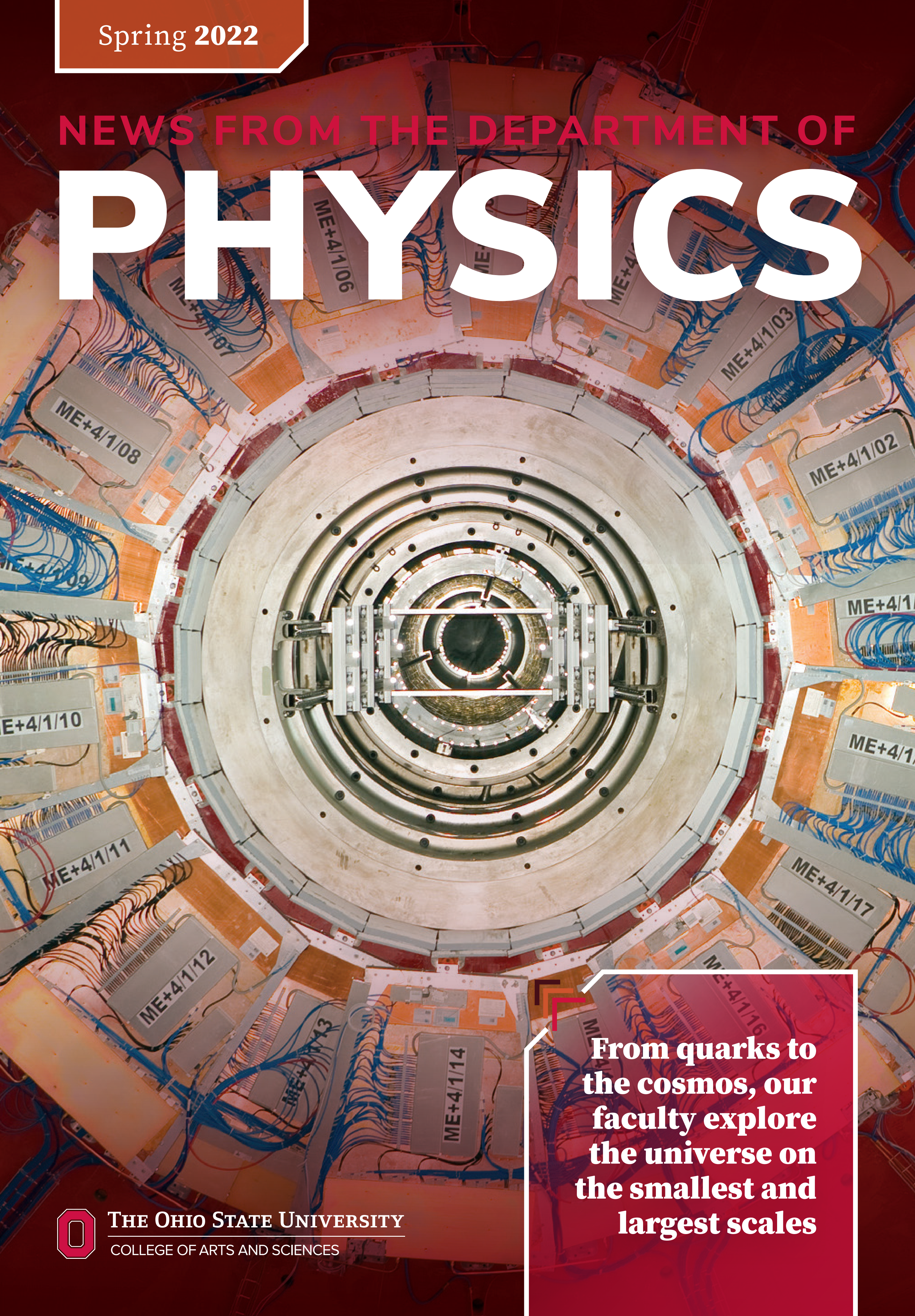
Spring **2022**

NEWS FROM THE DEPARTMENT OF

PHYSICS



From quarks to the cosmos, our faculty explore the universe on the smallest and largest scales

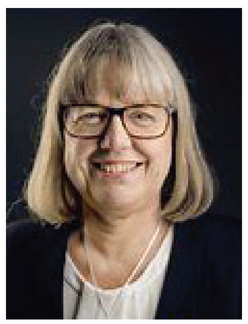
THE OHIO STATE UNIVERSITY
COLLEGE OF ARTS AND SCIENCES

The Annual Alpheus W. Smith Lecture

Joachim Frank, Professor of Biochemistry and Molecular BioPhysics and Professor of Biological Sciences, at Columbia University will present the next Alpheus W. Smith Lecture on March 22, 2022. He was awarded the 2017 Nobel Prize in Chemistry jointly with Jacques Dubochet and Richard Henderson "for developing cryo-electron microscopy for the high-resolution structure determination of biomolecules in solution."

Fundamental processes of life are governed by a number of complicated molecules. The electron microscope, which uses electron beams instead of light, expands the possibilities to image these molecules. However, electron beams destroy biological structures. Between 1975 and 1986, Joachim Frank developed a method for analyzing and merging blurry two-dimensional images of the electron microscope into a sharp three-dimensional image. Electron microscope images provide knowledge that is important for the development of pharmaceuticals, among other things.

Joachim Frank was born in Siegen, Germany. After studies at the universities in Freiburg and Munich, he received his doctor's degree at the Technical University of Munich in 1970. Frank has worked at several institutions in the U.S. and Europe, including the Wadsworth Center, New York State Department of Health, State University of New York at Albany, Howard Hughes Medical Institute and Columbia University, where he has remained since 2008.



COVID-19 delayed the opportunity for **Donna Strickland** to join us for the 2020 Alpheus Smith Lecture, but she plans to present the lecture in September of 2022. She is a 2018 Nobel Laureate for her "method of generating high-intensity, ultra -short optical pulses".

Born in Guelph, Ontario, Canada, Strickland became interested in laser and electro-optics early and studied at McMaster University in Hamilton, Ontario. She pursued her doctoral studies in the U.S. at the University of Rochester, where she did her Nobel Prize-awarded work. She obtained her PhD in 1989. She subsequently has worked at Princeton University and since 1997 at the University of Waterloo in Canada.

The sharp beams of laser light have given us new opportunities to deepen our knowledge about the world and shape it. In 1985, G'erard Mourou and Donna Strickland succeeded in creating ultrashort high-intensity laser pulses without destroying the amplifying material. They stretched the laser pulses in time to reduce their peak power, amplified them and compressed them, dramatically increasing their intensity. "Chirped pulse amplification" has many uses, including corrective eye surgeries.

Fortunately for us, on Oct. 20, 2020, **Sylvester James Gates Jr.** was able to present the 58th annual lecture virtually. Jim Gates is a theoretical physicist who works on supersymmetry, supergravity and superstring theory. He retired from the physics department and Center for Fundamental Physics at the University of Maryland College of Computer, Mathematical and Natural Sciences in 2017, and he is now director of the Brown Theoretical Physics Center, the Ford Foundation Professor of Physics, Affiliate Professor of Mathematics and Watson Institute for International Studies and Public Affairs Faculty Fellow at Brown University. He was a University of Maryland Regents Professor and served on former President Barack Obama's Council of Advisors on Science and Technology.

His topic for the lecture was "How Thinking Like A Geneticist Helped Me Solve A 25 Year-Old Einstein-Type Problem In String Theory." "Imagine if the world's smartest physicist made a mistake in a string theory calculation, while being observed by aliens in a passing starship. If the aliens are to communicate a helpful comment, the Earth-bound physicist must account for relativity and quantum theories simultaneously. For over two decades, the resolution to this puzzle was unknown. Using ideas from geneticists to sort through 4,294,967,296 functions, a solution was found in the summer of 2020."

In the afternoon, we were honored to have Jim present "My Journey Thinking About Racism & STEM Disciplines" with the Departments of Physics and Astronomy. "The worldwide response of moral revulsion triggered by the broad dissemination of a video showing the extrajudicial execution of George Floyd (as the crescendo to far too many such occurrences) has compelled even the organizers of the 'Strings 2020' conference to engage me in this conversation for their global cyberspace attendees. Thus, I feel a duty to respond."

■ *The Alpheus Smith Lecture has been bringing leading-edge work of Nobel Laureates and other prominent physicists to the community since 1960. The free, public lecture series is endowed by Robert Smith to honor his father, Professor Alpheus W. Smith.*

ON THE COVER

The pixel detector being installed at the center of the CMS detector at CERN.

Letter from the Chair

I am delighted to provide an introduction to the 2021 edition of the Physics Magazine. But first let me introduce myself. I started as chair at the beginning of July in 2020. I have been a member of our physics community since 2006. My research program is in the field of experimental biophysics, and since I started my laboratory, we have been working to understand how the physical properties of the human genome regulate gene expression using single molecule methods. Then, about 8 years ago, we expanded into the field of DNA nanotechnology where we are developing DNA nanodevices for cell and molecular biology applications.

It is an honor to serve as chair of one of the top physics departments in the country. Our department has a wonderful community of world-class faculty, staff, postdocs, graduate and undergraduate students that are working together to make cutting edge discoveries in a wide range of physics and to educate the next generation of scientific leaders.

Of course, these past 2 years have been a period of unique challenges because of the COVID-19 pandemic, which started at the beginning of 2020 soon after the last edition of the Physics Magazine came out. While the challenges were numerous, it has been truly amazing how the department came together to solve challenge after challenge to allow us to continue our outstanding instruction and cutting-edge research programs. I am particularly grateful to the previous chair, Professor Brian Winer, who led the department during the beginning of the pandemic, and to our outstanding graduate teaching assistants and lecturers, who were so essential to us providing laboratory instruction during the pandemic. For more details on how the department adapted during the pandemic, please read the article in this Physics Magazine, "The department responds to COVID."

Our research programs continue to be highly successful. Articles in the magazine provide a glimpse into the numerous research successes we have had over the past couple of years. We continue to expand our research output and funding and are one of leading institutions in granting both undergraduate and PhD Physics degrees. These numbers are listed in the magazine.

A key focus of the department is to make meaningful and lasting change on both race and gender diversity, equity and inclusion in our department. Some highlights are the department's Bridge Program to help students transition from their undergraduate studies to graduate school, the POLARIS mentoring program for first year undergraduate students, the URSA program and the American Physics Society Inclusion, Diversity, and Equity Alliance (APS-IDEA). Diversity, equity and inclusiveness are essential parts of excellence in all areas of the department. Physics is inherently a team endeavor and diverse teams are better at solving problems — whether this is part of group work in a class or research group solving unanswered problems at the forefront of their field.

I would like to thank everyone in our physics community for their effort and support. I am so very proud to be a part of such a vibrant and successful department.

I hope you enjoy reading about many of the great successes and accomplishments over the past couple of years.

Sincerely,

Michael Poirier

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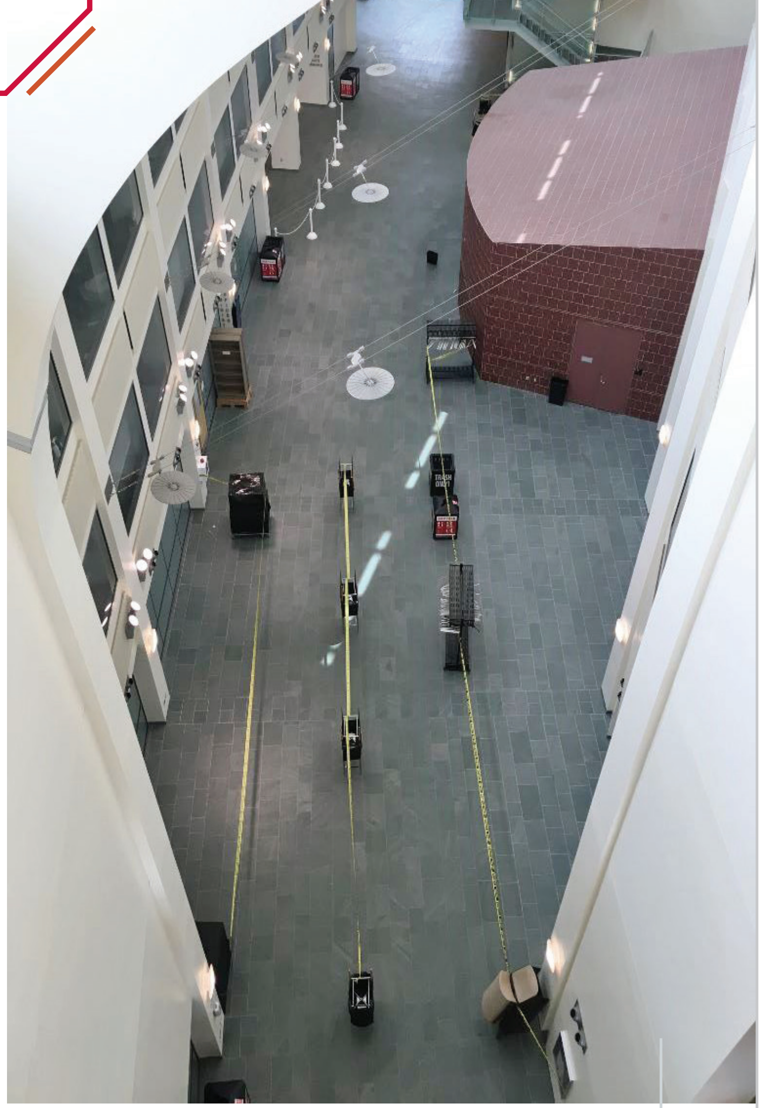
The department responds to COVID

BY MICHAEL POIRIER

The response and adaption to the COVID-19 pandemic has been a major focus of the department since the spring of 2020. The previous department chair, Brian Winer, led the department during the early months of the pandemic. This started with the abrupt transition to completely online classes after the 2020 spring break. Soon after, all research labs were shut down and essentially all instruction, research and administration operations were converted to being fully remote. This took a tremendous amount of effort with everyone working together. While there were a lot of challenges this was done successfully under Brian Winer's leadership.

On March 17, 2020, I sat down in the chair's office and began reading my email. One of the first items was a message from then-Ohio State President Michael Drake. It said every employee that could work from home should start doing so immediately. The pandemic's effects hit slowly at first as spring break was extended an extra week. But by mid-March, the effects had gained speed, and a huge shift in operations was required. The questions were plentiful. How do we transition all our classes online? What about the laboratory courses? How are we going to continue our research? Is there critical infrastructure in the research labs that must be maintained and protected? For those that need to come to campus, how do we keep them safe? What about personnel located at remote locations — do we need to get them home? These problems required an all-hands-on-deck approach. The Safety and Infrastructure Committee would be critical for establishing new safety protocols. A new Teaching Task Force would address the challenges with instructional delivery. The department faculty and staff were rallying, but everyone was dealing with uncertainty about the future. We were experiencing something that hadn't happened in a century.
■ **Brian Winer, Chair**

Once we got through the spring 2020 semester, we continued our summer instruction in a completely online format. We also began the process of planning for delivering instruction during the 2020-21 academic year. An Instructional Task Force with both faculty and staff was established that was co-chaired by Professors Tom Gramila and Andrew Heckler, to plan on instruction for the fall of 2020. The teaching staff played key roles in both delivering instruction online during the summer 2020 term and planning for the fall 2020. One



Directional lanes and stay-out zones were created to ensure pedestrians maintained social distance when walking through the atrium.

of the largest challenges was to determine how to deliver laboratory instruction safely. Some of the labs were delivered online (Jim will describe this), while many of our labs were delivered in a hybrid mode where some students were in person, and some were remote. The in-person portion of these hybrid laboratories were particularly challenging to deliver. The department is extremely grateful to the graduate teaching assistants in the department who delivered many of the in-person labs. They were key to the department providing an in-person laboratory experience during the worst periods of the pandemic.

Another key challenge was operating research programs while everyone was required to work remotely from March to July. Research programs that did not require access to laboratory space were able to proceed relatively unimpeded. However, research that required in-person laboratory work essentially stopped for about 4 months. During this period, experimentalists focused on manuscript writing, planning future experiments and reviewing literature. This period was very disruptive for graduate students and postdocs who were in the middle of their experimental research projects. In July, the labs began to reopen at a very limited capacity. Reopening of the Physics laboratories was guided by the Safety and Infrastructure Committee. This committee was spectacular in managing the reopening of the labs.

With the dramatic onset of the COVID-19 pandemic in March 2020 the Department Safety and Infrastructure Committee (S&I) took on an uncharacteristically urgent and critical role in department operations. Typically, this committee does not meet over the summer, and handoff between committees for subsequent years occurs at the beginning of fall semester. But in 2020 the committee met continuously (often several times a week) during the university-wide shut down and over the summer in order to help shape the department response to these unprecedented events. The 2019-2020 committee agreed to serve through the 2020-2021 academic year to provide continuity and led the development of a safety plan that would allow for the resumption of research activities under pandemic conditions. This included providing a template for experimental research groups to use in developing masked and socially distanced operating protocols as well as holding a number of town hall meetings throughout the summer with faculty, students, and staff to discuss how to work safely in the era of COVID. The department community responded with an impressive show of unity and collective action, leading to an exceptionally effective response that made the Department of Physics a model for pandemic response around campus. ■ **Professor Ezekiel Johnston-Halperin**

With the evacuation of campus, multiple countermeasures were needed for research facilities and department operations. New systems to handle mail, package deliveries, hazardous waste disposal, contactless pickups and other logistics were quickly created and implemented. Lab equipment was idled or completely shut down. Systems that could not be shut down were left in a minimum operating state but required tending. A team consisting of operations, research and computing staff was formed and charged with conducting daily inspections to avoid equipment damage.

A desperate call for personal protective equipment came from the Wexner Medical Center, and the Department of Physics marshalled resources and made a robust response offering numerous gloves, gowns, face shields, wipes and isopropyl alcohol. An overflowing truckload was delivered to the drop off, where personnel remarked that the delivery was among the largest donations they received from anywhere on campus.

A major effort to create new safety protocols in response to each of the shutdown stages was phased in from the initial closure to the controlled reopening. The resulting protocols were informed by careful analysis of area densities and volumetric air flow versus room volumes. Signage was obtained or created and installed throughout the facility to direct and instruct occupants on how to move about the facility if and when they entered. Common-area furniture was relocated and taken out of service to prevent gatherings. An entry monitoring program was put in place to track unauthorized entries into the building so corrective actions could be made.
■ **Phil Davids, Facilities Operations Manager**

When COVID hit in the spring semester of 2020, a lot of changes happened quickly in our physics courses. In short, almost everything went online for the remaining month or so of class: lectures, recitation, testing, even labs. Great effort and patience on the part of instructors and students alike helped us through. In May 2020, then chair Brian Winer assembled an instructional task force of faculty and lecturers to "consider instructional issues related to the delivery of physics courses in the next academic year." We used lessons learned from the spring and the summer (which was completely online) to craft a hybrid of online vs. in person learning experiences for the students. In autumn 2020 and spring 2021, lectures were live and online for almost all upper and lower-level courses. For the introductory courses, recitations had interactive groupwork via zoom rooms with four students per room working in groups. With careful planning and special TA training, these sessions went well — students were engaged and learning much like in-person recitation group work. Intro labs were in person, though for purposes of distancing and safety, only one person (rotating) from each group came in each week to manipulate the lab materials, while the rest of the group observed, recorded data, and communicated via zoom. In some cases, when necessary, labs were done via recordings of phenomena by the staff and faculty, and students could record the data and make reports. In all, the labs seemed to work, though of course everyone was looking forward to going back to in-person.

The transition to online delivery was particularly challenging for our senior advanced laboratory course, Physics 5700. I developed a take-home kit with a USB oscilloscope, breadboards and components that enabled students to conduct experiments on their own at home. Worldwide shortages of necessary items required procurement from sources as far away as Australia. Hands-on experiments on RLC circuits and Johnson noise were developed. In addition, Margie Farrell recorded video data for the Millikan Oil Drop experiment that the students analyzed at home. Professor Chris Hammel and course staff Margie Farrell and Jesse Martin tested the content developed for the lab, and the team delivered the course fully online in Fall 2020. ■ **Professor James Beatty**

In the autumn of 2021, things were a little more back to normal. The main components that were via zoom are now the introductory course lecture sessions. Recitations, labs and upper-level courses are back to in-person. One benefit occurring from this pandemic is that we have learned to use the advantages of electronic submission of assignments and tests. The tests are still in-person, but the work is uploaded online by the students in class. Modern software then allows for more efficient and effective administering and grading of tests and assignments. We are grateful to the faculty and staff for their dedication and efforts in this pandemic, the patience and hard work of the students, and we are continually seeking ways to improve student learning and the student experience in these trying times. ■ **Professor Andrew Heckler**

During the summer of 2020, the department chair position transitioned from Brian Winer to Michael Poirier. Professor Winer started working with Professor Poirier in May 2020 to facilitate a smooth transition, which officially occurred July 1, 2020. Poirier continued the Teaching Task force during the 2020-21 academic year. He also established a COVID Taskforce that was comprised of the Department Chair (Michael Poirier), Administrative Manager (Jean Ball, Nicola Betts), Facilities Operations Manager (Phil Davids), the three Vice Chairs (Jon Pelz, Tom Humanic, Tom Gramila), the IT Systems Manager (Bryan Dunlap), the Committee Chairs from Climate & Diversity and Safety & Infrastructure (Jay Gupta, Ezekiel Johnston-Halperin), and the Assistant to the Chair (Ruth Leonard). This committee met weekly throughout the 2020-21 academic year to identify and respond to numerous challenges related to the pandemic. Examples of challenges included managing shipping and receiving when the front office was not open, obtaining PPE for the department, providing IT support for the new modes of online instruction, providing guidelines for access to office space, and many more. Overall, this group was key in allowing the department to identify and respond to the wide range of issues that emerged.

In the spring of 2021, vaccinations became available to students, faculty and staff, which coincided with a drop to a low level of COVID cases during the summer of 2021. During this period the rules on social distancing were removed. There was even a brief period during the summer when masks were not required in doors. During this period there was optimism that we were near the end of the pandemic. The summer of 2021 we planned for a largely normal academic year where all courses with less than 100 students would be in person. Of course, the Delta variant emerged, and the cases rapidly rose back to very concerning levels. Before the beginning of the 2021-22 academic year, mask become required indoors and then the university mandated vaccinations for all students, staff and faculty.

Since the beginning of the 2021-22 academic year, the department has opened up significantly. Classes have largely been in person during the fall 2021 and in spring 2022. The Department Covid Taskforce still meets when required. The department has truly outstanding staff. We are trying to find a balance between staff working remotely and in person so they can continue to be highly effective while allowing staff to leverage their experience with working remotely so they can have more flexibility. We have a mix of in person and remote colloquiums. In person student meetings have restarted. Staff in the department typically have a hybrid work schedule. However, many activities continue in hybrid or fully online such as faculty meetings and research group meetings. There is a clear desire by many in the department to have more in person social events but there remains a wide range of safety concerns. So, the department is working to hold more social events as we progress through the 2021-22 academic year.

Overall, the department has continued its excellence in our research and instruction missions throughout the pandemic. We have worked to adapt to the evolving conditions, which will likely continue for some time. While the pandemic has been one of the most challenging periods for the department, it has also been a time for the department to come together and demonstrate that it can work together to overcome unprecedented changes and adversity. The department is on track to emerge from the pandemic stronger than ever.

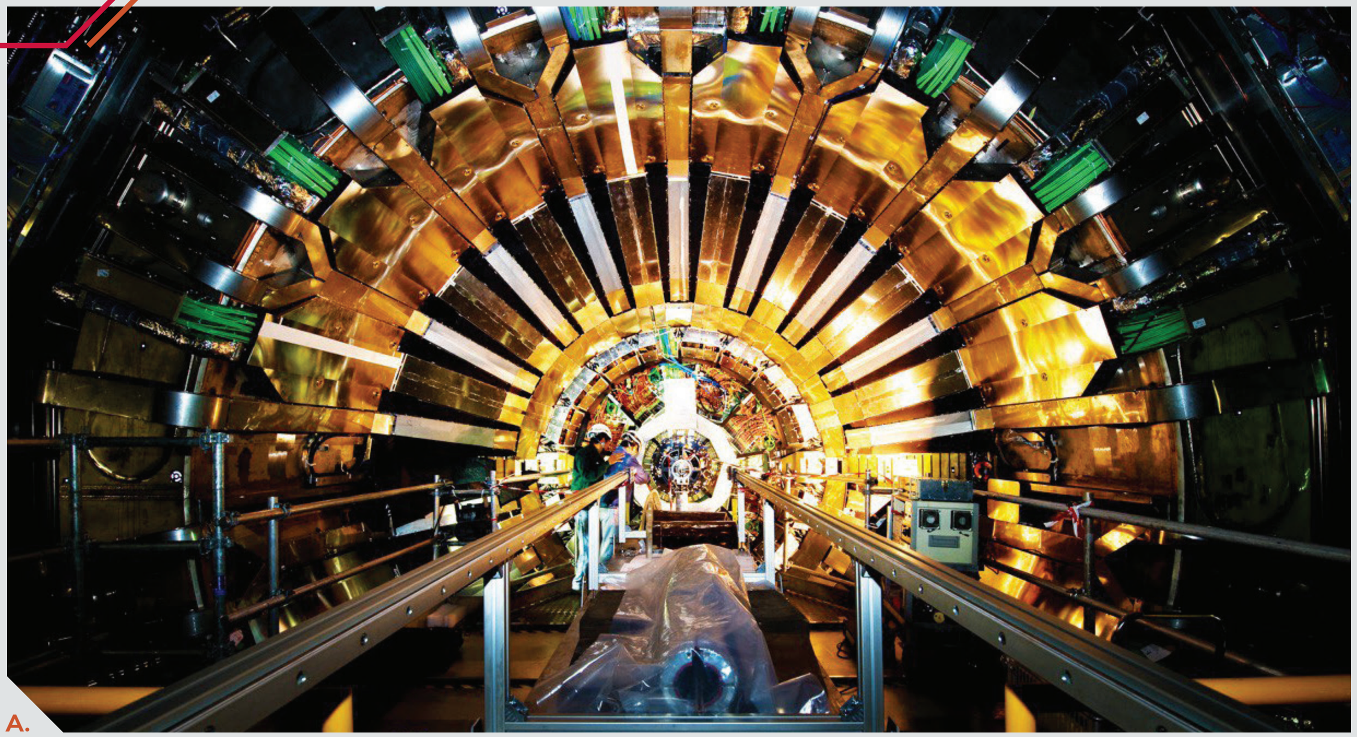
RESEARCH

High energy DOE grant

From quarks to the cosmos – physics department faculty explore the universe on the smallest and largest scales. They study the fundamental building blocks of nature using CERN's Large Hadron Collider (LHC), the largest scientific apparatus ever built. They use mountain top observatories to catalogue millions of galaxies to understand the evolution of the cosmos influenced by dark matter and dark energy. They develop important theoretical insight to explain the observations we make. In 2020, a group of department faculty were awarded a four-year $7.9 million grant from the U.S. Department of Energy to fund their efforts in these important areas.

Experimental faculty members (Professors Boveia, Gan, Hill, Kagan, Winer) play important roles in the LHC's two general purpose detectors (ATLAS, CMS). On ATLAS, Boveia performs searches for hypothetical particles connected to astrophysical dark matter and develops novel trigger capabilities, with a particular focus on applications of machine learning. Gan searches for exotic long-lived resonances that decay into lepton pairs. In addition, Gan is leading the effort in fabricating a new generation of optical modules to receive and transmit optical communications for the ATLAS pixel detector. Kagan searches for signals of di-Higgs decays and is a leading contributor in the design and fabrication of a diamond luminosity monitor and beam abort system to protect the silicon pixel and strip detectors at the ATLAS experiment.

The effort on the CMS Experiment at the LHC is led by Professors Hill and Winer. They are developing new experimental methods for the High Luminosity running of the LHC, scheduled to begin later this decade. Hill is helping develop a new forward pixel detector to provide high-precision charged particle tracking for the future CMS detector while Winer is contributing to the development of a new trigger system. The group uses the current data to search for extensions to the Standard Model by hunting for unusual long-lived particles and applying effective field theory techniques in events with top quarks.



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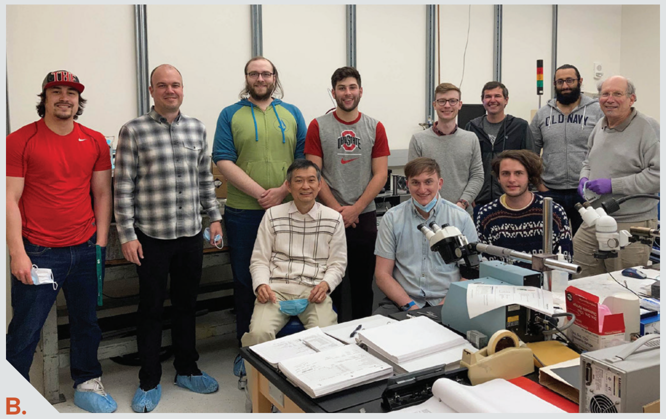

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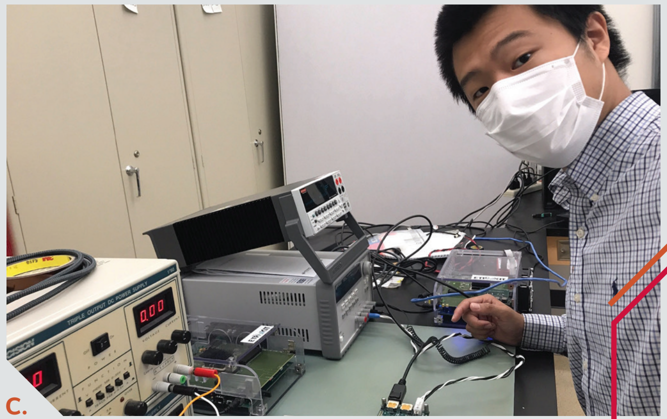

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The Cosmic Frontier group, Professors Honscheid and Martini (Astronomy), continues to focus on the exciting mystery of cosmic acceleration, which is attributed to an unknown dark energy. The group contributed to the data analysis from the Dark Energy Survey, which uses exquisite images of the night sky to measure the matter distribution in the universe. These results agree extraordinarily well with the standard model of cosmology. The group has taken leading roles in the recent completion of the powerful Dark Energy Spectroscopic Instrument (DESI). DESI has now begun a five-year survey of 35 million galaxies and quasars to obtain the most precise measurement of cosmic acceleration.

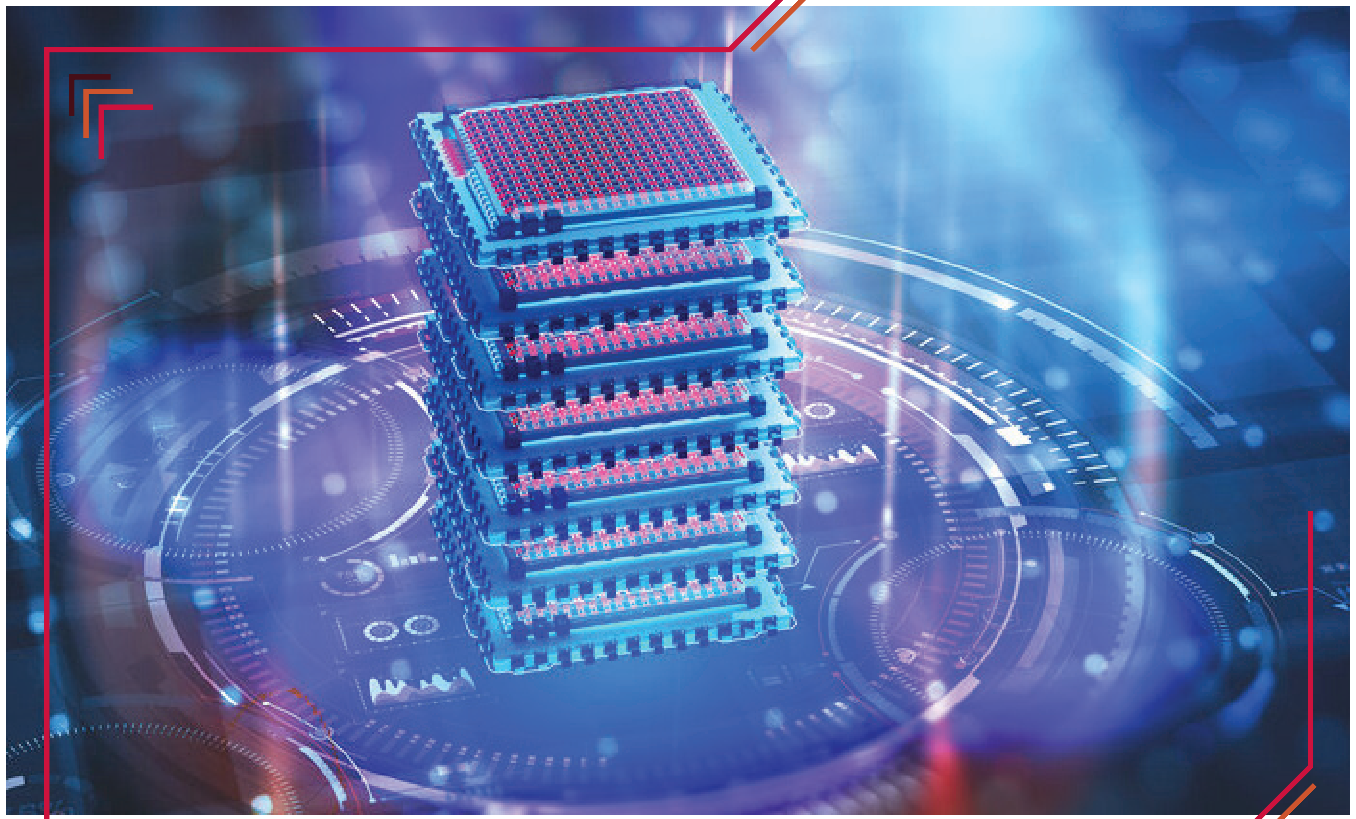
A solid theoretical framework plays an important role in furthering our understanding of the universe. The theory effort in particle physics is led by Professors Braaten, Carpenter, Mathur and Raby, who explore some of the most interesting questions in the field ranging from physics beyond the current standard model, to what is inside a black hole, to the nature of dark matter. Braaten uses effective field theories to further our understanding of Quantum Chromodynamics and how it impacts the formation of exotic heavy hadrons. Raby and Carpenter are working on physics beyond the Standard Model, including supersymmetry, grand unified theories, dark matter and baryogenesis. Mathur used the "fuzzball paradigm" to resolve the information paradox of blackholes and is now using this paradigm and string theory to explore its impact on our understanding of cosmology.

The grant from the DOE allows department faculty to probe deeper into the structure of the universe at the most extreme scales. The funds provide the opportunity to train young scientists for the next generation by supporting graduate students and postdocs. The young scientists are trained in the latest techniques of computers, electronics, data mining and theoretical approaches.

A. *Installation of the CMS pixel detector at CERN.*

B. *Ohio State physicists who are part of the ATLAS Collaboration.*

C. *Graduate student Kai Wei testing the ASIC that has been developed for the CMS TFPX detector as part of the HL-LHC upgrade.*



Ohio State-led QuSTEAM initiative awarded $5 million from NSF

MULTI-INSTITUTIONAL PROGRAM WILL DEVELOP A RESEARCH-BASED QUANTUM EDUCATION CURRICULUM

A multidisciplinary, multi-institutional program led by The Ohio State University is taking the next step in its aim to develop a diverse, effective and contemporary quantum-ready workforce by revolutionizing and creating more equitable pathways to quantum science education.

QuSTEAM: Convergence Undergraduate Education in Quantum Science, Technology, Engineering, Arts and Mathematics, was awarded a $5 million cooperative agreement over a two-year period from the National Science Foundation's (NSF) Convergence Accelerator. Following QuSTEAM's initial assessment period, Phase I, the award will fund Phase II's objective to build transformative, modular quantum science degree and certification programs.

"I know from personal experience that collaboration is the key to scientific success. Working across disciplines – especially when it comes to the highly complex and multidisciplinary world of quantum science research – will help us more quickly harness the enormous power of this emerging field and deliver real-world results more quickly and efficiently," said Ohio State President Kristina M. Johnson. "As an added bonus, this project enables Ohio State to further part of its core mission, which is to educate the next generation of researchers through educational opportunities that advance diversity and workforce development."

The rapidly evolving field of quantum information science will enable technological breakthroughs and have far-reaching economic and societal impacts — what researchers at the National Institute of Standards and Technology refer to as the second quantum revolution. Ohio State is emerging as a key leader in pushing the field forward, recently joining the Chicago Quantum Exchange, a growing intellectual hub for the research and development of quantum technology, as its first regional partner.

"NSF's Convergence Accelerator is focused on accelerating solutions toward societal impact. Within three years, funded teams are to deliver high-impact results, which is fast for product development," said Douglas Maughan, head of the NSF Convergence Accelerator program. "During Phase II, QuSTEAM and nine other 2020 cohort teams will participate in an Idea-to-Market curriculum to assist them in developing their solution further and to create a sustainability plan to ensure the effort provides a positive impact beyond NSF funding."

"QuSTEAM is a great example of how universities and industry can work together to build the foundation for a strong, diverse workforce," said David Awschalom, the director of the Chicago Quantum Exchange and Liew Family Professor in Molecular Engineering and Physics at the University of Chicago. "Innovations in this field require us to provide broadly accessible quantum education, and QuSTEAM represents an ambitious approach to training in quantum engineering."

Unlocking that potential, however, also requires a foundational shift in teaching and growing a quantum-literate workforce. QuSTEAM brings together scientists and educators from over 20 universities, national laboratories, community colleges, and historically Black colleges and universities (HBCUs) to develop a research-based quantum education curriculum and prepare the next generation of quantum information scientists and engineers. The initiative also has over 14 industrial partners, including GE Research, Honda and JPMorgan Chase, and collaborates with leading national research centers to help provide a holistic portrait of future workforce needs.

"We have leaders in quantum information and STEM education, and both of these groups independently do good work building undergraduate curriculum, but they actually work together surprisingly rarely," said QuSTEAM lead investigator Ezekiel Johnston-Halperin, professor in the Department of Physics at Ohio State. "We are talking to people in industry and academia about what aspects of quantum information are most critical, what skills are needed, what workforce training looks like today and what they expect it to look like a couple years from now."

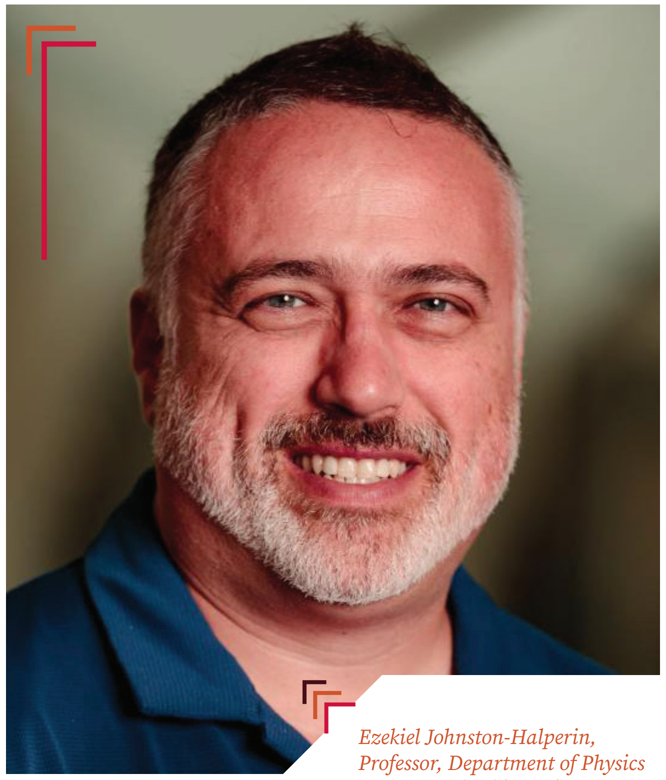
"We feel strongly about the need for redesigning quantum science education, which is the objective of QuSTEAM," said Marco Pistoia, head of the Future Lab for Applied Research and Engineering (FLARE) at JPMorgan Chase. "The complexity of the quantum computing stack is enabling the creation of many new job opportunities. It is crucial for quantum curricula nationwide to collectively support this multiplicity of needs, but for this to happen, quantum scientists and engineers must have the proper training. We are very excited to see the impact of QuSTEAM's work in the near and long term, considering finance is predicted to be the first industry sector to start realizing significant value from quantum computing."

QuSTEAM is headed by five Midwestern universities: lead institution Ohio State, the University of Chicago, the University of Michigan, Michigan State University and the University of Illinois at Urbana-Champaign, all of which have partnered with local community colleges and regional partners with established transfer pipelines to engage underrepresented student populations.

The group is also collaborating with the IBM-HBCU Quantum Center to recruit faculty from its network of over 20 partner colleges and universities, as well as Argonne National Laboratory. In all, the QuSTEAM team comprises 66 faculty who share expertise in quantum information science and engineering, creative arts and social sciences, and education research.

To best develop a quantum-ready workforce, QuSTEAM identified the establishment of a common template for an undergraduate minor and associate certificate programs as the near-term priority. The team will build curricula consisting of in-person, online and hybrid courses for these degree and certification programs — including initial offerings of the critical classes and modules at the respective universities while continuing to assess evolving workforce needs.

QuSTEAM plans to begin offering classes in spring 2022, with a full slate of core classes for a minor during the 2022-2023 academic year. The modular QuSTEAM curriculum will provide educational opportunities for two- and four-year institutions, minority-serving institutions and industry, while confronting and dismantling longstanding biases in STEM education.



Ezekiel Johnston-Halperin, Professor, Department of Physics QuSTEAM lead investigator

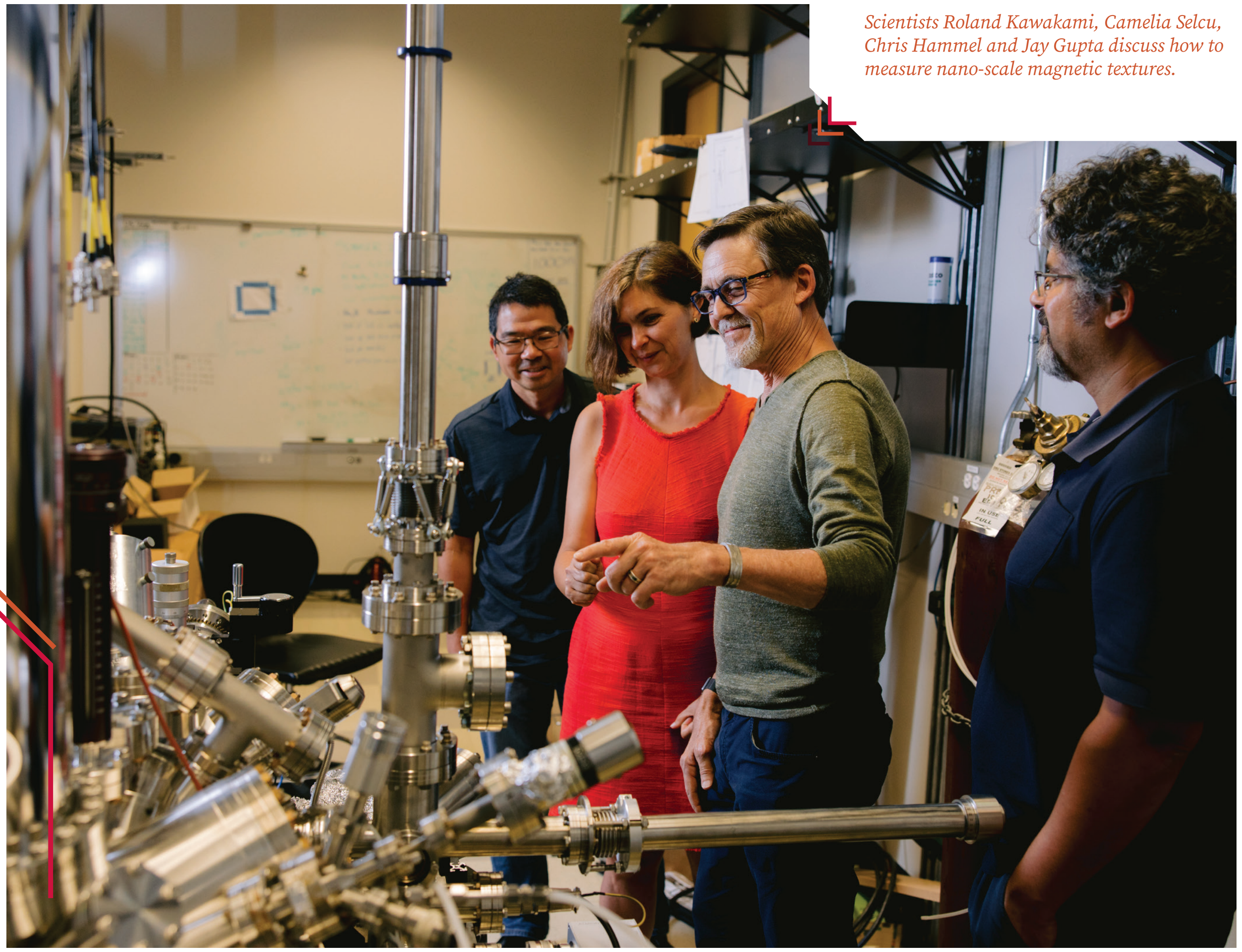
"If we want to increase diversity in quantum science, we need to really engage meaningfully with community colleges, minority-serving institutions and other small colleges and universities," Johnston-Halperin said. "The traditional STEM model builds a program at an elite, R1 university and then allows the content to diffuse out from there. But historically this means designing it for a specific subset of students, and everything else is going to be a retrofit. That's just never as effective."

QuSTEAM leverages integrated university support from faculty and staff from the Drake Institute for Teaching and Learning, the Institute for Materials Research, the Department of Physics and the Ohio State Office of Research.

Johnston-Halperin is joined at Ohio State by QuSTEAM co-PI Andrew Heckler, professor of physics and physics education research specialist. Other Ohio State faculty included on QuSTEAM are Daniel Gauthier, professor in the Department of Physics; Christopher Porter, postdoctoral researcher in the Department of Physics; David Penneys, associate professor in the Department of Mathematics; Zahra Atiq, assistant professor of practice of computer science and engineering in the College of Engineering; David Delaine and Emily Dringenberg, assistant professors of engineering education in the College of Engineering; and Edward Fletcher, associate professor of educational studies in the College of Education and Human Ecology.

QuSTEAM is one of 10 teams selected for two-year, $5 million Phase II funding as part the NSF Convergence Accelerator 2020 Cohort, which supports efforts to fast-track transitions from basic research and discovery into practice, and seeks to address national-scale societal challenges. With this funding, QuSTEAM will address the challenge of developing a strong national quantum workforce by instituting high-quality, engaging courses and educational tracks that allow for students of all backgrounds and interests to choose multiple paths of scholarship.

■ *Reposted from* ***news.osu.edu***



Scientists Roland Kawakami, Camelia Selcu, Chris Hammel and Jay Gupta discuss how to measure nano-scale magnetic textures.

Ohio State's Center for Emergent Materials awarded $18 million NSF grant to support high-impact, cutting-edge science

BY MICHELLE ROBERTS

The National Science Foundation (NSF) announced that the Center for Emergent Materials (CEM) at The Ohio State University has been awarded Materials Research Science and Engineering Center (MRSEC) funding for the third time since 2008. This $18 million, six-year grant will fund transformative science and complex materials discovery by two multidisciplinary, collaborative groups of researchers and includes funding to help ease entry into science from underrepresented groups.

"We are excited to have won this highly prized funding because it enables scientists to undertake complex and transformative projects at the scientific frontiers and provides sustained support for diverse teams to collaboratively synthesize new understanding and open new research topics," said P. Chris Hammel, Ohio Eminent Scholar, physics professor and director of the Center for Emergent Materials.

After an intense and highly competitive process, 11 MRSECs were funded for this cycle, bringing the nationwide total to 19. A flagship initiative for NSF, the MRSEC program funds research at the cutting-edge of scientific discovery by enabling teams of researchers to tackle scientific problems that are too large and complex for one person or one group to make an impact. These teams, called Interdisciplinary Research Groups (IRGs), are made up of a diverse group of faculty, their students and postdoctoral researchers.

This funding will allow CEM to continue its history of excellence with two new IRGs, which aim to develop materials that grant improved control over magnetic properties, generating new paradigms in computing and information storage.

IRG-1: Creation and Control of Metal/Magnetic-Insulator Interfaces is co-led by Jinwoo Hwang, associate professor of materials science engineering, and Fengyuan Yang, professor of physics. This group will focus on magnetic interactions at interfaces between magnets and two- or three-dimensional metals. The team includes faculty in the fields of chemistry and biochemistry, materials science engineering and physics at Ohio State and Carnegie Mellon University.

IRG-2: Topology and Fractionalization in Magnetic Materials is co-led by Joseph Heremans, professor of mechanical and aerospace engineering and physics, and Yuan-Ming Lu, associate professor of physics. Group members will focus on control of configurations and interrelationships between magnetic interactions that protect magnetic states against omnipresent disruptive forces. The team is made up of faculty in chemistry and biochemistry, materials science engineering, mechanical and aerospace engineering and physics at Ohio State and Duke University.

> *"An important benefit of this funding is its support for a seed program that that allows CEM to nurture new science and prepares young faculty to be scientific leaders."*

"An important benefit of this funding is its support for a seed program that allows CEM to nurture new science and prepares young faculty to be scientific leaders," explained Hammel. "For example, IRG-1 grew out of a project initiated by Prof. Jinwoo Hwang with seed funding support."

Both of the IRGs were nucleated in the Ohio State's Materials Research Seed Grant Program, an enterprising Ohio State program run by the CEM, the Center for Exploration of Novel Complex Materials (ENCOMM), and the Institute for Materials Research (IMR) that supports new developments in materials research.

A robust education, human resources and development (EHRD) program aimed at increasing scientific literacy and diversity from elementary school students through the faculty ranks round out the new initiatives this award will enable. CEM will continue to provide mentorship for high-needs K-12 students through outreach and tutoring programs. The externally funded Masters-to-PhD minority Bridge Program, which increases the pool of faculty candidates from underrepresented backgrounds continues to be a central component to CEM's EHRD efforts.

"Center faculty and current bridge students are vital participants that provide research and academic mentorship and support to incoming bridge students," said Michelle McCombs, CEM's outreach and inclusion director. "Connecting new students to a network of Bridge peers eases the transition to graduate school life and provides a direct link to older students who are invaluable sources of advice."

Additionally, CEM's new Diversity Action Plan, founded on proven strategies employing concrete, measurable steps, is focused on improving faculty and post-secondary diversity.

"Through implementation of the additional strategies, we will have the opportunity to further expand prior efforts to enhance diversity and inclusion of the CEM in more meaningful and sustainable ways," said La'Tonia Stiner-Jones, associate dean of graduate programs and associate professor of practice in biomedical engineering in the college of engineering and CEM's associate director and senior advisor for diversity and inclusion.

Does Columbus have enough tall buildings to support Spider-Man?

PROFESSOR MICHAEL LISA WEIGHS IN THROUGH WOSU'S CURIOUS CBUS PROJECT

In the world of comic books, New York City is swarming with crime-fighters. Dozens of superheroes, including perennial favorite Spider-Man, call the Big Apple home. But what about the rest of the cities around the country?

It's a question that occurred to Sean Smith, a business analyst from Westerville. While working in downtown Columbus, he looked up at the buildings and wondered if someone with Spider-Man's powers could be effective here.

With that in mind, Smith asked WOSU's Curious Cbus project: "Are there enough tall buildings in Columbus to support our own web-slinging, crime-fighting superhero?"

As fun as it might be to imagine, the feasibility of web-slinging through the city is really a matter of physics. Ohio State University physicist Michael Lisa used his analytical powers to solve that problem.

In addition to studying quark and gluon plasma in particle colliders, Lisa also teaches a "Physics of Sports" course at Ohio State, where students learn physics concepts by studying how athletes perform.

To answer the question, "Could Spider-Man travel significant distances by web given our skyline?", Lisa first had to decide just how strong an athlete like Spider-Man would be in real life.

With the Spidey-strength approximated, Lisa's next step was to figure out how his web-swinging technique would work. Lisa used mathematical computer modeling to estimate how different variables might play out.

After his analysis, Prof. Lisa identifies several routes that the wall-crawler could travel, to make a trailer for a Spidey-in-Columbus movie. But he concludes that, at the moment, the density and height of buildings in Columbus wouldn't provide our hero enough roaming space to fight crime here.

Watch Prof. Michael Lisa discuss his analysis here: ***youtube.com/watch?v=PNrVqrSkvbQ***

■ Read more on WOSU.org: ***news.wosu.org/news/2020-09-25/curious-cbus-does-columbus-have-enough-tall-buildings-to-support-spider-man***

Scientists harness chaos to protect devices from hackers

NEW TECH PACKS COMPUTER CHIPS WITH "UNCOUNTABLE" SECRETS

BY JEFF GRABMEIER

Researchers have found a way to use chaos to help develop digital fingerprints for electronic devices that may be unique enough to foil even the most sophisticated hackers.

Just how unique are these fingerprints? The researchers believe it would take longer than the lifetime of the universe to test for every possible combination available.

"In our system, chaos is very, very good," said Daniel Gauthier, senior author of the study and professor of physics at The Ohio State University.

The study was recently published online in the journal IEEE Access.

The researchers created a new version of an emerging technology called physically unclonable functions, or PUFs, that are built into computer chips.

Gauthier said these new PUFs could potentially be used to create secure ID cards, to track goods in supply chains and as part of authentication applications, where it is vital to know that you're not communicating with an impostor.

"The SolarWinds hack that targeted the U.S. government really got people thinking about how we're going to be doing authentication and cryptography," Gauthier said. "We're hopeful that this could be part of the solution."

The new solution makes use of PUFs, which take advantage of tiny manufacturing variations found in each computer chip – variations so small that they aren't noticeable to the end user, said Noeloikeau Charlot, lead author of the study and a doctoral student in physics at Ohio State.

"There's a wealth of information in even the smallest differences found on computers chips that we can exploit to create PUFs," Charlot said.

These slight variations – sometimes seen only at the atomic level – are used to create unique sequences of 0s and 1s that researchers in the field call, appropriately enough, "secrets." Other groups have developed what they thought were strong PUFs, but research showed that hackers could successfully attack them. The problem is that current PUFs contain only a limited number of secrets, Gauthier said.

"If you have a PUF where this number is 1,000 or 10,000 or even a million, a hacker with the right technology and enough time can learn all the secrets on the chip," Gauthier said.

Daniel Gauthier, Professor, Department of Physics

"We believe we have found a way to produce an uncountably large number of secrets to use that will make it next to impossible for hackers to figure them out, even if they had direct access to the computer chip."

The key to creating the improved PUF is chaos, a topic that Gauthier has studied for decades. No other PUFs have used chaos in the way demonstrated in this study, he said.

The researchers created a complex network in their PUFs using a web of randomly interconnected logic gates. Logic gates take two electric signals and use them to create a new signal.

"We are using the gates in a non-standard way that creates unreliable behavior. But that's what we want. We are exploiting that unreliable behavior to create a type of deterministic chaos," Gauthier said.

The chaos amplifies the small manufacturing variations found on the chip. Even the smallest differences, when amplified by chaos, can change the entire class of possible outcomes – in this case, the secrets that are being produced, according to Charlot.

"Chaos really expands the number of secrets that are available on a chip. This will likely confuse any attempts at predicting the secrets," Charlot said.

One key to the process is letting the chaos run just long enough on the chip, according to Gauthier. If you let it run too long, it becomes – well, too chaotic.

"We want the process to run long enough to create patterns that are too complex for hackers to attack and guess. But the pattern must be reproducible so we can use it for authentication tasks," Gauthier said.

The researchers calculated that their PUF could create 10^{77} secrets. How big is that number? Imagine if a hacker could guess one secret every microsecond – 1 million secrets per second. It would take the hacker longer than the life of the universe, about 20 billion years, to guess every secret available in that microchip, Gauthier said.

As part of the study, the researchers attacked their PUF to see if it could be successfully hacked. They attempted machine learning attacks, including deep learning-based methods and model-based attacks – all of which failed. They are now offering their data to other research groups to see if they can find a way to hack it.

> *"We are trying to come up with technology that no hacker – no matter your resources, no matter what supercomputer you use – will be able to crack."*

Gauthier said the hope is that PUFs like this could help beef up security against even state-sponsored hacker attacks, which are generally very sophisticated and backed up with a lot of computer resources.

For example, Russia is suspected of backing the SolarWinds hack that was uncovered in December. That hack reportedly gained access to email accounts of officials in the Department of Homeland Security and the department's cybersecurity staff.

"It is a constant battle to come up with technology that can stay ahead of hackers. We are trying to come up with technology that no hacker – no matter your resources, no matter what supercomputer you use – will be able to crack."

The researchers have applied for an international patent for their PUF device.

The goal of the team is to move beyond research and to move quickly to commercialize the technology. Gauthier and two partners recently founded Verilock, with a goal of bringing a product to market within a year.

"We see this technology as a real game changer in cybersecurity. This novel approach to a strong PUF could prove to be virtually un-hackable," said Jim Northup, CEO of Verilock.

The work was supported in part by the U.S. Department of the Army with Potomac Research, LLC, through the project Physically Unclonable Functions on FPGAs, and by the Ohio Federal Research Network with Asymmetric Technologies, LLC and Ohio University, through the project Resilient and Enhanced Security UAS Flight Control.

Other co-authors on the study were Daniel Canaday and Andrew Pomerance of Potomac Research in Alexandria, Virginia.

■ *Reposted from* ***news.osu.edu***

The universe is getting hot, hot, hot, a new study suggests

TEMPERATURE HAS INCREASED ABOUT 10-FOLD OVER THE LAST 10 BILLION YEARS

The universe is getting hotter, a new study has found.

The study, published in the Astrophysical Journal, probed the thermal history of the universe over the last 10 billion years. It found that the mean temperature of gas across the universe has increased more than 10 times over that time period and reached about 2 million degrees Kelvin today — approximately 4 million degrees Fahrenheit.

"Our new measurement provides a direct confirmation of the seminal work by Jim Peebles — the 2019 Nobel Laureate in Physics — who laid out the theory of how the large-scale structure forms in the universe," said Yi-Kuan Chiang, lead author of the study and a research fellow at The Ohio State University Center for Cosmology and AstroParticle Physics.

The large-scale structure of the universe refers to the global patterns of galaxies and galaxy clusters on scales beyond individual galaxies. It is formed by the gravitational collapse of dark matter and gas.

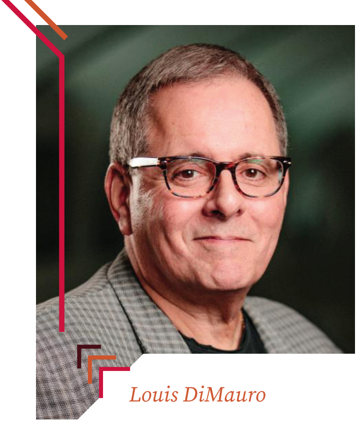
"As the universe evolves, gravity pulls dark matter and gas in space together into galaxies and clusters of galaxies," Chiang said. "The drag is violent — so violent that more and more gas is shocked and heated up."

The findings, Chiang said, showed scientists how to clock the progress of cosmic structure formation by "checking the temperature" of the universe.

The researchers used a new method that allowed them to estimate the temperature of gas farther away from Earth — which means further back in time — and compare them to gases closer to Earth and near the present time. Now, he said, researchers have confirmed that the universe is getting hotter over time due to the gravitational collapse of cosmic structure, and the heating will likely continue.

■ Read the full story on ***news.osu.edu*** at ***news.osu.edu/the-universe-is-getting-hot-hot-hot-a-new-study-suggests/***

NSF NeXUS workshop demonstrates ultrafast laser's interdisciplinary potential



Louis DiMauro

Robert Baker

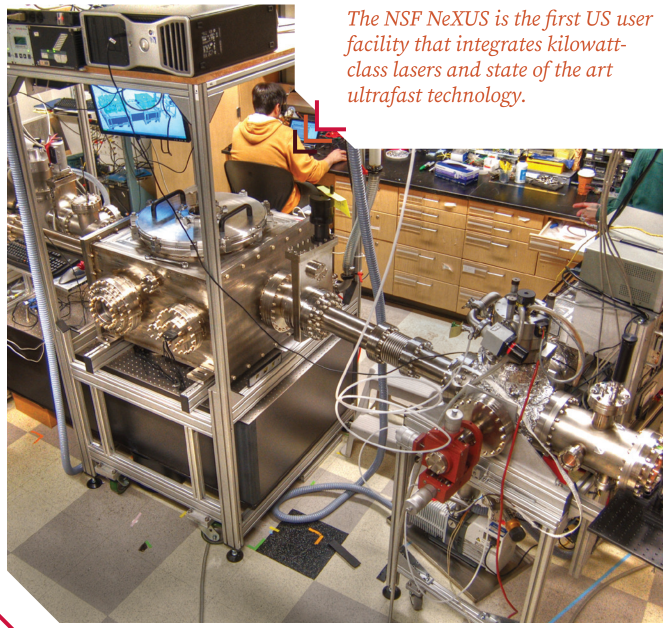
It's almost absurd how small an amount of time an attosecond is.

It's one quintillionth of a second. Or 1x10-18 of a second. Or 0.000000000000000001 seconds. In other words, light circles the Earth 7.5 times in one second. It takes one attosecond for light to traverse three hydrogen atoms.

This is the timeframe at which the one-of-a-kind, ultrafast laser at Ohio State's National Extreme Ultrafast Science Facility (NeXUS) will operate. NeXUS will be managed by the Institute for Optical Science (IOS) and includes researchers from the Department of Chemistry and Biochemistry and the Department of Physics. It was awarded $9.5 million in funding last fall from the National Science Foundation and will be an open-use NSF facility — the first such facility in the U.S. — housed in Celeste Lab. The facility will allow scientists from an array of fields to observe the high-speed interactions and relationships in the quantum world, the world in which nature's tiniest particles live.

"We always use this analog to movies," said IOS Director and professor of physics Louis DiMauro. "We're trying to make a movie, and the actor is the electron making up matter. Movies are simply a series of photographs you play in sequence, and when you play them, you see motion. We're doing the same thing. We're taking snapshots of the electron and playing them back."

"Let's say you're an expert on photosynthesis or artificial molecules designed to mimic what nature does by photosynthesis," added associate professor of chemistry and biochemistry Robert Baker. "You need a better understanding of how electrons move in these materials, but you're not an expert at probing ultrafast electron motion. People with these kinds of questions will bring their own expertise here and probe the systems they're interested in."



The NSF NeXUS is the first US user facility that integrates kilowatt-class lasers and state of the art ultrafast technology.

Development of NeXUS is one year into a five-year project, and its co-directors, DiMauro and Baker, are overseeing various milestones along the way. One of the first was in late July when they hosted the inaugural NSF NeXUS User Workshop, a two-day, virtual event attended by over 200 researchers from 75 institutions around the world.

The theme of the workshops was "killer experiments" — or experiments designed to push the capabilities of a facility and that can't be conducted in other labs — that attendees proposed. The exercise allowed DiMauro, Baker and the scientific community to get a sense of what kind of science the facility will be able to facilitate, and it reinforced NeXUS' interdisciplinary potential.

"It's basically a bunch of us sitting around discussing what we would love to see done and coming up with brilliant thought-experiments," DiMauro said. "And then someone says, 'Well, we can't do that. We don't have that capability.' But NeXUS does."

But the workshop did more than the NeXUS team a glimpse at the potential for NeXUS and what kind of mysteries it can probe. The event was an opportunity to create a sense of community among the researchers who participated. Along with another NSF ultrafast laser under development at the University of Michigan, the hope is that the two facilities can form a synergy that emerges as a leader in this kind of research.

"NeXUS is on the map in terms of playing an important role in these kinds of national and international connections," Baker said. "And it gives agencies like the National Science Foundation a sense of how vital this is to the community."

July's workshop was the first of three that are planned, and because of COVID-19, Baker, DiMauro and other faculty and staff in the Departments of Physics and Chemistry and Biochemistry had to convert it from an in-person event hosted on campus to a virtual one. The next planned workshop is slated for summer 2022, but the pair recognize the need for other, more specialized workshops that focus on, say, specifics fields.

In any case, NeXUS has an exciting future, and if the popularity of the workshop is any indication, it will be a hotspot for international scientists when it comes online.

"The community is very enthusiastic," Baker said. "They have a lot of exciting ideas. We now have a strong base of potential users from which we can grow and have the community coalesce around the science that's going to be studied here."

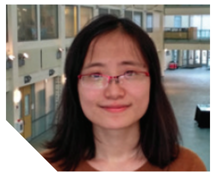
Thermal chiral anomaly in the magnetic-field induced ideal Weyl phase of Bi1-XSbx

PROFESSOR NANDINI TRIVEDI

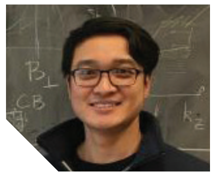
If you have a symmetry in a classical system, are you guaranteed that the symmetry will persist in the quantum system? An anomaly is the breakdown of a symmetry in the quantum system arising from the impossibility to assign a measure that preserves that symmetry when the action is summed over all paths. This profound question has been discussed in particle physics to understand the matter-antimatter asymmetry in the universe that may arise because baryon number is not conserved due to an anomaly. With this backdrop it is remarkable that in our experiment-theory collaboration in the Center for Emergent Materials, the NSF MRSEC at Ohio State reported in Nature Materials, we observe the breaking of a chiral symmetry, or a left-right handedness, in a topological Weyl semimetal revealed by a new pathway of heat conduction.

In a Weyl semimetal free electrons and holes (positively charged particles) merge in energy and behave like massless particles, called Weyl fermions, for two distinct values of momentum, called Weyl points. The complex phases of the wave functions of the Weyl fermions show textures of opposite chirality between the two Weyl points, looking like monopoles of magnetic field. We created such a Weyl semimetal by alloying bismuth and antimony at a specific concentration and applying an external magnetic field; we adjust the composition of the alloys so as to generate only Weyl fermions and eliminate all other electrons or holes that would normally conduct electricity or energy in the solid. Next, by applying a thermal gradient, a special highway is created that allows the Weyl fermions of one momentum and chirality to connect to those of the opposite momentum and chirality. The mathematical description of this phenomenon closely parallels the chiral anomaly in quantum field theories for elementary particles. No such pathways exist in ordinary metals. By activating this highway our group showed that it is possible to pump energy between the two Weyl points of opposite chirality arising from the breaking of chiral symmetry. The energy transfer between the Weyl points in the bismuth alloy results in a 300% increase in the thermal conductivity, a mechanism that can be used to create thermal switches, the heat equivalent of the transistor.

Thermal chiral anomaly in the magnetic-field induced ideal Weyl phase of Bi-Sb, Dung Vu, Wenjuan Zhang, Cuneyt Sahin, Michael Flatte, Nandini Trivedi, and Joseph P. Heremans, Nature Materials 20, 1525 (2021).



Wenjuan Zhang



Vu Dung

Prof. Joseph Heremans

A new way to detect subatomic particles from deep space

In order to solve some of our universe's biggest and most complex mysteries, we must first understand its tiniest and most elusive bits of matter.

Meet the neutrino, an elementary particle so mind-numbingly small that it has almost zero mass and is influenced by only one of nature's four fundamental forces: the weak force. Neutrinos constantly zip all around the universe, but they are so infinitesimal that they pass through normal matter undetected and unobstructed. Produced by nuclear reactions that occur inside things like stars, supernovae and particle accelerators, neutrinos are lighter than anything else on the known subatomic scale, and at any given moment, billions of them are passing through our planet, through our atmosphere and even through ourselves.

But despite how many of them pelt the Earth, finding the imperceptible interstellar particles is actually quite difficult. Steven Prohira, a postdoctoral researcher at Ohio State's Center for Cosmology and AstroParticle Physics, has spent the last four years hunting them, starting with his work as a physics graduate student at the University of Kansas.

"We have a model to explain them, but we don't really understand them," he said. "They're just incredibly interesting, curious particles, and we want to know more about them."

Prohira's quest to learning more about neutrinos — how to detect them, where they come from and the cosmic, energetic processes that produce them — will soon take him to Antarctica, where he is principal investigator on a new National Science Foundation-funded project, the Radar Echo Telescope (RET), a collaborative grant shared between Ohio State and the University of Kansas.

The Radar Echo Telescope, of which professors of physics James Beatty and Amy Connolly are co-principal investigators, will use radio inside the Antarctic ice to detect the spray of energized particles caused by the ultra high-energy cascade created when a neutrino collides with an atom.

■ Read the full story at: ***artsandsciences.osu.edu/news/new-way-detect-subatomic-particles-deep-space***

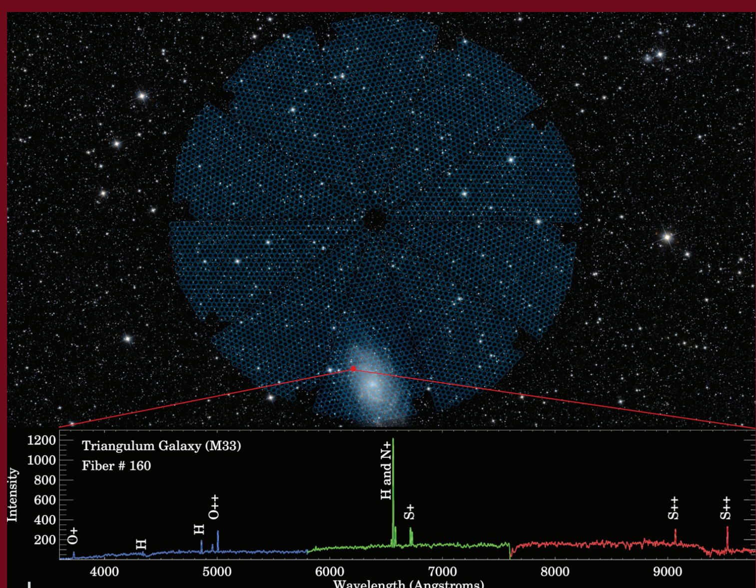
DESI project begins operation with help from Ohio State faculty, researchers

With large contributions from Ohio State faculty and researchers, a five-year quest to map the universe and unravel the mysteries of “dark energy” officially began in May of 2021 at Kitt Peak National Observatory near Tucson, Arizona, when the Dark Energy Spectroscopic Instrument (DESI) started capturing and studying light from tens of millions of galaxies and other distant objects in the universe. DESI is an international science collaboration managed by the Department of Energy’s Lawrence Berkeley National Laboratory (Berkeley Lab) with primary funding from DOE’s Office of Science.

By gathering light from some 30 million galaxies, project scientists say DESI will help them construct a 3D map of the universe with unprecedented detail. The data will help them better understand the repulsive force associated with “dark energy” that drives the acceleration of the expansion of the universe across vast cosmic distances.

Faculty members and researchers from Ohio State’s Center for Cosmology and AstroParticle Physics (CCAPP) have been a part of the project since the beginning. Physics professor Klaus Honscheid and astronomy professor Paul Martini were instrumental in designing and constructing the new instrument, which at its core includes 5,000 minuscule “fiber positioner robots” that aim DESI’s sensors at precise locations in the night sky. “It has been a long journey from the first ideas almost 10 years ago,” Honscheid said. “After years of design, construction, commissioning and endless project reviews, we completed arguably one of the most complex astronomical instruments ever built with more than 500,000 parts in the focal plane alone.” Honscheid said.

Read the rest of the story here: ***artsandsciences.osu.edu/news/desi-project-begins-operation-help-ohio-state-faculty-researchers***



DESI’s 5000 spectroscopic “eyes” can cover an area of sky about 38 times larger than that of the full moon, as seen in this overlay of DESI’s focal plane on the night sky (top). Each one of these robotically controlled eyes can fix a fiber-optic cable on a single object to gather its light. The gathered light collected from a small region in the Triangulum galaxy (bottom) by a single fiber-optic cable (red dot) is split into a spectrum (bottom) that reveals the fingerprints of the elements present in the galaxy and aid in gauging the distance to the galaxy. The test spectrum shown here was collected by DESI on Oct. 22. (Credit: DESI Collaboration; Legacy Surveys; NASA/JPL-Caltech/UCLA)

UNDERGRADUATES

UNDERGRAD RESEARCHER NASHAD RAHMAN GRADUATES ON A HIGH NOTE

Physics undergraduate Nashad Rahman had big plans to work on laser experiments in summer 2020. But of course COVID-19 changed all that. Out of an abundance of caution, the social distancing guidelines at Ohio State did not allow undergrads to participate in lab research during summer 2020. The timing was especially unfortunate because Nashad was going into his senior year.

Undeterred, Nashad got a tip that HEDP faculty member Chris Orban, a theorist, might be a potential advisor for a simulation project.

“I wasn’t necessarily looking to take on another student,” says Orban, “but I felt like I should do something to help minimize the impact of COVID-19 on our students. That, combined with Nashad’s experience coding in python and other languages, made it an easy decision for me to advise him over the summer.”

The two met regularly over zoom and exchanged messages over slack about setting up and running Particle-in-Cell simulations on a local computer cluster and at the Ohio Supercomputer Center. The project focused on an idea to enhance ion acceleration in ultra-intense laser experiments through an unusual setup that involves focusing two laser pulses on the same target so that the two beams constructively interfere.

The paper is published in *Physics of Plasmas:* ***doi.org/10.1063/5.0045320***

“To my surprise, we found that the two-pulse setup enhanced ion acceleration even more than other authors’ simulations had found. No one has yet done an experiment using this approach, so it was an exciting result,” says Orban, describing the work.

Orban and Nashad worked together along with postdocs Gregory Ngirmang and Joseph Smith to write up the results.

“I have never before in my career put an undergrad as first author on an academic paper, but Nashad worked so hard on the project, including running dozens of simulations and creating all the plots for the paper that it felt like the right thing to do,” said Orban. The group recently received news that the paper is accepted for publication by the journal Physics of Plasmas.

In addition, Nashad also received recognition in Ohio State’s Denman Forum, placing 3rd in the category “Innovations in Technology, Mathematics and Physics.” He graduated with a BS in physics in May 2021 with research distinction.

Rahman says, “I am incredibly grateful for Professor Orban providing me with this opportunity. It started off as a couple simulations we were running to explore the results of another paper, but quickly evolved into an entire research endeavor. Professor Orban has helped me every step of the way and has been extremely generous with his time and has encouraged me to follow my curiosity and conduct my own simulations. I would have never been able to conduct the simulations or write the paper without the help of Professor Orban, Dr. Gregory Ngirmang and Dr. Joseph Smith.”

THREE PHYSICS MAJORS RECOGNIZED AT THE 26TH ANNUAL DENMAN RESEARCH FORUM

We are proud to announce three physics majors were recognized at the 26th annual Denman Research Forum on April 7-8. Over 180 students presented in 21 categories and 63 winners were recognized. Arts and Sciences had the most students participating, and the physics students listed below with their faculty mentor were recognized as winners in their category.

Eric Fawcett, 1st place in the category of Innovations in Technology, Mathematics, and Physics
Title: Distinguishing Trees via the Symmetric Chromatic Polynomial
Mentor: Sergei Chmutov
Department: Mathematics

Ishan Patel, 2nd place in the category of Medical Technology and Informatics
Title: Detection of Pneumonia Using Machine Learning
Mentor: Richard Hughes
Department: Physics

Nashad Rahman, 3rd place in the category of Innovations in Technology, Mathematics, and Physics
Title: Are two laser beams better than one (with equal energy) for ion acceleration?
Mentor: Chris Orban
Department: Physics

Congratulations to all Denman participants and thank you to those who support undergraduate research.

JACOB BORISON SELECTED AS US ATLAS SUMMER UNDERGRADUATE PROGRAM FOR EXCEPTIONAL RESEARCHER (SUPER)

Jacob Borison, a second-year physics major from Beachwood, Ohio, was selected as one of the US ATLAS Summer Undergraduate Program for Exceptional Researchers (SUPER). The scholarship is funded by the Department of Energy via Brookhaven National Laboratory. The grant of $5,000 provides for 11 weeks of research in the summer.

Borison worked with Professor K.K. Gan in analyzing the optical spectra of vertical-cavity surface-emitting laser (VCSEL) arrays. The arrays are used in the optical electronics for the high-speed data transmission in the high radiation environment of the pixel detector of the ATLAS experiment at the Large Hadron Collider (LHC) at European Organization for Nuclear Research, known as CERN, Geneva Switzerland.

Borison participates in the fabrication of state-of-the-art optical electronics and collects some of the data. Over the summer he will write the program to automate the fitting and measurements of the multiple peaks in the spectra. Automation in the data analysis is critical because there are 16,000 spectra and each spectrum contains about 10 peaks. Any array identified to have a shift in the peaks will not be installed in the detector to eliminate premature failures. Borison’s work therefore ensures that the optical electronics fabricated by Ohio State are of the highest quality and will operate trouble-free for years to come.

Miss Allison Lucas of Cleveland, Ohio, was the previous year’s winner. She also worked with Professor Gan analyzing the LHC data.

DIVERSITY, EQUITY AND INCLUSION

ESTEFANY NUNEZ ORNELAS RECOGNIZED WITH CMS AWARD

Physics graduate student Martha (Estefany) Nunez Ornelas is a vital member of our department and a valued member of our Bridge Program. Estefany's interest in physics was solidified when she attended a "Particle People" program at her high school in Riverside County, CA. Afterwards, she became determined not only to be the first member of her family to obtain a college degree, but also to pursue a career in high energy particle physics. Estefany later enrolled in the University of California, Riverside's physics program and conducted undergraduate research with Professor Bill Gary, a member of the Compact Muon Solenoid (CMS) Detector Collaboration at the Large Hadron Collider (LHC) at the European Organization for Nuclear Research, known as CERN, in Geneva Switzerland. Estefany asked about doing summer research at CERN for more first-hand experience with particle physics research. She was told she could if she secured her own travel funding, which she promptly did through two different research awards.

Estefany came to the Ohio State Physics PhD program via the Ohio State Physics Bridge Program, which works to increase the diversity of the pool of students who can thrive in PhD programs by helping to fill in gaps in preparation and providing active mentoring and support. The Bridge Program seeks students with a determination to overcome obstacles to succeed, which Estefany has clearly demonstrated.

At Ohio State, she joined the research group of Professor Chris Hill, who is also part of the CMS collaboration, and continued pursuing her goal to do cutting-edge research in High Energy Particle Physics. While in residence at CERN in 2020, Estefany did critical work to test important electronics for the CMS experiment, resulting in her winning a 2020 CMS Award from the CMS Collaboration. The award announcement states: "CMS Awards aim to recognize individuals who have made outstanding contributions to the strength of CMS and who have given or are currently giving substantial and excellent contributions to the project and construction of the CMS sub-detectors." Estefany's CMS Award citation reads: "Martha Estefany Nunez Ornelas - For her outstanding contribution to the CSC LS2 testing of the post-refurbishment electronics and of the new generation trigger mother board. Her contribution was crucial to avoid any delay in the CSC LS2 upgrade that was the main driver of the whole CMS LS2 schedule."

URSA 2022 participants and facilitators at the end-of-program ceremony. Students received a certificate of completion to mark their time in the program after presenting their group projects to each other and select physics/astronomy faculty.

UNDERGRADUATE RESIDENTIAL SUMMER ACCESS (URSA) PROGRAM

After many months of effort by multiple individuals in the Departments of Physics and Astronomy, Polaris welcomed 15 new undergraduate physics and astronomy students at a welcome dinner in the Physics Research Building atrium on Aug. 7. It was just one piece of an intense two-week program known as URSA, the Undergraduate Residential Summer Access program.

Committed to fostering a sense of community and belonging among physics and astronomy's underrepresented students, URSA pairs a packed academic program with a calendar of social events. URSA participants were introduced to the world of exoplanet astrophysics through a combination of lectures, labs and group work, culminating in a research poster session where student groups presented the results of a project of their choosing. When not exploring exoplanets, URSA participants partook in activities to acquaint them with Ohio State, such as a campus-wide scavenger hunt, team building exercises and a weekend trip to Cedar Point. The program was a success, and student feedback has been overwhelmingly positive. Polaris looks forward to hosting URSA again in summer 2022.

APS-IDEA AT OHIO STATE PHYSICS

The American Physical Society Inclusion, Diversity and Equity Alliance (APS-IDEA) is a community-wide effort to work with the physics community to strengthen its efforts to improve equity, diversity and inclusion (EDI). Funded by the APS Innovation Fund in 2019, APS-IDEA convened representatives from about 30 physics departments, laboratories and research collaborations for an initial workshop June 12-13, 2020, to establish an online learning community, and, more broadly, form a community of practice with the goal of transforming the culture of physics. Since that time, it has grown to over 100 institutions which include experimental collaborations. As in any emerging subfield of physics, progress towards a more inclusive physics community will be accelerated by collaboration, sharing of promising practices, and grounding the work in research. APS-IDEA was created to support the physics community's efforts to improve EDI.

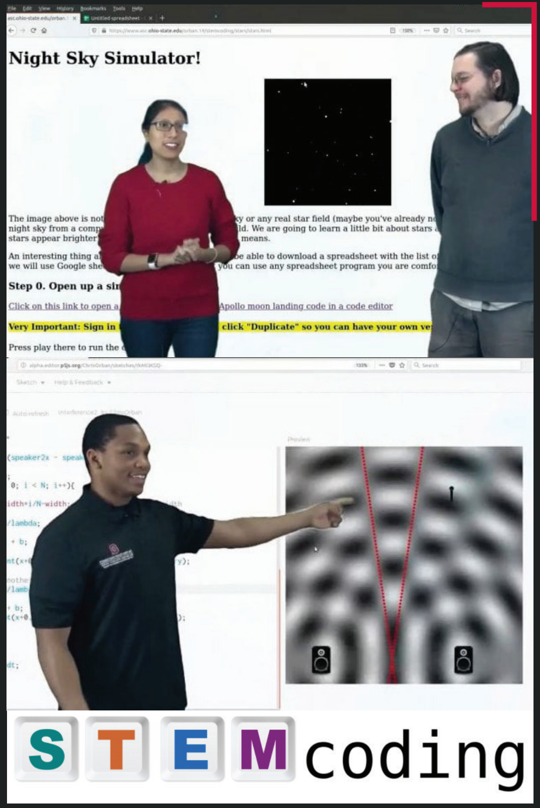
The Ohio State University Department of Physics was selected as part of the first 2020 cohort for the APS-IDEA Network. This international network of physics departments and labs will work together to develop and implement long-term plans to increase the equity, diversity and inclusiveness of individual departments and the field overall, utilizing best practices for institutional change. The Ohio State team includes undergraduates, graduate students, postdocs, staff and faculty, committed to working together and with the department on this important path to the future.

Our team held very well-attended virtual town hall meetings in 2020, and we look forward to continuing this practice. Our hope is that the town halls have served as an introduction and basis of discussion to changing department culture and will encourage the departmental communities to think more deeply and specifically about what the culture is and what it can be.

DR. BEATRIZ E. BURROLA GABILONDO NAMED TO APS EDI FELLOW PROGRAM

Despite the growing number of curricula, seminars and workshops providing resources for physics educators to address EDI in their classrooms, many physics educators are hesitant to engage in critical conversations due to lack of facilitation skills, fear of burdening minoritized students and/or fear of causing harm due to lack of expertise. The APS EDI Fellows Program seeks to address the gap between available EDI resources and physicists' lack of expertise in critical conversations by training a cohort of physicists and pairing them with critical conversation specialists to present interactive workshops that address fear and build capacity for physicists to engage in EDI conversations. Addressing equity, diversity, and inclusion (EDI) in physics is a prominent goal of the APS Strategic Plan.

Dr. Beatriz E Burrola Gabilondo has been named an EDI Fellow, and will be trained in how to foster EDI discussions in the classroom. The EDI Fellows, in partnership with the Curriculum Development Team (CDT), will develop and facilitate subsequent workshops for physics educators interested in building capacity to do EDI work in their classrooms.



The STEMcoding Project helps teachers through a difficult year

In 2017, Prof. Chris Orban worked with Ohio State physics alum Dr. Richelle Teeling-Smith to launch the STEMcoding Project which had a goal to help teachers thoughtfully integrate computer science into high school physics and physical science classes. Since then the two have worked to create innovative classroom content/videos and train teachers both inside and outside Ohio.

The years 2020 and 2021 were a busy time for the STEMcoding Project as teachers relied on their content more than ever as a solution for distance learning. Prof. Orban worked to improve their "physics of video games" activities and Prof. Teeling-Smith's students at the University of Mount Union recorded new videos for the STEMcoding youtube channel ***(youtube.com/c/STEMcoding)*** and for the hour of code ***(hourofcode.com)***. Interest in the STEMcoding Project has grown so much that in 2020 Orban and Teeling-Smith launched a non-profit called STEMcoding Education Ohio ***(stemcoding.github.io/)*** to better serve students and teachers.

To learn more about Prof. Orban's work with the STEMcoding Project, you can follow him on twitter or instagram @STEMcoding.

■ Read more about the STEMcoding Project at: ***u.osu.edu/stemcoding***

TIM XIA

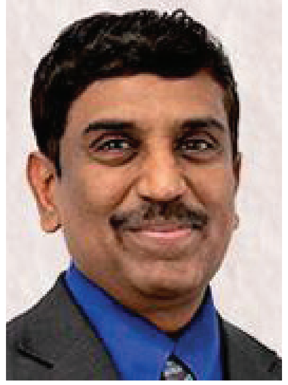
MS Physics ’86 PhD Physics ’90
Johns Creek, GA

Tim Xia is partner at Locke Lord, LLP. He devotes his practice to foreign and U.S. intellectual property and corporate matters, devising unique solutions for their matters. Xia counsels clients in all phases of intellectual property law, including U.S. and foreign patents, trademark and copyright prosecution, patentability, clearance, infringements, validity, licensing, patent portfolio development and management, and litigation. Xia is a co-chair of the firm’s International Transactional Practice where he also focuses on significant international corporate matters. Xia also serves on the Dean’s Advisory Committee (DAC) in the College of Arts and Sciences at Ohio State.

If you had any advice to offer current physics students, what would it be?
My advice is to take full advantage of the most rewarding education environment on Earth, which is the Department of Physics of The Ohio State University. No matter what career path you’re planning — being a particle physicist, a high school teacher or a patent attorney like me — please take as many classes as possible across the spectrum: astronomy, biophysics or condensed matter physics. A clear path will appear in front of your eyes for you to pursue after you climb up to the mountains of knowledge. Also, please visit your professors and TAs during their respective office hours, where you perhaps may learn more from them than from the classroom. Last but not least, please enjoy campus life beyond books, and the classroom. Scream in the ’Shoe, bike or walk along the Olentangy River banks in a summer evening and look up to the sky to find stars and think about the meaning of life.

Next, we know you’ve been involved as a member of the Deans Advisory Council: Why do you think it’s important to stay involved with one’s college?
We are whom we are mainly because of the nurturing and educations we receive from family, community and education institutions. Staying involved with one’s college is just a small way to give back to the institutions we benefited a lot from.

As a member of DAC you’ve been able to get an insider view: What excites you most about the current state of the university, college or Department of Physics?
Ohio State has been known as a world-class educational and research institution, where knowledge has been passed and created from generation to generation. Ohio State, however, has not been known as a place to utilize the knowledge, ideas and discoveries its faculty and students generated over years to benefit the society. I’m really excited by the fact the current university administration has put the “Innovation District” project as a priority, which will create unimaginable new education, research, entrepreneur and commercial opportunities for the university, city of Columbus, and in particular, the faculty and students.



SAILESH CHITTIPEDDI

MS Physics ’87; PhD Physics ’88;
San Jose, CA

Sailesh Chittipeddi became executive vice president and general manager of IoT and Infrastructure Business Unit of Renesas in July 2019. Renesas is a Japanese company involved with research, development, design, manufacture, sale and servicing of semiconductor products. Before joining Renesas, he served as executive vice president of global operations and CTO of IDT, with an additional focus on corporate growth and differentiation. Prior to joining IDT, Chittipeddi was president and CEO of Conexant Systems and served on its board of directors, and he began his career at AT&T Bell Laboratories. Chittipeddi has earned 64 U.S. patents related to semiconductor process, package and design, and he has had nearly 40 technical articles published.

If you had any advice to offer current physics students, what would it be?
My advice to physics graduates is the same as it would be to any other graduates: Make learning a life-long experience. Regardless of whether you choose to go into academic research or industry, the ability to adapt and learn in the face of new information is a key ingredient for success.

There’s been a lot in the news recently about the semiconductor industry being able to keep up due to the chip shortage. Do you see this changing any time soon, and how should we prepare to avoid this in the future?
Expect it to continue well into 2022. Given the manufacturing cycle for semiconductors is fairly long, it will take a while to get demand and supply in balance. Also, capacity expansions currently planned will take at least until 2H2022 before they are online.

Why should physics students consider industry as a career pathway?
Physics at its very best explains the laws governing nature using mathematics as a language of expression. What could be more exciting than that? The innate curiosity of most physicists is applicable to the widest range of areas in industry and academia from engineering to artificial intelligence. Look at several of the leaders in the science and technology fields across nations, and they started out as physicists. The ability to foster continuous learning places physics in the forefront of most academic fields.

MICHAEL COUGHLIN

MS Physics ’69 MBA ’70
Mission Hills, KS

Mike Coughlin is the founder, president, CEO, and CFO of ScriptPro. The company’s initial product, the SP 200 Robotic Prescription Dispensing System, pioneered the use of robotics in community pharmacies. Today, ScriptPro offers a comprehensive line of over 150 pharmacy automation and management system products that have revolutionized pharmacy operations in the U.S., Canada and many other countries.

If you had any advice to offer current physics students, what would it be?
I would suggest they get some exposure to the world of business. Even just a little bit will help. It will open their eyes to a larger world and probably come in handy someday. I would also point out that the skills of abstraction developing in the study of physics will be valuable in approaching problems in any field. It would be good to try out these skills in other areas (such as business) along the way.

What was your inspiration to start ScriptPro?
I admire the beauty of rigorous technical solutions when used to meet practical needs of people working to get complex jobs done. This is of paramount importance in health care where a seemingly small error can lead to disaster for a patient. When I saw, and confirmed, the data on error rates in medications dispensing, I knew that a powerful robotic solution combined with accurate and up-to-date medication data and integrated systems to make it all work in a busy retail environment was needed.

Where do you see the pharmaceutical industry going in the next decade?
The mapping of the Human Genome Project, completed in 2003, sparked the rise of a new approach to developing drugs. The resulting specialty pharmacy industry is still in its infancy. There are many exciting milestones that lie ahead. Most of these developments arise in small companies that need venture capital to get started and pursue their ideas. Hopefully this model will continue to flourish. If U.S. government interference destroys the model, as has been threatened, progress will be stymied — not just for the U.S., but for a world that has come to depend on the U.S. to lead the way in pharmaceutical research. Beyond the subject of pharmaceutical discovery and development, there is the very complex realm of how drugs are used and paid for. The systems to support this realm will need to be developed along with development of the drugs themselves.

Support

We are proud of the work we do in the Department of Physics and we invite you to help us make it better.

OPPORTUNITIES TO GIVE:

Thank you for your support of the Department of Physics at Ohio State. If you wish to make a donation to enhance our work and create opportunities for our students, please consider directing your contribution to one of the highlighted funds listed below:

Undergraduate Support
***Alva Smith Memorial Fund* / 606708**
Promotes and recognizes high standards in scholarship among undergraduate physics majors

Graduate Student Support
***Physics Graduate Assistance Fund* / 316001**
Assists graduate students in the department with vital expenses not covered by other scholarship awards. Students may receive awards more than once.

Research
***Physics Graduate Research Fund* / 312254**
Provides support for research and related expenses for graduate students in physics.

***Biard Scholarship Fund* / 640449**
Undergraduate research scholarship(s) to a student(s) enrolled in the College of Arts and Sciences, Division of Natural and Mathematical Sciences, majoring in physics.

Diversity and Inclusion
***Graduate Bridge Program Funds* / 315288**
Provides programming, operational, research and/or scholarship support for the Physics Bridge Program in the Department of Physics. The MS to PhD Bridge program at Ohio State strives to enhance the diversity of qualified applicants to physics PhD programs.

Physics Chair Discretionary
***Physics Chairman’s Discretionary Fund* / 302325**
Provides the chair with the flexibility to fund small but urgent academic and research priorities as well as the ability to host important community building events within the department.

For a full list of funds and ways you can give to support the department, visit: ***physics.osu.edu/giving-opportunities/physics-development-funds***

Physics by the numbers

55 / Faculty
55 / Staff (Administrative, Research and Facility, Instructional)
37 / Postdocs

208 Graduate students with about **30-40** PhDs each year
436 Undergraduate majors with **102** physics and engineering physics majors on track to graduate during 2021-2022
80% of Undergraduates participate in research or internships
5 Endowed faculty positions

1 / Rhodes Scholar
1 / Marshall Scholar
2 / Churchill Scholars
6 / Fulbright Scholars
22 / Goldwater Scholars
19 / NSF Graduate Fellows
30 / American Physical Society Fellows
11 / American Association for the Advancement of Science Fellows
1 / New Horizons Prize
1 / Onsager Prize
1 / Schawlow Prize
12 / University Distinguished Scholars or Professors
15 / University Distinguished Teaching Awards
28 / Faculty having won young investigator awards

FACULTY NEWS

2020-21 AWARDS

Professor Andrew Heckler Named APS Fellow
Professor of physics Andrew Heckler was named a 2021 Fellow of the American Physical Society for his "substantive contributions to research in physics education through the integration, application and dissemination of the practices, constructs and theoretical frameworks of cognitive science into high-quality scholarship advancing the field's understanding of physics learning and teaching." He was nominated by GPER.

Associate Professor Antonio Boveia Wins Undergraduate Teaching Award
Professor Tom Humanic surprised associate professor of physics Antonio Boveia during a virtual undergraduate studies committee meeting to announce Boveia had received the 2021 Physics Undergraduate Teaching Award. This award is given annually and is voted on by undergraduates. Boveia taught Physics 1251H during spring of 2021.

Professor Chris Hirata Awarded 2021 Distinguished Scholar Award
In March of 2021 Christopher Hirata, professor in the Department of Physics and the Department of Astronomy, received the Distinguished Scholar Award. Hirata is widely known for his theoretical breakthroughs in cosmology, high-precision cosmological measurements and intensive technical studies of space telescopes and detectors. He is a leading theory-to-pixels expert on weak gravitational lensing, which uses subtle distortions of galaxy shapes to measure dark matter clustering and probe the physics of the universe. His accurate, meticulous calculations of the cosmic recombination epoch — approximately 30,000 years after the Big Bang — furthered scientific understanding of key moments in the universe's infancy.

Assistant Professor Brian Skinner Receives CAREER Award from NSF
Assistant professor of physics Brian Skinner received the Faculty Early Career Development Award (CAREER) from the National Science Foundation (NSF). The CAREER Program is a foundation-wide initiative that offers the NSF's most prestigious awards in support of early-career faculty who have the potential to serve as academic role models in research and education and to lead advances in the mission of their department or organization. The award is a continuing grant from the National Science Foundation for his project "CAREER: Electrical and Thermoelectric Transport Beyond the Metal/Insulator Paradigm."

Professor Tin-Lun (Jason) Ho Awarded TOPTICA BEC Lifetime Award
The newly established TOPTICA BEC Award for Lifetime Achievements 2021 recognizes longstanding important contributions to the field. Tin-Lun Ho, Distinguished Professor of Mathematical and Physical Sciences in the Department of Physics, was the inaugural awardee of the Lifetime Achievement Award for his longstanding broad contributions to our understanding of ultracold quantum gases, including his pioneering works on spinor condensate, fast rotating quantum gases, universal thermodynamics of strongly interacting Fermi gases, cooling mechanisms, measuring algorithms in quantum simulation and spin-orbit coupled gases.

"The Elastic Vacuum:" Professor Samir Mathur Receives Prestigious Award from Gravity Research Foundation
The Gravity Research Foundation awarded Professor Samir Mathur first prize for his essay, The Elastic Vacuum. The Gravity Research Foundation encourages scientific research and to arrive at a more complete understanding of the phenomenon of gravitation through its annual awards for essays on gravitation with the expectation that beneficial uses will ensue.

Stamatikos Awarded Top Prize in Astrophysics
For the third time in his career, Ohio State -Newark Assistant Professor Michael Stamatikos has received the prestigious Bruno Rossi Prize from the American Astronomical Society's High Energy Astrophysics Division (HEAD). HEAD awards the Bruno Rossi Prize annually for significant contributions to high energy astrophysics, with particular emphasis on recent, original work.

Associate Professor Michael Stamatikos Recognized as Engaged Scholar
Michael Stamatikos was selected as the Community Engaged Scholar for October 2021 by Ohio State Outreach and Engagement. Find the feature here: ***engage.osu.edu/engaged-scholars-michael-stamatikos***.

Amy Connolly Awarded the 2019-2020 Susan M. Hartmann Mentoring and Leadership Award
Professor Amy Connolly has been awarded the 2019-2020 Susan M. Hartmann Mentoring and Leadership Award. This award recognizes a faculty member, staff member or student from within the College of Arts and Sciences who has demonstrated outstanding mentoring to and/or leadership on behalf of women or other historically underrepresented groups at the university.

Professor Michael Poirier Receives a 2020 Lumley Interdisciplinary Research Award
Professor Michael Poirier received a 2020 Lumley Interdisciplinary Research Award from the Ohio State College of Engineering. The accolade recognizes the interdisciplinary research contributions of up to three faculty and research staff per year and is made possible by an endowment established by John H. and Mildred C. Lumley.

Professor Ciriyam Jayaprakash Receives 2020 Alumni Award for Distinguished Teaching
Professor Ciriyam Jayaprakash received one of 10 2020 Ohio State Distinguished Teaching Awards. He was surprised in his classroom by representatives from the Office of Academic Affairs, the Alumni Association and the department. A former student wrote, "Professor Jayaprakash is by a large margin the best educator I have had in my five semesters at Ohio State. What really sets him apart as an educator was how he went beyond the subject material. Professor Jay really strove to not just teach us the course subject matter, but to make us better physicists, problem solvers and more well-rounded thinkers".

Professor John Beacom Receives National Postdoctoral Association 2020 Mentor Award
Physics and Astronomy Professor and CCAPP Director John Beacom has received the National Postdoctoral Association's 2020 Garnett-Powers Association Inc. Mentor Award, which annually recognizes a single faculty member in the U.S. who has engaged in exceptional mentoring of postdoctoral scholars. Dr. Beacom was presented with the award at the NPA's annual conference in San Diego.

Professor Michael Lisa Named 2020 Distinguished Scholar
Professor Michael Lisa received the 2020 Distinguished Scholar Award, which recognizes and honors six Ohio State faculty members annually who demonstrate scholarly activity, research or other creative works which represent exceptional achievement in their fields. Recipients of the award receive a $20,000 research grant and a $3,000 honorarium to pursue their scholarly activity.

Professor Michael Lisa Receives Fulbright Scholar Research Grant
Physics Professor Michael Lisa was awarded a 2019-2020 Fulbright Scholar Research Grant, which funded his research at the Universidade Estadual de Campinas - Instituto de Fisica in Campinas in Brazil. His research project was "Exploring Extreme Vortex Formation in High Nuclear Collisions".

Associate Professor Yuanming Lu Awarded Outstanding Young Researcher Award
Associate Professor Yuanming Lu was recently awarded the Outstanding Young Researcher Award (OYRA Macronix Prize) by the International organization of Chinese Physicists and Astronomers (OCPA) for "his leading theoretical investigation on the topological phases in strongly interacting systems."

Professors Yuri Kovchegov and Nandini Trivedi Elected Fellows of The American Association for the Advancement of Science (AAAS)
"Being named a Fellow of AAAS is a special honor that recognizes leading scientists and innovators," said Gretchen Ritter, executive dean and vice provost of the College of Arts and Sciences. "The election of these new AAAS Fellows is a mark of distinction for Ohio State and the College of Arts and Sciences."

Professor Michael Lisa Wins Undergraduate Teaching Award
Professor Michael Lisa was surprised by Professor Robert Perry with the 2020 Physics Undergraduate Teaching Award. This award is given annually and is voted on by undergraduate Physics and Engineering Physics majors. Dr. Lisa taught Physics 1250H during autumn 2019.

Professor Mike Lisa Elected Fellow of The American Association for the Advancement of Science (AAAS)
In November, 2021, the AAAS Council elected 564 members as Fellows of AAAS. Election as a Fellow honors members whose efforts on behalf of the advancement of science or its applications in service to society have distinguished them among their peers and colleagues.

Associate Professor Michael Stamatikos Awarded Teaching Excellence Award
The Thomas J. Evans Teaching Excellence Award is presented annually "to recognize individuals doing excellent teaching and to stimulate excellence in teaching." Recipients are selected by a committee of previous winners, faculty appointed to the Professional Standards Committee, and if possible, students appointed by the Student Senate Committee. Ohio State Newark students, faculty, administrators and alumni may make nominations. The 2021 Teaching Excellence Award in the category Pre-tenure was awarded to Michael Stamatikos (Physics).

Professor Mohit Randeria awarded 2022 John Bardeen Prize
Professor Mohit Randeria was awarded the John Bardeen Prize "for contributions to the theory of the BCS-BEC crossover, for providing theoretical understanding of angle-resolved photoemission experiments on superconducting and pseudo gap phases of the cuprate superconductors, and for providing rigorous bounds on the superconducting transition temperature in two-dimensional materials."

Professor John Beacom Named 2022 Distinguished Scholar
Professor John Beacom has been awarded The Distinguished Scholar Award, which is among the highest annual honors Ohio State bestows on a faculty member in recognition of outstanding scholarly activity, research or creative works. This university-level award is awarded by the Enterprise for Research, Innovation and Knowledge.

PROMOTIONS

Jay Gupta: Promoted to Full Professor (2021)
Antonio Boveia: Promoted to Associate Professor (2021)
Chris Orban: Promoted to Associate Professor (2021)
Michael Stamatikos: Promoted to Associate Professor (2021)

IN MEMORIAM

Dr. William Saam, Professor and Chair 1941-2020
William F. Saam, age 78, passed away on Saturday, July 18, 2020, at Kobacker House. William was born on Nov. 14, 1941, in Butte, Montana. He earned his bachelor of science from the California Institute of Technology and his master of science and doctorate in physics from the University of Illinois. After graduation, he did a fellowship in Germany and another in France. William joined the Department of Physics faculty in 1970. He was appointed department chair in 1996 through his retirement in 2008. He served as chair of the Midwest Physics Chairs and was a Fellow of the American Physical Society and American Association for the Advancement of Science.

The Ohio State University

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