Interactions

The Newsletter of the UB Department of Physics, 2018-19

Magnetic Nanoparticle Hyperthermia: Maximizing Specific Loss Power for Magnetic Hyperthermia by Hard–Soft Mixed Ferrites

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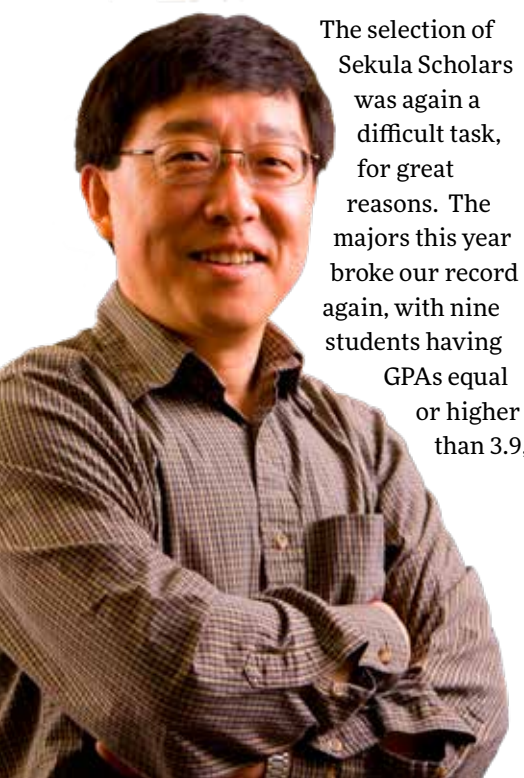
University at Buffalo
Department of Physics
College of Arts and Sciences

CHAIR'S LETTER | HONG LUO

Dear alumni and friends,

I hope last year was a successful year for you. Year after year, I was eager to tell you the wonderful stories of our undergraduate students, and this year is no exception. To start off, two of our graduating seniors, Anne Fortman (mentored by Professor Salvatore Rappoccio) and Tyler Barrett (mentored by Professor Surajit Sen), received NSF Graduate Fellowships this year (~$140 k each), joining our increasing list of undergrads who received this prestigious fellowship. As a class, more graduating seniors wrote senior theses than ever before, and more than 2/3 of the class graduated with latin honors, which has become a norm in the last few years! The CAS Outstanding Senior Award went to Dylan Delgado, mentored by Professor Doreen Wackeroth. We are very fortunate to have him as a graduate student in the Department. A large number of graduate students, 18 total, received well deserved scholarships in the Department and two received a CAS Dissertation Fellowship, supervised by Profs. Andrea Markelz and Igor Zutic.



The selection of Sekula Scholars was again a difficult task, for great reasons. The majors this year broke our record again, with nine students having GPAs equal or higher than 3.9, including three with 4.0. The cutoff has been raised consistently in recent years, leading to this new high. Upon consulting with Mrs. Sekula, we were able to award more deserving students this year than ever before.

On the faculty side, publications in high impact journals have been increasing. In terms of recognitions, Prof. Ciaran Williams received the UB Exceptional Scholar: Young Investigator Award for his outstanding research since joining UB. He also succeeded in bringing the international workshop QCD@LHC 2019 to Buffalo. Prof. Andrea Markelz made a successful bid to host the large and prestigious International Conference of Infrared, Millimeter, and Terahertz Waves 2020, which is a fitting indication of her stature in this field.

On a very sad note, Professor Richard Gonsalves passed away on December 19, 2018 after battling an illness for several months. Richard joined UB in 1980 and served the Department in many capacities with great success, including being the chair from 1996 to 2004. He will be truly missed.

We were extremely excited to hear earlier this year that our alum and a great supporter of the Department, Dr. Norman Jarosik at Princeton University, and the Wilkinson Microwave Anisotropy Probe (WMAP) science team received the 2018 Breakthrough Prize in Fundamental Physics for their contribution to the detailed mapping of the early universe (https://breakthroughprize.org/Laureates/1/L3811). Like the Gruber Cosmology Prize that he received in 2012, the first time we heard about the news was his donation of the total monetary part of the prize to the Department. We are all very grateful to his extraordinary level of generosity and constant support of the Department.

We are equally grateful to Frank Gasparini, PhD, SUNY Distinguished Professor Emeritus, and his wife Lucile, who established an endowment to fund a Gasparini Prize for outstanding PhD theses, to be awarded annually. This provides a mechanism to honor students who have carried out outstanding research as PhD students and also a boost to jump start their careers.

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

Best regards,

Hong Luo, Chair
Professor of Physics

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http://arts-sciences.buffalo.edu/physics/news-events/interactions.html

CONTACT
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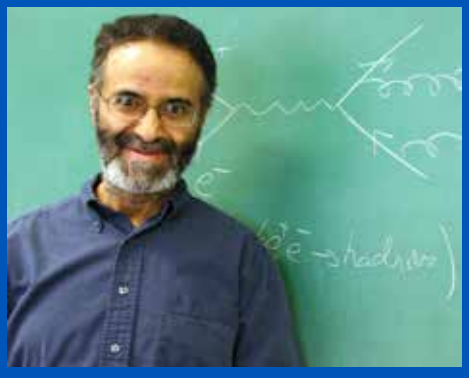


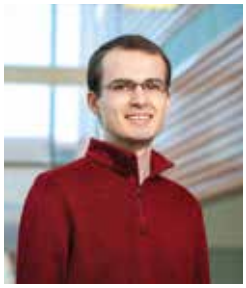
IN MEMORIAM

Richard Gonsalves, Professor Emeritus

It is with great sadness that we report the passing of our colleague Richard Gonsalves on December 19, 2018. Our condolences go out to his brother, Timothy A. Gonsalves, his sister, Maureen Gonsalves, and his nieces and nephews.

STUDENT ACHIEVEMENTS

John Cerne, PhD, Murthy Ganapathy, PhD, Salvatore Rappoccio, PhD, Surajit Sen, PhD, and Doreen Wackeroth, PhD »
Our rigorous curriculum combined with close faculty-student interaction empower our students who shine with academic excellence. Here are some highlights of recent achievements of our undergraduate and graduate students:



Tyler Barrett, BS 2018
Advisor: Prof. Surajit Sen

Tyler Barrett, a Presidential Fellow with a 4.00 CGPA, finished his BS in Physics in Spring 2018 and joined the PhD program in the Physics Department at Cornell University as both a NSF Graduate Fellow and as a Departmental Fellow. During his undergraduate years, Tyler worked with Prof. Surajit Sen on non-equilibrium statistical physics. In addition, Tyler assisted Prof. Ciaran Williams in his extensive outreach efforts to the disadvantaged communities in the Western New York area. In November 2017, the Department recognized Tyler's academic excellence by awarding him the first ever Departmental Excellence Award, which carried a prize of $4,000. Tyler's research focused on evaluating relaxation processes in strongly nonlinear Fermi-Pasta-Ulam-Tsingou chains. His studies used the continued fraction formalism for the calculations. A major challenge in the study concerned correctly calculating the contributions of various frequencies to the system relaxation by evaluating certain non-convergent infinite continued fractions (or series). Tyler successfully overcame this challenge by recognizing some peculiarities in how the frequencies were distributed, which eventually helped solve for the relaxation processes in these systems correctly, thereby potentially unlocking a new way to study relaxation phenomena in strongly nonlinear many body systems. The results of this work are expected to be published in due course. ■

Dylan Delgado, BS 2018
Advisor: Prof. Doreen Wackeroth

Dylan Delgado graduated with a BS in Physics in 2018. He received the CAS Outstanding Senior Award and twice the Sekula fellowship of the Department of Physics. Dylan's research interests lead him to study the impact of so-called dark fermions in Higgs boson production in association with a Z boson (ZH production) at the CERN Large Hadron Collider and possible future high-energy proton-proton and electron-positron colliders. Dark fermions are hypothetical new particles with weak interactions with known Standard Model particles, which could be candidates for dark matter. Dylan explored the possibility of finding hints for their existence through their virtual presence in ZH production, which could be observed in precision measurements of Higgs couplings. He presented the results of his research project at the poster session of UB's Celebration of Excellence in Spring 2018. He is now in the Physics PhD program at UB to pursue a PhD in theoretical particle physics ■

Anne Fortman, BS 2018
Advisor: Prof. Salvatore Rappoccio

Anne Fortman graduated with a BS in Physics in 2018. She was a recipient of the 2015 Goldwater Fellowship and the 2018 NSF Graduate Research Fellowship, as well as numerous departmental awards including the Sekula and Bahehti fellowships. She is also an author on the CMS publication at arXiv:1807.05974, published in the Journal of High Energy Physics. This paper focuses on a measurement of the differential production cross section of proton-proton collision events with respect to hadronic jet mass. While at UB, she spent three summers doing research for the Compact Muon Solenoid (CMS) experiment at Fermi National Accelerator Laboratory (FNAL) and the Large Hadron Collider (LHC) at CERN in Geneva, Switzerland. The CMS experiment is one of two experiments (along with the ATLAS experiment) that discovered the Higgs boson in 2012. She is now attending Harvard University to pursue a PhD in Physics ■

Colin Kilcoyne, PhD 2018
Advisor: Prof. Murthy Ganapathy

Colin Kilcoyne,PhD, joined UB as an undergraduate physics major in 2009. He joined my research group in 2012 to work on a short-term project to gain hands-on experience as an undergraduate researcher. Colin worked on exfoliation of graphene and single layer devices of graphene to study their transport properties. In the Fall of 2013, Colin joined UB as graduate student and continued his research in my group. Colin's thesis work was broadly based on understanding the transport characteristics in nanoscale strongly correlated materials and has authored/co-authored five peer-reviewed publications in my group till date. He has also presented talks in APS, MRS and other conferences. In addition to being a motivated researcher, Colin was an excellent TA for the Introductory Physics (101/102) sequence for several years and has also won the Outstanding TA Award in 2015. Colin has also served the Department through PGSA roles and was a model citizen for our Department students in all aspects of scholarship, teaching and service. Colin is married to Bahareh Roozbahani, currently a graduate student in Prof. Iashvili's group at UB. Colin successfully defended his PhD thesis in August 2018 and started as a Process Engineer at Intel Corporation in Portland, OR ■

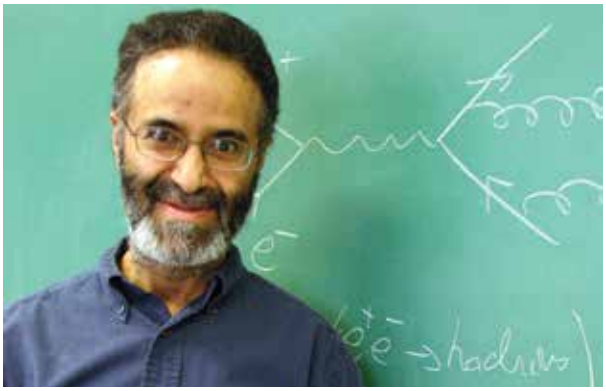
Alok Mukherjee, PhD 2018
Advisor: Prof. John Cerne

Alok Mukherjee, PhD, was born in India and received his BS in physics from Utkal University in 2005 and his MS in physics from Banaras Hindu University in 2007. He then worked as a junior research fellow at the Indian Space Research Organization. He came to UB in 2009 and joined my group in 2013. As a research assistant, Alok worked on a wide range of novel materials using many different experimental and analytical techniques. The materials ranged from iron-based and cuprate high temperature superconductors, to graphene and transition-metal dichalcogenides, to iron films. The techniques included magneto-transport, Fourier-transform infrared spectroscopy, SQUID magnetometry, and infrared magneto-optical Faraday/Kerr spectroscopy. In addition to being a creative researcher, Alok was an excellent mentor to fellow graduate students and undergrads, as well as local high school teachers and students. Alok came up with many research projects for undergraduates, and his latest paper published in Physical Review B in 2019 included as authors two UB undergraduate students, who were closely supervised by Alok. In 2015-2016, Alok worked with local school teachers and students as a doctoral fellow in UB's Interdisciplinary Science and Engineering Partnership program. Alok's excellent research record and his ability to motivate and explain his research to non-experts lead to a Mark Diamond Research Fund Award that he received in 2013. He also was awarded support from the Silvestro Fund for four years. Alok is married to Sushree Tripathi, who is working on her PhD in physics in Dr. Zheng's group at UB. Alok has a great passion for photography and astronomy. In fact, the cover photo of our spring 2018 Interactions newsletter was taken by Alok! In 2018, Alok received his PhD in physics and went to work at Intel Corporation, where he is currently a process engineer ■

Alexandra Westley, PhD 2018
Advisor: Prof. Surajit Sen

Alexandra Westley, PhD, was a Presidential Fellow and a NSF-URGE Fellow at UB Physics as an undergrad and a Presidential Fellow as a graduate student. She completed her PhD in early 2018 and is presently collaborating with Professor Sen and teaching at Buffalo State College. Recently, Alexandra was instrumental in constructing a highly accurate but approximate solution to the non-integrable equations of motion for the celebrated Fermi-Pasta-Ulam-Tsingou problem introduced by Fermi et al. in 1955. By non-integrable one means that it has not been possible to find an analytic closed form solution to the problem. The new solution which describes highly accurate simulational results surprisingly well is a simple hyperbolic function but with a polynomial argument which is in itself expressible as a hyperbolic function. The first paper on this work was recently published in Europhysics Letters: A. Westley and S. Sen, "Solitary waves and localized nonlinear excitations in the strongly nonlinear ß-Fermi-Pasta-Ulam-Tsingou chain," Europhysics Letters 123, 30005 (2018) ■

In Memoriam



Hong Luo, PhD and Doreen Wackeroth, PhD » It is with great sadness that we report the passing of our colleague Richard Gonsalves on December 19, 2018, only a few days after his 69th birthday, after battling an illness for several months. Our condolences go out to his brother, Timothy A. Gonsalves, his sister, Maureen Gonsalves, and his nieces and nephews.

Richard received his undergraduate and part of his graduate education at the University of Madras (B.Sc. in 1969 and M.Sc. in 1971) before he left India to pursue a Ph.D. degree in Theoretical High-Energy Physics at Columbia University. He graduated from Columbia University in 1976 with a thesis entitled On the Quantization of Soliton Scattering Solutions in Model Field Theories. From 1976 until 1978 he was a Member of the Princeton Institute for Advanced Studies, followed by a Postdoc position at the University of California at San Diego. Richard is a recipient of the Government of India Merit Scholarship (1969-1971), the Sir K.S. Krishnan Gold Medal for Physics (1971), and the Joseph C. Pfister Fellowship (1974-1976). Richard joined UB in 1980 and served the Department in many capacities with great success, including being the Chair from 1996 to 2004. But even before that, he made a lot of contributions to our education effort. He worked on streamlining the instruction of introductory University Physics classes with Prof. Athos Petrou, so that students could be taught and assessed uniformly, which is what we do nowadays for all our introductory physics classes. He received a SUNY Chancellor's Award for Excellence in Teaching in 1994. During his tenure as the Chair, he paved the way for the transition of the department and made it possible to evolve to the high quality of our research and education programs today that we have great pride in. He was also a great mentor for some faculty members who owe him a great deal for their success. Richard retired from UB in 2017.

As a theoretical particle physicist, Richard did groundbreaking work in Quantum Chromo Dynamics (QCD). In 1980, only a few years after the introduction of QCD as the quantum field theory of strong interactions of quarks and gluons, Richard published his most famous paper [1], pioneering the analytic calculation of higher-order QCD corrections to electron-positron scattering. This work enabled important tests of QCD when compared with experimental data and was crucial for establishing this new theory. He later expanded his highly influential work to the study of the carriers of the weak nuclear force, the W and Z bosons. His detailed calculations of the properties of these particles provided firm and reliable theoretical predictions, which allowed for precision tests of the underlying theory, in particular the QCD-improved parton model, at the high-energy colliders Tevatron at Fermilab and Large Hadron Collider at CERN. To this date, his contributions remain important ingredients to the mathematical toolbox used in the ongoing search for signals of new physics beyond the Standard Model at high-energy colliders.

Richard's contributions to UB and to his research field were recognized at a memorial service held on December 22, 2018. His colleagues, friends and family also shared their more private memories of this very gentle and kind person. He will be truly missed ■

[1] William Celmaster and Richard J. Gonsalves, Phys. Rev. Lett. 44, 560 – Published March 3, 1980.

In Memoriam

Hong Luo, PhD » I received word from Carl Isihara that his father, Akira Isihara, passed away at the age of 97 after a brief illness at his home in Cohasset, Massachusetts, on February 24, 2018. Dr. Isihara joined the Physics Department as Full Professor in 1964, served as the Department Chair from 1977 until 1987, and retired from UB in 1991. Dr. Isihara was a Fellow of the American Physical Society. Our condolences go out to his wife Iku, his 4 children and 4 grandchildren ■

Research on cancer-frying nanoparticles heats up

Hao Zeng, PhD » New research led by Prof. Hao Zeng at the University at Buffalo and conducted with colleagues from Capital Normal University in Beijing, China, the Chinese PLA General Hospital, and the University of Nebraska Omaha advances the development of nanoparticles that can destroy tumors with significant amounts of heat under a low ac magnetic field. This treatment will only heat up the region in the vicinity of nanoparticles without affecting healthy tissues that are further away, so that few side effects are anticipated. The study was published in the journal Small as a cover article (https://onlinelibrary.wiley.com/doi/abs/10.1002/smll.201800135), and featured in a UB Now article by Charlotte Hsu (www.buffalo.edu/ubnow/campus.host.html/content/shared/university/news/ub-reporter-articles/stories/2018/06/magnetic-nanoparticles.detail.html).

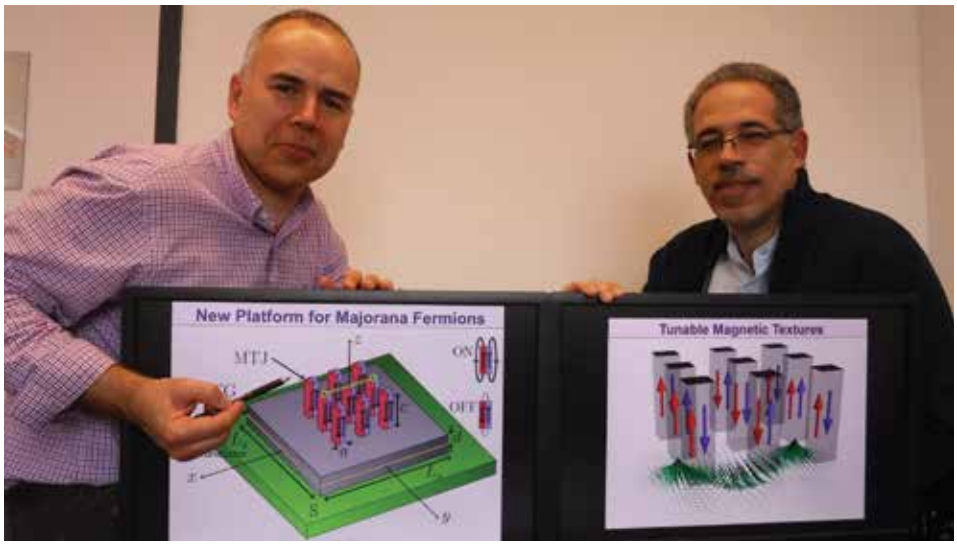
Cover photo for the article by Shuli He et al., Magnetic Nanoparticle Hyperthermia: Maximizing Specific Loss Power for Magnetic Hyperthermia by Hard–Soft Mixed Ferrites (Small 29/2018, Vol. 14), Copyright Wiley-VCH Verlag GmbH & Co. KGaA. Reproduced with permission.

The main accomplishment of this work is the greatly enhanced heating performance of nanoparticles under low-field conditions suitable for clinical applications. The best heating power obtained by this research team is close to the theoretical limit, greatly surpassing some of the best-performing particles that other research teams have produced. The therapy has a number of potential benefits over other treatment routes. It is minimally invasive, and is not expected to generate the type of severe side effects often associated with chemotherapy and radiation. In addition, the magnetic field that is used to excite the particles can penetrate deep into the body from an instrument that does not require any contact or insertion of probes. As such, the therapy can reach parts of the body that are not easily accessible to surgery.

A lot more research needs to be done before the nanoparticles are available to patients. But here is how the therapy would work: First, doctors would use targeting technologies to direct nanoparticles to tumors in patients' bodies. Then, exposure to an alternating magnetic field would prompt the particles' magnetic orientation to flip back and forth hundreds of thousands of times per second. This process would cause the particles to absorb energy from the electromagnetic field and convert it into thermal energy in the targeted regions. We envision bone cancer treatment as one early application for heated magnetic nanoparticles. Typically, after a surgery to remove bone tumors, a synthetic material called bone cement is injected to fill the voids. If we introduce our nanoparticles into the bone cement, they can be heated on demand to kill any tumor cells that remain nearby, and help prevent recurrence of the cancer. To simulate this scenario, we embedded these nanoparticles into bone cement and used it to heat up a pork rib. With just a small number of nanoparticles (1 percent of the bone cement, by weight), the experimental set-up reached a temperature high enough to kill tumor cells ■

Faculty Awards

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



Professors Igor Zutic (UB, left) and Alex Matos-Abiague (Wayne State University, right).

Professors Jong Han and Igor Zutic have received a DARPA grant entitled Engineering Topological States Using Electrically-Tunable Magnetic Chains, as part of the Topological Excitation in Electronics program. Translating topological properties to materials brings about physical behavior that is robust under external perturbations and various inherent imperfections, similar to a knot, preserved under small continuous movements of the rope. A striking example of such topological protection recently came to attention in the studies of elusive Majorana fermions in solid-state physics, originally predicted in high-energy physics 80 years ago. These Majorana fermions are their own antiparticles requiring them to have zero charge and zero energy and can be viewed as a half of an ordinary electron. The two halves of an electron are decoupled from their environment and spatially separated such that even if we try to alter one of them, the other half would be preserved and the information encoded in such Majorana pairs would be retained. These remarkable properties of Majorana fermions have spurred intense efforts at major technological companies, as a platform for future topologically protected quantum computers. Complemented by the effort of Prof. Zutic's former postdoc, Prof. Alex Matos-Abiague at Wayne State University, Profs. Han and Zutic, and Dr. Tong Thou at UB are formulating a theoretical description for the realization of Majorana fermions that under this award is being experimentally tested by researchers at New York University. ■

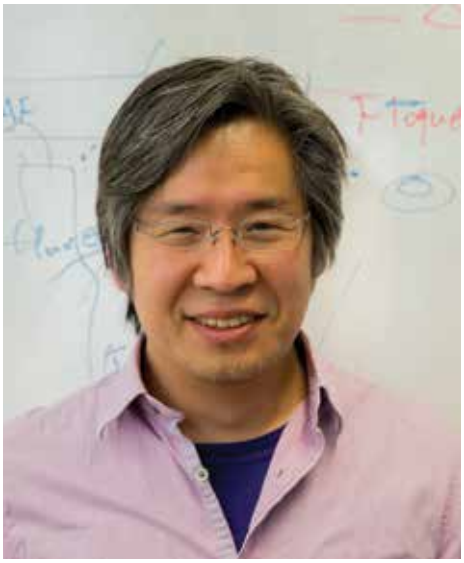

Professor Jong Han (UB). Photo credit: Hong Luo


Photo Credit: Douglas Levere / University at Buffalo / CERN

Professors Avto Kharchilava, Ia Iashvili and Salvatore Rappoccio (from left to right) received a grant from the National Science Foundation (NSF) for research that will be conducted with the Compact Muon Solenoid (CMS) detector at the CERN Large Hadron Collider (LHC) to search for new particles, study the decay of Higgs bosons, carry out precision measurements of other Standard Model (SM) processes, use jet substructure to reconstruct high-momentum objects, and extend the capabilities of the CMS particle-tracking detector to increase its acceptance and tolerance to high collision rates. For more information please see the UB News press release at www.buffalo.edu/news/releases/2018/09/005.html and the NSF announcement at https://www.nsf.gov/awardsearch/showAward?AWD_ID=1806573&HistoricalAwards=false ■

Assistant Professor Ciaran Williams (third from left with UB President Satish Tripathi (far left), Provost Charles Zukoski (far right), and co-honorees at the award ceremony) was awarded the 2018 UB Exceptional Scholars - Young Investigator Award. The Young Investigator Award is presented to untenured faculty members in recognition of the awardees' superior scholarly achievement and their position as an up-and-coming member of their field.

Assistant Professor Ciaran Williams (third from left with UB President Satish Tripathi (far left), Provost Charles Zukoski (far right), and co-honorees at the award ceremony) was awarded the 2018 UB Exceptional Scholars - Young Investigator Award. The Young Investigator Award is presented to untenured faculty members in recognition of the awardees' superior scholarly achievement and their position as an up-and-coming member of their field. ■

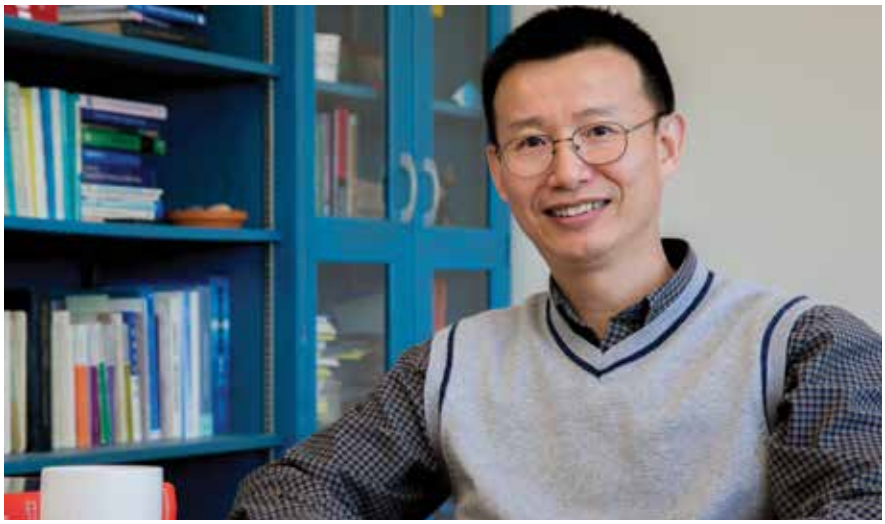


Photo credit: Hong Luo

Professor Xuedong Hu received a grant from US Army Research Office (ARO) to perform theoretical studies on the feasibility of spin qubits in silicon nanostructures such as quantum dots, phosphorus donors, and donor-dot hybrid structures. This grant started in 2017, and supports Professor Hu to continue his explorations of solid state quantum information processing, with focus on electron spin dynamics and decoherence. ■

Graduate Awards

Cambi Fellowship
Ibraheem Alshareedah, Muye He

CAS Dissertation Fellowship
Yanting Deng, Gaofeng Xu

John Ho & Martha Leung Scholarship
Garvita Agarwal, Michael Morse, Arman Najafi

Outstanding Graduate Student
Hsuan Hao Fan, Colin Kilcoyne, Han Wen, Peiyao Zhang

Outstanding TA
Michael Morse, Rahul Kashyap

Physics Graduate Student Memorial Fellowship (McCombe Fellowship)
Dasharath Adhikari, Tenzin Norden, Bahareh Roozbahani, Akansha Sharma

Presidential Fellowship
Roberto Mondini, Sushruth Muralidharan

Silvestro Scholarship
Dasharath Adhikari, Garvita Agarwal, Nargess Arbchigavkani, Guo Deng, Yanting Deng, Ruifeng Dong, Omar Elsherif, Hsuan Hao Fan, Nathaniel Fuller, Xing Liu, Arman Najafi, Bahareh Roozbahani, Matthew Schiavi, Akansha Sharma, Xiucheng Wei, Han Wen, Gaofeng Xu

Undergraduate Awards

CAS College Ambassadors
Julia Quebral, Benjamin Mannix

CAS Outstanding Senior
Dylan Delgado

NSF Graduate Research Fellowship
Anne Fortman, Tyler Barrett

Outstanding Seniors
Anne Fortman, Dane Dimaria, Megan Renz, Tyler Barrett

Sekula Scholarship Awards
Scott Abbot, Nicholas Bartelo, Eric Niblock, Julia Quebral, Hannah Seppala, Dylan Sabuda, Logan Walters, Cameron Watt

Dr. Myoung-Hwan Kim wins Outstanding Young Researcher Award from the Association of Korean Physicists in America

John Cerne, PhD » Dr. Myoung-Hwan Kim received the Outstanding Young Researcher Award from the Association of Korean Physicists in America in 2018. He is joining the ranks of other outstanding physicists who won this award, including Dr. Philip Kim at Harvard University, who very nearly won the Nobel prize for his seminal work on graphene and also presented the Rustgi lecture at UB in 2015. The link to the award is: https://www.akpa.org/2014-03-02-18-45-05/recent-awardees. Dr. Kim received his PhD from my group in 2010. He went on to do post-docs in Dr. H.D. Drew's group at the University of Maryland and Dr. Nanfang Yu's group at Columbia University. He is currently an assistant professor in the Department of Physics and Astronomy at Texas Tech University ■

Give to the Department of Physics

Thank you for your support of the Department of Physics! With the support of alumni and friends, we can access 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:
http://arts-sciences.buffalo.edu/physics/make-a-gift.html

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
- 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

To get involved: UB-CollegeAlumni@buffalo.edu

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 arts-sciences.buffalo.edu/physics/make-a-gift.html.

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.

Physics International Graduate Student Memorial Fund » Established with a generous endowment from our colleague Bruce E. McCombe, SUNY Distinguished Professor. This Fellowship is in memory of three former UB graduate students, Yong-Jie Wang, Taeman Yeo, and Christian Meining, 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

Dr. Stanley T. Sekula Memorial Scholarship Fund » This endowment, established in 1990 by Mrs. 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.

Frank B. Silvestro Endowment Fund » This endowment, established in 2000, and funded by donations of Mr. 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.

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.

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

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.

Physics and 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.

John Ho and Martha Leung Scholarship Fund » Established with a generous endowment from our colleague John Ho, SUNY Distinguished Service Professor, and his wife Dr. Martha Leung. 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.

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 TA's, and other needs.

Om and Saraswati Bahethi Foundation Scholarship Fund » This endowment was established by our generous alumnus Om P. Bahethi and his wife Saraswati Bahethi. Om received his PhD from our department in 1973 under the supervision of Professor Emeritus Michael Fuda, after receiving his undergraduate and masters degrees in India. He is the founder and the Chairman of the Board of Science Systems and Applications (SSAI). This endowment is used to offer undergraduate and graduate (both masters and PhD) scholarships to students who are showing great promise for future success, especially those with difficult socio-economic backgrounds, as Dr. Bahethi had ■

We congratulate our recent graduates!

Fall 2017

Physics Bachelor's (BS)

Jacob Appelbaum
Timothy Dubill
Kranthi Buggineni
Corbin Kilmer

Physics PhD

Alexandra Westley
Advisor: Surajit Sen
Thesis Title: "Analytical and numerical techniques for nonlinear many-body systems"

Mengyang Xu
Advisor: Andrea Markelz
Thesis Title: "Terahertz Optical and Computational Studies of Temperature and Photo Induced Changes to Protein Structural Dynamics"

Xuechen Zhu
Advisor: Hong Luo
Thesis Title: "Studies on Mn Ion Diffusion and Spin Injection Simulation of Spin LED Devices and STM/STS Study of Codoped TiO2"

Spring 2018

Physics Bachelor's (BS)

Mostafa Awad
Tyler Barrett
Didarul Bhulya
Jacob Collins
Hannah Cupples
Dylan Delgado
Dane DiMaria
Anne Fortman
Lauren Hay
Herbert Ludowieg
Xinyu Ma
Jacob Macano
Jinsong Ouyang
Sam Powers
Megan Renz
Ian Szczesniak
Aidan Tracy

Physics Master's (MS)

Luis Barajas-Lopez
Shuo Pin Chang
Tsering Dolma
John Nord
Changliang Zhu

Physics PhD

Nelson Gross
Advisor: Bernard Weinstein
Thesis: "Phonon and Stability Properties in Two novel Chalcogenide Solids Investigated by Raman Scattering Using High-Pressure and Photocrystalization Experiments"

Colin Kilcoyne
Advisor: Sambandamurthy Ganapathy
Thesis: "Charge Carrier Modulation in Low Dimensional Semiconductors"

Summer 2018

Physics Bachelor's (BS)

Jiyong Cheng

Physics PhD

Alok Mukherjee
Advisor: John Cerne
Thesis Title: "Polarization-sensitive infrared magneto-optical studies in two-dimensional materials ranging from graphene to high Tc superconductors"

2018-19 EVENTS CALENDAR

Aug 24 Welcome BBQ	**Nov 12** Discovery Day	**Apr 05** Moti Lal Rustgi Memorial Lecture	**May 17** Graduate Commencement
Oct 20 Open House	**Nov 30** Sigma Pi Sigma Induction Ceremony	**Apr 07** Accepted Students Day	**May 19** Undergraduate Commencement
Oct 26 Moti Lal Rustgi Memorial Lecture	**Dec 01** Holiday Party	**Apr 20** Accepted Students Day	**Jul 15** QCD@LHC 2019
Nov 02 Ta-You Wu Memorial Lecture	**Feb 26** Science & Art Cabaret	**May 13** Indeterminacy Festival	

Bridging disciplines: The Large Hadron Collider at the Indeterminacy Festival

Stanzi Vaubel and Doreen Wackeroth, PhD » The Indeterminacy Festival, launched in May of 2017 by founder and UB Media Study PhD candidate Stanzi Vaubel, is intended to allow artists, community members, and specialists to engage meaningfully around the theme of uncertainty. Uncertainty is generally associated with a sense of anxiety, fear, and unwanted instability, which if we can help it, is avoided at all costs. The festival offers a context in which uncertainty loses its negative connotations, and becomes a place of possibility, an instability that can create new, meaningful connections between communities and disciplines.

In May of 2018, the festival focused on the theme of Emergence. As the director, Stanzi worked closely with physics faculty member Doreen Wackeroth. Professor Wackeroth advised on how we might translate the ideas and processes that occur inside the CERN Large Hadron Collider (LHC) into a large-scale event. Stanzi then took the ideas and explanations discussed and shared them with fabrication and design engineers who collaborated with Stanzi to construct a stage set which would emulate the space of the collider itself. Stanzi also shared the concepts with UB Dance faculty Melanie Aceto and Jenna Del Monte, who structured choreography that was inspired by the LHC and enacting particle collision. The choreographers and dancers were given large spools of colored bungee cord, which mirrored the colored strings that appear in the photos of what emerges out of the particle collision simulated in the collider. The strings also visualize the process of creating so-called jets, which are sprays of hadrons formed in the collision via the strong nuclear force. Finally, Stanzi worked closely with The Indeterminacy Ensemble to create a sound score, which would enact this process as a sonic piece of music. Joining the ensemble was Our Lady Of Hope, a West Side youth choir alongside singers from the UB choir. The singers chanted the ideas expressed through movement and string by the dancers and all together these components enacted what happens inside the LHC and the process of particle collision that takes place within it.

Photo Credit: Paul Hokanson

The collaboration between Stanzi and Prof. Wackeroth and the support by the Physics Department was a critical part of the festival, bringing forward the emergent idea that through building enough energy, we can collide particles in the quest to discover something entirely new. We are looking forward to another exciting year of collaboration, with this year's focus on gravitational and electromagnetic waves. This time undergraduate and graduate students from the Physics Department are involved as well as part of a music performance. To learn more about the 2019 festival, please visit: www.indeterminacyfestival.com ■

John Cerne with students of the GTEST summer camp.

Drones offer campers learning experience outside the classroom

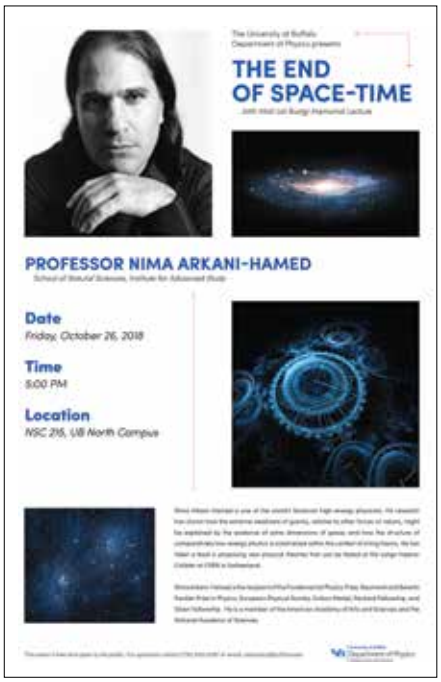
John Cerne, PhD » This is the second year that Prof. Cerne has participated in UB's Geo-Technology Experiences for Students and Teachers (GTEST) summer camp. GTEST is funded by NSF and introduces local high school teachers and students to basic concepts and hands-on learning for geographic information systems (GIS). Cerne used his background in radio controlled (RC) flight to cover some of the aerial aspects of GIS. He gave a lecture on and made demonstrations of RC flight. He also trained the participants to fly RC aircraft both indoors and outdoors on July 16 and 17, 2018. An article describing the GTEST camp can be found at: http://www.buffalo.edu/ubnow/stories/2018/07/gtest-camp-drones.html ■

John Cerne with students of the GTEST summer camp.

2018 Rustgi lecture: The end of space-time

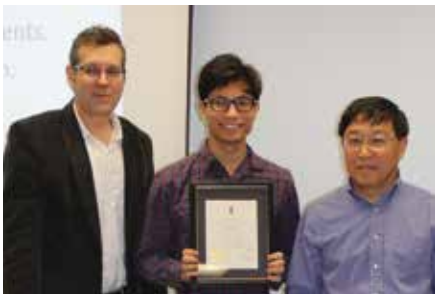
Photo Credit: Nancy J. Parisi

Dejan Stojkovic, PhD and Igor Zutic, PhD » The 2018 Moti Lal Rustgi Memorial Lecture was held on October 26. The lecture was delivered by Prof. Nima Arkani Hamed from the Institute for Advanced Studies in Princeton. He is one of the world's foremost theoretical high-energy physicists today, with more than one hundred published papers, cited more than 37, 000 times. He is a member of the American Academy of Arts and Sciences and the National Academy of Sciences. Among the numerous prizes he received so far, he was an inaugural awardee of the three million dollar Breakthrough in Fundamental Physics Prize established by Yuri Milner. His research spans a wide variety of topics in gravity, particle physics and cosmology. He launched some of the most creative ideas like large extra dimensions, little Higgs model, ghost condensate, and split supersymmetry. Most recently, he works on redefining how we calculate the scattering amplitudes in particle physics without using Feynman diagrams. His Rustgi Lecture, titled "The End of Space Time" was closely related to this line of research. As a great and thought provoking speaker, he talked about the possibility that space and time are not fundamental notions, but only emerge from some more fundamental principles. During his visit at UB he also met with undergraduate and graduate students



and gave a special seminar. See also the coverage in the UB News: www.buffalo.edu/news/releases/2018/10/043.html ■

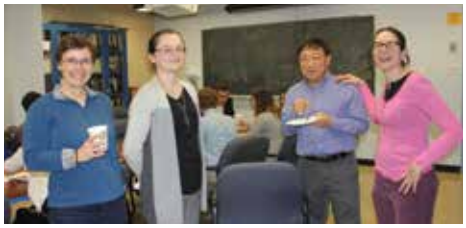
Six Sekula awardee undergraduate students inducted into Sigma Pi Sigma honor society



Left to right: Prof. Cerne, Cameron Watt, and Prof. Luo

John Cerne, PhD and Doreen Wackeroth, PhD » The Physics Department reactivated its Sigma Pi Sigma (ΣΠΣ) Chapter by holding an induction ceremony on November 30th, 2018. ΣΠΣ is a physics honor society housed within the Society of Physics Students (SPS). ΣΠΣ members support local and national SPS programs, represent physics to the public, provide alumni networking, work for sound national science policies, and offer science outreach opportunities. Six undergraduate students, Scott Abbot, Nicholas Bartelo, Julia Quebral, Hannah Seppala, Logan Walters, and Cameron Watt were inducted at the ceremony, and were joined by physics faculty, friends and family to celebrate. More information about the ΣΠΣ can be found here: https://www.spsnational.org/about/sigma-pi-sigma. These students were also selected for the Sekula Scholarship by the Sekula committee, consisting of Professors Cerne, Iashvili and Stojkovic. All the students had overall GPAs of over 3.90 and four of them had perfect 4.00 GPAs! We are very happy to be able to honor these students

Our ΣΠΣ inductees and Sekula awardees! Left to right: Cameron Watt, Logan Walters, Julia Quebral, Nicholas Bartelo, Scott Abbot, and Hannah Seppala.



Faculty well-wishers, left to right: Professors Wackeroth, Iashvili, Luo and Markelz

and are grateful to the Sekula family for supporting them with well-deserved and needed financial help. Please see page 11 for more information on the Stanley T. Sekula Memorial Scholarship Fund ■

2018 Ta-You Wu lecture: Dripping, jetting, drops and wetting: the magic of microfluidics

Arnd Pralle, PhD and Peihong Zhang, PhD » The 2018 Ta-You Wu Memorial Lecture was given by David A. Weitz, PhD, Mallinckrodt Professor of Physics and Applied Physics at Harvard, and marks the fifth lecture in this series since it was established in 2013. Weitz gave a lively lecture filled with animations and stimulating discussions. Under the title "Dripping, jetting, drops and wetting: the magic of microfluidics" he shared insides in the fascinating physical properties of very small drops of fluid. Small fluid drops inside a different fluid are called emulsions, the most common being milk vinegraite. The drops in milk are all different sizes and shapes. He discussed the use of microfluidic devices to precisely control the flow and mixing of fluids to make tiny drops perfectly identical to each other to create novel emulsions and exotic materials difficult to synthesize with any other method. Weitz explained in simple terms the fascinating physical properties of these new materials and their great potential for practical applications in cosmetics, medicine and foods.

About the speaker: Born in Canada, Weitz obtained his BS from Waterloo University. After receiving his PhD in physics from Harvard University, He joined Exxon Research and Engineering Company, where he worked for nearly 18 years. He then became a professor of physics at the University of Pennsylvania and moved to Harvard at the end of the last millennium as professor of physics and applied physics. At Harvard, he is co-director of the Materials Research Science and Engineering Center and the BASF Advanced Research Initiative, and member of the Kavli Institute for Bionano Science & Technology and the Wyss Institute for Biomedical Engineering. He leads a group studying soft matter science with a focus on materials science, biophysics and microfluidics. Several startup companies have come from his lab to commercialize research concepts.

About Ta-You Wu, PhD, and the Wu Memorial Lecture: Wu received his PhD degree in 1933 from the University of Michigan. He returned to China in 1934 to teach at Peking University and later National Southwestern Associated University until 1946. Wu's students during this time include Nobel Laureates C. N. Yang and T. D. Lee. After the Second World War, Wu returned to the US to continue his research. From 1949 to 1963, he directed the Theoretical Physics Division of the National Research Council of Canada. He joined the UB Physics Department in 1966. He was a member of our Department from 1966 to 1978 and served as chairman from 1966 to 1969. The endowment for the Wu Lectureship was established by Y. C. Lee, PhD, a long-time colleague and close friend of Wu, and has received contributions from over 70 donors. These donors wish to remember his long-lasting influence on their scientific and personal lives as well as promoting academic excellence and education in physics ■

UB Faculty at the Munich March for Science

John Cerne, PhD » Professors Markelz and Cerne, along with their son Marko, participated in the March for Science on April 14, 2018 in Munich, Germany. Profs Markelz and Cerne were on sabbatical in Germany at the time and enjoyed showing their enthusiasm for science in this international setting. An article describing the 2018 Munich March for Science can be found at: https://munichnow.com/2018-munich-march-for-science-rallies-at-marienplatz-on-a-sunny-saturday/ ■

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Interactions

The Newsletter of the UB Department of Physics, 2018-19

A group of physicists -- and fans of the Buffalo Sabres – from the UB Department of Physics who are doing research at the Large Hadron Collider at CERN, Geneva, Switzerland. The picture is taken at CERN in December 2018, with Sabres' great success in mind! Left to right: Prof. Sal Rappoccio, Christine McLean, PhD (postdoc), Charles Harrington (grad. student), Ashley Parker (grad. student), Juska Pekkanen, PhD (postdoc), and Prof. Avto Kharchilava.