charlottesville area.

Rogers Ritter (1961-2000) is active in his entrepreneurial activities.

Stephen Schnatterly (1977-2003) lives in the Charlottesville area.

Hans-Jürgen Weber (1967-2003) is still doing nuclear theoretical calculations and updating his mathematical methods textbook.

Vittorio Celli (1966-2004). See article on page 4.

Ralph Minehart (1966-2005) lives in Charlottesville and continues his work on JLAB data.

John Ruvalds (1969-2005) lives in the Charlottesville area.

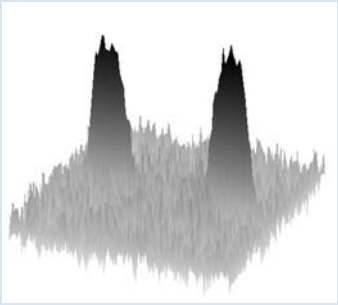
Doris Kuhlmann-Wilsdorf (1966-2005) is active locally in her two companies.

Deceased Faculty

We are sad to report the following: Professor **Julian Noble**, who served on the faculty from 1971-2003, passed away in March 2007 from cancer. Professor **Kees Gugelot**, who served on the faculty from 1966-90, passed away in February 2005 from heart failure. Professor **Prabahan (Pasha) Kabir**, who served on the faculty from 1971-98 passed away in August 2004 due to a drowning accident in India. President **Frank Hereford**, who served on the faculty from 1949-92 as Professor of Physics, Dean, Provost, and President (1974-85), passed away in September 2004.

The Bose-Einstein Man

Charles (Cass) Sackett was one of the first people to produce a Bose-Einstein condensate (BEC). He did so in 1995 while a graduate student at Rice University working under Randy Hulet. Their group was the second one to produce BEC. Then he pursued this line of research further while working with Davisson-Germer Prize winning physicist David Wineland at NIST in 1999-2001. Cass became an assistant professor of physics at UVa in 2001. Since then, he and his students have built a world-class atomic physics laboratory.



The two peaks show the BEC clouds of rubidium atoms in the two arms of the interferometer. The two peaks are separated by 260 microns and contain about 20,000 rubidium atoms.

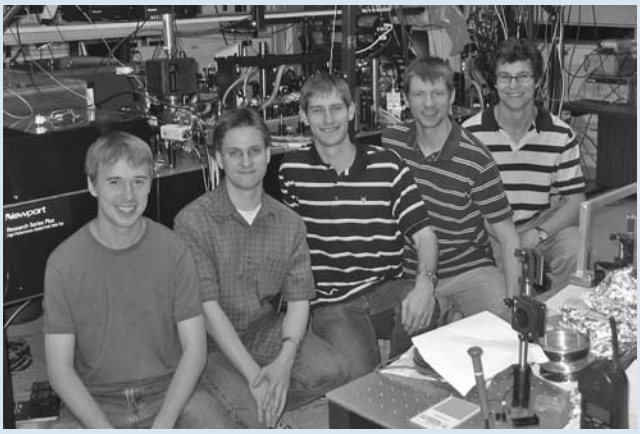
The heart of the laboratory is a Bose-condensed-atom interferometer, which allows a multitude of precision fundamental physics measurements. Sackett currently explores quantum mechanical phenomena at extremely low temperatures using atomic interferometry. We all remember the beautiful rainbow of colors produced when light constructively and destructively interferes from the two surfaces of soap bubbles. Michelson greatly improved interferometers in the late 19th century for his ether measurements of light. Sackett's group uses "matter waves", because it is well established that atoms have wavelike properties. Unfortunately, it is not easy to use atomic interferometers. The strong interactions between atoms require extremely high vacuum. While it is straightforward to steer, reflect, and focus light, it is much more difficult to do so with atoms. Scientists like Sackett, however, have managed to use laser cooling to produce a very cold cloud of atoms, which subsequently can be used as matter waves in an interferometer. As the atomic wavelengths grow increasingly larger due to the cold temperature, the atoms are able to condense into a quantum fluid described by a single matter wave and BEC occurs!

Sackett has been able to produce atomic clouds in two separate arms of his interferometer that are further apart than the size of the atomic clouds – a real achievement allowing Sackett's group to pursue extremely interesting experiments. For example, they can now expose atoms in one arm of the interferometer to other atoms, surfaces, electric fields, laser light, etc. and make precise measurements of the effects of these interactions on the atoms. Further improvements are planned.

A measurement is currently underway to determine the electric polarizability of rubidium atoms. (See figure above.) Rubidium is being considered as a replacement for cesium as the atom on which the definition of the second is based. Knowing the polarizability is an important step to allow this. A high precision measurement of the rubidium polarizability would also provide a useful test for atomic theory calculations. These would help clarify parity violation measurements in atoms as well as fundamental particle properties in the standard model.

While at UVa Sackett has received a prestigious Sloan Fellowship, a Young Investigator Award from the Office of Naval Research and other grants from NSF and the Army Research Office. Sackett and Olivier Pfister have developed a new undergraduate optics laboratory that is an essential component of the new Optics Concentration for the undergraduate physics major program. Professor Sackett has received rave reviews for his teaching of optics and quantum physics I and II courses.

Many students have worked in Sackett's laboratory. Ofir Garcia and Jessica Reeves each received a PhD in 2006. Ken Baranowski received a MS in 2006. Currently Ben Deissler, Jeramy Hughes, John Burke, and Eun Oh are conducting their PhD research with Sackett. Patrick Keith-Hynes worked in summer 2003. In addition several students have done undergraduate research and/or independent study with Sackett. These undergraduates include Justin Wright, Ashley Mowery, Tiffany Soinsky, Jessica Aikin, Peter Berger, Patipan Uttaryat, J. R. Powers-Luhn, Brian Livedalen, Michael Grogan, Taylor Hollis, Kiadtisak Saenboonruang, and Doug O'Reagan.



The Sackett Group kneeling in front of the BEC apparatus: Doug O'Reagan (undergrad), Ben Deissler, John Burke, Jeramy Hughes, Cass Sackett.

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Trekking in the Alps

If it is summertime Vittorio Celli can be found walking in the Alps with his son's family. Otherwise, since retiring in 2004 he can be found puttering around in his yard and garden in Charlottesville, teaching his popular University Seminar on *The Origin of the Universe*, or having a spirited discussion about Galileo and ocean tides. Each spring he climbs Old Rag Mountain in Madison County, dragging along anyone who dares to keep up with him. He hasn't slowed down any, to the chagrin of his wife Eija. Professor Celli divides his time between Charlottesville, his home in the Italian Alps, and the occasional visit to another home in Helsinki, Finland with his wife. Needless to say, you can always find him at UVa in the winter, but the allergies in Charlottesville usually direct him to Europe by late April.

His colleagues can always count on a spirited discussion whether it be about dark energy, the latest Bush administration "surge", the most recent Friday colloquium, or backscattering from atomic surfaces. He presented a Friday colloquium in fall 2006 about Galileo and ocean tides. He believes much of the current thinking about how tides are formed is incorrect.

After graduating from the University of Pavia in Italy in 1958, he came to the United States for stays at the University of Illinois and UC-San Diego before returning to the faculty of the University of Bologna in 1964. He came to UVa in 1966 where he has been since except for many summers and research leaves all over the world including Argonne, Trieste, Madrid, Jülich and Göttingen in Germany, UC-Irvine, Milan, Padua, Genova, and Helsinki. He is a fellow of the American Physical Society and has been both a Fulbright Scholar and a senior US Fellow of the Humboldt Foundation.

Celli continues to be a referee for a number of physics journals. At present, he and Alessandro Marvin, a former PhD student now at the University of Trieste, are preparing a tome for non-mathematicians who want to use tensor calculus and differential geometry to study surface science. This relates back to work they did in the 1970s. He is also preparing a paper for publication with Spanish colleagues in Madrid on *Phonon lineshapes in atom-surface scattering*. Celli is one of the persons who actually does contribute to *Wikipedia – The Free Encyclopedia*.