



Quanta

A publication for the faculty, staff, students, alumni & friends of the Virginia Tech Physics Department

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Message from the Chair

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Virginia Tech dominated the international news media for several weeks in April of 2007. We just wish it had been for different reasons. You will find a short article on the next page, describing how the tragic events unfolded for us.

This fall, we welcomed a record number of new students: 54 freshmen, 6 transfer students, and 18 new graduate students. We wish all of them much success and will support them in their studies and their personal growth, by providing individual attention and a close-knit, friendly community. The academic credentials of this incoming class are very strong. For example, about one quarter of the freshmen already have credit for all or part of the introductory "Foundations of Physics" sequence. We expect that many of our "newbies" will be working on different undergraduate research projects before too long.



Our faculty continue to be engaged in world-class research. In this newsletter, you will read about some of their most recent achievements, such as being elected to Fellowship of the American Physical Society, receiving prestigious junior investigator awards, and exploring neutrinos, which count amongst the most elusive particles in the universe.

With this newsletter, we introduce a new feature: articles by our alumni about their work and the role played by their physics education. If you would like to contribute an article, please contact us; we would love to hear from you! And please consider including us in your holiday giving. Details can be found on the last page.

In the meantime, you can always read the most recent news and updates about the department at www.phys.vt.edu and www.phys.vt.edu/news/news.html.

With best wishes for a wonderful holiday season and a happy New Year 2008,

Beate Schmittmann
Professor and Chair



VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

The tragic shootings on April 16, 2007

By Beate Schmittmann

Life at Virginia Tech changed irrevocably over the span of a few minutes on Monday, April 16, 2007, when a seemingly safe environment turned into a nightmare. As everywhere on campus, the tragic shooting incident left Physics students, faculty, and staff in shock. On the one hand, we are profoundly grateful that all members of the department were found to be safe. On the other hand, many students and faculty lost close friends. In the days and weeks after the shootings, they struggled with their grief and other feelings that were brought to the surface while trying to support immediate family members of the victims. The whole department came together on Thursday, in a ceremony of remembrance, supported by staff from the Cook Counseling Center. Subsequent meetings were devoted to an in-depth exploration of how to return to the classroom and how to support our students. With the help of the counselors, faculty, instructors and graduate teaching assistants explored ways of talking about the tragic events, acknowledging grief, sadness, and anger, while making space for many different ways of mourning. The “Ladies of Robeson”, a group of female students and faculty, met Thursday night for dinner and emotional support. When classes resumed, the vast majority of our students attended; however, once the generous university grading policy became known, class attendance dropped rapidly. Still, returning to a regular class schedule, reconnecting with friends, and finding Virginia Tech “still there” was doubtlessly an important step on the road towards recovery.

A particularly poignant issue concerned the incoming freshmen class whose decision date was May 1. Both the chair and the undergraduate coordinator had been in touch by phone and e-mail before the events, in order to recruit top students. After the tragedy, it became paramount to let prospective students and their parents know that the events had not changed the quality of research and education in the department and had, if anything, brought the university and the department community closer together. In the end, our freshmen admissions for this year were significantly above those of the previous year, and the academic preparation of the class is very promising.

During this difficult period, the support of hundreds, if not thousands, of personal friends, colleagues, and alumni from across the world served as a major source of comfort. We would like to thank all of you for the many different expressions of concern which we received. Your support really meant a lot to us.



According to an old Japanese tradition, folding 1000 cranes for a sick or injured person will help the healing process. In the weeks after the tragedy, physics professor Tatsu Takeuchi inspired faculty, students, and friends to fold a total of 7600 cranes which were displayed in Squires Student Center.



A Day in the Life of a High School Physics Teacher

By Alma Robinson, Class of 2002



Alma Robinson (standing at the back) and her students. Jose Umanzor-Alvarez (front right) is now a physics major at Virginia Tech.

It's odd to have a bell dictate the structure of your day; it's a bit too reminiscent of the opening credits of *The Flintstones* and I like to think that we've progressed beyond the stone age. Nevertheless, such is the life of this fourth year physics teacher at Wakefield High School in Arlington, VA. When the bell rings at 8:19 AM (high school bell schedules seem to have an unhealthy fascination with prime numbers!), I present my students with a "question of the day" about the physical world around them.

Many of you probably remember the days when high schools employed a sole physics teacher and studying physics was a privilege reserved only for the elite math and science students, but I'm delighted to report that things have changed. We provide students from all backgrounds and interests a chance to study this

fundamental science, or, as my students see it, the class that gets to take a field trip to Six Flags. Our school offers five different levels of physics, ranging from a calculus-based AP course to a hands-on, applied physics course geared towards students who tend not to excel in traditional math and science classes.

Wakefield, with its remarkable racial and socio-economic diversity, is quite an amazing place to teach. Traditionally, our student population is underrepresented in upper level science courses, but our school offers multiple programs to support those students who choose to take challenging course work, resulting in increased participation and success for all of our students. About half of my AP physics class, for example, is comprised of students who either qualify for the Federal Free and Reduced Lunch program and/or speak English as a second language.



In any language, it's clear that my students most enjoy the classic demonstrations and problems that I learned at Virginia Tech from Amy Emerson Missoum and the Outreach program as well as the late, great Dr. Dale Long's freshman mechanics course. Every year, jaws drop as I make Pyrex beakers "disappear" with ordinary vegetable oil and I hope that if my student's are intrigued enough, they might just stick around to learn the physics behind it.

I have no delusions that all of my students will become physicists or appreciate the aesthetics of Maxwell's equations. I do, however, hope that my students will learn to think critically, problem solve, and develop an operative level of scientific literacy, enabling them to make educated decisions as individuals and as citizens. Or, at the very least, develop a bell schedule that doesn't end at 3:01.

Events for Alumni



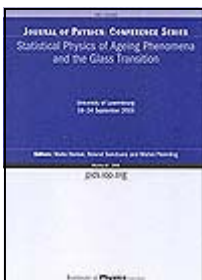
Alumni Andrew Landahl (left) and Leah Shaw (right) chat with senior James Dowd, in Denver, CO.

Alumni relations are an important component of a well-rounded department. Two events were held this year, one on-campus and one off-campus. In conjunction with the College of Science Homecoming Weekend, the “Ladies of Robeson”, a group of female students and faculty, invited several recent alumni to campus. Some of our visitors are in graduate school, at Princeton, Duke, and elsewhere, and others are in the workforce, teaching high school physics or developing software for an astronomy publishing house. A networking event with our current students was well attended, followed by a reception, a football game and dinner at the Inn with all the other College of Science alumni.

The off-campus event took place in Denver, Colorado, as part of the March Meeting of the American Physical Society. This large conference brings over 5000 scientists together, working in a broad range of areas, from materials science and biological physics to quantum computing and climate modeling. Alumni, ex-postdocs and ex-faculty members joined the Virginia Tech contingent for good food and good company.

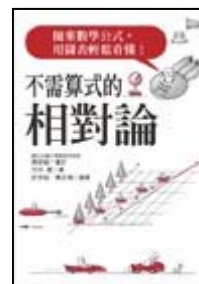
The department will be holding similar events in the future: One is planned for the Northern Virginia and DC area in February, and another one for the March Meeting in New Orleans. Stay tuned!

Books published by faculty



Statistical Physics of Ageing Phenomena and the Glass Transition

Edited by: Malte Henkel, **Michel Pleimling**, and Roland Sanctuary



No Equations! Relativity Illustrated (Chinese translation)

By: **Tatsu Takeuchi**

Royce Zia named fellow in the American Physical Society

Article courtesy of Catherine Doss, VT News, January 5, 2007



Royce K. P. Zia, of Blacksburg, Va., professor of physics in the College of Science at Virginia Tech, has been named a Fellow in the American Physical Society (APS).

According to the APS, Zia was honored for “seminal and sustained contributions to statistical physics, especially critical phenomena, interfacial properties and far-from-equilibrium phenomena.” APS guidelines state that each year no more than one-half of one percent of the current membership of the society is recognized by their peers in this fashion. The organization currently has approximately 46,000 members.

“Royce is internationally known for his highly creative and insightful contributions to physics, and this honor is more than well-deserved,” said physics department head Beate Schmittmann.

In addition to his many other accolades, Zia holds a lifetime Alexander von Humboldt Research Award for his work in the area of theoretical condensed matter physics, a discipline devoted to the understanding of the cooperative behavior in systems with large numbers of constituent particles.

Zia received his bachelor’s degree from Princeton and his doctorate degree from the Massachusetts Institute for Technology.

The APS was formed in 1899 and is the authoritative source for the advancement of physics. Today the organization collaborates with other national scientific societies for the advancement of science, science education and the scientific community. The organization also cooperates with international physics societies to promote physics, to support physicists worldwide and to foster international collaboration.

In short...

- ♦ **Randy Heflin** was recognized as Virginia Tech Scholar of the Week December 11-17, 2006.
- ♦ **Prof. Giti Khodaparast’s** paper on ultrafast magneto-optics in ferromagnetic III-V semiconductors was chosen for inclusion in the Journal of Physics: Condensed Matter (JPCM) Top Papers 2006 Showcase.
- ♦ **Prof. John Simonetti** presented a talk on Dark Energy and Dark Matter for the Graduate Life Center’s Spring 2007 Speakers Series.
- ♦ Congratulations to **Scott Allen** on his promotion to shop foreman. He assumed the role when Melvin Shaver retired.
- ♦ Our deepest condolences go out to **Dick Rusk** (Associate Professor 1949-1982) and his family. His wife, Thelma, passed away March 20, 2007.

Simonetti collaborates with Athletic Department on ad campaign

Dr. John Simonetti worked with Virginia Tech University Relations on a TV commercial designed to promote the university. The commercial runs during televised sporting events. Dr. Simonetti also prepared the physics content for four print advertisements, produced by the University Athletic Department as part of its “Winning – It’s All in the Mind” campaign.



Virginia Tech scientists help clarify the mystery of sterile neutrinos

Article courtesy of Catherine Doss, VT News, April 13, 2007

An announcement by scientists at the Department of Energy (DOE) significantly clarifies the overall picture of how neutrinos--a fundamental building block of the universe--behave.

The results of the so-named MiniBooNE project, which included Virginia Tech College of Science physicist **Jonathan Link** and 77 scientists from 16 universities around the world, resolve questions raised by observations in an earlier DOE experiment--Liquid Scintillator Neutrino Detector (LSND)--in the 1990s that appeared to contradict findings of other neutrino experiments worldwide. The April 11 announcement significantly clarifies the overall picture of how neutrinos behave.

Simply put, neutrinos are particles that originate from the center of the sun. They are one of the fundamental particles of the universe, but also one of the least understood. Neutrinos differ from electrons in that they do not carry an electric charge and can pass through great distances in matter without being affected by it.

Neutrinos

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Studying neutrinos helps scientists understand about the sun, stars, and even the deep core of the Earth. It also provides the capability to detect extremely small trace amounts of radioactivity contained in samples of material, resulting in applications for homeland security, microelectronics, and space science.

“The possibility of sterile-neutrino-induced oscillations observed earlier by LSND now seems to be ruled out,” said Link of the MiniBooNE collaboration findings. “But there may still be sterile neutrinos with somewhat different properties.”

Since the LSND result, theorists have used sterile neutrinos to solve many problems in physics from supernova explosions to the mysterious dark matter that binds galaxies together.

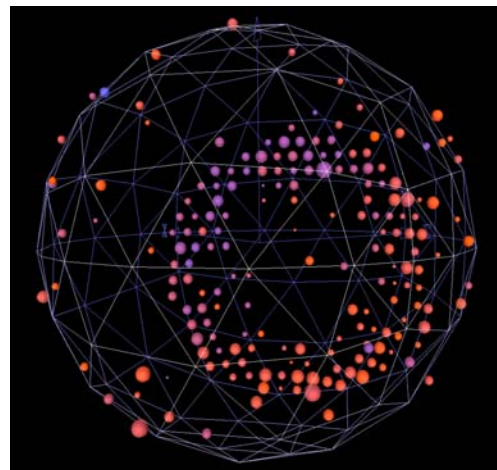
Scientists at Virginia Tech have also proposed a new experiment, known as LENS (Low Energy Neutrino Spectroscopy), that will push the search for sterile neutrinos well beyond the scope of the MiniBooNE project.

Currently, three types or “flavors” of neutrinos are known to exist: electron neutrinos, muon neutrinos and tau neutrinos. In the last 10 years, several experiments—including the LSND collaboration—have shown that neutrinos can oscillate from one flavor to another and back. However, reconciling the LSND observations with the oscillation results of other neutrino experiments would have required the presence of a fourth, or “sterile” type of neutrino, with properties different from the three standard neutrinos. The existence of sterile neutrinos would throw serious doubt on the current structure of particle physics, known as the Standard Model of Particles and Forces. Because of the far-reaching consequences of this interpretation, the LSND findings cried out for independent verification.

The MiniBooNE experiment, approved in 1998, took data for the current analysis from 2002 until the end of 2005 using neutrinos produced by the Booster accelerator at the DOE's Fermilab facility. The experiment's goal was either to confirm or to refute the startling observations reported by the LSND collaboration, thus answering a long-standing question that has troubled the neutrino physics community for more than a decade.

The MiniBooNE collaboration used a blind-experiment technique to ensure the credibility of their analysis and results. While collecting their neutrino data, the MiniBooNE collaboration did not permit themselves access to data in the region, or “box,” where they would expect to see the same signature of oscillations as LSND. When the MiniBooNE collaboration opened the box and “unblinded” its data less than three weeks ago, the telltale oscillation signature was absent.

For its observations, MiniBooNE relied on a 250,000-gallon tank filled with ultra pure mineral oil, clearer than water from a faucet. A layer of 1280 light-sensitive photomultiplier tubes, mounted inside the tank, detects collisions between neutrinos made by the Booster accelerator and carbon nuclei of oil molecules. Since January 2006, the MiniBooNE experiment has been collecting data using beams of antineutrinos instead of neutrinos, and expects further results from these new data.



A neutrino signal observed by the MiniBooNE experiment



Jonathan Link joined Virginia Tech from Columbia University, where he was a post-doctoral research associate based at Fermi National Accelerator Laboratory in Batavia, Illinois. He completed his doctoral studies at the University of California, Davis. His current work centers on the study of neutrino oscillations. He is a member

of the MiniBooNE collaboration, which will test the anomalous high Δm^2 oscillation signal observed in the LSND experiment. He is also working on the construction of a new experiment in China that seeks to measure the last unknown mixing angle in the neutrino mixing matrix using neutrinos from nuclear reactors.



Michel J. F. Pleimling joins us from the University of Erlangen-Nürnberg in Germany where he was a faculty member. Prior to that, he was a post-doctoral research associate at the University Henri Poincaré in Nancy, France, and at the Rheinisch-Westfälische Technische Hochschule in Aachen, Germany. Michel earned his Ph.D. degree

from the Universität des Saarlandes in Germany. He is working in the fields of Condensed Matter Physics, Statistical Physics, and Computational Physics. Currently, his main research interest lies in the study of the dynamical behavior of non-equilibrium systems. He focuses on aging phenomena in systems with slow dynamics. These kinds of processes are encountered in a large variety of systems, ranging from magnets and glasses to reaction-diffusion systems and living cells. Further areas of research include the study of phase transitions and of critical phenomena.



Eric Sharpe arrived in August 2007 from the University of Utah. He received his PhD from Princeton University under the supervision of Ed Witten, one of the world's most respected theoretical physicists. Eric is interested in understanding string theory and some of its relationships with mathematics.

This field is especially exciting for him, as developments in physics inspire ideas in mathematics, and vice versa. Eric brings extensive teaching experience, having taught both introductory and advanced courses at Utah. He is also very active as a conference organizer, on the national and the international stage.



Ron plays guitar at the 2006 holiday luncheon

Ron Stables joined the department in September 2006 as a lab instrument maker. His job duties include using various machines and tools to make and fabricate parts for faculty and students. Ron's hobbies include playing the guitar and harmonica. He also collects watches.

U.S. Air Force Office of Scientific Research funds Prof. Giti Khodaparast

Article courtesy of Catherine Doss, VT News, January 11, 2007



Giti Khodaparast of Blacksburg, assistant professor of physics in the College of Science at Virginia Tech, has been awarded \$329,831 by the U.S. Air Force to study coherent phenomena and develop concepts for new device functionality using ferromagnetic semiconductors.

Khodaparast is one of 21 scientists and engineers who were awarded a total of \$6.3 million in grants over the next three years by the Air Force Office of Scientific Research as part of its new Young Investigator Research Program (YIP). A total of 145 proposals were submitted for the grant program, which targets specific areas of interest to the Air Force. These areas include aerospace and materials sciences, chemistry and life sciences, mathematics and information sciences, and physics and electronics.

Khodaparast's research will focus on the probing and manipulation of coherent states in ferromagnetic narrow-gap semiconductors with an eye towards developing concepts for new device functionalities. The YIP supports scientists and engineers who have received Ph.D.s or equivalent degrees in the last five years. Grant recipients must show exceptional ability and promise for conducting basic research. The objective of the program is to foster creative basic research in science and engineering and enhance early career development of outstanding young investigators.

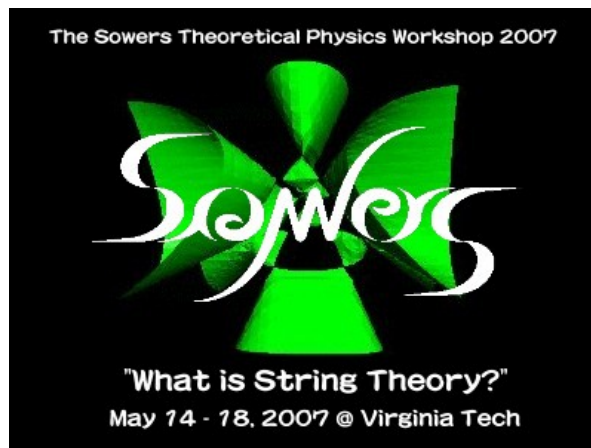
Khodaparast joined the Virginia Tech faculty in 2004. She earned her Ph.D. in physics at the University of Oklahoma.

Department hosts first Sowers Theoretical Physics Workshop

On May 14-18, 2007, the Physics Department hosted the first workshop in a series designed to address the deepest and most fundamental questions in theoretical physics. Under the header "What is String Theory", over 50 researchers working on a variety of aspects of string theory and related fields came together to discuss the most recent developments and exchange new ideas. The workshop was organized by Profs. Djordje Minic, Eric Sharpe, and Tatsu Takeuchi, and was made possible by a generous donation of Mr. Mark Sowers, a friend and benefactor of the department.

To view more details, go to:

<http://www.phys.vt.edu/~sowers/>



Workshop logo, designed by T. Takeuchi and E. Sharpe.

Sandor Benczik honored as Featured Graduate Student, November 2006

Article courtesy of the Virginia Tech Graduate School

How would you describe your area of study to your grandmother?

Probably you know that if you a big enough “hammer” and break matter into smaller and smaller pieces, you eventually end up with tiny particles that are no longer divisible: electrons, quarks and the like. There is the possibility that space behaves rather similarly, and there is a minimal distance so that no two objects, as tiny as they may be, can get closer than that. I am investigating how the already bizarre (quantum) behavior of small sub-atomic particles will be different if this minimal distance was confirmed by experiments.

What is your primary motivation for persevering through graduate school?

The love of science and insatiable curiosity.

Do you think there is any value in social networking with other graduate students in non-related fields?

Most certainly. Today, in order to be able to obtain new results, researchers and graduate students in particular have to concentrate on a rather restrained scientific domain. I think a healthy intellect needs much more than that.

Which field are you most happy that you did not enter?

Medicine. I would never be able to remember all the tiny details of the workings of the human body a doctor should know. Also, I have the unfortunate habit of messing up things when I first try something new, which in really bad with human patients, where you don't have the luxury of being able to rectify your mistakes.

What is your favorite stress-reduction technique?

Taking long walks. I do get strange looks sometimes when it happens that I feel compelled to do this in inclement weather, at 3am in the morning, or places where no sane person would go for a walk. I also love spending time with my wife Gilia, chatting with friends over a beer, and cooking.

What is the last book you read strictly for pleasure and how long ago was it?

About 2 or 3 weekends ago I read “Slaughterhouse-Five”, by Kurt Vonnegut, an eyewitness’ tale about the bombing of Dresden during WWII. I highly recommend it. I was also impressed by another book read some months ago, “The Curious Incident of the Dog in the Night-Time”, by Mark Haddon. It is about the way an autistic child sees the world, and I could not help seeing the parallels with scientific, or at least my way of thinking.

Please describe your most meaningful academic relationship.

It is certainly with my advisor, professor Lay Nam Chang. With his expertise and attention to both detail and the big picture, he provides invaluable guidance for my research, and yet his is so friendly and straightforward that during our discussions I feel like talking to a fellow graduate student.

What do you feel is the greatest challenge that graduate students face and how have you dealt with this challenge?

Managing one's time. One should find a delicate balance between time devoted to research, whose results often appear only in the long term, and extra-curricular activities and relaxing.

Benczik *continued from pg 10*

What is your favorite comfort food and why? How often do you consume it?

Cabbage stuffed with a spicy mix of rice and ground meat, a traditional Eastern European meal. Unfortunately, I rarely got to eat it --- once or twice a year during the holidays ---, because it is really time-consuming to prepare, especially that one of the main ingredients, whole (not shredded) sauerkraut is not available in the US and has to be made at home.

If you hadn't been admitted to graduate school, what do you think you would be doing right now?

I would probably be teaching high school Mathematics or being a programmer. The former is more likely, as I went through one year of teacher's training and I really liked it.

Student Recognitions

- ♦ **Sandor Benczik** received the Sigma Xi Ph.D. Research Award for his work on the minimal length uncertainty relation.
- ♦ **David A. Adams** received the Sigma Xi Undergraduate Research Award for his work on non-equilibrium statistical physics.
- ♦ **Austin Amaya** received the 2007 COS Outstanding Masters Student Award.
- ♦ **Brian J. Skinner** was awarded a 2007 NSF Graduate Research Fellowship.
- ♦ **Juliette M. Mammei** was a runner-up for the College of Science Roundtable Scholarship for Graduate Study.
- ♦ A team consisting of undergraduate and graduate physics students were crowned 2006 Co-Rec B 9-on-9 soccer champions.



Soccer champs!



Sandor and David pose with their awards



Quanta 2007

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Additional editing, content, and design: Beate Schmittmann

Contributors: Catherine Doss, Alma Robinson, John Simonetti

The Physics Department Annual Fund



Under the header “The Campaign for Virginia Tech: Invent the Future”, the university has launched its next fund raising campaign. At the same time, the Department of Physics is seeking strongly enhanced national and international recognition for its research and educational programs. With excellence in nanoscience, complex systems, and neutrino physics, the department is already targeting areas of nationally recognized importance. By strengthening these efforts and expanding them towards biological and medical problems on the one hand, and astrophysics and cosmology on the other hand, we will position the department at the leading edge of scientific discovery for many years into the future. We will continue to set high standards of excellence in undergraduate and graduate education, focused on fundamental principles and emerging frontiers.

Your support will be critical for our success. When you receive your College of Science Annual Fund letter or phone call, please earmark your support for the Physics Department. Simply make a notation on the gift card or let the caller know that you want to direct your donation to the Physics Department. You can also visit our website, <http://www.phys.vt.edu/giving.html>, or give us a call at (540) 231-7472. We thank you in advance for your support.

When you contribute to physics, you contribute to the future.