

Quanta

2015/2016 Volume 16, Issue 1

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

Message from the Chair:

IN THIS ISSUE:

Faculty news... p. 2

New Faculty p. 5

In Short... p. 8

Staff News... p. 9



'Tis the season to take stock and to summarize an eventful year. The months since I have become department chair in September have been flying by and we are now approaching the end of the fall semester and with that, the beginning of the Holiday season. The transition in the department leadership came as a surprise to us all, and I would like to express my sincere gratitude to Leo Piilonen for all he has done for the department during his tenure as department chair.

The University, the college and the department are currently in a phase of change – with a new president, provost and soon vice president for research, a new dean who will be named sometime in the spring and a new department chair we essentially will have a complete change of leadership at all levels by summer of 2016. This represents a unique opportunity for the physics department to consolidate the progress we have made and to fulfill our ambition to become an even better department. We already have seen very significant changes over the past few years, we have nearly tripled our freshmen physics majors and I commend the faculty and staff on how there are able to maintain the high quality of education and advising our students receive.

We are fortunate to welcome three new faculty: Sara Petty and Edwin Barnes join as assistant professors and Sophia Economou as associate professor. You will find a brief introduction of our new faculty in this newsletter. Michel Pleimling is now holding a dual position as faculty in our department and as director of the Academy of Integrated Science where he already has made a real difference in how the new degree programs and the department collaborate. Eric Sharpe has been promoted to full professor, a well deserved recognition and I myself had only a few weeks to enjoy my time as newly minted full professor before being asked to serve as chair. At the staff level, we are glad to have a new business manager, Jackie Woodyard and we will try our best to keep her for a while. Jackie is supported by a new program support technician, Katrina Loan. Unfortunately, Katrina currently is dealing with a medical condition and we hope to have her back in January.

Change always also causes anxiety but the department has managed to capitalize on the associated opportunities in the past, especially during the Great Recession where our faculty numbers fell into the low 20s. We are now back at more than 30 faculty and as a result this is a very young faculty with a full third of faculty being assistant professors. Thus, we can look confidently towards the future, even if we may hit an occasional bump in the road, *per aspera ad astra!*

I hope you enjoy this newsletter, feel free to drop me a line or even better, should you be in Blacksburg come and see me in Robeson Hall.

Happy Holidays!



New Virginia Tech QuarkNET center aimed at helping high school teachers



The Center for Neutrino Physics at Virginia Tech, the only center of its kind in the world, recently became home to the Virginia Tech QuarkNET Center.

Funded by the National Science Foundation, QuarkNET is an outreach program run by the University of Notre Dame and funded by the National Science Foundation aimed at helping high school teachers gain a deeper understanding of particle physics through inquiry-based instruction.

“Creating a QuarkNET Center here has been one of my goals through my NSF CAREER Award,” said Camillo Mariani, assistant professor of physics. “We will begin full operation in the summer and we’ll spend the first two years identifying high school teachers who are interested in doing research with members of the Center for Neutrino Physics and attending a camp at the Department of Energy’s Fermilab National Laboratory in Chicago where they will learn the excitement of building a particle detector and data analysis.”

Teachers will take their research experience, and their detectors, to high school classrooms where they can integrate the equipment into lessons using real-world data. Members of the Center for Neutrino Physics will continue to work with teachers and promote physics research in the schools with a goal to leave students with an understanding that science and physics, while not easy, can be done by anyone.

“It’s also fun,” said Mariani, “I think teachers and students will enjoy working on these projects.”

Virginia Tech undergraduate students, graduate students, and postdoctoral fellows will also be involved with the outreach project. QuarkNET will complement current efforts such as the Virginia-North Carolina Alliance for Minority Participation and PhysTEC, an effort promoted by John Simonetti, professor of physics, associate chair of the physics department, and director of the astronomy outreach program.

“This is another step in increasing the quality and number of underrepresented students successfully completing science, technology, engineering and mathematics baccalaureate degree programs,” Mariani said.

Written by Rosaire Bushey

VT News January 28, 2014

Physicist Giti Khodaparast awarded \$1.2 million to study high performance materials



Giti Khodaparast, an associate professor in the Department of Physics in the College of Science at Virginia Tech, has been awarded \$1,199,998 over three years by the U.S. Air Force Office of Scientific Research to probe “Nonlinear and Terahertz Studies of Electro-Optic and Magneto-Electric Materials.”

The multidisciplinary and multi-university project involves Shashank Priya, a professor of mechanical engineering in the College of Engineering, as well as the University of Colorado in Boulder, the University of Florida, and Texas A&M University.

The phenomena where a magnetic polarization is induced via an external electric field has been known for more than 100 years and studied for more than 50 years.

Research interest has been renewed because of the possibility of creating novel and high performance materials with potential applications for generating new optical frequencies in nonlinear processes.

In order to harness the full potential of the electro-optic and magneto-electric materials, extensive characterization techniques as well as theoretical approaches are required.

The ability to control light in different scenarios has a variety of applications, such as creating all-optical computers that theoretically could be faster and more efficient than electronic devices.

“This work is important because experimental and theoretical efforts can be pursued simultaneously toward developing multifunctional devices for our fast-paced, technological world,” said Khodaparast, who is affiliated with the Institute for Critical Technology and Applied Science at Virginia Tech.

The research will focus on specific material compositions and composite architectures that demonstrate the possibility of providing giant optical nonlinear conversion.

Khodaparast is the recipient of the Air Force Office of Scientific Research Young Investigator Award as well as the National Science Foundation Career award.

She joined Virginia Tech in 2004 and received her Ph.D. in physics at the University of Oklahoma.

College of Science part of two international teams to win Breakthrough Prize in Fundamental Physics

Several faculty members with the Virginia Tech College of Science are part of two international groups to win 2016 Breakthrough Prizes in Fundamental Physics for years-long projects involving the discovery and exploration of neutrino oscillations.

The Fundamental Physics Prize Foundation honored two separate projects worked on by four faculty members from the Department of Physics. Jonathan Link, Leo Piilonen, and Patrick Huber, all professors, are part of the China-based Daya Bay Reactor Neutrino Experiment. Honored for work made prior to coming to Virginia Tech is Camillo Mariani, an assistant professor who is a member of the Japanese-led team heading the KEK to Kamioka Long Baseline Neutrino Oscillation Experiments, or K2K, for short.

The Breakthrough Prize in Fundamental Physics, according to organizers, “recognizes major insights into the deepest questions of the Universe.” It is part of several Breakthrough awards honoring achievements in fundamental physics, life sciences, and mathematics. Among the awards’ high-profile sponsors are Google co-founder Sergey Brin; Facebook founder Mark Zuckerberg; Russian entrepreneur Yuri Milner; and Chinese businessman chairman Jack Ma.

“All of us at the College of Science are delighted with this honor won by our faculty,” said Lay Nam Chang, dean of the College of Science. “The Breakthrough Prize describes the award as honoring scientists who are seeking new ‘insights into the deepest questions of the Universe.’ The scientists in our faculty are doing exactly that, cracking the puzzles of what lays beyond our vision, where we came from, where we are going, and what is the limit of possible. We are proud of our faculty’s collaborative work with their colleagues around the world, and look forward to the team’s findings for years to come.”

The Breakthrough Prize committee selected a total of five winning teams in Fundamental Physics, honoring roughly 1,380 scientists and physicists from around the world “for the fundamental discovery and exploration of neutrino oscillations, revealing a new frontier beyond, and possibly far beyond, the standard model of particle physics.” Winners were chosen by selection committees comprised of prior Breakthrough Prize laureates. The awards are designed to generate excitement about science as a career.

All teams in the Fundamental Physics category will share in a \$3 million prize, according to organizers.

Daya Bay

The prize for the Daya Bay team honors work from 2012 when Virginia Tech and its collaborators discovered a new type of neutrino oscillation – a third neutrino angle – during high-tech scientific experiments held near the Day Bay nuclear reactor facility in southern China. The experiments, carried out inside massive tunnels built near the plant, open new avenues for studying neutrinos – subatomic particles so infinitely small and so weakly interacting that most will pass through the entirety of the Earth as does light through glass. Initial work was carried out in late 2011 and early 2012, using six of a planned eight particle detectors placed in underground labs built within miles of the reactor, said Link.

“When we started this experiment, we knew that there would be competition and as we were building the detectors it became clear that the competition was getting close, so we decided to deploy the first six detectors and try to make a quick measurement,” said Link, director of the Virginia Tech Center for Neutrino Physics and the university’s leader on the Daya Bay project. “This plan worked and we were the first to report the discovery. After taking six months of data, we shutdown and installed the last two detectors, which allows us to accumulate data 33 percent faster.”

Virginia Tech’s Daya Bay team includes Yuen-Keung of Hong Kong, China, and Yue Meng of Harbin, China, who were doctoral students in 2012 and now are post-doctoral researchers at the University of Alabama, post-doctoral researcher Deb Mohapatra, and Jo Ellen Morgan, a lab technician on the project who earlier graduated with a bachelor’s degree in physics from Virginia Tech.

Collaborating institutions include the Chinese Academy of Sciences, the University of California Berkeley, the U.S. Department of Energy’s Lawrence Berkeley National Laboratory, and two dozen other groups from universities and labs in the United States, Russia, the Czech Republic, Hong Kong, and Taiwan.

The Daya Bay experiment continues to take data and more potential breakthroughs may follow, said Link. A new project involving Link and Virginia Tech’s physics department also is set to begin at another nuclear reactor facility in Belgium. Here, researchers hope to determine if theorized sterile neutrinos – hypothetical particles that interact even more weakly than all known neutrinos– indeed exist.

K2K

The Breakthrough board’s honoring of Japanese-led KEK to Kamioka Long Baseline Neutrino Oscillation Experiments, known as the K2K project that predated Daya Bay. Camillo Mariani worked on the project while at University of Rome, Sapienza, with his efforts focusing on electromagnetic calorimeters and neutrino cross-sections.

“The K2K was the first experiment to see neutrino oscillations from an accelerator produced beam of neutrinos” said Mariani. “The experiment confirmed neutrino oscillation through disappearance. ... My work focused on the electromagnetic calorimeter for the near detector complex of K2K, analysis of the contamination of the anti-neutrinos in the beam -- few neutrinos of the wrong flavor are always produced from the pions and kaons decay -- and measurement of neutrino cross-sections.”

Written by Steven Mackay

VT News November 23, 2015

Virginia Tech selected to host Conference for Undergraduate Women in Physics

Virginia Tech was selected by the American Physical Society to host a 2017 Conference for Undergraduate Women in Physics. This conference is a regional meeting for undergraduate physics majors. Virginia Tech is one of nine sites that will host a 2017 conference.

The American Physical Society's goal with the conference, with support from the National Science Foundation and the U.S. Department of Energy, is to encourage undergraduate women to continue physics by providing them with the opportunity to participate in a professional conference, learn about graduate school and professions in physics, and interact with the other women in physics at different stages of their education and career.

Giti Khodaparast, associate professor of physics, and Lara Anderson, assistant professor of physics, are leading the efforts for the conference. "We strongly believe this conference provides inspiration for future generations of female scientists, allowing them to connect with peers and mentors, and to engage in dialogues not always possible at their home institutions," said Khodaparast. "Moreover, with six female faculty, one physics teacher-in-residence, and many female graduate and undergraduate students in the physics department who will be involved in organizing this event, we have the perspective and personnel to make this conference a success."

Other Virginia Tech groups that are supporting the conference include the Department of Physics, Center for the Neutrino Physics, College of Science, Office of the Vice Provost for Research, Office of the Vice Provost for Undergraduate Academic Affairs, AdvanceVT, the Graduate School, Multicultural Academic Opportunities Program (MAOP), and the Institute for Critical Technology and Applied Sciences (ICTAS).

The conference will be held in January 2017. Specific dates, location, and more information will be available in summer of 2016.

Written by Alison Matthiessen

VT News December 8, 2015

A Well Deserved Congratulations!!



Patrick Huber on being promoted to full Professor and Chair.



Eric Sharpe on being promoted to full Professor.



Michel Pleimling on being appointed as new Director of the Academy of Integrated Science in the College of Science.

American Physical Society honors College of Science's Michel Pleimling with Fellowship



The American Physical Society has elected Michel Pleimling, a professor with the Department of Physics and director of the Academy of Integrated Science, both in the Virginia Tech College of Science, as a Fellow.

The honor comes from the society's Council of Representatives on the recommendation of its Statistical Nonlinear Physics topical group. Fellowships, according to the society, are limited to no more than one half of 1 percent of all members. Pleimling's honorarium will read, "For seminal and sustained contributions to computational statistical physics, specifically his investigations of complex systems far from thermal equilibrium, and in-depth understanding of non-equilibrium relaxation and physical aging phenomena."

A Luxembourg native, Pleimling joined the Virginia Tech faculty in 2006. As academy director, he leads the development and integration of science-based, interdisciplinary degree programs, with responsibility for fostering and enhancing research opportunities and for strengthening the college's inter-departmental collaboration in discovery, learning, and engagement.

He also heads the academy's Integrated Science Curriculum. Prior to Virginia Tech, Pleimling was on faculty with University of Erlangen's Department of Physics. He earned his Ph.D. from the University Saarland (Germany) and worked as a postdoctoral research associate at the University of Aachen in Germany and the University of Nancy in France.

"Michel has been a leading educator and researcher of physics for the past 10 years, and as director of our new Academy of Integrated Science, which takes an innovative, interdisciplinary approach to solving the world's challenges through biology, chemistry, math, statistics, and physics, he is making our college a national leader in the field of Virginia Tech's mantra of inventing the future," said Lay Nam Chang, dean of the College of Science.

He has published more than 110 papers covering statistical physics and condensed matter physics, edited two books, and authored a study on physical aging. He serves as vice-chairman for the Southeastern section of the American Physical Society and is a vice-chairman for the Marie Skłodowska-Curie Fellowships of the European Union's physics panel. Pleimling has received research funding from the National Science Foundation, the U.S. Department of Energy, and the U.S. Army Research Laboratory.

According to its website, the American Physical Society is a nonprofit membership organization working to advance and diffuse the knowledge of physics through its outstanding research journals, scientific meetings, and education, outreach, advocacy, and international activities. It boasts more than 51,000 members, including physicists in academia, national laboratories, and industry throughout the world.

The College of Science at Virginia Tech gives students a comprehensive foundation in the scientific method. Outstanding faculty members teach courses and conduct research in biological sciences, chemistry, economics, geosciences, mathematics, physics, psychology, and statistics. The college offers programs in cutting-edge areas including, among others, those in energy and the environment, developmental science across the lifespan, infectious diseases, computational science, nanoscience, and neuroscience. The College of Science is dedicated to fostering a research-intensive environment that promotes scientific inquiry and outreach.

Written by Steven Mackay

VT News October 19, 2015

Welcome Our New Faculty Members



Edwin Barnes appointed as assistant professor, works on topics in theoretical condensed matter physics and quantum information science. He studies non-equilibrium and many-particle quantum dynamics in novel materials. He earned a bachelor's degree in physics from Cornell University in 2001 and a doctoral degree in physics from the University of California San Diego in 2006.



Sofia Economou appointed as associate professor, is a theoretical physicist working at the interface of condensed matter physics and quantum information science, with an interest in understanding and designing "quantum hardware" for future technologies based on quantum mechanics. Her interests include spin physics in nanostructures, quantum optics, superconducting qubits, quantum control, and decoherence. She earned her bachelor's degree in physics from the University of Crete in Greece in 2000 and her doctoral degree from the University of California, San Diego, in 2006.



Sara Petty is an assistant professor whose astrophysics research focuses on the evolution of galaxies in the Universe. She observes distant galaxies with multi-wavelength data from ground and space-based observatories, utilizing sophisticated data and imaging analysis techniques, including the Hubble Space Telescope. She previously was a senior research scientist here at Virginia Tech, and, prior to this, a post-doctoral research scholar at University of California Los Angeles. She earned a bachelor's degree in physics from Evergreen State College in Olympia, Washington, and a masters and doctoral degree in physics from Catholic University of America in Washington, D.C.

In short...

Assistant Professor Will Mather recognized as Scholar of the week August 5-8.

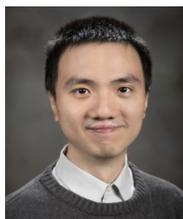
Assistant Professor Camillo Mariani recognized as Scholar of the week June 1-5.

Assistant Professor Lara Anderson recognized as Scholar of the week April 27– May 1.

Welcome our new Research Faculty



John Cherry is working with Prof. Shunsaku Horiuchi. Dr. Cherry is presently investigating complementarity between neutrino detector experiments in extracting information from a supernova neutrino burst, as well as developing new probes of sterile neutrino dark matter.



Hoi Hui Hoi Yin Hui is working with Prof. Vito Scarola on theoretical cold atoms and condensed matter physics



Oscar Macias Oscar Macias is working with Prof. Shunsaku Horiuchi on indirect Dark Matter searches

Welcome Our New Staff Members



Jackie Woodyard - has been with Virginia Tech since 2004, and has over eleven years of experience working with Faculty, Staff, and Students. She served as Fiscal tech, and Program Support for the Mechanical Engineering Department for seven years, and is knowledgeable of all university policies and procedures. Jackie joined the department of Physics in June 2015 as Business Manager. She received her BS in Business Management from Liberty University, and when not working enjoys spending time with family and friends.



Katrina Loan - joined the department in June as a Program Support Technician. She started working for Virginia Tech in the Controller's Office, 2012. She graduated from Patrick Henry Community College in 2001 with an Associate's Degree in Accounting.

Student News

Applause, Applause!

Undergraduate students **Mark Brown** and **Hilton Galyean** (class of 2015) and graduate student **Xiangwen Wang** publish in the Physical Review E

Paper by graduate student **Nicholas Borchers** and Profs. **Michel Pleimling** and **Royce Zia** selected as Editors' Suggestion for the Physical Review E.

Jeong-Ah Lee won the 2015 Graduate Teaching Assistant Excellence Award.

Graduate student **Shadi Esmaeili** received the 2015 Jamie Dunn Award.

Brandon Bear was awarded the 2015 Lubna R Ijaz Scholarship.

The Physics Department Annual Fund



One person can make a big difference!

The Department of Physics continues to increase the quality and prominence of its research and educational programs. Our nationally and internationally recognized faculty, pursuing research in the areas of particle and nuclear physics, hard and soft condensed matter physics, biophysics and astrophysics while providing our students with a sound education that melds fundamental principles with current research, are helping Virginia Tech improve its standing as one of the top STEM schools in the country.

Your support is critical for our success. Any monetary contribution you make could be used to expand and renovate Robeson Hall or fund student scholarships. You may also establish a fellowship or professorship in your name or endow a postdoctoral research position. 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 Web site, <http://www.phys.vt.edu/giving>, or call gift accounting at 1-800-533-1144. For more information or to learn more about other ways to give, please contact Jenny Orzolek, Director of Development for the College of Science, at 540-231-5643 or jorzolek@vt.edu.

We thank you in advance for your support!

Physics in Your Neighborhood!

Alumni Reunion – 2016 March Meeting of the APS in Baltimore, Maryland (Time and Place TBD)

For more information, go to <http://www.phys.vt.edu/events>

Quanta 2015

Editor: Michele Strauss

Additional editing, content, and design: Patrick Huber

Contributors: Edwin Barnes, Rosaire Bushey, John Cherry, Sophia Economou, Hoi Hui, Katrina Loan, Steven Mackay, Oscar Macias, Alison Matthiessen, Sara Petty, Jackie Woodyard