Interactions

The Newsletter of the UB Department of Physics, 2017-18

The 2017 solar eclipse as observed from the rooftop of Fronczak Hall

Alok Mukherjee, PhD student
Condensed Matter Experiment

University at Buffalo
Department of Physics
College of Arts and Sciences

CHAIR'S LETTER | HONG LUO

Dear alumni and friends,
I hope you had another great year since I last wrote to you. It has been a rewarding year for us here in the department. I am very excited to tell you that our undergraduates continue to amaze us. One of them, Anne Fortman, became our newest Goldwater Scholar. It is rewarding to see that this once illusive scholarship has become a regular scholarship for our majors. The quality and hard work of the students and the dedication of faculty mentors made it almost an annual scholarship, although it is usually no more than three for a university, including the most elite institutions. Anne came to UB as a chemistry major with a chemistry departmental scholarship. After one year at UB taking some physics classes, Anne expressed her interest in joining us to Prof. Rappoccio, who later became her research mentor. The department did not have a similar scholarship, but managed to put enough resources together to match the chemistry scholarship. She is now a senior, maintains a 4.0 GPA, is one of the CAS Ambassadors, jointly gave a departmental seminar with another student, and has one paper in preparation.

One great development last year was the very generous contribution from our alum Dr. Om Bahethi and his wife Saraswati Bahethi. It was used for six scholarships to our very deserving graduate and undergraduate students, in addition to funds dedicated to cutting-edge research. More details can be found on page four. We were so pleased that Om and Saraswati could visit the department a little earlier in October, a homecoming for them after more than forty years, and an inspiration for our faculty and students. We are also very grateful to Dr. Ashok Kaveeshwar, a long-time staunch supporter of UB, who allocated 100% of his generous annual CAS contribution to the department this year.

I am also very happy to tell you that one of our junior faculty members, Prof. Ciaran Williams, received the prestigious NSF CAREER award. He is the ninth winner in the department, keeping us first in CAS by a large margin.

The department went through its comprehensive review earlier in April, which takes place every six or seven years. It involves a self-study of the department, and a team of external experts spending two days interacting with faculty, staff and students to see where the department is and where it should go in the future. While the department typically has some level of preparation for such a review, it was clear after the self-study that the faculty, staff and students made great strides during the review period and we decided to have an impromptu review. It was a very successful review, with both the reviewers and the university administrations at all levels recognizing the outstanding achievements of the department, in addition to providing very insightful input for both the department and UB administration for further growth.

As a part of the effort to promote CAS undergraduate programs, and educating students and the public, CAS decided to put together videos of various departments. They piloted the program with Physics, not entirely a surprise to us. It is very rewarding to get a glimpse of student accomplishments with the guidance of faculty members. You can view this video at: https://arts-sciences.buffalo.edu/physics/about/physics-ub.html

Two new faculty members joined us this year, Prof. Priya Banerjee from UC San Diego, working in biophysics, and Instructional Assistant Prof. Landon Lehman, who is responsible for instruction of lecture and lab courses. Both have made their presence felt in a very short period of time and we all wish them great success in the future.

Our former colleague Prof. Jan Per Roalsvig passed away on Aug. 16, 2017. I overlapped with him very briefly, and he was a very gentle and kind colleague. To honor his great service of 35 years to UB and the wish of his wife Myrth, many made donations to the department, including a very generous donation from Myrth, to be used to support our graduate students.

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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WEBSITE
http://arts-sciences.buffalo.edu/physics.html

CONTACT
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In this Issue:

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: https://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
- Becoming a Regional Network Leader
- Helping 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

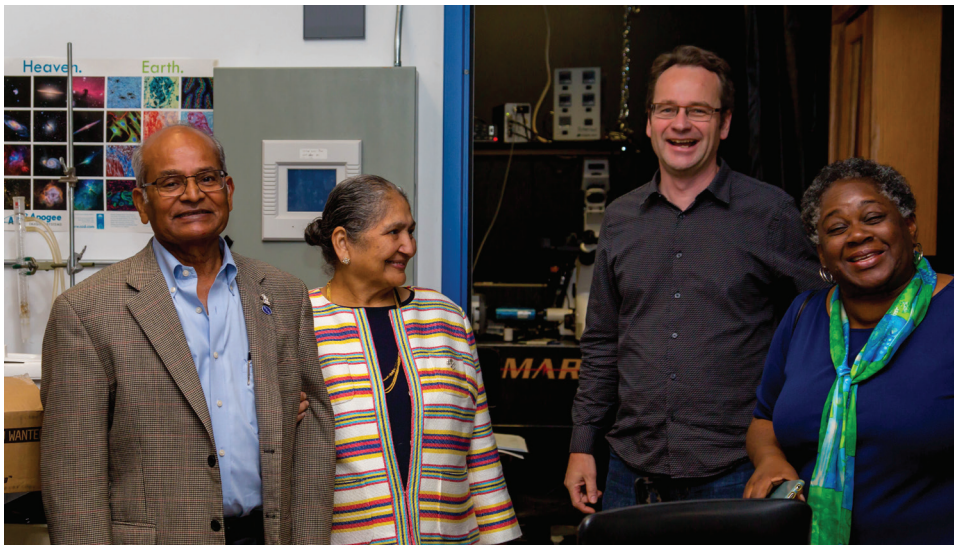
TO GET INVOLVED, please visit http://arts-sciences.buffalo.edu/alumni/get-involved.html or email UB-CollegeAlumni@buffalo.edu

Om and Saraswati Bahethi Foundation U.S.A. supports students and research at the Department of Physics

Hong Luo, PhD, and Xuedong Hu, PhD »
In 1967, Om Bahethi came to the U.S. from India to pursue a PhD in physics at UB. He had seven dollars in his pocket, as he recalled. He was two months late for his teaching assistant position, but was able to receive the assistantship and start his graduate studies. He was the first student of Prof. Emeritus Michael Fuda. Upon successful completion of his PhD, he started his career in industry. He and his wife, Saraswati Bahethi, co-founded Science Systems and Applications, Inc. in 1977 and Dr. Bahethi has been its Chairman of the Board. Dr. Bahethi served as President of Science Systems and Applications, Inc. until June 15, 2016. He has provided hands-on direction for support services on NASA, and NOAA contracts for scientific R&D, satellite remote sensing and retrieval of physical parameters. Through the Om and Saraswati Bahethi Foundation U.S.A. (OSBFUSA), the Bahethis made an extremely generous donation to the department for undergraduate and graduate scholarships and cutting edge research for the first round. Future plans are currently being made so that more students can benefit from their help.

We have two winners for the OSBFUSA Scholarship for Master's students and three winners for the OSBFUSA Scholarship for PhD students. They are Zhao Tang and Changliang Zhu in the MS program, and Rahul Munshi, Anshul Saini and Chuan Zhao in the PhD program.

Zhao Tang entered the Master's program in the Department of Physics at UB in 2016 after graduating from the University of Science and Technology of China.



Dr. Om Bahethi and his wife, Sarswati Bahethi, with Professor Arnd Pralle (second from right) and Associate Vice President for Individual and Planned Giving, Wendy Irving (right), share a laugh at their visit to the UB Physics Department. Photo: Hong Luo

During his first year in the Master's program, Zhao studied diligently, solved problems independently and got an excellent GPA of 3.875, the highest among all MS students over the past few years. Zhao has not only focused on courses, but worked hard to find his research interest. In fall 2017, he joined Prof. Peihong Zhang's research group for his Master's project, and will study first-principle simulation of materials. With a solid foundation of knowledge and an intense enthusiasm for research, Zhao plans to pursue a PhD degree in the area of Computational Physics in the future.

Changliang Zhu entered the Physics Master's program in the fall of 2016. He studied hard and achieved an impressive GPA of 3.834. He passed the Qualifying Exam at the PhD level after one year of study. Changliang Zhu plans to join our PhD program after getting his Master's degree. His life goal is to perform physics research into the unknown realm. Right now his research interest is in Condensed Matter Physics, specifically the interesting materials of Semiconducting Transition-Metal Dichalcogenide. He has been doing experiments in the group led by Prof. Hao Zeng.

Rahul Munshi is a PhD student working in Prof. Pralle's group on experimental biophysics, with a research focus on behavioral modification by magnetothermal modulation of neurons. Rahul did his undergraduate study at the Indian Institute of Technology, and had research experience in theoretical and experimental optics. He did an internship project at the Indian Institute of Astrophysics, and designed a far-ultraviolet spectrograph for a satellite based observatory for monitoring nascent galaxies. His excellent performance earned him a Presidential Fellowship when he came to UB for his graduate studies in 2012. At UB, he joined Prof. Pralle's biophysics lab, with an initial research focus on optically studying dynamic physiological changes in live cells. Soon, however, he assumed a multifunctional role and became increasingly engaged in experimental neuroscience. He quickly realized that a lot remains to be understood about the intricate functioning of the networks in the brain. This realization motivates Rahul to try to apply tools and principles of physics to better understand how neurons communicate and how one can externally modulate

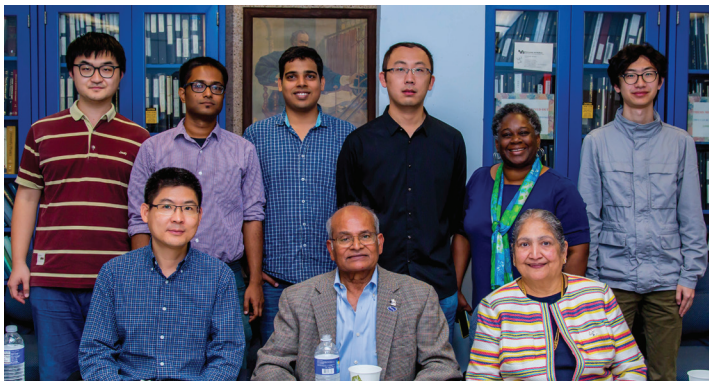
the communication pathways to address a variety of debilitating neurological disorders. Rahul has made important progress in his studies. His contribution was essential in developing contact-less, magnetic nanoparticle based deep-brain stimulation of specific behavior in mice that are awake. This success lays the foundation for studying how brain circuits control emotions and behaviors and opens new therapeutic options. His efforts have led to two high profile publications, with his latest paper published in *eLife*, a highly selective online journal on par with *Nature* and *Science*, and receiving a lot of coverage (accessed 8,000 times and downloaded 1,170 times in the first month alone). Rahul plans to graduate next summer, and will seek a postdoctoral position to explore deeper into neurons. His long-term goal is to become a working neuroscientist and establish his own research laboratory.

Anshul Saini is a sixth year PhD student who is deeply interested in theoretical high energy physics. Prior to coming to UB, he did his undergraduate studies at IISER Kolkata, India, where he worked on the propagation of light in optical fibers in the femtosecond regime. Additionally, he did a year-long research project in IACS Kolkata to understand the effect of torsion in space-time on the light coming from distant stars. At UB, Anshul joined Prof. Stojkovic's theoretical cosmological group. His PhD research is primarily focused on understanding gravitational collapse in a semi-classical framework. He has worked on predicting the final stages of the gravitational collapse. One of the major aspects of semi-classical gravity, the thermal nature of Hawking radiation, has challenged the fundamental tenets of quantum mechanics. Anshul, in collaboration with his adviser, has worked on seeking a resolution to this outstanding problem. While they did not solve the black hole information loss paradox in its entirety, they did make significant progress toward solving it by identifying where the information is most likely hidden. His work has been published in prestigious journals in the field and led to multiple presentations in important international conferences. In the future, Anshul plans to continue working on the origin of Hawking radiation and investigate the mechanism behind the accelerated expansion of the universe.

Chuan Zhao entered the PhD program in the UB Department of Physics in 2014. He received his BS in Physics from the University of Science and Technology of China in 2013. After joining UB, he quickly became a research assistant working with Prof. Hao Zeng. His research interests include two-dimensional materials and chalcogenide perovskite semiconductors. These emerging materials show great promise for applications in information processing and energy harvesting. Chuan has worked hard on his research and progressed quickly. He is instrumental in achieving greatly enhanced valley exciton energy splitting in atomically thin transition metal dichalcogenides, an important step toward realizing valley electronic devices. He has published four research papers, including a first author publication in *Nature Nanotechnology* and a second author publication in *Nano Energy*. For his fast and significant research achievements, Chuan won the Department of Physics Fellowship for Outstanding Graduate Student for the 2016-17 academic year. At present, he is working on two projects, one on the fabrication of valleytronic devices, the other on molecular beam epitaxy growth of perovskite thin films. ■

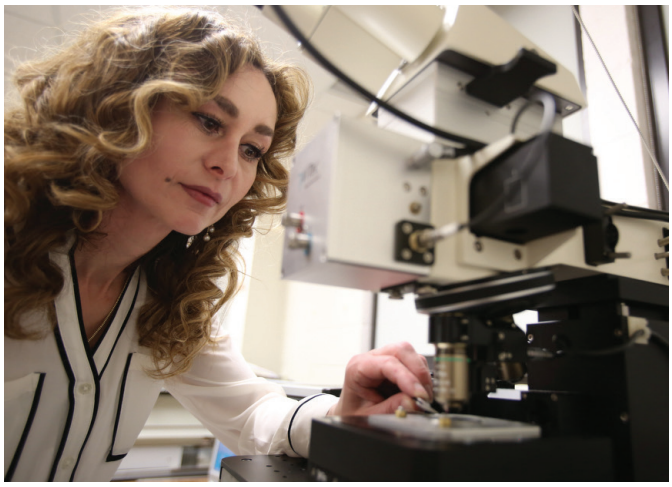
A meeting with Physics faculty (from left to right: Profs. Ciaran Williams, Dejan Stojkovic, and Doreen Wackeroth) was a wonderful opportunity to learn about Dr. Bahethi's experience at UB and his subsequent professional endeavors, and to share some current research activities with him and his wife, Sarswati Bahethi, and with Wendy Irving.

Photo: Hong Luo



Om and Sarswati Bahethi with Professor Hao Zeng (front row, left) and Wendy Irving (back row,second from right) with the 2017 OSBFUSA fellows (back row, from left to right): Changliang Zhu, Rahul Munshi, Anshul Saini, Chuan Zhao and Zhao Tang.

Photo: Hong Luo



Felicia S. Manciu, PhD `04

Hong Luo, PhD » Felicia S. Manciu, PhD '04, is currently a Professor at the University of Texas at El Paso (UTEP). Very shortly after receiving her PhD in Physics from UB under the guidance of Professor McCombe, she joined UTEP faculty as an Assistant Professor. She established and has since directed the Optical Spectroscopy & Microscopy Laboratory (http://science.utep.edu/physics/index.php/research-areas/research-facilities-/optical-spectroscopy - microscopy-lab). Her research interests have addressed cross-cutting emerging technologies, both in biomedicine and in clean energy. She carried out important studies in a broad area of optical investigations of soft and hard condensed matter, with specific focus on Raman spectroscopy and microscopy. During her 12 years at UTEP she was able to receive grants from NSF, DODMDA, DOE, NIH and the Mayo Clinic in Rochester, Minn. over several million dollars. In addition, she has had close collaboration with the Mayo Clinic, currently having a joint NIH U01 research grant. The combination of a large number of grants and interesting research topics allowed five PhD and 11 MS students to graduate in a short period of time. More importantly, direct evidence of her sustained high standards in mentoring is that all of her student alumni were either admitted to graduate/professional school, or entered the STEM workforce or academia. She was recognized twice with the New Grant Award Recognition (Fall 2014 and Fall 2015) by the UTEP Office of Research and Sponsored Projects and the College of Science, and awarded the Outstanding Research Performance Award from the University in 2007–08. Because of her outstanding research accomplishments, she is a Research Collaborator in the Department of Neurosurgery at the Mayo Clinic (2011–present) and Honorary Associate Professor, Deakin University, School of Engineering, Faculty of Science, Engineering and Built Environment, Australia (2014–17).

Manciu has been elected to serve on various advisory boards and committees, such as Officer of the American Physical Society and Member at large of the Texas Section Executive Committee Board (2006–10), President (2009–10) and Vice-President (2008–09) of the Sigma Xi Scientific Research Society UTEP Chapter, Chair of the Graduate Scholarship Committee at UTEP (2011–12), Member of the Council of the Materials Science and Engineering PhD Program at UTEP (2010–15), Representative of the College of Science in the Faculty Senate Graduate Council at UTEP (2012–15). In addition, her teaching achievements include her having been awarded the UTEP College of Science Undergraduate Student Choice Award for Outstanding Teaching three times (Spring 2015, Spring 2016 and Spring 2017), and the Miguel Izquierdo Award for Outstanding Teaching in 2015.

It is rewarding to see her flourish in her position, which has been, as Manciu puts it, "influenced in many ways by the training and mentoring I received at UB." ■

Breakthrough prize in Fundamental Physics awarded to alumnus

Norman Jarosik, PhD '84, senior research physicist and lecturer at Princeton University, received the 2018 Breakthrough Prize in Fundamental Physics in December at the event known as the "Oscars of Science." The Breakthrough Prize in Fundamental Physics recognizes significant insights into the deepest questions of the universe. Jarosik and a team of researchers were recognized for their work on the Wilkinson Microwave Anisotropy Probe, the NASA satellite known as WMAP.

The Breakthrough Prizes recognize top achievements in Life Sciences, Fundamental Physics and Mathematics.

Two new faculty joined the Department of Physics

Doreen Wackeroth, PhD » In the field of the physics of living systems, it's a time of paradigm shift where disorder appears to be the new order, the diffraction limit of light is broken, and optical microscopy can illuminate nanoscale structures in the cell. Recognizing the seminal ongoing work on biophysical spectroscopy, microscopy and computational biophysics, **Priya Banerjee, PhD,** joined the Department of Physics to further strengthen our research in this area. Prof. Banerjee received his PhD from the University at Albany, SUNY, in 2012, followed by a postdoctoral research position in Single-molecule Biophysics at the Scripps Research Institute. At Scripps, Prof. Banerjee was the recipient of a prestigious fellowship from the American Heart Association. Prof. Banerjee is an expert in the (non)folding, self-assembly and phase transition of intrinsically disordered proteins (IDPs). IDPs are prevalent in the eukaryotic proteome, perform fundamental cellular processes and are associated with almost every fatal human disease. A major challenge in studying the physics of this interesting set of biomolecules is their stochastic dynamics and conformational heterogeneity, which inherently limits the application of conventional spectroscopic tools that suffer from ensemble averaging. To overcome such an issue, Prof. Banerjee applies fluorescence microscopy and spectroscopy to watch one molecule at a time. Using this state-of-the-art experimental approach, Prof. Banerjee's recent research has led to several important discoveries in the IDP biophysics field, including the intrinsic plasticity of an IDP interaction-folding landscape, role of two-dimensional crowding on IDP folding and cryptic IDP sequences that code for their phase transition into liquid droplets. Prof. Banerjee's published work received a high degree of accolades from academic fraternity (published commentary on Prof. Banerjee's work), and was highlighted by several press releases, including the C&EN, BioTechniques and *The Scientists* magazine. At UB, Prof. Banerjee's highly innovative and interdisciplinary research now seeks to uncover the role of intrinsic protein disorder in bringing order to the inherent chaos of a living system. This is an upcoming field of Biological Physics that has widespread relevance, including the discovery of organizational principles of a cell adapting to its ever-changing environment, development of effective therapeutic interventions for cancer and neurodegeneration and exploiting disorder to design "smart" biomaterial with improved functionalities.

Asst. Prof. Priya Banerjee, PhD `12

Clinical Asst. Prof. Landon Lehman, PhD `17

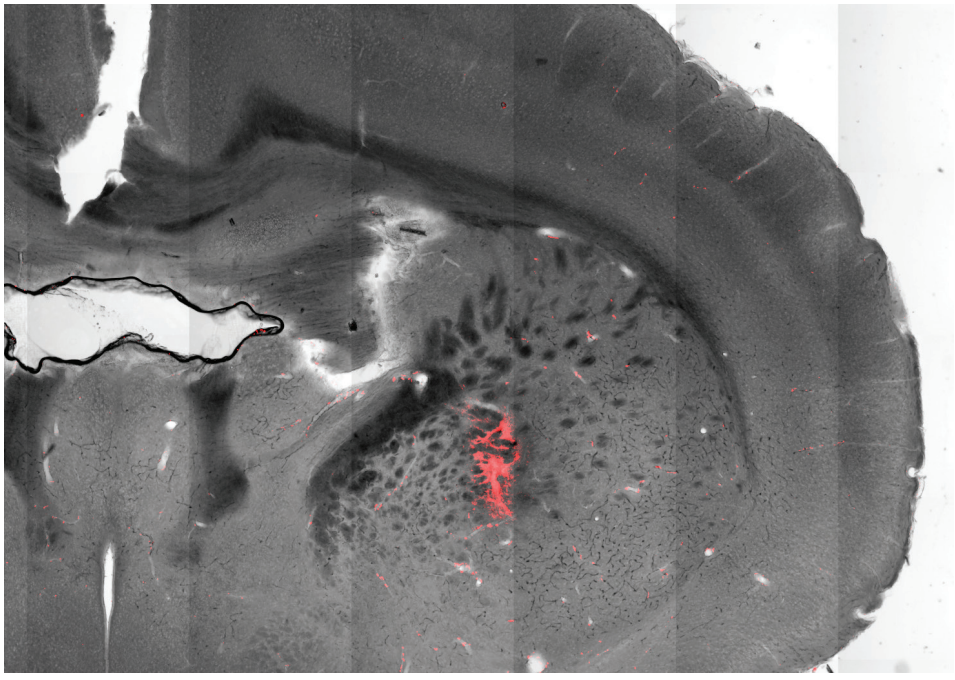
Landon Lehman, PhD, was recently hired as a Clinical Assistant Professor. Prof. Lehman did his undergraduate work at Purdue University in Indiana, and completed his PhD in early 2017 at the University of Notre Dame, also in Indiana. His PhD research was on some mathematical aspects of effective field theories. Prof. Lehman's primary responsibility within the department is teaching. He enjoys thinking of new ways to explain basic physics concepts, and introducing others to both the practical necessity and the beauty of understanding our world through physics. In his spare time, he reads books and tries to keep track of his three boys. ■

Stimulating specific neurons deep in the brain using magnetic fields

Arnd Pralle, PhD » Thanks to some novel techniques and with support of the BRAIN initiative, neuroscientists are quickly advancing our understanding of the brain. However, deciphering how specific brain circuits control emotions or behaviors requires signaling to and recording from the switches of complex brain circuits. Current technology requires a physical connection into the brain to relay electrical or optical signals. Over the past years, we have developed a tetherless remote magnetic field-based method to stimulate cells deep inside the brain, and recently succeeded in evoking specific behavioral responses in mice.

Magnetic fields penetrate the body without affecting it. To stimulate specific cells, the magnetic field signal needs to be converted into a biological signal. As a transducer, we synthesized superparamagnetic ferrite nanoparticles (NP) with manganese ferrite core and cobalt ferrite shell, about 10 nanometer in diameter. When exposed to an external magnetic field their magnetic moment aligns with that field. However, they are so small that any magnetic moment relaxes quickly at room temperature. We use an alternating magnetic field to constantly repolarize the NP, which causes a small hysteresis loss dissipated as heat. The local heat opens temperature-sensitive ion-channels which are genetically expressed in specific neurons, activates or silences those neurons. This magnetothermal neuromodulation provides a remote, minimally invasive way to trigger activity deep inside the brain. We have used magnetothermal neurostimulation to trigger small groups of neurons deep in the brain in freely moving mice. In response to stimulation, and depending on the brain region stimulated, the mice initiated specific body movements including running, rotating and losing control of the extremities.

Magnetothermal stimulation enables neuroscientists to study neurological function in disease and in health. Current research focuses on the heat distribution as function of type, shape and distribution of NP to further improve the response. In addition, we are investigating the thermal biophysics of neurons to explore other remote neurostimulation and silencing methods for translational applications. This research is funded by an NIH Brain initiative grant to Prof. Pralle and collaborators at MIT. For more information, see the paper published in https://elifesciences.org/articles/27069 ■



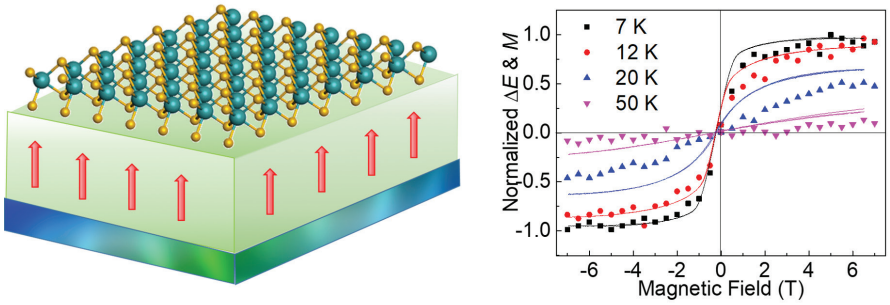
Confirmation of correct target site in striatum: nanoparticles (red) in a slice through the right brain half of a mouse, imaged using a laser scanning microscope. urations of the MTJ array [(b)-(i)]. Dots/crosses: magnetization direction in MTJs.

Speeding up GW calculations to meet the challenge of large scale quasiparticle predictions

Weiwei Gao, Weiyi Xia, Xiang Gao and Peihong Zhang, PhD » Accurate predictions of excited states properties are critical for computational screening and design of materials for energy and electronics applications. Although the GW approximation, based on using the one-particle Green's function and the screened Coulomb interaction, is recognized as one of the most accurate theories for predicting materials excited states properties, scaling up conventional GW calculations for large systems remains a major challenge. Recent research in Prof. Zhang's group enables fully converged, large scale GW calculations for large systems such as nanostructures, complex multinary compounds, surfaces and interfaces, and defects in solids. This work has been published in *Scientific Reports*. [Scientific Reports 6, 36849 (2016).] ■

Using a ferromagnet to enhance "valley splitting" in 2D semiconductors

Hao Zeng, PhD and Athos Petrou, PhD » The information in the digital world is encoded by two distinct states of a physical system, such as the "on" and "off" states of a transistor. An emerging field called "valleytronics" proposes to use the valley degree of freedom for information processing and storage, promising electronic devices with high speed and low power consumption. An "energy valley" is the local extremum of the electronic bands in a crystalline solid, not much different from the peaks and valleys in mountains. A single layer of a transition metal dichalcogenide (TMD) that contains only three atomic layers is just such a system with two distinct valley states that may be used for valleytronics.



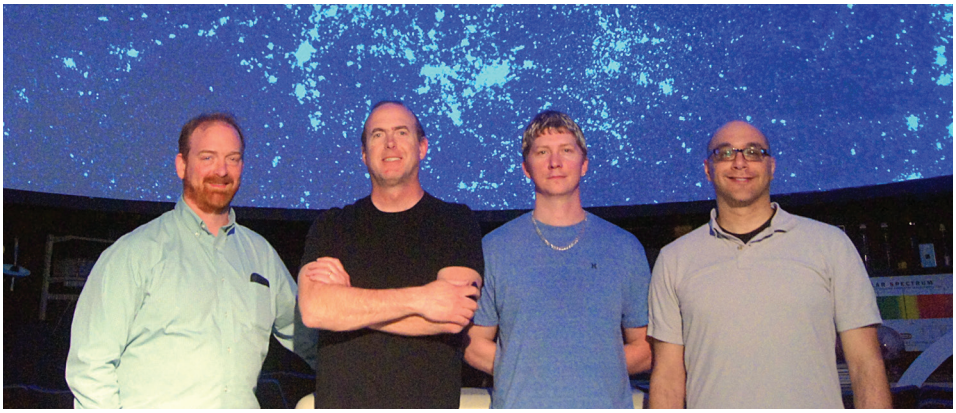
Caption: A two-layered heterostructure, with a 10 nanometer thick film of magnetic EuS (europium sulfide) on the bottom and a single layer (less than one nanometer) of the transition metal dichalcogenide WSe2 (tungsten diselenide) on top. The magnetic field of the bottom layer forced the energy separation of the valleys in the WSe2.

The two valleys of the TMDs possess the same energy (the two valleys are said to be "degenerate") but opposite momentum (i.e. electrons moving in opposite directions). Light with opposite circular polarizations can be used to access and control different valleys. However, from the point of view of device integration, it is desirable to control valleys using means other than light helicity. This often requires lifting the valley degeneracy. Recent experiments demonstrated that an external magnetic field can be used to pull the energy levels apart, and split the energies of the valley states. However, the splitting obtained is rather modest for any practical use. In recent work done by the graduate students in Profs. Hao Zeng and Athos Petrou's groups, in collaboration with several other institutions, a ferromagnetic material was used as an "amplifier" to enlarge the effective magnetic field by more than an order of magnitude, achieving a greatly enhanced valley splitting.

Large, tunable and non-volatile valley splitting allows convenient control of valley polarization, (e.g. by an electric field), thus offering new paradigm for information processing. This work was published in *Nature Nanotechnology (Nature Nanotech. 12, 757–762 (2017))*. A news article covering the work in more detail can be found at: http://www.buffalo.edu/news/releases/2017/04/051.html ■

Visualizing cosmological simulation data on planetarium domes

Will Kinney, PhD » Master's student Leigh Korbel, under the supervision of Profs. Will Kinney and Salvatore Rappoccio, completed a project to implement an immersive visualization of a high-resolution cosmic structure simulation at Williamsville Spacelab Planetarium, directed by Mark Percy at Williamsville North High School. Large-scale structure simulations follow the formation of galaxies and clusters of galaxies in the early universe as Dark Matter and Gas evolve under gravity. The simulations were performed using supercomputer facilities at UB's Center for Computational Research (CCR), and implemented for visualization using the Digital Sky software system. This work is published in *Planetarian, Journal of the International Planetarium Society, Vol. 46, no. 3, September 2017*, and can be found at: http://c.ymcdn.com/sites/www.ips-planetarium.org/resource/resmgr/planetarian/201709planetarian.pdf ■



From left to right: Mark Percy, Prof. Will Kinney, Leigh Korbel, and Associate Prof. Salvatore Rappoccio in front of a high-resolution cosmic structure simulation.

Faculty Awards

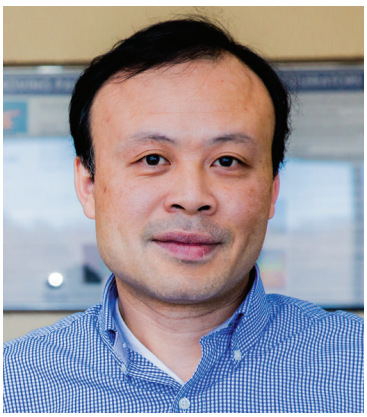
Doreen Wackeroth, PhD » Please join us in congratulating all our recent award and fellowship recipients:

Associate Professor Sambandamurthy Ganapathy received a grant (with co-PIs J. Bird, A. Petrou and H. Zeng) from the National Science Foundation to acquire a state-of-the-art, cryogen-free, superconducting magnet system for magneto optical and magneto transport measurements. This instrument will be a user facility serving the entire UB community and researchers in the WNY region. For more details about this grant, please see: https://www.nsf.gov/awardsearch/showAward?AWD_ID=1726303&HistoricalAwards=false

Professor Surajit Sen was awarded a Fulbright-Nehru Academic and Professional Excellence Fellowship in 2017. This Fellowship has facilitated a four-month visit spread across the summers of 2017 and 2018 at the Indian Institute of Engineering, Science and Technology near Kolkata, India. He is collaborating with an experimentalist colleague to help develop experimental studies related to his research on nonlinear dynamics in many particle systems. Prof. Sen also gave his first named institute-wide lecture, the Steel Institute Colloquium titled "Nonlinear dynamics in the real world" at the Indian Institute of Technology in Bombay on July 13, 2017. The lecture is on YouTube: https://www.youtube.com/watch?v=PynQD5Qg56g

Photo: Douglas Levere

Assistant Professor Ciaran Williams was awarded the prestigious CAREER award of the National Science Foundation, titled CAREER: Exquisite Calculations for Colliders. This award started on June 1, 2017, and will fund cutting-edge calculations for key processes at the CERN Large Hadron Collider, which are needed to extract information from the data, in particular when searching for signals of new physics. The results of his calculations will be released publicly to both experimental and theoretical users and will be utilized in experimental analyses. Prof. Williams will also establish an educational outreach program targeting a minority population (Native Americans), one of the most under-represented in the sciences. By working directly with Superintendents from the local Native-American school districts, Prof. Williams will, over the lifetime of the award, arrange after-school programs as well as field trips to the Fermilab National Accelerator laboratory. For more details about this award, please see: https://www.nsf.gov/awardsearch/showAward?AWD_ID=1652066&HistoricalAwards=false



Professor Peihong Zhang is a co-principle investigator of a four-year major NSF grant titled DMREF: A Blueprint for Photocatalytic Water Splitting: Mapping Multidimensional Compositional Space to Simultaneously Optimize Thermodynamics and Kinetics. The grant started on Oct. 1, 2016. This is a collaborative research project involving researchers from UB, Binghamton, RPI and Texas A&M. The research will involve the integration of computation and experiment to design, synthesize and characterize nanoscale semiconductor heterostructures with programmable light-harvesting, charge transfer and charge-transport properties for photocatalysis. For more details about this grant, please see: https://www.nsf.gov/awardsearch/showAward?AWD_ID=1626967&HistoricalAwards=false. ■

Graduate Awards

Cambi Fellowship
Nathaniel Fuller, Ishiaka Mansaray

John Ho & Martha Leung Scholarship
Dasharath Adhikari, Colin Kilcoyne, Tenzin Norden, Han Wen

OSBFUSA
PhD
Rahul Munshi, Ansul Saini, Chuan Zhao
MS
Zhao Tang, Changliang Zhu

Outstanding Graduate Student
Anshul Saini, Chuan Zhao

Outstanding TA
Arman Najafi, Syed Hasan

Department of Physics Fellowship
Anshul Saini, Chuan Zhao

Physics Graduate Student Memorial Fellowship
Arman Najafi, Rahul Kashyap

Presidential Fellowship
Haolei Hui

Silvestro Scholarship
Nargess Arabchigavkani, Yanting Deng, Guo Deng, Ruifeng Dong, Hsuan-Hao Fan, Syed Hasan, Rahul Kashyap, Xing Lin, Arman Najafi, John Nord, Tenzin Norden, Bahareh Roozbahani, Anshul Saini, Akansha Sharma, Kevin Van Slyke, Bilal Tariq, Han Wen, Mengyang Xu, Gaofeng Xu

Undergraduate Awards

CAS College Ambassadors
Tyler Barrett, Anne Fortman, Johnny Hayes

Exceptional Performance Student Award
Tyler Barrett

Goldwater Scholarship
Anne Fortman

Outstanding Seniors
Kenneth Budzinski, Timothy Leeney

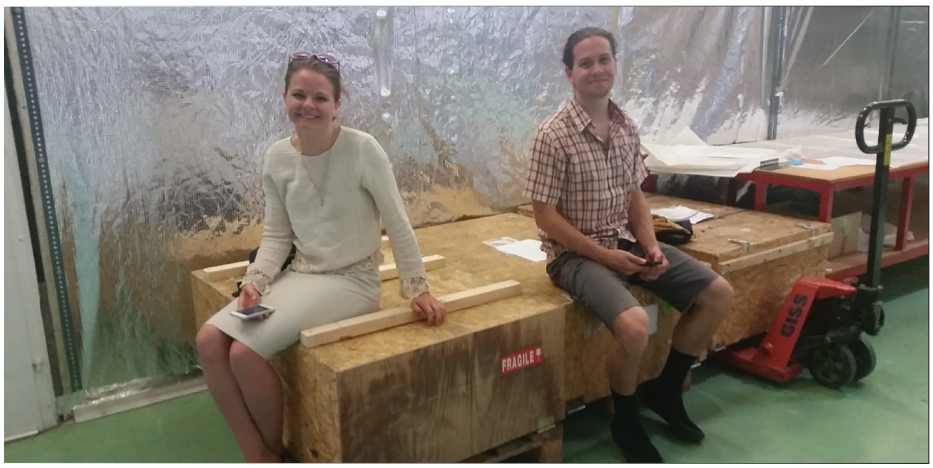
Sekula Scholarship Awards
Tyler Barret, Dylan Delgado, Anne Fortman, Megan Renz, Dylan Sabuda, Julia Quebral

Student wins 2017 Goldwater Scholarship

Goldwater Scholarship 2017 Winner, Anne Fortman.

Salvatore Rappoccio, PhD » Anne Fortman, a UB Physics major, has recently won the 2017 Barry Goldwater Scholarship, a prestigious and highly competitive national competition. In addition to her extensive work helping to test electronics for the Compact Muon Solenoid (CMS) detector at the Large Hadron Collider (LHC) in Geneva, Switzerland, Anne has also contributed to an analysis measuring the rate of production of events at the LHC with two hadronic jets (sprays of particles created by the strong nuclear force) as a function of their mass and momentum. The analysis is scheduled for publication in the *Journal of High Energy Physics*. Anne intends to go on to graduate school in particle physics and eventually obtain a faculty position to continue her research. ■

UB students receive support to work at CERN (European Organization for Nuclear Research, Geneva, Switzerland)



UB graduate students Ashley Parker and Charles Harrington at CERN in CMSTracking Facility.

Ia Iashvili, PhD, Avto Kharchilava, PhD, and Salvatore Rappoccio, PhD »

The Compact Muon Solenoid (CMS) detector at CERN's Large Hadron Collider (LHC) has undergone a major upgrade in 2017. The University at Buffalo played an important role in this, under the leadership of Profs. Iashvili, Kharchilava and Rappoccio. The group worked on the upgrade of the Forward Pixel Detector (FPIX) which is a silicon tracking device inside CMS. In 2016, UB students received funding to work on FPIX upgrade at Fermilab (Batavia, Ill.). Last summer, two graduate students (Charles Harrington and Ashley Parker) and one undergraduate student (Anne Fortman) received funding for summer research at CERN to assist in the commissioning of the upgraded FPIX. The students worked on data quality diagnostic tests to ensure functionality of FPIX according to its specifications. Upgraded FPIX is crucial for physics output of the CMS experiment. ■

We congratulate our recent graduates!

Fall 2016

Physics Bachelor's (BS)

Jesse Hernandez
Syed Zain

Physics PhD

Maral Alyari
Advisor: Salvatore Rappoccio
Thesis Title: "Measurements and Searches for New Physics with Boosted Top Quarks"

Katherine Lindberg
Advisor: Andrea Markelz
Thesis Title: "Sensitivity to Protein Vibration Directionality in the THz Regime"

James Perry
Advisor: Hao Zeng
Thesis Title: "Growth, Optical Absorption, and Photoresponse of Copper Oxide Thin Films and Nanocavities"

Samanthe Perera
Advisor: Hao Zeng
Thesis Title: "Chalcogenide Perovskites for Solar Energy Harvesting"

Spring 2017

Physics Bachelor's (BS)

Kenneth Budzinski
Benjamin Cammett
Lisong Chen
Giovanni Chiappone
Nicholas Jerla
Rachel Leary
Timothy Leeney
Stephen Muehlemann
Ryan Nyweide
Yuichi Okugawa
Matthew Schiavi
Darren Stanford
Robert Waelder

Physics Master's (MS)

Leigh Korbel

Physics PhD

Ali Alsaqqa
Advisor: Sambandamurthy Ganapathy
Thesis: "Noise spectroscopy in strongly correlated oxides"

Christian Beynis
Advisor: Hao Zeng
Thesis Title: "Methods of "counter-doping" of p-type non stoichiomatic Copper Sulfides and turning of the Localized Surface Plasmon Resonance"

Weiwei Gao
Advisor: Peihong Zhang
Thesis Title: "First-Principles Calculations of Excited States of Solids: Methodology Development and Applications"

Summer 2017

Physics Bachelor's (BS)

Eric Oliverio

Physics Master's (MS)

Sai Dong
Catherine Luck
Chang Wu

Physics PhD

Weixiang Jin
Advisor: Arnd Pralle
Thesis Title: "Studies of cell membrane ultra-structure by membrane protein diffusion measurements using camera-based fluorescence correlation spectroscopy"

Archana Kumari
Advisor: Hong Luo
Thesis Title: "Growth, Fabrication and Characterization of Patterned Semiconductor Nanostructures using Alumina Template"

Jiajun Li
Advisor: Jong Han
Thesis Title: "Non-equilibrium Effects in Dissipative Strongly Corrected Systems"

2017-18 EVENTS CALENDAR

Aug 25 Welcome BBQ	Oct 27 Ta-You Wu Lecture	Jan 27 Faculty Retreat	APR 20 Moti Lal Rustgi Memorial Lecture–Dr. Margaret Geller
Oct 04 Science and Art Cabaret	Nov 10 Retirement Party: Prof. Bruce McCombe	Feb 07 Science and Art Cabaret	May 18 Graduate Commencement
Oct 07 Bahethi Donor Luncheon	Dec 02 Holiday Party	Mar 10 Accepted Students Day	May 20 Undergraduate Commencement
Oct 21 Open House		Apr 15 Accepted Students Day	

The New York State Section of the American Physical Society held at UB

Photo: Hao Zeng

Ready for the March for Science right after the NYSSAS meeting. Left to right: Dong Su (BNL), Vincent Crespi (Penn State), Shengbai Zhang (RPI), Peihong Zhang.

Hao Zeng, PhD » The New York State Section of the American Physical Society held its 116th topical symposium titled *Materials for Renewable Energy* at UB on April 21-22, 2017. The event was sponsored in part by UB's Department of Physics, Department of Electrical Engineering, the School of Engineering and Applied Sciences and the UB RENEW Institute. The symposium was co-organized by Hao Zeng and Peihong Zhang, both professors of physics, and Uttam Singisetti, assistant professor of electrical engineering. The symposium featured eight invited talks given by prominent researchers from universities and national labs in New York and nearby regions, and covering the design and development of materials for renewable energy. The research topics included photovoltaics, catalysis and membranes to nanogenerators and piezotronics. Additional discussions included encompassing materials synthesis, characterization, device fabrication and theory. The keynote lecture was given by Dr. Zhong Lin Wang, the Hightower Chair in Materials Science and Engineering and Regents Professor at Georgia Institute of Technology. Prof. Wang is credited with inventing piezoelectric nanogenerators and initiating the field of nanoenergy. ■

BOOST 2017

Salvatore Rappoccio, PhD » The BOOST 2017 International Conference in High Energy Particle Physics was hosted by UB at the Embassy Suites Hotel in July 2017. The focus of this workshop series is to bring together experimental and theoretical High Energy Particle Physicists to work on cutting-edge reconstruction techniques to identify highly energetic massive particles and the evolution of proton collision remnants. This was a very successful conference with 100 participants from all over the world. It also featured a poster session designed for undergraduate and graduate students to present their cutting-edge research in an enjoyable and vibrant setting. A full day of overlap with other theoretical communities within particle physics was also very successful, bringing these development tools more into the mainstream of particle physics. This event included a team-building day at Niagara Falls. ■

Boost 2017 participants at the conference dinner in Niagara Falls.

2017 Rustgi Memorial Lecture

Dejan Stojkovic, PhD, and Igor Zutic, PhD » The 23rd Annual Moti Lal Rustgi Memorial Lecture, entitled "The Future of Small," was presented by Paul L. McEuen, John A. Newman Professor of Physical Science at Cornell University and Director of the Kavli Institute at Cornell for Nanoscale Science. McEuen, who received his PhD from Yale in 1991, joined the faculty at UC-Berkeley in 1992 before moving to Cornell in 2001. He is a world-renowned expert on nanostructure, which spans the gap between the macroscopic and molecular worlds. He uses them to explore electronics, optics, mechanics, chemistry and biology at the nanoscale. For his pioneering work in nanoscience, he was elected to the National Academy of Sciences in 2011 and the American Academy of Arts and Sciences in 2015.

The lecture, given to a full audience of UB students, faculty and the general public in 225 Natural Science Complex on the UB North Campus, provided a fascinating trip to the edge between nanoscience and science fiction where remarkable feats in scaling-down nanomachines transform fiction into reality. With the help of frequency conversion, the audience even had a chance to hear what strumming the first atomic-size guitar would sound like. The topic of nanoscience and nanotechnology he presented brings many profound implications for our understanding of not only the new generations of machines, but also of the origin of life and how it could possibly be emulated in nano-mechanical systems. Throughout his stay, McEuen had to answer many students' questions pertaining to nanoscience as they were eager to learn about the Future of Small.

The Rustgi Lecture Series has allowed some of the world's premier scientists like McEuen (including eight Nobel laureates), to tell our community about their research. However, what may set McEuen apart from past speakers is that he is also a novelist. His scientific thriller *SPIRAL* won the 2012 debut novel of the year from the International Thriller Writers Association.

The department is grateful to the family of Dr. Moti Lal Rustgi, Professor of Physics at UB 1966-92, for funding this public lecture series in his memory. ■

Buffalo March for Science

Doreen Wackeroth, PhD » On April 22, 2017, members of the Department of Physics took part in the Buffalo March for Science in solidarity with the Washington, D.C. March for Science. As stated by the American Physical Society (APS), the March for Science is a worldwide movement to "draw attention to the importance of science in exploring and explaining our world, enhancing our daily lives, and improving policymaking." There was a large turnout of enthusiastic marchers who came prepared with their own posters to show their support for the goals of the March. Read more about the March for Science and the APS endorsement at: https://www.aps.org/about/marchforscience.cfm. ■

UB Physics faculty (above: Salvatore Rappoccio, Andrea Markelz, Doreen Wackeroth, below: Avto Kharchilava), their families and UB students at the Buffalo March for Science with a collection of their own March posters.

Photos: Hong Luo

Eclipse viewing on Fronczak Hall's rooftop

Nicole Pannullo » All of North America was treated to a total solar eclipse of the sun on Monday, Aug. 21, 2017. The department hosted an eclipse viewing party on Fronczak Hall's rooftop and, even though Buffalo was not in the path of totality, we were certainly offered much to see. The department provided a 10" Meade LX200 telescope, a Canon high powered camera and a box projector, and handed out 50 pairs of viewing glasses for spectators. Physics faculty and graduate students were available to answer questions and assist onlookers. The event was open to the public and over 150 administrators, faculty, staff and students attended, including President Satish K. Tripathi, Provost Charles Zukoski and Dean Robin G. Schulze. Excitement filled the air as everyone looked up to catch a glimpse of the moon passing between the sun and the Earth. Staff breathed a sigh of relief that it was not a cloudy or rainy afternoon. Many took to social media, including Twitter and Instagram, to post about how much they were enjoying our gathering, which increased the size of the crowd. Everyone was so impressed with our celebration, I have already received requests to hold an event for the next total solar eclipse visible from North America on April 8, 2024! ■

Physics graduate student Alok Mukherjee (to the right of the camera) took photos by using a Celestron 4SE, f = 1325mm, black polymer solar filter, Canon 600D, 1/60 exposure, ISO 1600.

Professor Andrea Markelz and physics graduate students getting ready for the eclipse viewing.

Photos: Douglas Levere

Science and Art Cabaret keeps going strong

Doreen Wackeroth, PhD » In 2017, two Science and Art Cabarets took place in the usual venue at The 9th Ward at Babeville, featuring a conversation about "color" and a talk by Prof. Jeff Forshaw (University of Manchester) about the Big Bang. Prof. Forshaw was in Buffalo for BOOST 2017. The Cabaret is presented by Hallwalls Contemporary Arts Center, the Buffalo Museum of Science, the Technē Institute for Arts and Emerging Technologies at UB, the UB College of Arts and Sciences, and the Department of Physics, and was co-founded in 2009 by Prof. Will Kinney. "What makes the Cabaret unique is our mash-up of cutting-edge science and technology with art, music, poetry and performance. We celebrate and explore creativity in all its forms, from the quantitative to the whimsical," says Prof. Kinney.

More information about the cabaret can be found at: http://www.hallwalls.org/scienceart.php. ■

The Vorechestra performed live at the Science and Art Cabaret 17.0 "signal:noise."

Prof. Will Kinney at the Science and Art Cabaret 20.0 "color" describing the role of color in the interaction of quarks and gluons through the strong nuclear force. Read more about the event in the UB News: http://www.buffalo.edu/news/releases/2017/09/021.html

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INTERACTIONS

Nicole Pannullo organized the eclipse viewing party on the rooftop of Fronczak Hall. Professor John Cerne (middle), PhD students Alok Mukharjee (right) and Ashley Parker (left) were among about 175 people who came to Fronczak Hall to experience the viewing together.

Read more at https://www.buffalo.edu/ubnow/stories/2017/08/eclipse-viewing.html.
Photo: Hong Luo