Interactions

The Newsletter of the UB Department of Physics, 2016-2017

Shining a Light

On New Physics Searches at the LHC p10

Gasparini and Weinstein

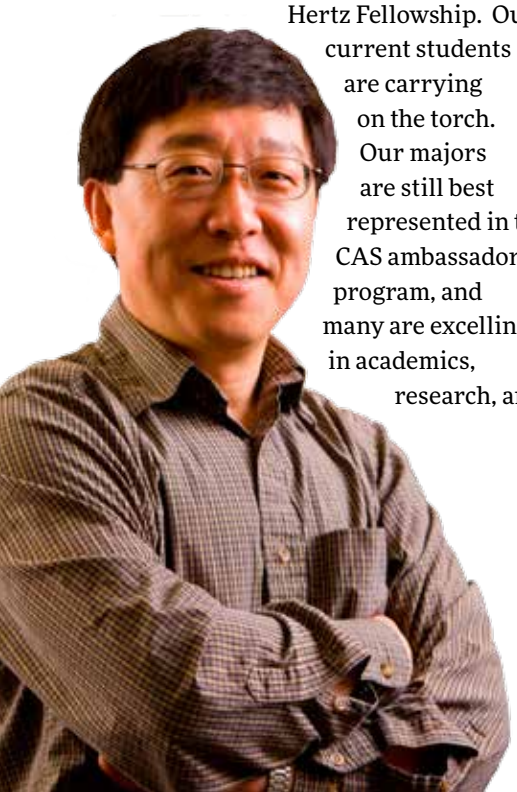
Retirement Celebrations p6

Photo: Doug Levere

University at Buffalo
Department of Physics
College of Arts and Sciences

CHAIR'S LETTER | HONG LUO

It has been another eventful year. Our undergraduate students continued to push the envelope and move the bar higher for the whole program. To start out, 13 of the 19 graduates last year received Latin Honors, which is unheard of, in addition to a large number of college and departmental honors upon graduation. Following the NSF Graduate Research Fellowship received by Sean Bearden two years ago, three were awarded to our majors last year, two from NSF ($138,000) and one from DoD ($120,000). With recent graduate fellowships also received from universities, such as Paul Glenn from UC Berkeley and Junhong Choi from Stanford, it shows the recognition of our majors at the national level. Many faculty members devoted a great deal of time and effort mentoring our majors, and the outcome showed. I need to make a correction to what I wrote in my letter last year. Our graduate Geoffrey Faitin didn't get a nearly perfect score on the physics GRE; it was perfect! To cap off his career at UB, he published a paper as the first author in the prestigious Physical Review Letters, under the guidance of Professor Igor Zutic. Dante Iozzo received the SUNY Chancellor's Award for Student Excellence, and Nigel Michki was a finalist for the prestigious Hertz Fellowship. Our current students are carrying on the torch. Our majors are still best represented in the CAS ambassadors program, and many are excelling in academics, research, and equally important in student outreach, especially under-privileged students in Western New York. Two of our majors, Anne Fortman and Joseph Pusztay, gave a regular seminar on their research at the Fermi Lab, supervised by Professor Salvatore Rappoccio. Professor John Cerne has taken over as the Director of Undergraduate Studies. Professor Cerne's dedication to undergraduate students over the years will definitely serve him well.



It is with great sadness to inform you that Professor John Ho passed away on September 22, 2016, after a long and distinguished career at UB. A university-wide memorial service was held to celebrate his extraordinary life and his outstanding contributions. One of the first things John did after getting his diagnosis was to donate $150,000 to the department to start an endowment for the John Ho and Martha Leung Scholarship. Two rounds of scholarships have already been awarded to our outstanding graduate students.

Our graduate students were also recognized with several awards, including Katherine Niessen receiving the 2016 APS Shirley Chan Travel Award, Biophysical Society Tascione Travel Award, and Platform Talk; Mengyang Xu the 2015-2016 UB Dissertation Fellowship, SPIE Education Scholarship, and 2016 Protein Science Young Investigator Travel Award; Yanting Deng the 2016 Protein Science Young Investigator Travel Award; and Paulo Faria, Jr., the Brazilian National Fellowship. Several of them were supervised by Professor Andrea Markelz.

Faculty members also continued to collect well-deserved accolades. To mention a few, Professor Doreen Wackeroth was chosen as a Fermilab Distinguished Scholar, a prestigious recognition, and also as a winner of the UB Sustained Achievement Award. Professor Hao Zeng became an editor for *Journal of Magnetism and Magnetic Materials*, the top journal in this field. With the retirement of Professor Francis Gasparini, the last holder of the Rustgi Professorship, Professor Markelz became our first female Rustgi Professor, one among her long list of firsts. Markelz is our first NSF CAREER award winner, leading the way for a total of nine now in the department, by far the largest in the college. Markelz has made great contributions to biophysics and played a critical role in building the biophysics group in the department.

The College of Arts and Sciences has a new dean, Robin Schulze, since the start of this academic year. The national trend in student/market demand, shifting from arts and humanities to STEM fields, requires real changes and new approaches in many areas. I hope this will bring opportunities for the department.

The faculty continue to attract national and international conferences, which is much more impressive if one looks at the competition for hosting the meetings. With several held in the past year, two large international conferences have already been scheduled for the next couple of years, namely, BOOST 2017 (proposed by Professor Rappoccio) and QCD@LHC (proposed by Professor Ciaran Williams) in 2019. The 2017 New York Sectional Meeting of the American Physical Society was organized by Professors Hao Zeng and Peihang Zhang, and was held at UB in April this year.

Stay in touch and share things at work and in life with us!

Best regards,

Hong Luo, Chair
Professor of Physics

DEPARTMENT ANNOUNCEMENTS

EDITING STAFF

Editors: Professor Jong Han, Professor Doreen Wackeroth, and Nicole Pannullo

Editorial Assistant: Tracy Gasinski

Design and Production: CAS Communications

WEBSITE

www.physics.buffalo.edu/newsletter

CONTACT

Comments about the newsletter, or information about yourself for our Alumni News section, may be sent to Tracy Gasinski via email tracygas@buffalo.edu or mailed to:
Department of Physics
University at Buffalo
239 Fronczak Hall
Buffalo, NY 14260

On the cover

Professor Markelz and her former graduate student Katherine Niessen (PhD 2017) in Professor Markelz's lab.

In this Issue:

Professor John Ho, 1942-2016.
Photo: Douglas Levere

In Memoriam

John Ho, SUNY Distinguished Service Professor

It is with great sadness that we report the passing of our colleague John Ho. John fought valiantly after his cancer diagnosis. He was cheerful and hopeful until the very end. Our condolences go out to his wife Martha Leung and his extended family. He will be missed by all.

In Memorium

Francis M. Gasparini, PhD » It is with great sadness that we report the passing of our colleague John Ho. John fought valiantly after his cancer diagnosis. He was cheerful and hopeful until the very end. Our condolences go out to his wife Martha Leung and his extended family. He will be missed by all.

Professor John Ho, 1942–2016.
Photo: Douglas Levere

John joined the department in 1975. His expertise was in phase transitions and critical phenomena. He set up his research laboratory to study transitions in liquid crystals using birefringence, Faraday rotation, and Raman scattering. His group also devised a way to study freely-suspended liquid crystal films using electron diffraction. This technique in particular allowed his group to identify the hexatic phase, which had been predicted for two-dimensional films. John trained 11 PhD students with whom he maintained contact after graduation, and in some cases continued with collaborative research. John's research work was recognized by his election to Fellowship of the American Physical Society and by a Guggenheim Fellowship. John was an outstanding teacher, known for his clarity and deep understanding of the material. I recall, in particular, my interactions with him on the third year undergraduate course in quantum mechanics which both of us taught over the years. He strongly believed in simplicity and clarity. His often voiced belief was that one does not need sophisticated problems to test students' understanding. John was recognized by his undergraduate alma mater the University of Hong Kong with the award of Distinguished Science Alumnus.

John served in many administrative posts at UB. Among these are associate dean and dean of the College of Natural Science and Mathematics, and then associate dean of the merged College of Arts and Sciences. His last position, over a period of almost 10 years, was as vice provost for graduate education and dean of the graduate school. During these administrative years he served on a prodigious number of university committees, to which he brought his wisdom and clarity of thinking. His contributions to UB were recognized by his promotion to SUNY Distinguished Service Professor, and in 2015 by the highest honor that is bestowed by the university to a faculty, the President's Medal. John did not lose contact with the department during those years. He attended faculty meetings, and in particular I recall long conversations with him on various administrative issues, especially during the years I served as department chair. His identification and loyalty to our department was never a question. A year ago he, along with his wife Martha, established a $154,000 endowment to provide support for our graduate students. This is very generous and is recognition of the importance of our graduate students to the quality of our research efforts.

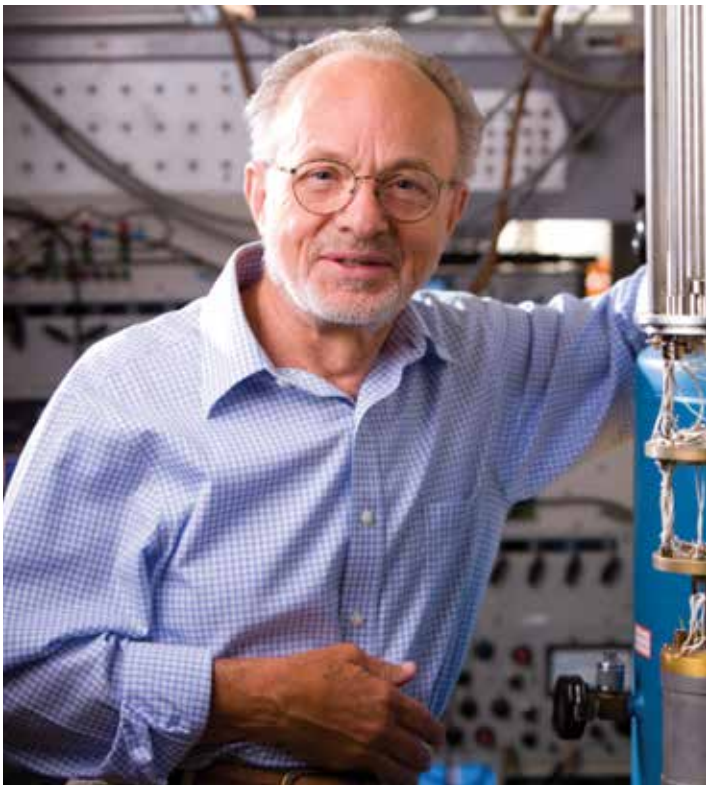
John's contributions to UB were recognized in a memorial service held on October 18, 2016. Many spoke of his unselfish work on behalf of the university, and the influence he had in policy decisions. John will be missed by all of us in the department, but in particular by the generation of faculty who shared with him his early years and established friendships that go beyond professional interactions. The UB community will miss his wisdom and tireless and effective leadership. ■

Gasparini and Weinstein Retirement Celebrations

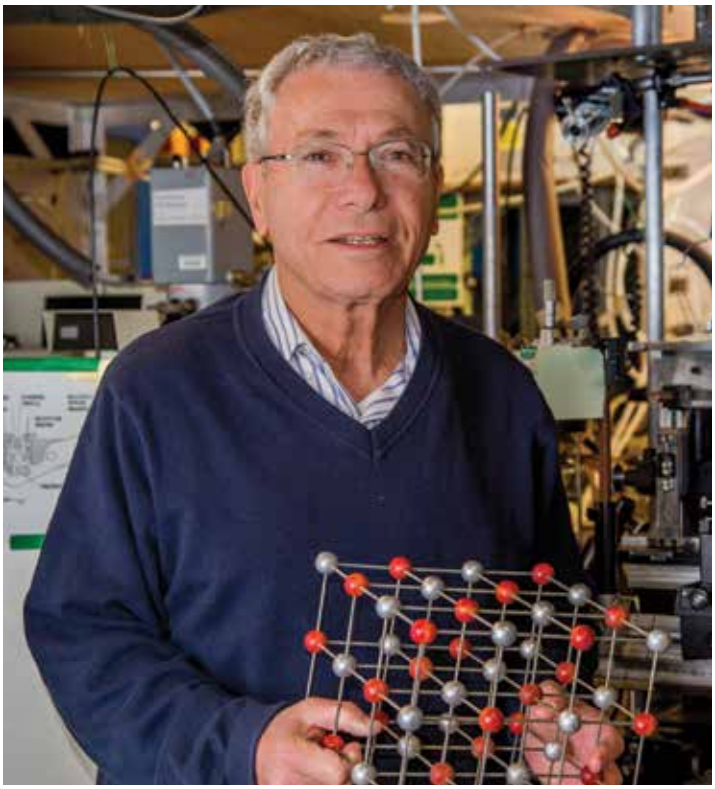
John Cerne, PhD » Although we will greatly miss their presence as regular faculty, the department, family, and friends celebrated the retirements of Frank Gasparini and Bernard Weinstein at two parties in October and November 2016, respectively. If the number of attendees is any indication, Frank and Bernie have had a huge impact. Over 60 people at each event celebrated the careers and contributions of these two scientists, who have served as role models to the rest of the faculty and students. Their accomplishments and dedication to UB are impressive.

Frank started at UB as an assistant professor in 1973. He is a leading experimentalist exploring confinement effects in superfluid helium. His honors include becoming a Fellow of the American Physical Society (1990), winning the UB Provost's Sustained Achievement Award (2002), and SUNY Chancellor's Award for Excellence in Teaching (1996), as well as being selected as a UB Distinguished Professor (2007), a Rustgi Professor (2012), and a SUNY Distinguished Professor (2013). During his tenure as chair from 2004 to 2010, 14 new faculty members were hired. He also was able to significantly raise the teaching assistant stipend and established a support fund to help our graduate students attend research conferences, which greatly helped recruit and retain graduate students. He was actively involved in development, establishing the Physics Excellence Endowment, the Ta-You Wu Endowment (with the leadership of our own Y.C. Lee), and the Rustgi Professorship. His hard work, optimism, sense of humor, and leadership made a large impact on all of us. If you like donuts and team-building, you should thank Frank for instituting the department's Friday mentoring hour while he was chair.

Bernie came to UB as a professor in 1987, after being a faculty member at Purdue University and working at Xerox in Rochester for nearly a decade. His research is focused on high pressure studies of semiconductors. He is a winner of the Alfred P. Sloan Foundation Fellowship (1976-1978), a Fellow of the American Physical Society (1997), a winner of the SUNY Chancellor's Award for Excellence in Teaching (2000), a winner of the Milton Plesur Award (nominated and elected by students in 2003), and a winner of the SUNY Chancellor's Award for Excellence in Faculty Service (2014). He was the department's director of undergraduate studies when new and significantly more rigorous program assessment standards were required for accreditation. He also led the department through the challenging opening phases of UB's new general education reformation. His work on the general education program and undergraduate recruitment were often used as exemplary models by the College of Arts and Sciences to show other departments how things should be done.



Professor Frank Gasparini, SUNY Distinguished Professor. Photo: Douglas Levere



Professor Bernard Weinstein. Photo: Hong Luo

The department's special events coordinator, Tracy Gasinski, organized the parties, which were held at Templeton Landing and Marquis de Lafayette in Buffalo. At both parties, friends, family, and former students gave speeches (including some PowerPoint slides) about the impact Frank and Bernie had on them. At Frank's party, UB President Satish Tripathi made a surprise visit. About 60 attendees were present at each party to celebrate Frank and Bernie.

Although Frank and Bernie are officially retired, they are still spending lots of time in the department, working on papers as well as helping students and colleagues. Frank and Bernie's wives, Lucille and Helen, are probably wondering what definition of "retirement" their husbands are using! ■

Professor Bernard Weinstein (second from the right) with his former students and postdocs at his retirement party (from right to left: Joseph Tischler (PhD 2000), Uma Venkateswaran (postdoc 1988-91), Timothy Ritter (PhD 1997), Valentin Herbei Iota (PhD 1998), Nelson Gross (current PhD student), George Lindberg (PhD 2016), Robert Tallman (PhD 2009)). Photo: Hong Luo

Professor Frank Gasparini (in the middle of the front row with his granddaughter, daughter to his right and wife Lucille to his left) and his guests at his retirement party. Photo: Hong Luo

Hong Luo, PhD » Myunghee Na received her Ph.D. as my second graduate student in 2000. Among several projects she successfully carried out, her signature achievement was to, for the first time, successfully fabricate flexible single

Myunghee Na, Ph.D. 2000.

crystal semiconductor structures, which was featured in many places, including *Scientific American*. She also received a scholarship from IRIS Technology, Malaysia, for her leading role in this project. She was clearly ahead of her time, given how many things came out in this direction since then. In addition to being one of the top students in her class, she was very active in departmental activities and social events. She remained great friends with many here.

Myunghee joined IBM as a senior engineer upon graduation. She continued her excellent work in her new role, as the importance of her responsibilities increased rapidly over the years. She was the lead engineer for the 130nm and 65 nm SOI device model development soon after her arrival. In 2008, she became a senior engineering manager/scientist, responsible for low-power CMOS and RF compact model development. It was very nice that she was able to act as a senior engineering manager/scientist in Korea through a collaboration between IBM and Samsung during 2011 – 2013. Among many responsibilities, she was the local executive for relevant projects between Samsung and IBM. I am quite sure that she also enjoyed seeing her family and local cuisine back home. Currently she is a technical program manager responsible for technology IP licensing and project manager/scientist for technology strategy and technology path finding. She is also exploring new approaches to integrate graduate students into industrial settings, beyond the conventional internships, and is engaging UB for partnership.

She has been involved in many important professional activities, including serving as a committee member of IEDM in 2013 and a review board member for Burlington IBM Invention Disclosure. She received the IBM Outstanding Technical Innovation Awards in 2006 and 2012.

Myunghee currently resides in Fishkill, N.Y., with her husband Jens Haetty, one of Professor Athos Petrou's students, and their son David. ■

She was clearly ahead of her time, given how many things came out in this direction since then.

Wireless Majorana Bound States

Igor Žutić and Alex Matos-Abiague

» Superconducting structures combine quantum coherence, electron pairing, and an energy gap which offer many opportunities for studying exotic states with intriguing applications. In recent years, a huge effort has been focused on Majorana bound states (MBS), emergent quasiparticles in superconductors with particle-antiparticle symmetry that are neither Fermions, nor Bosons. Instead, exchanging MBS yields a non-commutative phase, a sign of non-Abelian statistics and non-local degrees of freedom suitable for implementing fault-tolerant quantum computing. Despite impressive experimental progress in fabricating one-dimensional (1D) structures to realize MBS, these architectures are inherently limited. In 1D, the evidence of MBS detection remains indirect, rather than probing directly their non-Abelian statistics. The existing 1D geometries also pose additional obstacles to realize braiding and fusing of MBS, the key elements for fault-tolerant quantum computing. To address these difficulties, a versatile platform to realize MBS and enable their braiding in 2D systems without the need for wire networks was recently proposed [G. L. Fatin, A. Matos-Abiague, B. Scharf, and I. Žutić, *Wireless Majorana Bound States: From Magnetic Tunability to Braiding*, Phys. Rev. Lett. **117**, 077002 (2016)]. The first author, Geoffrey Fatin, completed this work as an undergraduate at UB and gave an invited presentation at the 2016 SPIE Optics + Photonics, in San Diego. Geoffrey was co-mentored by Igor Žutić and research assistant Alex Matos-Abiague, who gave a related invited talk at the 2017 APS March Meeting in New Orleans.

This proposal, depicted in Fig. 1, seemingly contradicts prior knowledge. In semiconductor wires the energetically isolated MBS do not survive the transition to 2D, but rather evolve into edge states with increasing wire width. However, Fig. 2 from the same work shows that in a properly designed magnetic texture acting on a 2D electron gas with proximity induced s-wave superconductivity can support localized MBS. The effect of the magnetic texture is twofold: (i) it drives local transitions to the topological regime and the emergence of MBS and (ii) it confines MBS by forming effective wires. The size, position, and shape of the effective wires can be modified by altering the magnetic texture, permitting exchange of the MBS. Remarkably, the required magnetic textures can be generated by an array of MTJs, similar to those used commercially. ■

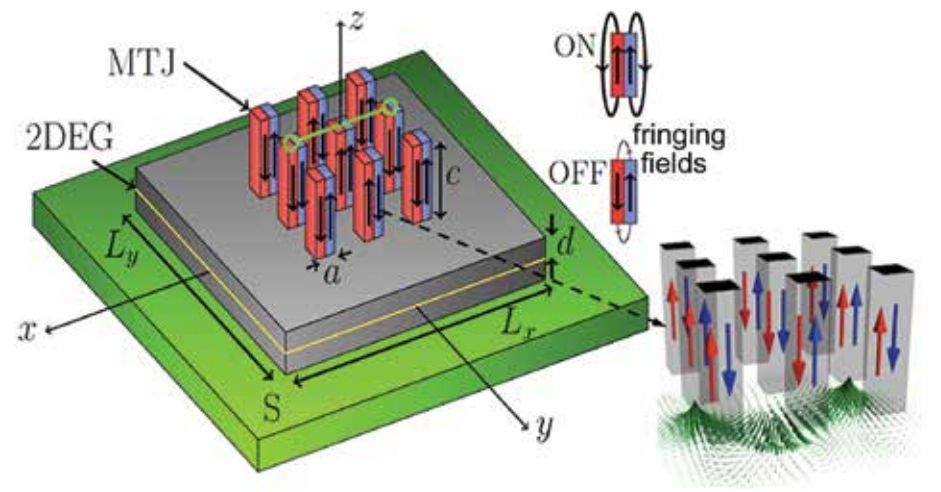


Fig. 1. 2D platform to create, manipulate, and detect MBS. A 2D electron gas (2DEG) next to an s-wave superconductor and 3x3 array of magnetic tunnel junctions (MTJs) which produce a magnetic texture (fringing fields), tunable by magnetization (arrows) switching of individual MTJs. For this configuration, two MBS form at the ends of the middle row (green curve).

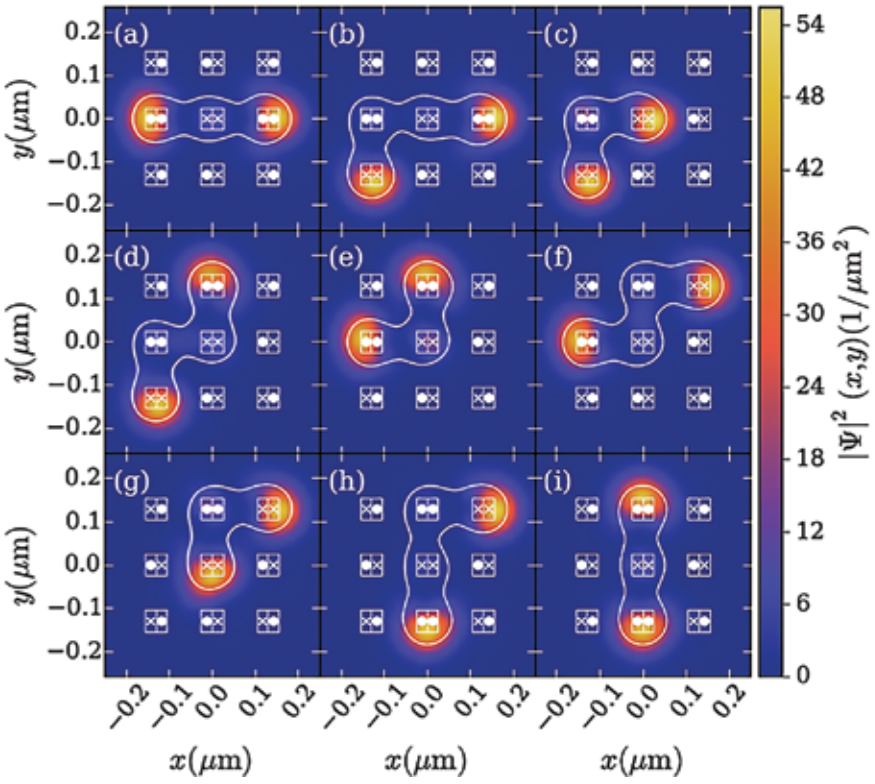


Fig. 2. Probability densities of the MBS localized at the ends of the "wire" (white contours): initial state (a) and 1st 8 stable configurations of the MTJ array [(b)-(i)]. Dots/crosses: magnetization direction in MTJs.

Shining a light on new physics searches at the LHC

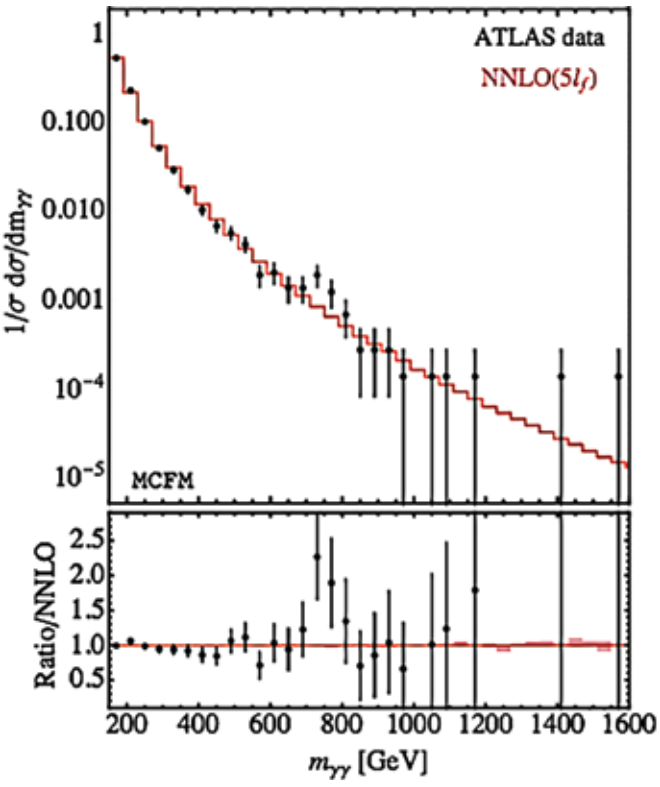
Ciaran Williams, PhD » The world of collider physics has had an exciting year! In December 2015, the two large general-purpose detectors, ATLAS and CMS, at the CERN Large Hadron Collider (LHC) held a joint seminar announcing their results from the previous year of data taking. Such seminars are, of course, routine, the experimental collaborations have thousands of members and produce hundreds of scientific results each year. This one, however, created a frenzy of excitement in the theoretical community. Both experiments reported an excess of events at high energies in the same final state. The final state of interest was two photons (or diphotons). We think of photons as particles of light, but at the LHC, photons have extremely high energies and are therefore short wavelength gamma rays. The combination of the two measured photons can result in a "bump" in the spectrum. These bumps occur when a heavy particle decays to two photons. The photons form a resonance, just like the resonant phenomena observed in driven oscillations. The most famous example at the LHC was the bump observed in 2012 at 125 times the proton mass. This was the Higgs boson and its discovery confirmed the particle content of the Standard Model of particle physics.

Ever since the discovery of the Higgs, we have searched for new particles which arise in theories beyond the Standard Model. These searches are motivated by the many problems arising within and beyond the model; examples include the mass of the Higgs itself and the lack of dark matter in the theory. The diphoton final state is a great place to look for new physics. This is because the final state is reasonably clean, allowing for an excellent experimental resolution of the photon's energies. Also, since the Higgs decays to two photons, it is possible that other heavier particles, similar to the Standard Higgs, may decay to photons, too. As a result, the announcement that something may have been found in diphoton events caused huge anticipation and excitement in the theoretical world. The excess of events would have corresponded to a particle at around 750 times heavier than the proton.

In order to search for bumps in the spectrum, the experimental community fits a smooth function to the spectrum. One of the concerns was that the excess occurred at the tail of the data. It was possible that the fitted function, which did a great job at low energies, underestimated the high energy tail and therefore the excess was not due to a new particle, but a fitting error on the background.

An area of expertise for the HEPCOS group at UB is the calculation of precision prediction in the Standard Model. With the excitement generated by the search, this was a natural area for the group to investigate. Assistant Professor Ciaran Williams, together with his collaborators at the Fermi National Accelerator Laboratory and Durham University, performed a new calculation of the diphoton continuum production at a new level of accuracy. This second order result in perturbation theory (NNLO) resulted in a more accurate theoretical prediction than any previous calculation. The research team used the results to compare the shape of the theory to the data (shown in the figure). It became clear that, when compared to fits used by the experimental community, the theory prediction for the background was in good agreement. This motivated the experimental analysis and confirmed that the deviation from the fitted curve was not a result of theoretical misunderstanding.

Sadly, with the accumulation of more data over 2016 the excess faded. However, the lessons learnt from this analysis and the theoretical insights obtained from our improved calculations means that, in the future, the comparison between data and theory will be dramatically improved, and any further deviations may indeed arise from new physics. The hunt continues. ■



The distribution of the invariant mass of two photons produced in proton-proton collisions at the LHC as measured by the ATLAS collaboration (black dots with error bars indicating the experimental uncertainty in this measurement) and as predicted by the Standard Model (in red) according to a precise calculation performed by Ciaran Williams and his collaborators. The lower plot highlights the deviation of the data from the Standard Model expectation at 750 GeV. The figure is taken from Campbell, Ellis, Li, Williams, JHEP 1607 (2016) 148.

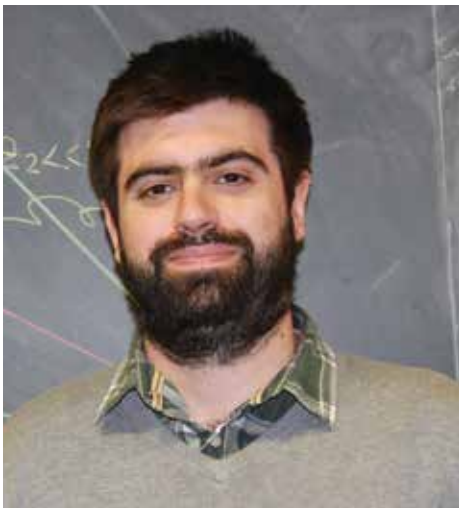
Faculty Awards

Doreen Wackeroth, PhD » Please join us in congratulating all our recent award recipients:

Professor John Cerne is the co-principal investigator of a grant awarded by the National Science Foundation (NSF) titled Geotechnology Experiences for Students and Teachers, which started on January 15, 2017. For more information please see the announcement in UBNow (www.buffalo.edu/ubnow/stories/2017/01/isep-renewal.html) and the information provided by NSF at https://www.nsf.gov/awardsearch/showAward?AWD_ID=1614976&HistoricalAwards=false. Recently, Cerne was interviewed by WGRZ on the physics of pole vaulting (www.wgrz.com/news/sport-science-the-physics-of-pole-vaulting/300632557).

Photo: Douglas Levere

Professor Andrea Markelz received two grants awarded by the National Science Foundation. The award titled Impact of Collective Motions on Protein Function started on August 15, 2016, and the proposed research will be conducted in collaboration with co-principal investigator, Associate Professor Wenjun Zheng. Markelz is a co-principal investigator on the award titled MRI: Development of a single-mode terahertz free electron lasers for research in materials, physics, chemistry and biology, which started on August 1, 2016. For more information on both awards see https://www.nsf.gov/awardsearch/showAward?AWD_ID=1616529&HistoricalAwards=false and https://www.nsf.gov/awardsearch/showAward?AWD_ID=1626681&HistoricalAwards=false. In May 2016, Markelz was elected the UB Department's Rustgi Professor.

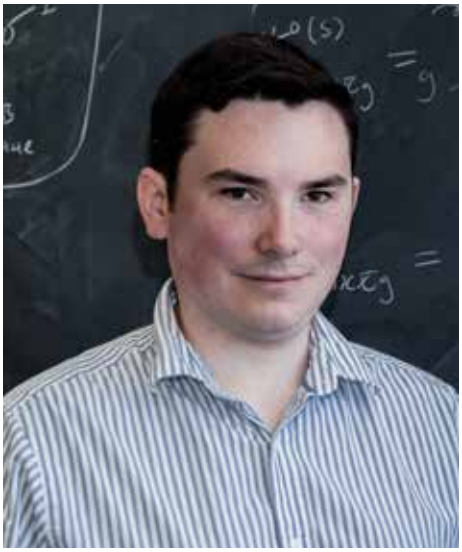


Assistant Professor Simone Marzani received a grant for his research awarded by the National Science Foundation (NSF), titled All-Order Precision for LHC Phenomenology, which started on August 15, 2016. Marzani is also a recipient of the prestigious NSF LHC-TI fellowship, which enabled him to spend one year at MIT before moving to Buffalo. For more details about the NSF grant please see the information provided by NSF at https://www.nsf.gov/awardsearch/showAward?AWD_ID=1619867&HistoricalAwards=false.

Photo: Douglas Levere

Professor Doreen Wackeroth was named a Fermilab Distinguished Scholar in 2016, which is a 2-year appointment in the Fermilab Theoretical Physics Department with the opportunity to spend at least one month total per year

in residence at Fermilab. For more information please see the article in UBNow, https://www.buffalo.edu/ubnow/stories/2016/11/wacheroth-fermilab-scholar.html. In 2016, Wackeroth also received the UB Exceptional Scholars – Sustained Achievement Award for her research in theoretical particle physics.



Assistant Professor Ciaran Williams received a grant for his research awarded by the National Science Foundation (NSF), titled Precision Phenomenology for LHC Run II: The Standard Model and Beyond, which started on August 15, 2016. For more details please see the information provided by NSF at https://www.nsf.gov/awardsearch/showAward?AWD_ID=1619877&HistoricalAwards=false. Williams is also the recipient of the 2016 Wu-Ki Tung award for Early Career Research on QCD. The Wu-Ki Tung award is to recognize outstanding contributions made by early career physicists on experimental or theoretical research on QCD. The award consists of a plaque citing his contributions and support for travel to a future CTEQ summer school to deliver an invited lecture. The citation reads, "for significant contributions to higher-order QCD calculations for hadron scattering processes, and for their practicable implementation for the analysis of hadron collider data."

Photo: Douglas Levere

Professor Igor Zutic was elected a Fellow of the American Physical Society for pioneering contributions to the theory of spin-dependent transport, magnetism in semiconductor nanostructures, and novel spintronic devices. ■

Graduate Awards

Outstanding Graduate Student
Guo Deng
Jiajun Li

Outstanding TA
Ali Alasaqua
Alexandra Westley

Physics Graduate Student Memorial Fellowship
Alireza Jalouli
Weiyi Xia

Presidential Fellowship
Sushruth Muralidharan

John Ho & Martha Leung Scholarship
Alireza Jalouli
Nina Stein
Chang Wu
Weiyi Xia

Silvestro Scholarship
Yanting Deng
Ruifeng Dong
Hsuan Hao Fan
Weiwei Gao
Weixiang Jin
Rahul Kashyap
Colin Kilcoyne
Muhammed Kilinc
Jiajun Li
Alok Mukherjee
Rahul Munshi
Arman Najafi
Tenzin Norden
Bahareh Roozbahani
Anshul Saini
Akansha Sharma
Chenghao Shen
Bilal Tariq
Sushree Tripathy
Han Wen
Chang Wu
Weiyi Xia
Gaofeng Xu

Undergraduate Awards

CAS College Ambassadors
Tyler Barrett
Anne Fortman
Johnny Hayes

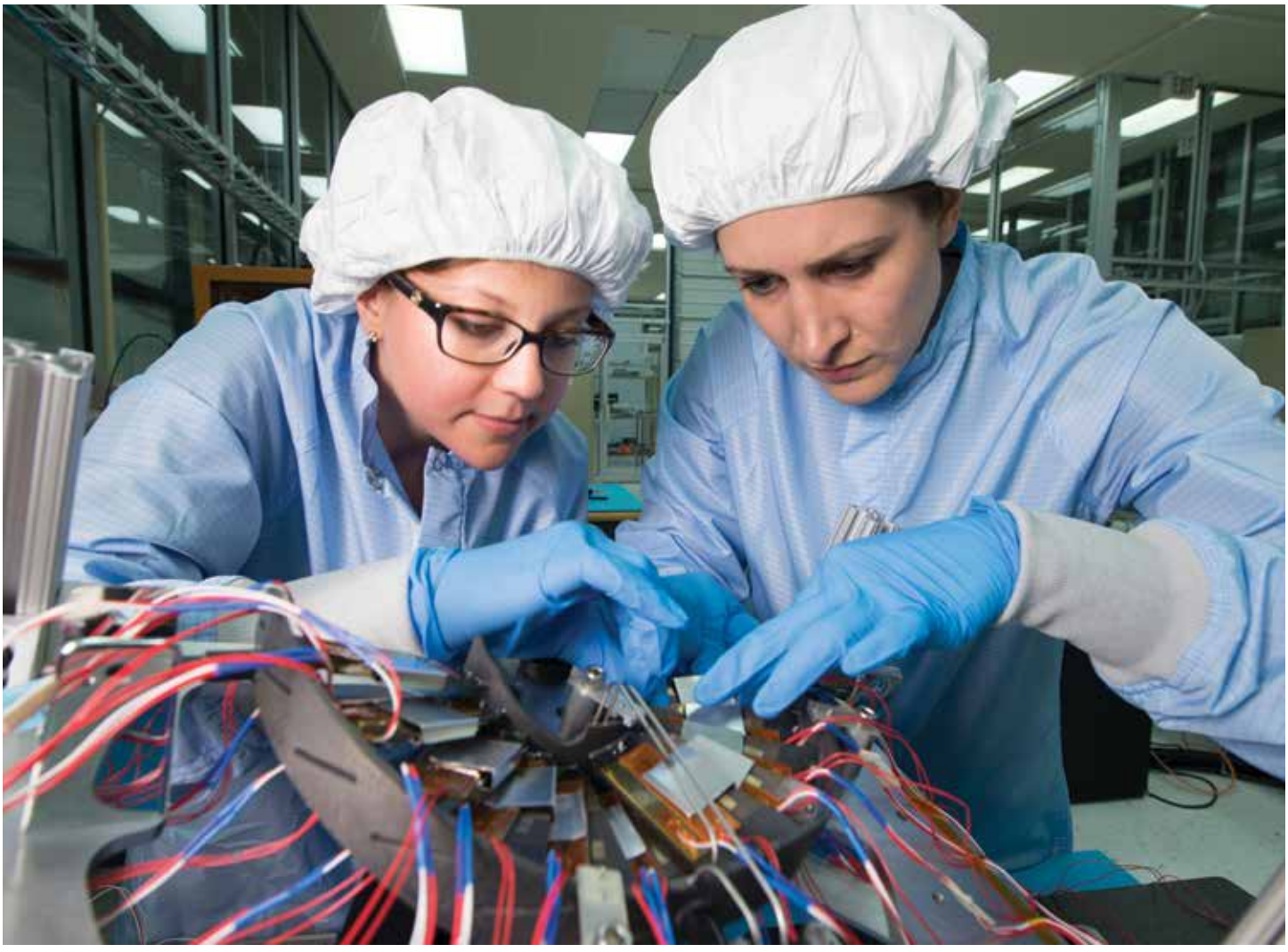
Outstanding Seniors
Geoffrey Fatin

Sekula Scholarship Awards
Tyler Barret
Ken Budzinski
Dylan Delgado
Dane Dimaria
Anne Fortman
Julia Quebral
Megan Renz

UB undergraduate students, Joseph Pusztay and Anne Fortman, presenting a poster at the 39th International High-Energy Physics Conference, which took place in Chicago in August 2016.

UB students contributing to the CMS upgrade receive Fermilab support

Salvatore Rappoccio, PhD » The Compact Muon Solenoid (CMS) detector at CERN's Large Hadron Collider (LHC) is undergoing a major upgrade at this time. The University at Buffalo plays a critical role in this, under the instruction of Professors. Iashvili, Kharchilava, and Rappoccio. Last summer, four undergraduate students (Anne Fortman, Joseph Pusztay, Matthew Schiavi, and Yuichi Okugawa) received funding to spend the summer at the Fermi National Accelerator Laboratory to assist in the construction and testing of this upgrade. Fortman and Pusztay were also able to present a physics measurement at the International Conference for High Energy Physics (ICHEP) at the University of Chicago (see photo). Maral Alyari just completed her PhD thesis here at UB in experimental high-energy physics, and is accepted for employment at Fermi National Accelerator Laboratory. In the last six months of her study, she was a recipient of the Fermilab Guests and Visitors Grant, allowing her to broaden her research experiences. In the photo Maral is shown working with Stephanie Timpone (Fermilab engineer) on the FPIX CO2 cooling system. ■



Recent UB graduate, Dr. Maral Alyari (left), at Fermilab working on the FPIX CO2 cooling system.

Support the Department of Physics Programs

Thank you for your support of the Department of Physics. With the support of alumni and friends, we can provide vital resources to enhance our department and provide support for students, research projects, and programs. We are grateful for your generosity.

You can support your department and help to provide for our students by making a gift online at physics.buffalo.edu.

Stay Connected

You will always be a part of UB and we want you to stay connected and get involved by:

- Attending alumni events and programs Becoming a Regional Network Leader
- Help build a strong network of alumni in your region
- Mentoring UB students
- Attending career events with students
- Recruiting prospective students as a UB Admissions Ambassador
- Connecting with an alumni chapter in your area
- Giving to UB and making an impact on students
- Following UB and the College of Arts and Sciences on social media

To get involved, visit http://www.cas.buffalo.edu/alumni-friends/get-involved/ or email UB-CollegeAlumni@buffalo.edu

Physics Department Funds

Physics Excellence Endowment: The Physics Excellence Endowment is of paramount importance in achieving overall excellence in the broad mission of the physics department. These expendable, undesignated funds support recruitment of outstanding graduate and undergraduate students, outreach efforts to the community, upper level experimental laboratories, undergraduate research projects, and activities of the Society for Physics Students. In addition, the Physics Excellence Endowment funds provide partial support for the department's colloquium and seminars series, and for the tangible recognition of our outstanding faculty and students.

Frank B. Silvestro Endowment Fund: This endowment, established in 2000, and funded by donations of Frank Silvestro, BA 1962, MA 1968, is used to support physics students who show academic promise and demonstrate financial need. Currently, the available endowment funds are used for the support of graduate students.

Dr. Stanley T. Sekula Memorial Scholarship Fund: This endowment, established in 1990 by Anne H. Sekula, honors the memory of Stanley T. Sekula, BA 1951. The endowment income is used to recognize outstanding undergraduates who show academic promise and demonstrate financial need.

Moti Lal Rustgi Professorship in Physics: Endowed by the Rustgi family in 2006 to honor the late Professor Moti Lal Rustgi. Provides support for the Rustgi Professor, currently held by Professor Andrea Markelz (see page 10).

Ta-You Wu Lectureship Fund: Established in 2008 by Professor Yung-Chang Lee in remembrance of the late Professor Ta-You Wu, who was a key member of the department from 1966 to 1978.

Moti Lal Rustgi Memorial Lectureship Fund: Established in 1993 by the Rustgi family, the fund supports an annual lecture by distinguished researchers.

Physics & Arts Exhibition Fund: This interactive permanent exhibition in Fronczak Hall opened in 2006, and was funded by alumni. It is one of the department's most effective outreach initiatives. Support will allow continued evolution and development.

Physics Department Resource Fund: The resource fund is not an endowment fund. Contributions to this fund are available immediately to the department less a minimum of five percent deduction by the UB Foundation. These funds from our donors are used to give partial support to activities such as graduation receptions for our physics majors, welcoming picnics for new graduate students, activities of the undergraduate Society of Physics Students, awards for our outstanding TAs, and other needs.

Fellowship for Outstanding Graduate Students is established with departmental funds to reward students who have shown significant academic progress since coming to UB. All graduate students who enter the department without a Presidential Fellowship or Dean's Scholarship are eligible for this fellowship. We offer one or two fellowships per year.

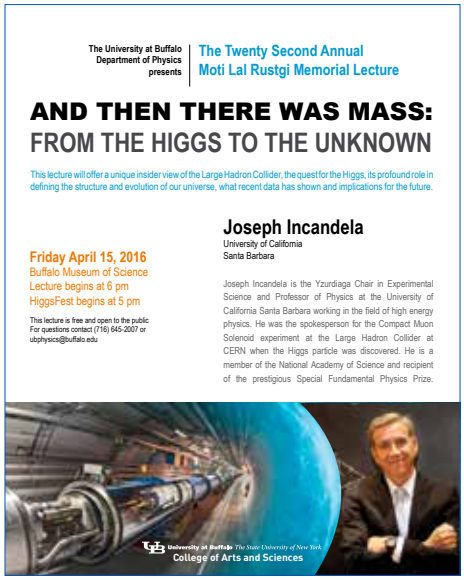
Physics Graduate Student Memorial Fellowship is established with a generous endowment from our colleague Bruce E. McCombe, SUNY Distinguished Professor. This fellowship is in memory of two former UB graduate students, Yong-Jie Wang and Taeman Yeo, and will be used to provide assistance to international graduate students, with preference given to Asian students and first year PhD students who have demonstrated financial need and academic promise.

John Ho and Martha Leung Scholarship is established with a generous endowment from our colleague John Ho, SUNY Distinguished Service Professor and his wife Martha Leung, PhD. This annual scholarship will promote further advancement of the graduate programs in physics at UB and will recognize outstanding unsupported students and early-career students who have demonstrated academic excellence. ■

2016 Rustgi Memorial Lecture

Dejan Stojkovic, PhD » The 22nd annual Rustgi Lecture was given in April 2016 by Professor Joseph Incandela, who served as a spokesperson for one of the most important scientific discoveries in this century — the detection of the Higgs boson.

The Rustgi Lecture series was established in 1993 with a gift from the family of Professor Moti Lal Rustgi, a faculty member in the Department of Physics who died unexpectedly in 1992. Rustgi Lectures are aimed at the general public, and are always well attended by UB faculty from a wide range of disciplines, by graduate and undergraduate students interested in the sciences, and by area high school students and their physics teachers. The Lectures are widely advertised to the public in the Buffalo metropolitan area, Western New York, and Southern Ontario.

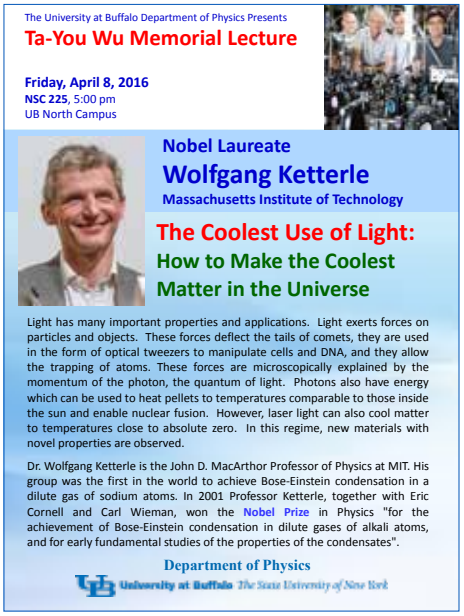


Joseph Incandela is a professor of physics and the Interim Vice Chancellor for Research at the University of California, Santa Barbara. When the Higgs particle discovery was announced in 2012, he was serving as head of the Compact Muon Solenoid (CMS) experiment, one of two large, international experiments at CERN that detected the Higgs particle.

The importance of the Higgs particle lies in the fact that almost all of the other elementary particles that matter is made of (like electrons and quarks) acquire their masses in interactions with the Higgs field. This, along with the theory of the strong nuclear interactions, helps explain why objects around us have mass. Without mass, the particles would be flying around at the speed of light, compact objects like stars and planets could not have been formed, and life could not exist as we know it. Physicists had been looking for the Higgs particle for many years, since this was the last particle in the standard model that was still missing. Incandela had the honor to announce the discovery on behalf of an international team of thousands of scientists.

This year's Rustgi Lecture was held at the Buffalo Museum of Science, and it was very well attended. In his talk, Incandela provided a nice overview of the Higgs particle's important role in defining the composition, structure and evolution of the world around us. He also discussed the Large Hadron Collider at CERN, the particle accelerator that allowed the physicists to look for and ultimately detect the Higgs. The lecture was followed by questions from the local scientists and general public.

Incandela also headlined HiggsFest 2, an event which preceded the Rustgi Lecture and featured a variety of science activities and demos geared toward children. For more information, please see UBNews (http://www.buffalo.edu/news/releases/2016/04/001.html). ■



2016 Ta-You Wu Lecture

Xuedong Hu, PhD » The 2016 Ta-You Wu Lecture was delivered by Professor Wolfgang Ketterle of MIT on April 8, 2016. Professor Ketterle is an atomic physicist, and was awarded the 2001 Nobel Prize for his contribution in creating and characterizing Bose-Einstein Condensation using cold atoms. In the Wu Lecture he described how to use light to cool down hot gases and create extremely cold and quantum coherent matter at temperatures near absolute zero. His simple demo using a mass and rubber bands gave a vivid illustration of how resonant and off-resonant driving transfer energy into and out of an oscillator, which is at the bottom of the laser cooling technique. In addition to the lecture, he talked to many faculty members, and had an intense session with more than 15 physics graduate students, discussing his ideas of how to do great physics. ■

We Congratulate Our Graduates!

Fall 2015

Physics Bachelors

Geoffrey Fatin

Physics PhD

Joseph Murphy
Advisor: A. N. Cartwright
Thesis Title: "Time-Resolved Spectroscopy Of Low-Dimensional Materials"

Spring 2016

Physics Bachelors

Michael Benson
Eric Bigenwald
Luke Bodmer
Alexandra Clark
Sara Diletti
Courtney Fitzgerald
Aaron Flieri
Sarah Freed
Matthew Gordon
James Grossi
Jessica Hinaman
Dante Iozzo
Luke Lyle
John Maher
Nigel Michki
Olga Neliobov
Seo Park
Victoria Riso
Nitesh Sharma

Physics Masters

Young In Kim
Advisor: Sambandamurthy Ganapathy

Phsyics PhD

George Lindberg
Advisor: Bernard Weinstein
Thesis Title: "Pressure and Photo-Induced Modification of Structural and Chemical Disorder In Binary and Elemental Chalcogenide Based Materials"

Sujay Kumar Singh
Advisor: Sambandamurthy Ganapathy
Thesis Title: "Metal-Insulator and Charge Ordering Transitions in Oxide Nanostructures"

Summer 2016

Physics Masters

Austin Anuta-Darling
Advisor: Jong Han

Physics PhD

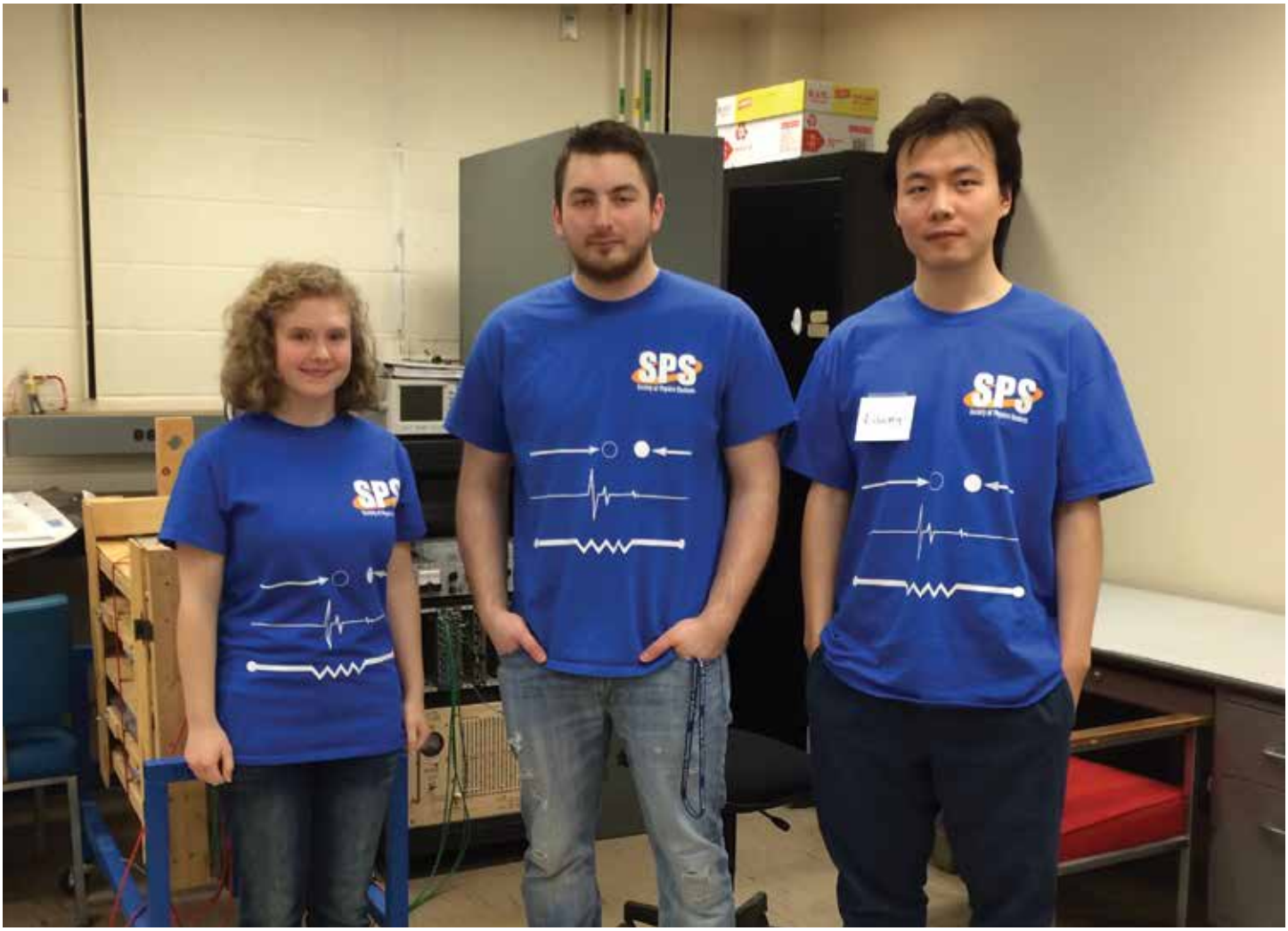
Thomas Scrace
Advisor: Athos Petrou
Thesis Title: "Magnetospectroscopy on WS2 single layer crystals"

Stephen Thomson
Advisor: Francis Gasparini
Thesis Title: "Action-at-a-Distance in Confined Superfluid 4-He"

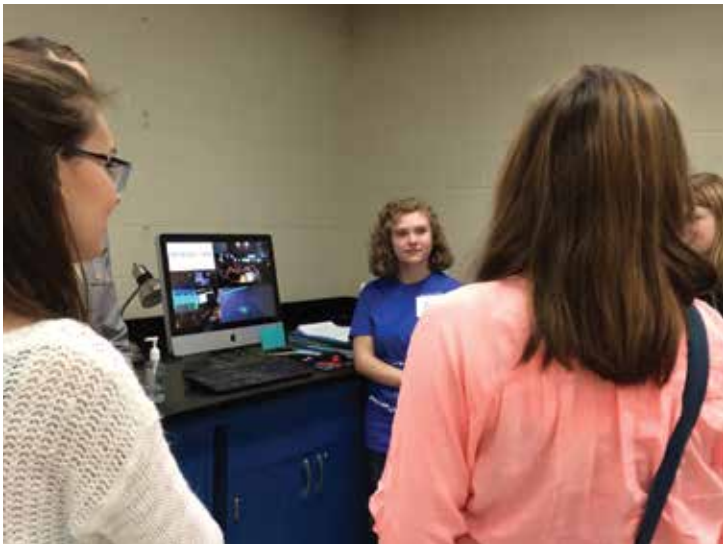
Jia Zhou
Advisor: Doreen Wackeroth
Thesis Title: "Precision Calculations for Electroweak Physics at Hadron Colliders" ■

2016-2017 Events Calendar

Oct 09	Retirement Party: Prof. Frank Gasparini
Oct 15	Open House
Oct 18	John Ho Memorial Service
Nov 12	Retirement Party: Prof. Bernard Weinstein
Apr 28	Rustgi Memorial Lecture
May 19	Graduate Commencement
May 21	Undergraduate Commencement
July 16-22	BOOST 2017 Conference



Undergraduate students Anne Fortman, Joseph Pusztay and Lisong Chen participated in the UB's Science Exploration Day in March 2016 by presenting their research work in high-energy physics to a group of high-school students (shown here in front of the department's cosmic ray detector). Photo: Doreen Wackeroth



Undergraduate students Anne Fortman, Joseph Pusztay and Lisong Chen participated in the UB's Science Exploration Day in March 2016 by presenting their research work in high-energy physics to a group of high-school students (shown here in front of the department's cosmic ray detector). Photo: Doreen Wackeroth

HST 2016 teachers at the CERN S'Cool Lab facility. Jennifer Gazdovich is seen 4th from right in the second row

CERN High School Teacher Program

Ia Iashvili, PhD » Since 2006, the UB Physics department is one of the centers of the nationwide QuarkNet outreach program. Mentors of the UB QuarkNet are Professors Ia Iashvili and Avto Kharchilava. The center sponsors regular workshops and master classes to introduce local high school teachers and their students to particle physics research. In summer 2016, one of the UB QuarkNet teachers, Jennifer Gazdovich, was selected to participate in the High School Teachers (HST) program at CERN, Geneva, Switzerland. This is a prestigious 3-week residential program that selects teachers from all over the world on a competitive basis. The HST 2016 hosted 48 high school physics teachers from 37 countries.

The HST program consists of lectures and activities at different facilities on the CERN campus. The lectures cover a wide range of topics such as introduction to particle physics, medical applications of particle physics, engineering at CERN, particle accelerators and detectors, computing at CERN, discovery of the Higgs Boson, and cosmology. Tours and activities take place at several CERN facilities and experimental sites, including the Synchrocyclotron facility, Cryogenic Lab, CMS, AMS, POCC, CCC, Large Magnetic Hall, and the Antimatter facility.

Gazdovich found the opportunity to collaborate with many accomplished teachers from around the world the best part of the HST experience. The teachers worked together in small groups on a topic of their choice, and developed activities to use in their classrooms. Gazdovich's group focused on medical applications of particle physics. They developed a way to teach PET scan operation principles using an Arduino and LED lights. Teachers also developed the methodology for students to determine a tumor location in the brain of a patient.

Through the HST program, Gazdovich received support for professional development in the field of particle physics and found ways to involve her students in the related research. Gazdovich keeps in contact with her fellow HST teachers from all over the world to exchange knowledge and ideas to further promote particle physics in their classrooms. ■

The Mars capsule has landed

Doreen Wackeroth, PhD »

We are excited to announce a new addition to the department's Physics and Arts Exhibition donated by Profs. Gary Nickard and Reinhard Reitzenstein, both faculty members of the UB Department of Art. The Mars Capsule, pictured here in its new location on the third floor of Fronczak Hall, was part of the Final Frontier, a collaborative piece by artists Reinhard Reitzenstein, Gary Nickard, and Patty Wallace, which was shown at the Grimsby Public Art Gallery, Ontario, Canada (please see http://www.garynickard.com/projects/2014-final-frontier for more information). This piece "*takes a fanciful look at how human beings have tried to breach the 'final frontier' by attempting to travel in space, and in the immortal words of Captain James T. Kirk, to endeavor to explore strange new worlds, to seek out new life and new civilizations, to boldly go where no man has gone before.*" The Physics and Arts exhibition continues to be an excellent vehicle for our outreach efforts, conveying through art our excitement about science and exploration. Thanks to a long lasting and fruitful collaboration with Profs. Nickard and Reitzenstein, as well as our alumni's generous contributions, we are able to keep this effort vibrant and alive. The exhibition is open to the public and can be experienced any time via a self-guided tour. Guided tours are offered at the department's open house or by appointment (please contact Tracy Gasinski at 716-645-3629 or tracygas@buffalo.edu). ■

The Mars Capsule is the newest addition to the Physics and Arts Exhibition and can be viewed on the third floor of Fronczak Hall. Photo: Doreen Wackeroth

Johnny Hayes and Robert Waelder making smoke rings.

Tyler Barrett showing how water can boil at room temperature.

Undergraduates organize and present their own physics outreach event this summer

John Cerne, PhD » Junior physics major Johnny Hayes has been actively participating in our physics outreach programs since coming to UB. In the past year he has taken the initiative in organizing outreach events on his own, and in May we discussed developing and doing outreach activities over the summer. We talked about our current physics demos and developing new ones to help primary and secondary school students learn new concepts and get excited about physics. Johnny started working on developing outreach events and started talking to organizations such as UB's Interdisciplinary Science and Engineering Partnership to look for opportunities to reach out to public schools over the summer. In June, I was contacted about doing a science outreach event for summer students at Starpoint Middle School in Pendleton, New York. The number (about 80) and age range (5-15 years old) of the students made this a very challenging project. I enjoyed discussing with Johnny his presentation plans and was impressed by work on the liquid nitrogen trash demo, which he greatly improved. Johnny also worked with Professor Serdar Gozpinar, who helped choose appropriate demos, and also explained how they work.

On August 11, Johnny Hayes, Robert Waelder, Tyler Barrett, and Eric Oliverio (all undergraduate physics majors), entertained and enthralled the students at Starpoint Middle School. Here is the description of the event from Johnny:

We broke the kids up into two age groups (5-9, 10-15) with about 30 to 40 kids in each group. We started with the smoke rings demo to get the kids thinking about air and how you can manipulate it. The kids really enjoyed the rings and willingly wanted to get hit with them. With that idea we moved to the bell jar. We asked the kids if they knew how water boiled; they responded with the usual answer of 'TEMPERATURE!!" Well, we blew their minds. Some of them were kind of close to figuring out how we could do it. We asked them if they've heard of pressure, and most replied yes, but couldn't give an answer as to what it was really. We used a vacuum to remove the air from a bell jar filled with water and watched as the water started to boil. They all gathered around to touch the jar to see that the temperature was not changed, and actually the water had gotten colder as opposed to hotter. They seemed to be confused on how this was possible, but thought it was cool. We explained it to them to the best of our abilities.

Next up, we linked this idea of pressure to the liquid nitrogen rocket, but instead of reducing pressure we raised it. The older kids sort of knew what was going to happen, which led to a dull discussion that bought time until the rocket went off. After about a minute or two, the rocket launched 20 feet in the air with a loud bang (echoed because we were in the gym). The kids screamed in excitement (and possibly fear) and were all yelling about how cool it was.

We explained the concept of forces, which they already seemed to know a little of, to connect that demo to E&M. They said they've heard of the magnetic force, which helped when doing flying rings. The flying rings and Lenz's law demo concepts didn't seem to stick well with the kids, but they really enjoyed the concept of levitation, which led perfectly into the levitron.

Again, the concepts were hard to grasp, but the kids sort of knew that it was going to float because of the previous demo. I asked them why we had to rotate the magnet in order to get it to stay levitating. No one really understood it, but the concept for why it was possible led right into the bike wheel demo. We gave all the kids a chance to get the magnet to float because none of us could. (I suspect the temperature and table were to

Students making a spinning magnet levitate.

Who thought physics could be this fun and interesting!?

Robert Waelder and Johnny Hayes demonstrating angular momentum.

Robert Waelder showing some surprising properties of angular momentum

Conservation of angular momentum can be fun!

blame.) The kids really wanted to get it to work and a few came closer than us.

Lastly we did the bike wheel, which the younger kids couldn't get enough of. We had a bunch of the students come up and try out the demo. Since they were so little, they flew when they changed the orientation of the wheel. None of them seemed to expect it and didn't expect it to move them that much. After the demo show the little kids just wanted to do that demo over and over again. They thought it was cool that if we rotated the tire and put it on the ground, it would just move forward for a while. We spun it and dropped it down bleachers and showed that it still went forward even though it was bouncing on the stairs. After about 20 extra minutes of that we left. The kids seemed to really enjoy it and said that out of all the events, ours was the best.

We are very fortunate to have physics majors like Johnny, Robert, Tyler, and Eric, whose passion for physics and interest in sharing it with others has driven them to reach out to our community! We look forward to more events like this. ■

Using radio control flight to get students excited about science and technology

John Cerne, PhD » For the past 5 years I have been using hands-on radio control (RC) flying to get Buffalo public school (BPS) students interested in science and technology. This year I focused on their teachers. I gave two workshops to show teachers how they can use RC concepts in their teaching and get their feedback on what would/wouldn't work in their classrooms. The first workshop was organized by Michelle Schroeder (project administrator for the Math Science Partnership Curriculum, Assessment and Instruction Division Buffalo Public Schools) through UB's Interdisciplinary Science and Engineering Partnership. I met with about 20 BPS teachers In February. The workshop took three hours, with the first part covering the basic physics and technology involved in RC aviation (there's a lot!). In the second part, teachers built and tested several types of model airplanes, flew model airplanes on a flight simulator, and learned to fly a drone and 14g model airplane.

The second workshop took place in October at Buffalo State College. The workshop was organized by Profs. Dan MacIsaac and David Henry from the physics department at Buffalo State for the Western New York Physics Teachers Alliance. The workshop lasted three hours. About a dozen teachers were challenged with questions involving basic physics, such as what powers a glider and how to calculate that power, as well as more technological questions like, "What does the Foucault pendulum have to do with modern aviation, ranging from spacecraft, to airplanes, to micro drones?" After a one hour lecture with many demos, the teachers built and flew their own "foam-plate gliders." They also did some hands-on flying of an RC airplane in the beautiful new atrium of the Sciences and Mathematics Complex at Buffalo State.

By working directly with teachers rather than students, I'm hoping to broaden the impact in terms of numbers of students involved. Working with teachers will also help improve the educational content and allow the development and use of these RC concepts for years to come. I am grateful to NSF for supporting this work through two grants. ■

Some lectures just drone on... Photo: David Henry

14g model airplane flying over teachers at the WNYPTA Workshop. Photo: David Henry

Teachers marching to demonstrate the Bernoulli principle. Photo: David Henry

Some planes can fly like helicopters. Photo: David Henry

University at Buffalo
Department of Physics
College of Arts and Sciences
239 Fronczak Hall
Buffalo, New York 14260

Discover their Research
www.physics.buffalo.edu

Newsletter 2016–2017

INTERACTIONS

Participants of LoopFest XV, which took place at UB, August 15-17, 2016, and was organized by Profs. Marzani, Williams and Wackeroth and UB Postdocs, Vincent Theeuwes and Tobias Neumann. The LoopFest series of workshops aims to provide a forum to coordinate activities focused on the theoretical challenges from the LHC and future high-energy colliders. At this LoopFest we welcomed 64 researchers from Canada, China, Germany, Italy, Spain, Switzerland, U.K., and the U.S. Photo: Hong Luo