Quanta

2014/2015 Volume 15, 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:

Someone once said, "Time flies when you're having fun!" And so it has. As we approach Thanksgiving and the fall colors give way to colder weather, we here in the Physics Department are thankful for the bounty that we are privileged to investigate, from the smallest objects -- quantum strings -- to the largest -- the entire universe. Nature provides us with so many astounding surprises and avenues to explore in our pursuit of a better understanding of the world around us and how we might use these insights to improve the human condition.

Please celebrate with us as you read in the following pages about a few of the many achievements of our faculty and students, an introduction to our new colleagues (tenure-track faculty member Shunsaku Horiuchi, our many new postdoctoral research associates, and staff members Erin Rust and Sarah Sullivan), the winning entry in the annual Robert Bowden, Jr. Essay contest by physics major Travis DePriest, and contributions from two of our alumni, Sara Case and Seth Smith).

Please also commiserate with us as we mourn the passing of two of our long-time and cherished colleagues: Dr. Tom Gilmer, former department chair (who hired me into Virginia Tech Physics family way back in 1987) and Ms. Christa Thomas, former graduate coordinator and jack of all trades, who had been with the Physics Department for over 37 years before her retirement in 2013.

We are now preparing for the cyclical external review of the department that will happen in early 2015, with a team of six high-profile physicists coming to Blacksburg to assess our state of affairs and our plans for the future. The previous review happened in 2007 and we have achieved quite a few of our goals expressed in that strategic plan and endorsed by its reviewers. We hope to see a repeat of that success in the coming years! One critical item that I mentioned to you in last year's newsletter was the need for the modernization and expansion of our home, Robeson Hall. Last year, I said that we were bursting at the seams. Actually, it is more dire! Our operations are spread across six buildings on campus (Robeson, Hahn North, Derring, ICTAS II, Life Sciences I, and Newman Library) for lack of adequate space and modern infrastructure in our home. Your continued encouragement will help us convince the University administration to get this ball rolling!

Please enjoy this newsletter and drop me a line whenever the mood strikes. Or stop by my office in Robeson 125: we can go for a cup of espresso in new theory-research lounge on the third floor! Remember, you can follow our day-to-day activities on our web site, www.phys.vt.edu, and subscribe to our Twitter feed and Facebook page there.

I wish you a pleasant and healthy fall and holiday season and best wishes for the new year!

COLLEGE OF SCIENCE

Virginia Tech

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Camillo Mariani earns National Science Foundation CAREER Award

Virginia Tech physicist Camillo Mariani has been named as the recipient of a prestigious CAREER Award from the National Science Foundation.

Mariani, an assistant professor of physics in the College of Science, will receive $630,000 for his research on neutrino interactions in matter. Mariani's award also includes an educational component to create a QuarkNet center at Virginia Tech to attract high school teachers and students, with initial emphasis on neutrino physics.

"Camillo is a key part of our neutrino physics group," said Jonathan Link, director of Virginia Tech's Center for Neutrino Physics. "The research and educational programs laid out in his proposal will have a significant and positive impact well beyond Virginia Tech."

The Faculty Early Career Development (CAREER) Program offers the National Science Foundation's most prestigious awards in support of junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education and the integration of education and research within the context of the mission of their organizations.

"Camillo's award recognizes the nationally and internationally ranked caliber of his research and teaching program in neutrino physics," said Leo Piilonen, the William E. Hassinger Jr., Senior Faculty Fellow in Physics and chair of the Department of Physics. "We were fortunate to recruit him to Virginia Tech since he exemplifies the outstanding caliber of our faculty, many of whom have garnered similar early-career awards from the NSF, the Department of Energy, DARPA, and the Air Force Office of Scientific Research."

"Among the key areas of study in particle physics are precision measurements of neutrino oscillation parameters, the neutrino mass hierarchy and measurement of CP violation in the neutrino sector," Mariani said. "To address these requires a more detailed understanding, both experimentally and theoretically, of neutrino interactions in nuclear matter. The research effort at Virginia Tech is aimed directly at these questions and is based on a complementary and holistic approach using experiment, theory and simulation."

Virginia Tech's Center for Neutrino Physics has grown into one of the largest and most visible neutrino research groups in the world. Mariani was the third junior faculty to be hired as a part of the Physics Department's Neutrino Initiative and the third to receive such an award.

Mariani joined Virginia Tech in 2012 after four years as a postdoctoral research associate at Columbia University. He received his master's degree and doctoral degree from the University of Rome (Italy).

Written by Rosaire Bushey

VT News January 28, 2014

Will Mather named Blackwood Junior Faculty Fellow of Life Sciences

Will Mather, assistant professor of physics in the College of Science at Virginia Tech, has been named the Blackwood Junior Faculty Fellow of Life Sciences by the Virginia Tech Board of Visitors.

The Blackwood Junior Faculty Fellowship of Life Sciences was established in 2006 with a gift from Mary and Willis Blackwood to support and advance instruction, research, and collaboration in the life sciences with a complementary focus on the development of entrepreneurial opportunities. The recipient will work with the Bringing Science to Market program, a collaborative effort between the College of Science and the Pamplin College of Business. The fellowship appointment is for three years.

A member of the Virginia Tech community since 2012, Mather is a highly regarded biophysicist who was hired as part of the College of Science's emerging undergraduate systems biology degree program and Integrated Science Curriculum.

His research spans the theoretical and experimental aspects of synthetic and natural biological circuits, using computer modeling based on the formalism of nonlinear dynamics as well as laboratory investigations that involve placing suitable markers in yeast cells and other single-cell organisms to identify the behavior that results when the biological circuits under study are modified or disrupted.

To further his research, Mather hired staff and recruited graduate students to set up his laboratory and began computations in synthetic biology and stochastic modeling. He secured a highly competitive three-year $960,000 sole-principal investigator grant from the National Science Foundation.

Mather is committed to the Integrated Science Curriculum and the systems biology courses in support of the college's entrepreneurial mission to create educational opportunities that will attract new students to Virginia Tech.

Mather's work in microfluidics and related devices will lead to new patents that will impact research laboratories, hospitals, and other settings. His software efforts will lead to licensable software that will bring systems biology research into educational settings and traditional research laboratories. And his synthetic-biology techniques may be patented for use in a broad array of academic and commercial settings.

Mather received his bachelor's degree and Ph.D. from Georgia Tech.

Written by Rosaire Bushey

VT News June 10, 2014

Randy Heflin named Associate Dean for Research and Graduate Studies in College of Science

Randy Heflin, professor of physics in the College of Science at Virginia Tech, has been named the college's associate dean for research and graduate studies.

Heflin replaces Tim Long, professor of chemistry, who held the position since 2011. As a member of the dean's leadership and advisory team, Heflin will be responsible for enhancing research and graduate training in all college programs.

"Randy has taught some of the key courses for our new degree in nanoscience," said Lay Nam Chang, dean of the College of Science. "He is a well-respected researcher who co-wrote the book, 'Introduction to Nanoscale Science and Technology' (with Stephane Evoy and Max Di Ventra) and I'm confident his experience and his visionary commitment to integrated science will serve the college and its students exceedingly well."

A member of the Virginia Tech community since 1992, Heflin's research interests include nonlinear optical and optoelectronic properties of organic self-assembled and nanoscale materials and he currently holds three patents.

Heflin received his bachelor's degree in physics from the College of William and Mary and his doctoral degree from the University of Pennsylvania.

Written by Rosaire Bushey

VT News September 30, 2014

A Well Deserved Congratulations!!

Vito Scarola on being tenured and promoted to Associate Professor

Djordje Minic on being promoted to Professor.

Jon Link on being promoted to Professor.

Michel Pleimling on being promoted to Professor.

In short...

Professor Uwe Täuber publishes advanced graduate-level textbook on "Critical Dynamics"

Named Scholar of the week June 9-13

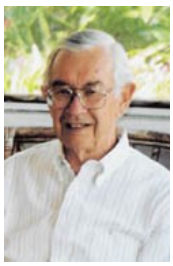
Associate Professor Nahum Arav awarded the Carroll B Shannon Certificate of Teaching Excellence.

Assistant Professor Will Mather receives grant from the National Science Foundation for is work on Queuing theory.

Prof. Michel Pleimling recognized as Scholar of the week August 11-15.

Prof. Bruce Vogelaar recognized as Scholar of the week October 13-17.

In Memoriam



Dr. Tom Gilmer, former chair and long-time faculty member in the Department of Physics, passed away July 22, 2014.

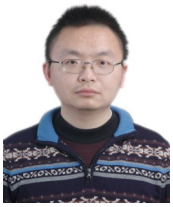
Christa Thomas, former graduate program coordinator, passed away June 15 at Lewis Gale Hospital-Montgomery. She was 75.

Welcome Our New Faculty Members

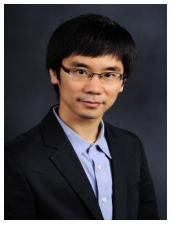
Shunsaku Horiuchi joined the department as an assistant professor in August 2014. He completed his PhD at the University of Tokyo in 2009, and has held postdoctoral positions at The Ohio State University and University of California, Irvine. His research interests are in the interface of particle physics and astrophysics. In particular, he explores the role of neutrinos in supernova explosions, its connection to cosmic rays, and as candidates of dark matter. He is also interested in the detectability of neutrino signals, which involves the use of astronomical observations. When not thinking about the next nearby supernova, he enjoys hiking, skiing, photography, and visiting national parks.

Welcome our new Research Faculty

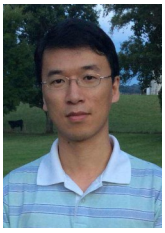
Artur Ankowski is working with Prof. Camillo Mariani in Theoretical Neutrino Physics.



Xin Gao is working with Profs. Lara Anderson and James Gray on String compactifications and phenomenology.



Seung-Joo Lee is working with Profs. Lara Anderson and James Gray on String compactifications and phenomenology.

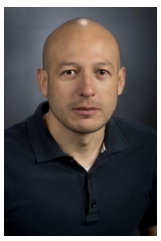


Guilin Liu works with Prof. Nahum Arav on integral field spectroscopic observations of energetic quasar-driven outflows.

Dmitri Liventsev is working with Prof. Leo Piilonen on B physics with the Belle and Belle II experiments at the KEK laboratory in Japan.

Jaewon Park is working with Prof. Jon Link on the Daya Bay Reactor Neutrino Experiment.

Chola Regmi is working with Prof. Shengfeng Cheng on Microtubule self-assembly and Hydration of ions and proteins.



David Vanegas is working with Prof. Patrick Huber. Currently, Dr. Vanegas and the Huber group are investigating how experiments in the near future might improve existing bounds on non-standard interactions.

Christa C. Thomas receives 2014 Staff Career Achievement Award

A member of the Virginia Tech community since 1975, Thomas served employees, students, and community members in many different ways. She began her career as a clerk typist, and after six years she became an accountant in 1981.

Serving as an accountant for nine years, she was then promoted to executive secretary in 1990 and program support technician in 1995.

With her broad scope of experience in all aspects of the department, Thomas became graduate program coordinator for the Department of Physics in 1997.

Thomas was involved in many university committees including the Commission on Graduate Studies and Policies, the Commission on Outreach and International Affairs, and the Intellectual Property Committee. She also co-hosted a weekly event for the International Club, providing a way for international students to connect with one another and share their personal stories.

During her time at Virginia Tech, Thomas' contributions to the Department of Physics positively impacted the lives of all who have had the pleasure of knowing her. Her efforts span the tenures of eight department heads and chairs, and have helped the graduate careers of many students. She was known by her colleagues as the "soul" of the department.

In addition to her own professional success, Thomas inspired others. She was known for her personal investment in the well-being of her students and demonstrated unwavering compassion toward those who needed her most. For instance, when a student in the graduate program became ill, she became treasurer of a committee whose goal was to raise funds for the student's expensive treatment. Her personal interest in the lives of every individual has motivated others to continue her legacy, and she continues to serve as a role model to all who were lucky enough to know her.

Written by Laura L Neff-Henderson

VT News April 21, 2014

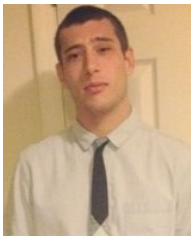
Welcome Our New Staff Members

Erin Rust - Erin joined the department in April as a Program Support Technician. She received her MS in Geosciences from Mississippi State, and has had a lifelong fascination with science. Erin spent almost 10 years as a high school Earth Science teacher before coming to Tech, and enjoys seeing her former students on campus. In her spare time she enjoys science fiction, cooking, Crossfit, and running half marathons. She lives in Blacksburg with her elderly cat.

Sarah Sullivan - Sarah joined the department in May as a Program Support Technician. She is an alumna of Virginia Tech, graduating in 2012 with a BS in Sociology. During her time as an undergraduate, she worked in the Mechanical Engineering department as an Office Assistant, so it looks like she is just moving up the ladder! Sarah is an avid reader, and has finished more than an entire library's worth of books in her lifetime. She also enjoys TV shows, most notably The Big Bang Theory, an interest she shares with many in her current department.

Travis DePriest takes Bowden essay prize

A Day in the Life of a Physics Major



I wake up at 6:00 a.m. to the repetitive roar of my alarm clock. I fumble underneath the soft cotton cushion and finally locate my cell phone; the source of the draconian noise. I pick it up and press the button – "Dismiss". Millions of transistors behind the shell of the plastic phone and LCD screen command the digital to analog signals to cease, while simultaneously changing the display on the screen back to the familiar picture of my background. Millions of transistors "chiseled" intricately into a chip, following Boolean logic, command the electrons' flow.

I snap out of it. I have to make it to Jiu-Jitsu by 7:00 a.m. I stumble out of bed and make my way to the kitchen and pour myself a glass of billions of trillions of water molecules, muddled with impurities (fluoride to name one) that the Brita filter 's technology has failed to catch. There are more water molecules in this cup than cups of water in the world. I gulp down the cold water which wakes me up. I head over to one of the cabinets and swing it open with ease; torque. I fill a small bowl full of oatmeal to the brim. I watch as gravity takes over the individual motions of each oat. Potential is converted to kinetic energy by the command of my hand. I fill the water in the bowl and pop it in the microwave. I press in the time for one minute and thirty seconds. There seem to be transistors everywhere.

2.45 gigahertz is the standard frequency of the waves this convenient modern day commodity produces. The speed of light is equal to frequency times the wavelength of any electromagnetic radiation, which makes the waves bouncing inside roughly 12 cm. Huh. A magnetron consisting of a cathode in the middle, an anode ring around it, and resonant cavities carved to precision within the anode all reside in a neat compartment near the top right of the microwave. A voltage, applied between the cathode and anode, originates from the power source of the wall. The electrons ejected by the cathode are caught in a swirl before reaching the anode, due to a magnetic field strategically placed, where the resonant cavities are carved along the perimeter of the ring. The Lorentz Force is to blame for the capture of the swirling electrons. The electrons exhibit the properties of a wave and a particle where the momentum and position cannot be simultaneously determined. The whizzing electrons induce microwave frequency electromagnetic waves within the cavities (thanks Faraday); much like a resonant sound is produced when blowing into a didgeridoo. The microwaves are guided by the waveguide, designed with particular dimensions only allowing certain minimum wavelengths through. You only have to solve a few partial differential equations with boundary conditions to figure out what this cutoff wavelength is. Trivial (in the sense all physicists use the word). Finally the waves reach my food where they act like standing waves on a string. The cold spots on my food originating from the nodes of the standing wave are conquered by means of a rotating table. The microwaves hardly penetrate the metals within the microwaves, interacting with the free electrons of the metals, reemitting the waves hardly undisturbed (reflected if you will). BEEP…BEEP... BEEP. My train of thought screeches to a halt.

I take out the steaming hot oatmeal and cut a fresh peeled banana on top. Let's be honest, I sprinkle a little sugar on top too. I chow it down. I rely on the fact that the oatmeal, sugar, and banana will be relatively easily digested, providing me with adequate energy to get through my workout. I brush my teeth, and then I gear up. I put my knee pads on, ankle brace, and shoulder brace. I put my gi pants on and shove my water bottle and blue belt and kimono in my book bag. I put on my jacket, then another, my beanie, and my gloves. I turn on my IPod to a familiar song by Modest Mouse. I can't seem to get away from these transistors. Out the back door I go.

To find out what happens next, go to:

http://www.phys.vt.edu/awards/Bowden.shtml

Applause, Applause!

Ron Pelkey (class of 2014) and graduate student **Evan Guarnaccia** (Ph.D. earned in June 2014) publish their research in the Journal of Instrumentation, Volume 9, August 2014. The measurements happened at the Kimballton Underground Research Facility.

James Mayberry and **Keith Tauscher** (both Class of 2014) publish their undergraduate research in the Physical Review B.

Graduate student **Cheng-Ying Tsai** receives JSA/Jefferson Lab Graduate Fellowship for the 2014 - 2015 academic year.

Article by Undergraduate **Ron Pelkey** featured in Break Through Student Research Magazine.

Undergraduate student **Mark Brown** earns an Honorable Mention in Goldwater Scholarship.

Undergraduate student **Keith Tauscher** (Physics '14) and **Associate Professor Michel Pleimling** publish in Physical Review E.

Travis Merritt won the 2014 Graduate Teaching Assistant Excellence Award.

Graduate student **Hiba Assi** received the 2014 Jamie Dunn Award.

Brandon Bear was awarded the 2014 Lubna R Ijaz Scholarship.

Awards Day 2014

On Friday, April 11, 2014, the department held its annual awards day assembly. Awards were presented to thirty nine students in honor of their academic excellence in undergraduate and graduate studies.

Keynote speaker Dr. Steve Hardy (class of 2010) spoke of his time as a graduate student at Virginia Tech. He also spoke of his experience working for the Office of the Secretary of Defense, Cost Assessment and Program Evaluation at the Pentagon.

Dear alumni:

As graduates from Virginia Tech, we are part of a worldwide network of great thinkers, inventors and leaders. I am currently a medical physics resident at Vanderbilt University, but I would have never reached this goal without my Hokie connections. I joined the Hokie family in 2008 and, four years later, received my B.S. in Physics and Minors in Mathematics and Astronomy. During my undergraduate career, I relied on the faculty and staff of the physics department for advice, research and leadership opportunities, and references. I also turned to my classmates for support and friendship. Consequently, my senior year was a time of happiness and apprehension. I was leaving my friends and my mentors. There were so many choices and so many questions: how do I choose the right path? what if I don't like it? what if I don't succeed?

During this exciting and stressful time, I applied to two medical physics graduate programs, including the Doctorate of Medical Physics (DMP) program at Vanderbilt in Nashville, TN. I was accepted into both programs and turned to the undergraduate advisor, Diane Walker-Green, for advice. Diane recalled a VT alumnus who now works at Vanderbilt, Dr. Seth Smith. Diane emailed Dr. Smith on my behalf and he soon responded. Dr. Smith is a researcher at the Vanderbilt Institute of Imaging Sciences and teaches an introductory imaging course to the incoming medical physics students. He sent me a link to his course website and got me in contact with a current medical physics student who answered my many questions about Vanderbilt's DMP program. The best advice Dr. Smith gave me was where to watch VT football games in Nashville! Shortly after our communication, I accepted Vanderbilt's admission offer.

After I moved to Nashville, Dr. Smith asked me to stop by his office to introduce myself. We swapped stories about Blacksburg and reminisced about past professors. Then, Dr. Smith discussed his research using magnetic resonance imaging (MRI), as well as his imaging course that I was now enrolled in. Although Dr. Smith is not directly in my planned field of study, his perspective on Vanderbilt's medical physics program was invaluable. Most importantly, Dr. Smith gave me the extra confidence I needed to excel my first year in graduate school. I knew I had family and friends in Virginia rooting for me, but now I also had a support system at Vanderbilt. I have often heard "once a Hokie, always a Hokie," but it wasn't until meeting Dr. Smith that I genuinely appreciated the motto.

Networking is a critical aspect of any career. Alumni can offer guidance, opportunities, and support. Recent graduates can provide fresh thinking and ingenuity. At the bare minimum, networking among VT alumni provides a chance to relive the glory days of Robeson Hall, the Drillfield, and Lane Stadium. As VT alumni, I challenge you to always remember what it means to be a Hokie, no matter where you now live.

Sincerely,

Sara O. Case

Dear VT Physics Alumni,

It has been about 8 years since I have stepped back onto the grounds at VT after graduating. Nevertheless, the impressions made on me during my time there still remain exceptionally strong. After graduating with my B.S. in Physics and B.S. in Math from VT in 2001, I went to Johns Hopkins University to pursue a PhD in a "softer science," as was once told to me. In 2006 I earned a PhD in Molecular Biophysics and was promoted to the faculty at Johns Hopkins thereafter. In 2009 I joined the faculty at Vanderbilt University and am currently an Assistant Professor in Radiology, Biomedical Engineering, Physics and Ophthalmology, and the Director for the Center for Human Imaging at the VU Institute of Imaging Science. I have to say that my training at VT in the Physics Department has, without a doubt, set me up into a position to be successful throughout my career and I am forever indebted to the effort, training, and rigorous instruction that I gained while at VT.

I teach a graduate course every fall: Foundations of Medical Imaging. Every year, I teach the same course. On purpose. The reason is that it is designed as the foundations course for all incoming Doctor of Medical Physics (DMP) students at Vanderbilt and it gives me a unique opportunity to interact with newly minted physicists who are keen on developing their skill set to influence the medical community for the purpose of helping the greater human condition. I was contacted in the middle of my 2nd year teaching this course and was asked to encourage Sara Case to join Vanderbilt to pursue her career in Medical Physics. I was excited to be able to have an opportunity to help a VT Physics student, but importantly (and perhaps selfishly) to recruit a student I knew to be well trained and would likely be an outstanding addition to the Vanderbilt community. I immediately reflected on the years I had at VT, the pride of having graduated from an outstanding department, the friendships that were developed, and the knowledge that was imparted to me. I was thrilled to help in anyway I could. And we are absolutely delighted to have been able to convince her.

Mentorship takes on a variety of roles. Sometimes, it is just to introduce the student to the area, or for us physicists, show a cool lab to lighten the load of moving to a new town with new friends embarking on a new career. Sometimes, it is teaching, others it is simply caring. I think sometimes we may forget how difficult the path is to get from high school to a career where one can settle in a bit more. I write this letter to encourage any who can to provide mentorship to a student, trainee, post-doctoral fellow, etc. Not only is it rewarding, but provides an opportunity to reflect on your own path a bit and to be proud of where you came from, where you are, and that you are in a position to help others. It is a unique opportunity, and one that hopefully you will cherish. Life is tough, so I would encourage each of us to lend a helping hand.

Sincerely,

Seth Smith

Quanta 2014

Editor: Michele Strauss

Additional editing, content, and design: Leo Piilonen

Contributors: Rosaire Bushey, Sara Case, Travis DePriest, Randy Heflin, Shunsaku Horiuch, Will Mather, Camillo Mariani, Erin Rust, Seth Smith, and Sarah Sullivan

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 – 2015 March Meeting of the APS in San Antonio, Texas (Time and Place TBD)

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