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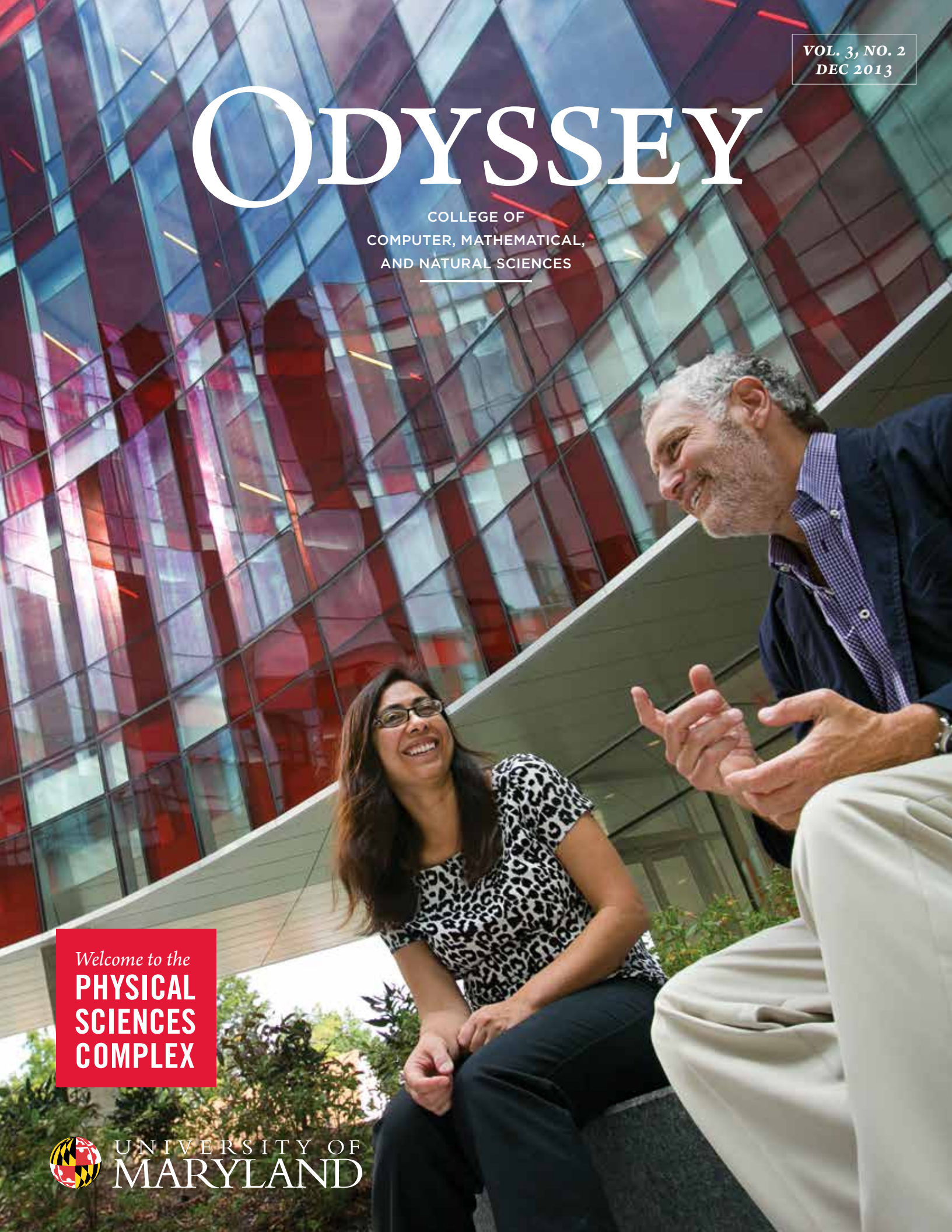
ODYSSEY

COLLEGE OF
COMPUTER, MATHEMATICAL,
AND NATURAL SCIENCES



Welcome to the
PHYSICAL SCIENCES COMPLEX

UNIVERSITY OF MARYLAND

"The fences are down, and the keys are in hand to the new Physical Sciences Complex."

Dear Friends,

Increasingly, our university embraces interdisciplinary research across departments, colleges and institutions. The most recent addition to the CMNS infrastructure is an excellent example of the university's commitment to cross-disciplinary work. This fall, the fences are down, and the keys are in hand to the new Physical Sciences Complex. This extraordinary facility will house faculty members and researchers, including student researchers, from physics, astronomy, the Institute for Physical Sciences and Technology, and the Joint Quantum Institute. The spectacular building, including its laboratories with exquisite controls, will attract collaborators from NIST, a major government partner, as well as NASA and NIH. We are especially grateful for the work of Jordan Goodman, Steve Halperin, Dan Mote, and other college and university leaders who pushed hard to make this exemplary facility a reality.

Collaboration is alive and well in virtually every area of the college. In this issue, we present a snapshot of climate change research across disciplines. Much of the research is carried out in collaboration with government agencies, including NOAA, NASA and USDA.

We are pleased to profile two accomplished scholars, Michael Fisher and Jim Yorke, who excel in their pursuit of interdisciplinary science. We present inspiring conversations with them in this issue of *Odyssey*. In addition, we celebrate many CMNS colleagues who have been recognized for their contributions to the university.

The college continues to attract increasing numbers of undergraduate students. The latest figures show that CMNS enrolls the largest number of undergraduate student majors among all colleges and schools at UMD (more than 4,400 students). The newest undergraduate major in atmospheric and oceanic science is now more than 50 students strong, and several student research projects are highlighted in this issue. Our Department of Computer Science has seen a 90 percent increase in enrollment in the last five years. You can read more about the department's innovative efforts to transform the educational experience for students in this issue of the magazine.

We take great pride in our continuing achievements, which reflect your investment in the future of the college. We remain indebted to you—our alumni, friends and well-wishers—for your invaluable support of and dedication to our college.

Jayanth Banavar
Dean

ON THE COVER

PHYSICS FACULTY MEMBERS JORDAN GOODMAN AND ARPITA UPADHYAYA ARE SURROUNDED BY THE ELLIPSE OF THE PHYSICAL SCIENCES COMPLEX. PHOTO BY JOHN T. CONSOLI.

CORRECTION
ON PAGE 14 OF THE MAY 2013 ISSUE OF *ODYSSEY*, WE FAILED TO INCLUDE EUGENIA KALNAY'S FULL TITLE: SHE IS DISTINGUISHED UNIVERSITY PROFESSOR AND EUGENIA BRIN PROFESSOR OF DATA ASSIMILATION.

ODYSSEY

Odyssey is published twice a year for alumni, friends, faculty, staff and students of the College of Computer, Mathematical, and Natural Sciences.

Alumni notes are welcome.
Please send them to *Odyssey*, CMNS Dean's Office, University of Maryland, 2300 Symons Hall, College Park, MD 20742. Send information by fax to 301.314.9949 or by email to mkearney@umd.edu.

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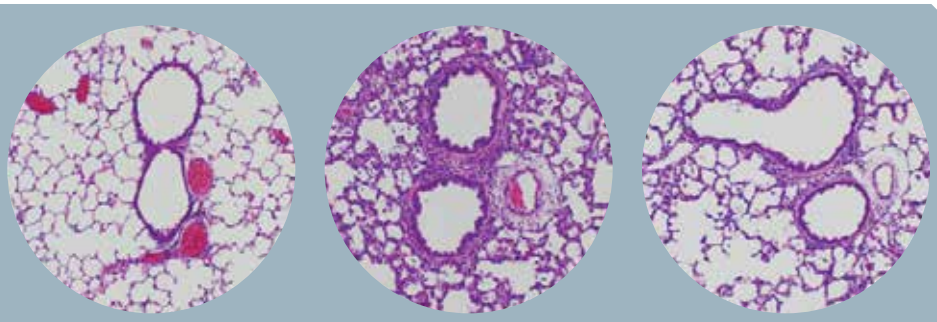
A New Twist in Tackling the Flu

Flu season is here, along with the latest set of flu vaccines to keep us all healthy in the months to come. University of Maryland School of Medicine Immunologist **Stefanie N. Vogel**, B.S. '72, Ph.D. '77, microbiology, is exploring a potentially potent flu remedy that follows a different course of action. Instead of targeting the virus, Vogel and her group have tried to interfere with an overzealous host immune system.

Vogel's group investigated Eritoran, a drug previously tested as a sepsis treatment, as a potentially potent anti-influenza medication. "Because Eritoran made it to Phase III clinical trials, we know a good deal about how this drug works," describes Vogel. "We also know that it has an excellent safety record." In lab studies with mice infected with a mouse strain of influenza, 90 percent of mice that were not treated with Eritoran died compared with only 10 percent of those given the drug for five days beginning two days after infection. The study was published in *Nature* earlier this year.



STAINED SECTIONS FROM COTTON RATS SHOW ERITORAN TREATMENT IMPROVES LUNG PATHOLOGY OF H3N2-INFECTED RATS.

Scientists have long speculated that some severe influenza cases are not the direct result of the virus, but may be due to an overactive immune system that leads to numerous inflammatory substances being released in the whole body that, in turn, result in multiple organ failure. Previous studies have indicated that the process may be triggered by the activation of a molecule called Toll-like receptor 4 (TLR4), which is blocked by Eritoran.

Surprised by the attention her recent research has received, Vogel acknowledges, "We did take an unusual approach by focusing on the host immune response." The studies are now moving to the "gold standard" for animal models. "We are working with cotton rats that are susceptible to human influenza strains, and we expect to progress to ferrets that transmit disease by aerosol." The latter studies will be carried out with Daniel Perez, associate professor of virology at UMD, who is a leader in avian flu research.

The Importance of a Strong Mentor

Vogel's brief stint as a technician at Walter Reed Army Institute of Research in its viral diseases department led her to the field of immunology. "I discovered that I was not as interested in the specific organism but, rather, in the host response to infection," she recalls. After completing her Ph.D. in microbiology at UMD, she served a postdoctoral fellowship at the National Institute of Dental Research, Laboratory of Microbiology and Immunology. In 1980, she joined the Uniformed Services University of the Health Sciences as an assistant professor, rising to the rank of professor in her 22-year career there.

Vogel joined the Department of Microbiology and Immunology at the University of Maryland School of Medicine in 2002 to increase opportunities to conduct translational research. During her career, Vogel has mentored more than 10 Ph.D. students and 35 postdoctoral researchers. She claims the key to professional success is a strong mentor, and she has never forgotten her early mentors.

STEFANIE N. VOGEL IS LEADING GROUNDBREAKING RESEARCH ON A NEW FLU TREATMENT.

"I remain in touch with my doctoral advisor Bob Roberson," says Vogel. "He was a remarkable mentor who always found time for us despite his many teaching and administrative obligations."

An even earlier mentor was her undergraduate math tutor and future husband, Richard L. Vogel, Jr., who obtained his B.S. from the Clark School of Engineering and his M.B.A. from the Smith School of Business. "I was in a calculus class that consisted mainly of engineering students. When I approached the instructor for help, she turned to Rich and said, 'You will tutor her.'" The rest is history.

The Maryland connection runs deep in the family. Their daughter, Sarah, received her B.S. from the Smith School and has worked for Booz Allen Hamilton for nearly 10 years. Their son, Andrew, earned his B.S. and M.S. in mechanical engineering from the Clark School, where he is now pursuing his Ph.D. in the same department. "Our children were accepted at top public and private schools around the country, and they chose Maryland," explains Vogel.

When her parents died, Vogel knew the best way to honor them. Today, the Stefanie and Richard Vogel Graduate Student Award Fund in Memory of Anne DeStefano Nucci and Elidio John Nucci supports graduate students who study host responses to infectious agents. The Vogels are also loyal supporters of the Clark School, where they have established similar graduate stipends. ■

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Vogel photo courtesy of UM School of Medicine

GREAT SCIENCE HAPPENS HERE

Photos by John T. Consoli

By Nancy Grund

PHYSICAL SCIENCES COMPLEX OPENS ITS DOORS

It has been more than 15 years in the making, and this fall the college's dreams and aspirations for a state-of-the-art research facility have become a reality as the Physical Sciences Complex (PSC) opens its doors. One of the largest building projects in University of Maryland history in both size and cost, the complex promises to be one of the nation's premier research buildings.

With more than 160,000 square feet of space for collaborative efforts that cross CMNS departments and nearby federal agencies, the PSC is the long-awaited home for leading researchers who are making ground-breaking discoveries about the universe, quantum physics and the battle against disease. "Science is social," explains Professor Drew Baden, chair of the physics department. "This building will allow intellectual currents to flow, and our goal is to generate an explosion of ideas." Many of those ideas will be generated in the PSC's nearly 50 laboratories, more than half of which were constructed to meet the stringent requirements associated with the National Institute of Standards and Technology (NIST) Advanced Measurements Lab, one of the most sophisticated labs in the country for quantum research.

The new facility will house the Joint Quantum Institute (JQI), a partnership with NIST; the Joint-Space Science Institute, a partnership with NASA-Goddard Space Flight Center; and a growing collaboration between the college's Institute for Physical Science and Technology (IPST) and the National Institutes of Health. This fall faculty members and researchers began moving their labs and offices into the complex, which has been supported by university, state and federal funding.

"The University of Maryland is a recognized leader in the physical sciences, and this building provides the perfect setting for scientists and students from around the world to pursue research and make exceptional contributions to the field," says CMNS Dean Jayanth Banavar. "The Physical Sciences Complex further validates the university's position among the world's elite research institutions. We can only begin to imagine all of the great ideas this new facility will inspire."

"SCIENCE IS SOCIAL. THIS BUILDING WILL ALLOW INTELLECTUAL CURRENTS TO FLOW, AND OUR GOAL IS TO GENERATE AN EXPLOSION OF IDEAS."

—DREW BADEN

Quality of Facility Now Matches Quality of Research

For years, JQI researchers have pieced together labs and jostled equipment in less than optimal settings to conduct the highest level of quantum physics research. Just ask physics graduate student Ben Reschovsky, who in 2010 was recruited to JQI to study ultra-cold atoms. Reschovsky, who currently works in a conference room that was retrofitted as a lab in the Computer and Space Science (CSS) Building, admits, "Temperature stability issues are probably our biggest challenge as laser systems are easily perturbed by small changes in temperature and humidity." Last winter, when the HVAC system malfunctioned in the CSS Building, Reschovsky's work was seriously delayed. "These kinds of challenges are exactly what the PSC will address. I can imagine a 10 to 20 percent increase in research productivity," he attests.

JQI Co-director Steve Rolston agrees. "We often spend many hours realigning experiments due to temperature and humidity changes. We still conduct good research, but it is inefficient," explains Rolston. "With the PSC, the quality of our research is no longer out of sync with the quality of our facilities."

Another key asset of the facility is its ability to help attract the best and the brightest undergraduate, graduate and postdoctoral students. "At least 80 percent of all undergraduate physics majors participate in a research project that can last from one semester to several years," explains Baden. "This space will give our students a more complete research experience."

Katie Hergenreder, B.S. '15, physics, is one of those students who is looking forward to working in the PSC. "Right now, our cramped lab is in the basement of the CSS building where we have one optics table that fills the entire room. We created shelves to provide more room, but it is not ideal for work with lasers," explains Hergenreder, who is participating in photon-ion research. "The new lab will give us the space and equipment to construct the experiment safely and more efficiently." Hergenreder predicts that students will enjoy the landscaped plaza and open space inside the building. "There are so many places to meet and talk and plenty of conference rooms that could be used for group study."

Faculty Input Guides Process

With so many expectations riding on the new facility, CMNS faculty members were committed to ensuring that the PSC laboratories met the long list of requirements for advanced research. "We looked at other universities that had constructed research buildings, and we learned from their experiences," explains Jordan Goodman, former chair of the physics department. One valuable lesson: Faculty involvement in the process is key, from selecting the architect to reviewing construction progress.

Physics Professor Fred Wellstood, who was involved in early discussions about the building as a former associate chair of the physics department, is the project's faculty liaison, working alongside CMNS and university capital projects staff; representatives from HDR Inc., the project's engineering, architecture and consulting firm; and contractors from Gilbane, Inc., a real estate development and construction company. "This building raised the bar in terms of faculty input," says Wellstood, who met regularly with faculty colleagues and weekly with the construction team during the three-year construction phase. "I was always impressed by the level of professionalism and the ability of the construction management team to resolve issues that were raised on a daily and weekly basis."

BY THE NUMBERS

- 160,246 SQUARE-FOOT COMPLEX
- 57,000 SQUARE-FOOT PLAZA
- 3,000 SQUARE-FOOT LOBBY
- 7 STORIES WITH 2 UNDERGROUND LEVELS AND 5 LEVELS ABOVE GROUND (WITH THE LOWEST LEVEL 50 FEET BELOW THE PLAZA)
- 27 TYPE II LABS IN BASEMENT AND SUB-BASEMENT (PRIMARILY LASER AND CONDENSED MATTER LABS)
- 18 TYPE I LABS ON UPPER FLOORS (PREP OR WET LABS)
- 8 TYPE I LABS DEDICATED TO BIOPHYSICS
- 12 CONFERENCE ROOMS, WITH 12 KITCHEN AREAS
- 97 FACULTY OFFICES
- 1 CAFE

The pressure was on HDR, Inc. to construct the most technically sophisticated laboratories. "We knew this building had to mitigate internal vibrations and those from the surrounding area to ensure all of the sensitive equipment was operating properly," says Michael Vinkler, HDR's senior associate and the project manager. "The bigger and heavier the mass, the better, so this building is a reinforced concrete structure. All columns and beams are concrete, not lighter-weight steel."

Baden recalls how the design process broke new ground in the way facility staff and faculty members form partnerships. "The job of campus facilities staff was to complete the building on time, on budget and to specification," Baden says, while the faculty goals were to build "a fantastic building" that would attract the highest caliber of individuals to campus. "We knew if we want to attract Nobel Prize winners, this building must be a jewel, which means sweating the details." As a result, Baden says, "The PSC will do for science buildings what Camden Yards did for baseball," noting how the Baltimore baseball facility raised the standard for constructing sports stadiums worldwide.

RAJ ROY (CENTER) USES ONE OF THE BUILT-IN WHITEBOARDS LINING MANY OF THE PSC'S CORRIDORS TO ILLUSTRATE HIS POINTS IN AN IMPROMPTU DISCUSSION.

DESIGN INNOVATIONS FOSTER RESEARCH BREAKTHROUGHS

The PSC was planned and designed to provide a comfortable, welcoming environment for all CMNS students and faculty, with laboratories that can accommodate the most sensitive scientific experiments.

The building is LEED certified "Silver" and contains various sustainable features including:

- Underfloor HVAC distribution system in the office areas for more efficient heating and cooling.
- A sophisticated lighting control system that meets the latest energy code criteria.
- A ground water reclamation system for the storage and use of water in the building's sanitation system.
- A green roof, the first such roof designed on a campus building. This system allows the university to meet the state of Maryland's new environmental regulations for protecting the Chesapeake Bay.
- Solar shades act as visors on the exterior of the building and serve as screens on the building's interior to reduce sun exposure. Vertical fins on the glass provide additional sun protection.

KEY PSC FEATURES:

- A spiral staircase provides easier access between the second and third floors, allowing clear lines of sight between floors, which further promotes collaboration and integration.
- Public areas around the ellipse and corridor walls on all floors offer writing surfaces for students and researchers to jot down notes and problem solve on whiteboards and chalkboard-painted walls.
- Faculty offices are separated by "fritted" tempered glass, not cinder block walls, to add to the transparency and open feel of the building without compromising privacy.
- A specialized redundant air system provides up to nine air exchanges an hour in some labs.
- All concrete reinforcing bars (rebars) in the lower levels of the building are epoxy coated to prevent radiofrequency (RF) current from running through them. Electrical panels and wiring are shielded to avoid RF and electromagnetic interference.
- Additional effort was made to reduce the electromagnetic interference created by the movement of elevators. To protect the lower-level laboratories, multiple continuous sheets of silicone iron were applied in layers to the inside walls of the elevator shaft to contain the electromagnetism created by a moving elevator car.
- To accommodate all types of mechanical equipment, the basement labs include 22-foot ceilings with a 14-foot clearance.
- Utility corridors line one side of the basement and sub-basement labs with pedestrian corridors on the other side. The utility corridors house pumps, vacuums, gas tanks and electrical panels, providing easy access for researchers to modify lab utility requirements. Many of the building's utility systems run through the corridor spaces.

NEW COMPLEX HELPS ATTRACT NATION'S TOP PHYSICISTS TO JQI

From a scientific perspective, JQI Co-director Charles Clark attests that the PSC labs offer "the best space available for quantum measurement." That space translated into a tremendous advantage for JQI in its recent recruitment of the nation's top two experimental condensed matter physicists to UMD.

In 2014, Vladimir Manucharyan, a junior fellow in the Society of Fellows of Harvard University, and James R. Williams, the Karl van Bibber Postdoctoral Fellow in the Department of Physics at Stanford University, will join JQI. "Jimmy and Vlad were arguably the top two candidates in their field in the last year, and it is a significant accomplishment that we could attract them to UMD in the face of extremely tough competition with top-tier universities in the country," says JQI Co-director Steve Rolston.

VLADIMIR MANUCHARYAN

When making his decision to accept a position at JQI, Manucharyan cited the expertise of current faculty members in quantum information science as well as the PSC's technical superiority and enhanced lab space as important factors. Williams agrees, "To do the best physics, you need the best facilities, there's no way around it." Williams also attests to the benefits of locating JQI researchers in close physical proximity. "There is a certain ambition among young researchers, a youthful energy here. We believe we can dominate this field."

"TO DO THE BEST PHYSICS, YOU NEED THE BEST FACILITIES, THERE'S NO WAY AROUND IT."

Manucharyan received his Ph.D. from the Department of Physics at Yale University. Prior to his appointment at Harvard, he was a research assistant at Yale and the Landau Institute for Theoretical Physics. "My research is related to harnessing the quantum-mechanical behavior of microscopic objects, such as electrons in atoms, to store and process information more efficiently than macroscopic, classical computers," he explains. At Harvard, he provided evidence that controlled manipulations of superconducting quasiparticles may be possible in the near future.

JIMMY WILLIAMS

Williams received his Ph.D. in applied physics from Harvard University. As a postdoctoral researcher at Stanford, he managed a team pursuing research on two-dimensional materials where electrons elude conventional make-up and can take on more exotic forms: complex oxide materials, topological insulators and graphene. His work furthered the investigation of unconventional behavior of superconducting devices based on a topological insulator. ■

A Signature Campus Complex

Strategically nestled between the CSS and the IPST Buildings, directly across from North Campus residence halls, the structure and its grounds serve as both a gateway to campus and a bridge between disciplines. "When you enter the complex from the north side, you walk through a slightly elevated, landscaped plaza which creates a perfect walkway. Outdoor seating allows for faculty, students and staff to meet, relax and have lunch," says CMNS Assistant Dean for Facilities Tom McMullen, who has overseen the project from design inception to the final stages of construction. "This building is a part of campus that everyone will participate in."

Entering from either side of the plaza, the glass-walled lobby on the ground floor is equipped with tables, chairs and comfortable couches. A nine-panel display of 55-inch monitors, totaling 150 by 90 inches, will air multiple high-definition video along with audio in the main collaboration space in the lobby. A single monitor will be placed in the nearby lobby cafe. "We designed the lobby with undergraduates in mind—the furniture is comfortable, laptops can be plugged in everywhere, and there is breakout space for student groups and faculty," says McMullen, who notes that most of the meeting spaces include whiteboards or chalkboard walls. The university will purchase the bulk of new furniture for the building from the state through Maryland Corrections Enterprises, one of the top 10 prison industry programs in the country.

While the entire building is designed to generate scientific discussions, groundbreaking research will occur in state-of-the-art laboratories, many of which were constructed to exact standards for humidity control, constant to within one percent; temperature control, constant to about 0.5 degree Celsius; and isolation against vibration—all of which are critical to the validity of quantum research. The labs used primarily for research involving atoms and lasers (Type II), are located some 50 feet below the plaza to provide environmental stability and reduce radiofrequency (RF) interference and electromagnetic variations. To further prevent electromagnetic interference, telephone connections are made through fiber optics, and electrical wiring is transported through insulated conduits installed in the basement labs. To reduce static electricity, anti-static materials were used in the flooring. Wet labs (Type I) on the first floor give researchers greater access to electric power along with proper ventilation and equipment to perform basic soldering tasks.

The structure's most visible element and its aesthetic hallmark is a multi-story, elliptical glass cone extending from ground level to the roof and sky beyond. The cone consists of 953 separate pieces of glass, all of which are original in shape and size. A checkerboard effect is achieved by red film (UMD red) laminated between select pieces of glass. Passing through the center of the building, the cone provides natural light for the collaborative space. "The ellipse area is spectacular," says Stuart Vogel, chair of the Department of Astronomy. "It gives you a sense of activity and will foster spontaneous discussions between researchers from different groups and departments." At the base of the ellipse in the center of the plaza is the beautifully landscaped Gluckstern Garden, which was funded by a generous gift from Liz Nuss, Ph.D. '81, Education, in memory of her late husband, Robert L. Gluckstern, a physicist, educator and former UMD chancellor.

Photos provided by V. Manucharyan and J. Williams

THE GLUCKSTERN GARDEN IS A PERFECT SETTING FOR A QUIET CONVERSATION.

ABOVE LEFT: TOM MCMULLEN GIVES A TOUR OF THE PSC.

ABOVE RIGHT: THE GROUNDS OF THE PSC SERVE AS A GATEWAY TO THE CAMPUS.

BELOW: PHYSICS STUDENTS KATIE HERGENREDER AND BEN RESCHOVSKY STROLL ON THE GREEN ROOF, THE FIRST OF ITS KIND DESIGNED FOR A CAMPUS BUILDING.

At the Forefront of Collaboration and Discovery

At a time when the boundaries between scientific disciplines are blurring and researchers regularly tap the expertise of colleagues in diverse fields, the PSC places the university front and center in that interdisciplinary arena. "All research today must be conducted with eyes and ears open for connections between disciplines," says Raj Roy, IPST director. "The most interesting science will occur at that intersection."

Rolston recalls, "When the Joint Quantum Institute was created in 2006, we always had the feeling that to be truly successful all the researchers from NIST and UMD needed to be in one location." More than two dozen NIST fellows and staff members moving full time to the PSC have been looking forward to vibrant discussions that are sure to ensue with campus colleagues, according to NIST Physicist and JQI Co-director Charles Clark, an adjunct professor in physics at College Park since the early '90s. "This facility gives NIST a substantial outlying location that is accessible to visitors to the Washington, D.C. area," says Clark.

Vogel is confident the PSC will strengthen the college's growing partnership with NASA Goddard as well. "This space will act as a magnet to attract scientists to campus for workshops and conferences and provide a wonderful environment for developing new ideas and collaborations."

Arpita Upadhyaya, an assistant professor in physics, biophysics and IPST, is most looking forward to working in an environment surrounded by a variety of colleagues. "I am eager for the cross-talk about our work that can spawn new ideas," says Upadhyaya, whose research relies heavily on high-resolution microscopy to understand the physical properties of cells and how they interact. "Working in a brand new lab with the very latest equipment is so exciting for our students as well."

As faculty and researchers make the big move this fall, attention is already turning to the next phases of the building. "Phase I of the Physical Sciences Complex was constructed with the idea that we would extend the building," explains Vinkler, who notes that the east side concrete foundation wall is designed to allow for the removal of existing concrete to directly connect to Phase II of the building. "Our intention is to maintain the integrity of the PSC by designing the additional phases as an integration of one design, not a compilation of annexes to the original structure." Planning is well underway for Phase II, which will bring together the rest of the physics department and other science activities within CMNS.

Looking forward, Baden acknowledges, "We very much appreciate the resources the state has entrusted to us. Every dollar of sponsored research funds generates additional economic activity for the state," he notes. The physics and astronomy departments received more than $50 million in research funding in 2013, and faculty members anticipate the complex will help garner even greater levels of support for CMNS research activities. "The PSC is a good deal for everyone: the state, faculty members, the university and our students," Baden adds.

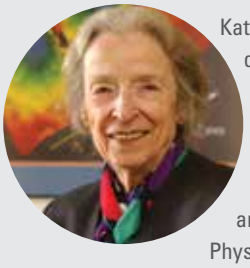
Christopher Lobb, director of the Center for Nanophysics and Advanced Materials, expresses a sentiment shared by the entire CMNS community. "This is a very exciting time for science at Maryland. We all agree we must keep the momentum going." ■

SUPPORT THE PHYSICAL SCIENCES COMPLEX

ALTHOUGH CONSTRUCTION OF PHASE I OF THE PHYSICAL SCIENCES COMPLEX IS NEARING COMPLETION, OPPORTUNITIES REMAIN TO SUPPORT SCIENTIFIC RESEARCH AND DISCOVERY BY FUNDING A SPACE IN THE BUILDING. A NUMBER OF PROMINENT LOCATIONS ARE STILL AVAILABLE TO BE NAMED—FROM INDIVIDUAL LABORATORIES TO OPEN COLLABORATION SPACES. FOR MORE INFORMATION, CONTACT ANDREA MORRIS, ASSISTANT DEAN FOR DEVELOPMENT AND ALUMNI RELATIONS, AT AEMORRIS@UMD.EDU.

PSC STRENGTHENS NIST PARTNERSHIP

Katharine Gebbie Advocated for JQI and New Facility



Katharine Gebbie, a founding director of NIST's Physics Laboratory and Physical Measurement Laboratory who played a major role in the creation of the JQI and the development of the Physical Sciences Complex, is more than pleased to see the project come to fruition. "NIST and UMD have attracted high-caliber scientists to JQI, and will certainly continue to do so with the wonderful new complex," says Gebbie, who credits former CMNS Dean Steve Halperin and the college's leadership team with having the vision and management expertise to see the building to completion. "The university's investment in this facility speaks to its commitment to JQI and the highest level of research."

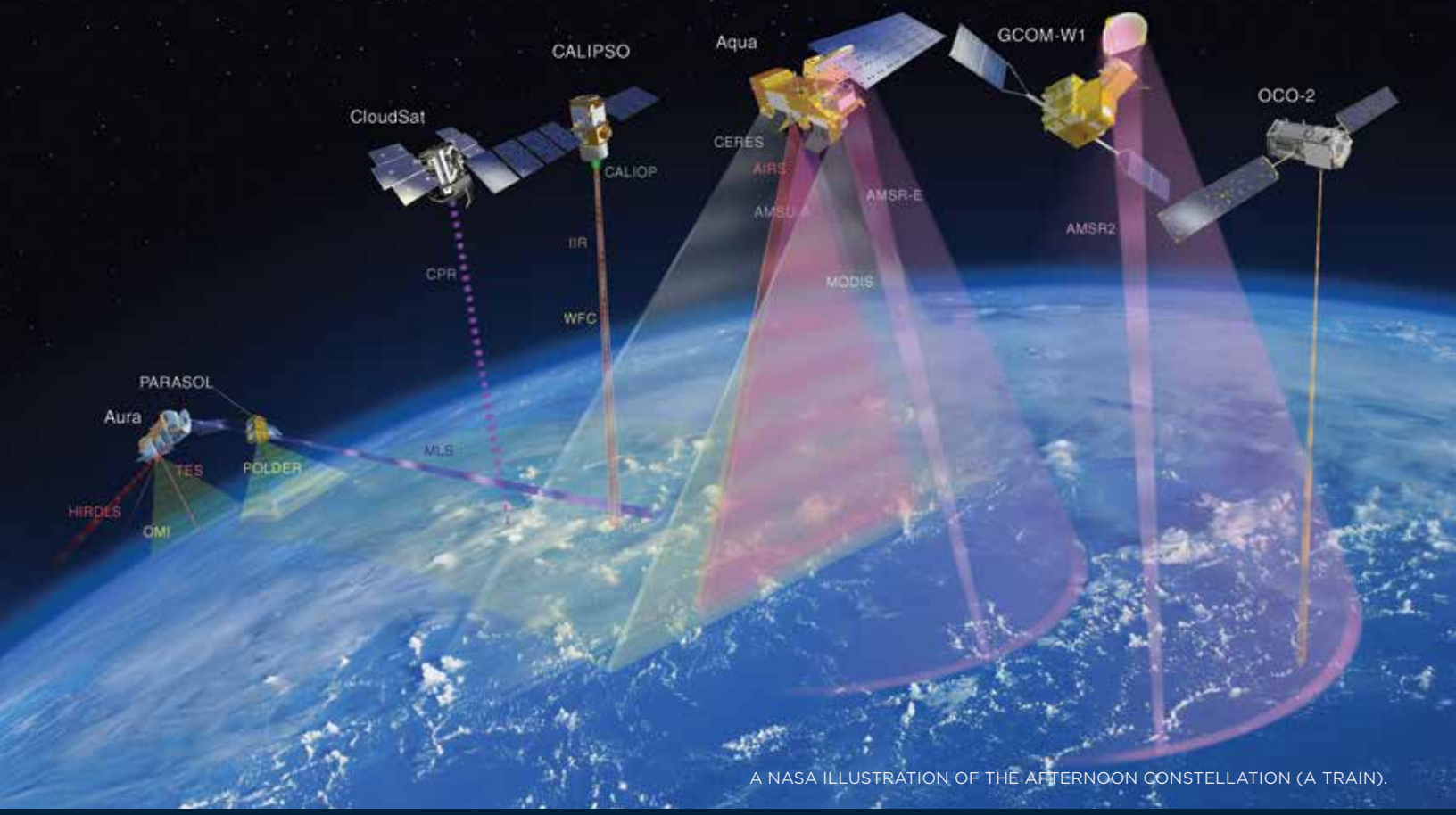
Gebbie began her career as an astrophysicist and the first female fellow at JILA, formerly known as the Joint Institute for Laboratory Astrophysics, which is a joint venture between NIST Boulder and the University of Colorado Boulder. She is a strong advocate of university and federal agency partnerships, which can leverage the agency's mission by providing a critical mass of scientists in any given field. "Through JQI, more scientists are exploring coherent quantum phenomena than either NIST or the university could support on its own," says Gebbie.

A major force in the field of physics, Gebbie has received many of the nation's top scientific honors, including the Women in Science and Engineering Lifetime Achievement Award. She is a fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science, the American Physical Society and the Washington Academy of Sciences.

Gebbie follows in the footsteps of her accomplished aunt, Katharine Burr Blodgett, the first female to receive a Ph.D. in physics from Cambridge University and the first female researcher at the General Electric Company. A graduate fellowship in physics at UMD in honor of Dr. Blodgett seeks to enhance the diversity of talented students interested in the field of physics. The fellowship was established as "an open fund capable of receiving additional contributions." If you are interested in supporting the fellowship, contact Andrea Morris, assistant dean for development and alumni relations, at aemorris@umd.edu. ■

Photo provided by K. Gebbie

Remote Sensing *to the* Rescue



A NASA ILLUSTRATION OF THE AFTERNOON CONSTELLATION (A TRAIN).

Researchers Mine Satellite Data for Critical Answers to Climate Change Questions

By Beth Panitz

HUNDREDS OF MILES ABOVE US, ROVING LABORATORIES SCAN EARTH, collecting sophisticated clues about climate change. Closer to home, CMNS researchers scan the satellite data generated by this remote sensing equipment to learn more about global and regional climate change trends and patterns.

ZOOMING IN ON CHINA

Zhanqing Li, a professor in the Department of Atmospheric and Oceanic Science and the Earth System Science Interdisciplinary Center (ESSIC), is analyzing the dramatic weather patterns of the last half-century in his native China to improve our understanding of climate change. In the last 50 years, temperatures have cooled slightly in Eastern China, while warming in other regions. The Northern region has faced drought, while the South has coped with flooding thunderstorms.

During the same time period, China has undergone a manufacturing boom that has led to increased pollution, including a rise in aerosols. Tiny aerosol particles may have a huge effect on our climate, says Li, with far-ranging impact, from the amount of radiation that reaches Earth to the type of clouds that are formed. To analyze the effects, Li relies, in part, on sophisticated remote-sensing technology aboard a collection of seven U.S. and international satellites. Called the Afternoon Constellation, or A Train, the seven satellites fly within approximately 30 minutes of each other, generating joint measurements that provide an unprecedented sensor system for Earth observations.

The CloudSat and CALIPSO satellites, which both joined the A Train in 2006, offer insights into the interactions between aerosols and clouds. Using radar technology, CloudSat acts like an X-ray machine for clouds. CALIPSO probes the vertical structure and properties of thin clouds and aerosols using LIDAR, a technology that determines distances by analyzing the reflected light from laser pulses.

After analyzing the satellite data, Li found that increased pollution leads to fewer but thicker clouds associated with heavy thunderstorms. The number of heavy rain days has increased by 10 percent in Eastern China in the past 50 years, while drizzly days decreased 5 percent. "This is a real concern," warns Li. "Heavy storms wash away the soil, and don't allow for water absorption and effective utilization of the water." The change in weather could have serious implications for the water and food supply in this highly populated area, advises Li.

MAPPING THE GRAVITY FIELD

Atmospheric and Oceanic Science Professor Sumant Nigam is unraveling the reasons for China's South-Flood, North-Drought pattern as well as the drying of the Gangetic Plain, the agricultural heartland of India. As a starting point for his research, Nigam must gather accurate rainfall data—a challenging task in this part of Asia, which is home to the world's highest mountains. With many uninhabitable areas across the Tibetan Plateau and the Himalayas, rainfall data is sketchy at best. To fill in the gaps, Nigam and his colleagues rely on data supplied by the Gravity Recovery and Climate Experiment Mission (GRACE). A partnership between NASA and the German space agency, GRACE uses twin satellites to map the Earth's gravity field, tracking monthly changes.

When the gravitational pull changes at a specific location, it often indicates variations in groundwater stores, an indirect measure of antecedent precipitation levels. It also provides information about how much groundwater was pumped out for irrigation. "Hydrologists are finding that human uptake of ground water is proceeding at an alarming rate across Asia," says Nigam. "We are depleting stores much more rapidly than we can replenish them, especially with the declining summer monsoon rainfall trend."

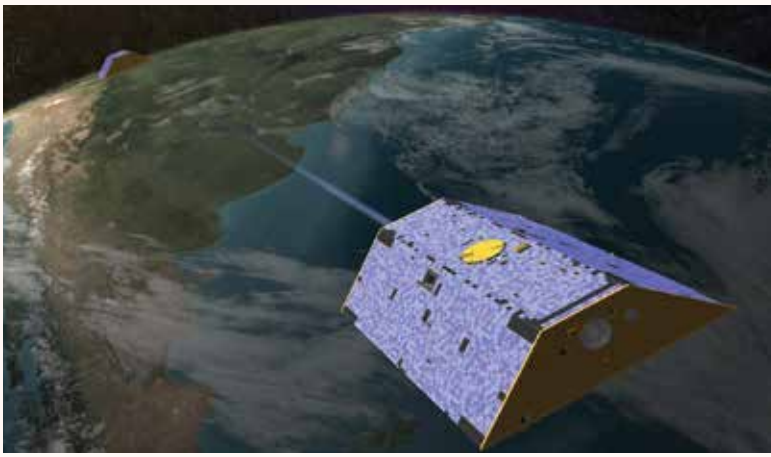
While the GRACE data help identify how hydroclimate conditions are changing in Asia, Nigam is still working to find the root cause of the changes. Aerosols have been advanced as a likely cause, but Nigam hypothesizes that natural variability of sea surface temperatures in the Pacific and Indian Oceans also plays a role. "There is the natural cycle, and on top of that is the human imprint," says Nigam, who admits scientists are still sorting one from the other.

MEASURING LAKE LEVELS

One of the newest ways to monitor climate change is to track variations in lake water levels. Charon Birkett, an associate research scientist with ESSIC, helped pioneer the use of radar altimeters to study the rise and fall of lakes, information that serves as a proxy for precipitation measurements.

From satellite perches, altimeters have measured sea surface levels around the globe for nearly 40 years. These remote-sensing instruments calculate measurements by clocking the time it takes for radar pulses to travel from the satellite to the water's surface and then back to the satellite receiver.

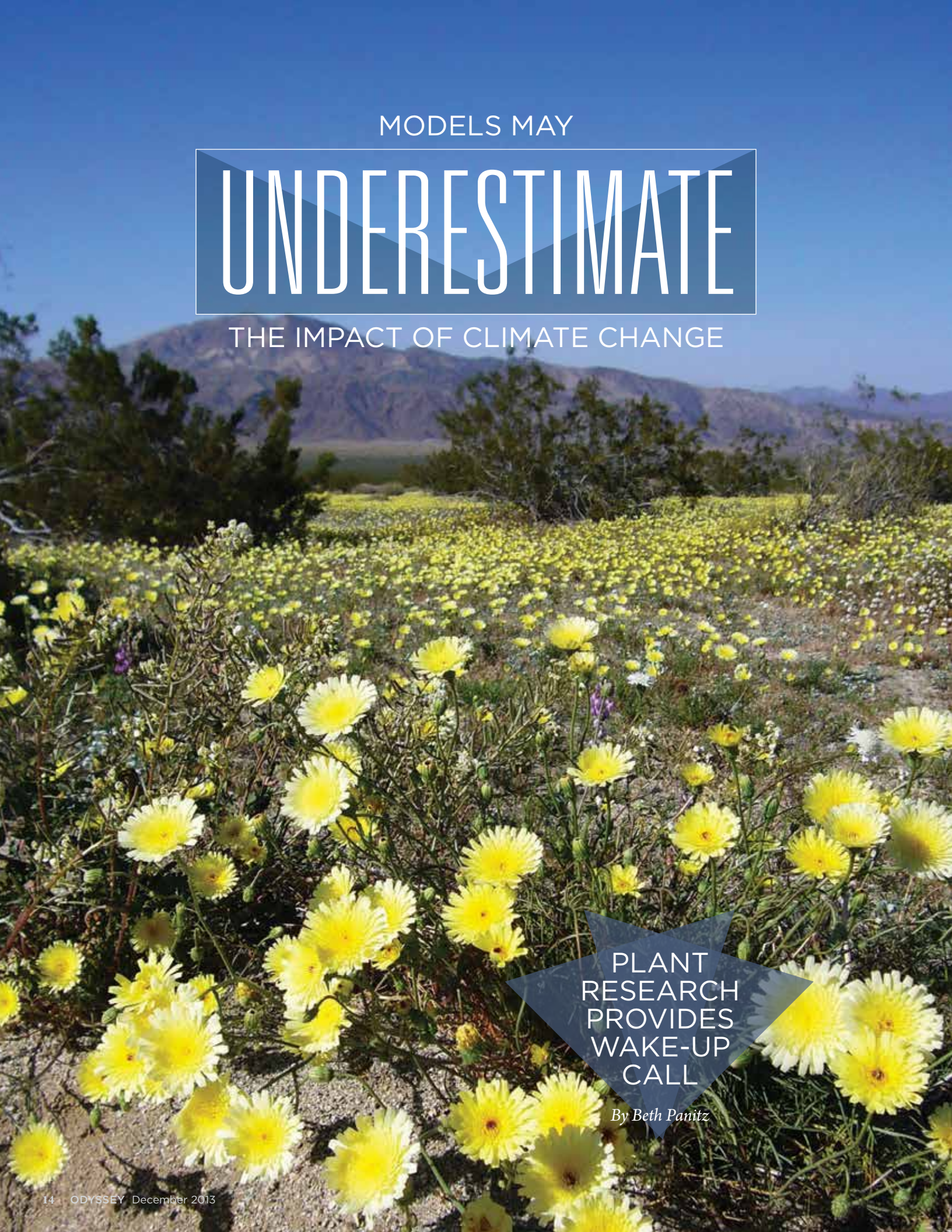
The technology, originally designed for oceans, works best over large, flat areas of water. Through a European Space Agency project in the early 90s, Birkett explored whether altimeters could yield information about smaller bodies of water. "We began to find the data were good over select areas inland," she says.



THE TWIN SATELLITES OF GRACE MAP THE EARTH'S GRAVITY FIELD.

Today's altimeters have been tweaked to enhance their performance over inland waters. Birkett leads a U.S. Department of Agriculture/NASA project to analyze altimeter data, producing near real-time data for large lakes and reservoirs. While the information is largely used to monitor water resources worldwide, climatologists are examining some 20 years of data to shed light on climate change. With breakthroughs in altimeter technology projected within the decade, including NASA's upcoming Surface Water and Ocean Topography mission, Birkett expects scientists will soon have richer data sets to enhance climate change monitoring. ■

A Train illustration by NASA / GRACE illustration by NASA/JPL-Caltech



MODELS MAY

UNDERESTIMATE

THE IMPACT OF CLIMATE CHANGE

PLANT RESEARCH PROVIDES WAKE-UP CALL

By Beth Panitz

The discussion and debate around climate change is taking a new turn. CMNS researchers are raising key questions about the validity of certain data sets. Their work indicates that, in some cases, climate models and experiments may underestimate the effects of climate changes on the environment.

Warming temperatures may play more havoc on plant life cycle events than previously predicted, says Nathan Kraft, an assistant professor of biology. For at least 20 years, researchers have known that global warming impacts phenology—the seasonal timing of recurring events in plant and animal life—prompting plants to flower and leaf earlier than they have historically, explains Kraft.

To better understand this effect, scientists conduct experiments in which they artificially warm a community of plants with overhead infrared lamps, ground heaters or open-top chambers. Even though researchers have used the data for decades to extrapolate plant responses to climate change, they have never extensively tested whether the experiments sufficiently mimic nature until now, according to Kraft.

An international working group of scientists, including Kraft, recently compared the data from short-term warming experiments with long-term observational data about the phenology of plant communities in nature. The researchers were alarmed to find a mismatch. "What was surprising is that the experiments tended to underpredict the severity of the changes that have been charted in nature through long-term observations," says Kraft. The team published its findings in *Nature* in 2012.

NATHAN KRAFT IS ANALYZING THE DIFFERENCES BETWEEN LAB EXPERIMENTS AND OBSERVATIONAL DATA TO PINPOINT THE EFFECTS OF GLOBAL WARMING ON EVENTS IN PLANT AND ANIMAL LIFE, INCLUDING THE FLOWERING AND LEAFING OF PLANTS.

The warming experiments lowball the advances in the timing of flowering and leafing by more than eightfold and fourfold, respectively. For example, observational data indicated that warming a plant community by 1 degree Celsius caused plants to flower four to five days earlier, while the experimental data predicted flowering occurred roughly one day early. Even when only comparing species found in both the experiments and the natural plant communities, the experiments predicted that warming would have less impact than was actually observed in nature.

"This is a wakeup call," says Kraft. "Researchers need to think more carefully about how they design these experiments," he says, pointing out that changes in additional factors like precipitation and increased pollution over the course of the long-term observations may contribute to the discrepancies.

Ecologists are concerned that shifting phenology could affect the entire ecosystem. "If a pollinator, such as a hummingbird or butterfly, is also sensitive to changes in temperature, but not to the same degree as a host plant, a plant could flower at a time when its pollinator is not present," says Kraft. This mismatch in timing could negatively impact pollinator populations as well as reduce the reproductive success of the associated plants.

THE RESEARCHERS WERE ALARMED TO FIND A MISMATCH... WARMING HAS A GREATER IMPACT THAN EXPERIMENTS PREDICT.

HOW ONE ECOSYSTEM CHANGE LEADS TO ANOTHER

Not only does global warming impact vegetation, but the opposite may be true. Changes in vegetation can escalate climate change in some regions of the world, says Ning Zeng, an associate professor in atmospheric and oceanic science. His research shows that climate change may affect subtropical regions more severely than previously projected due to complex interactions of the atmosphere-land-vegetation-ocean system.

Warmer temperatures in the subtropics lead to increased evaporation, explains Zeng. As the soil becomes arid, vegetation naturally decreases. "This change in the ecosystem can come back to modify the climate, making it even drier," says Zeng, whose research explores this feedback mechanism.

With less vegetation, the surface reflects more sunlight. Scientists refer to this phenomenon as "increased albedo," and Zeng's model shows it could have dire effects. "Increased albedo reduces the monsoon strength and further weakens the moisture supply that comes from the ocean," he explains. The result: drier conditions with even less vegetation. The cycle continues, and the desert widens. The research leads Zeng to anticipate a far greater increase in desert areas than predicted by the Intergovernmental Panel on Climate Change (IPCC) in its 2007 Fourth Assessment Report.

A typical IPCC model simulation shows an increase in the world's "warm desert" area of 2.5 million km^2, or 10 percent, from 1900 to the end of the 21st century. "In a more realistic simulation where the vegetation-albedo feedback is allowed to interact, the warm desert area expands by 8.5 million km^2, or 34 percent," says Zeng. He projects an expansion of the world's major subtropical deserts such as the Sahara, the Kalahari, the Gobi and the Great Sandy Desert, and has recommended that the vegetation-albedo feedback be included in future IPCC climate projections. ■

Photo by Nathan Kraft

COMPUTER SCIENCE EDUCATION FOR TOMORROW

With nearly 1,400 undergraduate students majoring in computer science, faculty members in the department are exploring how to provide the optimal learning experience tailored to student needs. This fall, thanks to the generosity of two key donors, a radical transformation in teaching practices has begun that will allow the department to teach students in ways that address the needs of the rapidly changing work world.

Computer Science Professor Emeritus Bill Pugh, Jr. has pledged $500,000 as seed money for the Computer Science Education for Tomorrow initiative, committing to donate $100,000 per year for up to five years contingent on a one-on-one match by other donors. Phillip H. Horvitz, B.S. '75, Computer Science, a trustee of the University of Maryland College Park Foundation, has stepped forward to provide the first $100,000 matching grant.

"This is a pivotal time for education, in general, and computer science in particular," says Pugh, who was a UMD faculty member for 22 years before retiring to become a software developer and entrepreneur. "Innovations in pedagogy, technology and data mining have opened up lots of possibilities. I'm thrilled to be able to supply some of the impetus and funding to allow the department to be part of this excitement." A Packard Fellow and former consultant to Google, Pugh invented Skip Lists, a randomized data structure widely taught in undergraduate courses, and FindBugs, a code analysis tool.

Horvitz, chief technology officer at URS Apptis, Inc., is a pioneer in computing innovation and a longtime supporter of computer education and UMD. He previously established the Phillip H. and Catherine C. Horvitz Professorship in computer science, a research fellowship fund and a graduate assistant fund. The large lecture hall in the Computer Science Instructional Center is named in his honor.

"In many ways, we still teach classes the way we did 40 years ago," says Samir Khuller, chair of the Department of Computer Science. "Our enrollments are going through the roof, and we struggle to offer students a personalized experience. Using current technology, we can do a better job delivering materials and prompting more lively, informed discussions."

At the heart of the department's initial strategy is the "flipped classroom model" in which professors make lectures available before class—often videotaped lectures that can be viewed online. Class time can then be devoted to hands-on projects and group activities tailored to student learning styles and levels of understanding. As the project progresses, the department anticipates implementing broader innovations through new technology, new partnerships and new courses.

Engaging Students in the Learning Process

Ben Bederson and Adam Porter, computer science professors with appointments in the University of Maryland Institute for Advanced Computer Studies, are leading the transformation. Bederson, special advisor to the UMD provost on technology and educational transformation, is teaching "Pathways to Computer Science," an introductory course for non-majors and the first programming course many students take. Porter is teaching "Programming Handheld Systems," which covers mobile phone application development.

"Educators have known for a long time that the lecture format is not the best way for students to learn," explains Bederson. "In medical school, students are told: listen, do, teach—then you know you have learned the material. We want to give our students the opportunity for hands-on learning and doing."

In addition to boosting retention rates, Porter adds, "We need to attract and better

HANDS-ON LEARNING AND DOING ARE KEY COMPONENTS OF THE "PATHWAYS TO COMPUTER SCIENCE" COURSE. LEFT: PROF. BEDERSON ASSISTS STUDENTS OGUE ADDEH AND EDISON LIN WITH IN-CLASS ACTIVITIES. BELOW: GRADUATE TEACHING ASSISTANT TAK LEE HELPS STUDENTS SAMANTHA SUPLEE AND POLLY MATZINGER WORK ON A PAIR PROGRAMMING EXERCISE.

BILL PUGH

PHIL HORVITZ

serve under-represented groups, including those with non-traditional backgrounds." A challenge for instructors is the range of knowledge among students enrolled in basic computer science courses. "Some students have been programming since they were 12 years old. Others are new to it. When both types show up for an introductory class, the 'newer' students are at a disadvantage," says Porter. "Mastery-based learning adapts to how students learn and helps identify when it is necessary to give more technology support."

Both instructors are leveraging the success of massive open online courses (MOOCs) to reach students. For Bederson's course, students view class content in advance through a previously recorded lecture in a format similar to MOOCs. "Then we meet once a week for three hours," he explains. "The first third of the class is a shared activity on a timely topic or student presentations; then students work together collaborating on homework; and the last third of the class is spent on assessment."

The mastery-based course moves at a fast pace, and Bederson acknowledges, "This is a total experiment we are piloting." The number of credits earned varies according to students' success in mastering core skills. "If you register for a one-credit course, you have five weeks of work at the regular pace. If you need seven weeks, you can take the exam at that point then register for the second credit. When the semester ends, if students are in the middle of a credit, they can finish it the following semester," says Bederson. Both professors will be working with colleagues in the department to integrate online activities into coursework. "Our goal at the end of this five-year initiative is to offer many of our courses with an online component," says Khuller.

Tu-Anh Ha, B.S. '14, Communications, describes the class as "a blessing." After working as a summer intern at Uber, a technology company that is revolutionizing the transportation industry, she quickly realized that managers at all levels need some basic computer science experience. "This course is a perfect way to get my feet wet and learn a computer science language," says Ha. "Each week we spend time in class working in groups, and we have time to collaborate in class on fun exercises based on what we learn that week."

In yet another pioneering venture, UMD is collaborating with Vanderbilt University to offer a two-part, two-semester MOOC. Porter's course will be adapted as "Programming Handheld Systems with Android" and offered by Coursera as a MOOC, starting in January 2014, with the second section of the course, "Pattern-Oriented Software Architecture," offered by Vanderbilt University later in the spring. Porter's class already has more than 40,000 students signed up. "We will teach the front end of application development, and Vanderbilt will teach the back end that connects to the network. This is the first example of a transinstitutional MOOC." Porter believes that providing the course in both on-campus and online formats creates a cycle in which all versions of the course improve rapidly. ■

SHOW YOUR SUPPORT

IF YOU WOULD LIKE TO HELP ADVANCE THE COMPUTER SCIENCE EDUCATION FOR TOMORROW INITIATIVE, CONTACT ANDREA MORRIS, ASSISTANT DEAN FOR DEVELOPMENT AND ALUMNI RELATIONS AT AEMORRIS@UMD.EDU. FUNDRAISING EFFORTS ARE UNDERWAY FOR THE NEXT $100,000 MATCHING GIFT.

Horvitz photo by Thai Nguyen / Pugh photo courtesy of Bill Pugh / Other photos by Loretta Kuo

TWO YEARS STRONG AND GROWING

AOSC UNDERGRAD PROGRAM FILLS NICHE, PROMOTES STUDENT RESEARCH

Introduced just two years ago, the college's undergraduate major in atmospheric and oceanic science (AOSC) continues to attract a growing number of students. Some 15 incoming freshmen declared AOSC their major in fall 2013, bringing the total number of undergraduate majors to 50. Jeff Stehr, former associate director of the undergraduate program, cites three main reasons for the major's popularity.

"We definitely have the cool factor going for us," says Stehr. "Every student has watched a weather forecast and has experienced a weather situation. They all know about weather." He adds that The Weather Channel has created new generations of weather watchers, and strong job availability in the field also makes AOSC an attractive undergraduate option. "We anticipate that graduates will attain positions in private industry and at federal agencies, including NASA, the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of Agriculture."

Another point of interest: AOSC majors participate in a variety of research activities, culminating in a senior thesis. Many students are gaining valuable experience in campus centers and federal agencies, and a sampling of student research follows.

TRACKING LIGHTNING JUMPS

Sarah Shellum, B.S. '15, a former pastry chef turned scientist, attended UMD for a year, "but the AOSC major was not offered at the time and nothing else really interested me," recalls Shellum. The long hours and low wages of a pastry chef led her back to UMD to become one of the first students to declare the AOSC major in fall 2011.

Shellum is earning credits for research analyzing the connection between lightning jumps and severe weather occurrences conducted in the lab of Visiting Assistant Research Scientist Scott Rudlowsky in the Earth System Science Interdisciplinary Center (ESSIC). "Eventually, this work could lead to a forecasting product to provide early storm warnings and watches," explains Shellum. She also is on call with the Washington, D.C., Lightning Mapping Array Network to repair sensors located throughout the region that measure electrical discharges. "The sensors detect high-frequency radio waves emitted by lightning in the region. By mapping the data, researchers can create models to demonstrate when and where the most severe storms will occur," says Shellum, who still feels her adrenaline rise when watching lightning storms.

> "WE DEFINITELY HAVE THE COOL FACTOR GOING FOR US."

ANALYZING TROPICAL DISTURBANCES

As part of a communications class, Mike Natoli, B.S. '16, a double major in Math and AOSC, interviewed E. Hugo Berbery, an ESSIC research professor and director of the Cooperative Institute for Climate and Satellites (CICS). "He was looking for students to participate in research opportunities," explains Natoli. The CICS launched a summer program to provide training and outreach opportunities, pairing undergraduate and graduate students with mentors to conduct original scientific research and train future NOAA scientists.

Natoli is adding to the body of knowledge on the Madden-Julian oscillation, a tropical disturbance that moves eastward around the tropics on a 30- to 60-day cycle, dissipating in the Central Pacific

Ocean. Natoli writes code and analyzes data to better understand weather patterns—work that could lead to increased lead times for forecasts. "There are eight phases of an active oscillation that correlate with different temperatures and precipitation around the world," explains Natoli. He looks forward to completing a research paper and making presentations at upcoming NOAA and American Meteorological Society conferences. "There are so many exciting opportunities here compared to most other institutions," says Natoli, citing the university's partnerships with NOAA and NASA.

THE HEAT IS ON

Katie O'Brien, B.S. '14, who has wanted to pursue a career in meteorology since grade school, transferred into the major two years ago. She has been conducting research with Berbery for the last three summers, most recently at CICS. Her research focuses on analyzing how data generated by four heat flux towers in Oklahoma, Oregon, Arizona and Illinois compare with modeled heat fluxes. O'Brien was also part of an interdepartmental team, which built a radiosonde and launched it via a large weather balloon from Western Maryland in November 2012 to collect temperature, pressure and humidity readings every 30 seconds.

The team compared the data on atmospheric conditions collected through the Balloon Payload Program, funded by the Maryland Space Grant Consortium, with data collected at Dulles International Airport to analyze differences in the profiles for a class project. "In class, I have learned theory and have applied my learning through the research internships." From 2008 to the end of the project, O'Brien also volunteered as a storm spotter for the National Weather Service (NWS). "I've reported on hail, followed tornado warnings and noted weather changes to the NWS," explains O'Brien.

"BY 2050, WE COULD SEE ICE-FREE SUMMERS IN THE ARCTIC CIRCLE."

TOP: SUN GLINTS OFF NARROW LEADS WITHIN THE ARCTIC SEA ICE PACK. BOTTOM: NASA'S OPERATION ICEBRIDGE MISSION SURVEYS ARCTIC SEA ICE IN MARCH 2013.

THE ICELESS AGE

"Technically a physics major," Julia Ruth, B.S. '14, has always been interested in weather and climate, which led her to complete eight ASOC courses. She has been working with Sinead Farrell, an assistant research scientist at ESSIC in collaboration with the NOAA Laboratory for Satellite Altimetry and the NASA Cryospheric Sciences Program. Ruth is analyzing data about sea ice levels off the eastern coast of Greenland in the Fram Strait. Sea ice is an important indicator of climate change, and a real shrinkage of Arctic sea ice has been observed during the last 30 years. "I am analyzing aerial imagery and data collected by satellite monitoring to determine the elevation of sea ice," says Ruth. "Knowing the buoyancy and dynamics of sea ice, we can make some conclusions about the volume. By 2050, we could see ice-free summers in the Arctic Circle," adds Ruth, who now is considering graduate school and a future career as a scientist thanks to mentoring from Farrell. ■

"I'VE REPORTED ON HAIL, FOLLOWED TORNADO WARNINGS AND NOTED WEATHER CHANGES TO THE NWS."

Photos by Sinead L. Farrell/University of Maryland

Deep Impact Comes To An End

Mission Transformed Understanding of Comets

In late September, NASA announced the unanticipated end of operations for the Deep Impact spacecraft, history's most traveled deep-space comet hunter, after trying unsuccessfully for more than a month to regain contact with the spacecraft.

UMD scientists—who helped conceive the mission, bring it to reality and keep it going years longer than originally planned—say it is a big loss, but find great satisfaction that Deep Impact exceeded all expectations and that the science derived from it transformed our understanding of comets.

"The impact on Comet Tempel 1, the flyby of Comet Hartley 2, and the remote sensing of Comet Garradd have led to so many surprising results that there is a complete rethinking of our understanding of the formation of comets and of how they work," says Astronomy Professor Michael A'Hearn, who led the Deep Impact science team from the original proposal to its unanticipated completion. "These small, icy remnants of the formation of our solar system are much more varied, both one from another and even from one part to another of a single comet, than we had ever anticipated."

ARTIST'S RENDERING OF THE MOMENT OF IMPACT AND THE FORMATION OF THE CRATER.

Originally built to conduct a mission to one comet, under the guidance of the UMD science team the Deep Impact spacecraft gathered information from four different comets, Earth and the Moon. In the process it provided insights into the forces that created comets 4.5 billion years ago and drive them today, and into the origin of our solar system. ■

TOM SNITCH DEMONSTRATES A HAND LAUNCH OF THE FALCON UAV, NICKNAMED TERRAPIN 1, AT OLIFANT WEST, A PRIVATE GAME PRESERVE NEAR SOUTH AFRICA'S KRUEGER NATIONAL PARK.

Terrapin 1 Drone Provides Rhino Protection

A series of successful test flights have shown that unmanned aerial vehicles (UAVs), or drones, combined with anti-poaching computer software, can successfully protect rhinoceros from poachers in the South African bush.

In response to a deadly epidemic of rhino killings, Tom Snitch, CMNS Board of Visitors chair and visiting scholar at the University of Maryland Institute for Advanced Computer Studies (UMIACS), organized an all-volunteer expedition that conducted experimental anti-poaching surveillance near South Africa's Krueger National Park in May.

The UAV, on loan from Denver-based manufacturer Falcon UAV, was equipped with an infrared night vision camera and guided by a UMD-designed computer program that successfully predicted the movements of rhinos and poachers. The combined technology provides a new weapon in the war on wildlife poachers. The technology incorporates game theory and other types of advanced programming and is designed to predict future changes in poachers' behavior. Researchers plan to add several years of data collected by local game wardens to the computer model. ■

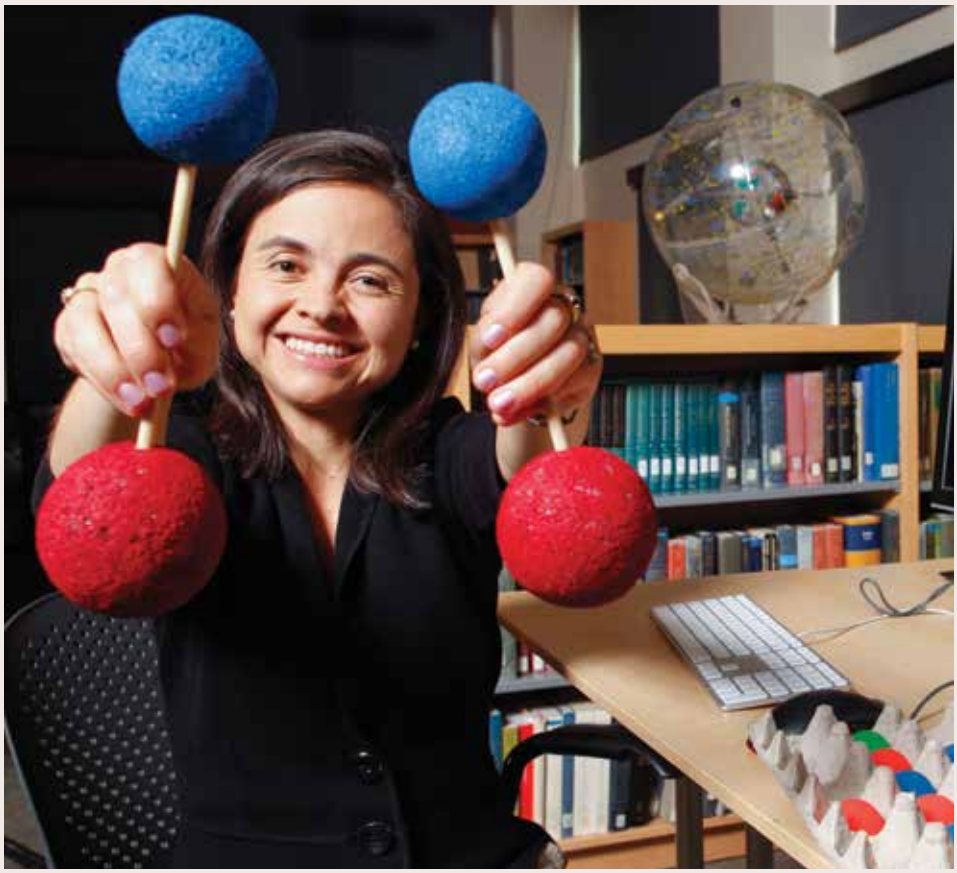
Artwork by Pat Rawlings, courtesy of NASA/JPL/UMD / Photo, left, by Chris Miser

Physics Grad Named MacArthur Fellow

Researchers at the National Institute of Standards and Technology (NIST) unveiled the most accurate atomic clock ever built in August 2013, a breakthrough made possible by the ideas of theoretical physicist Ana Maria Rey, Ph.D. '04, Physics. In recognition of her work, the John D. and Catherine T. MacArthur Foundation has tapped Rey for a 2013 MacArthur Fellowship, also known as a "genius grant." The fellowship carries a $625,000 stipend over five years to allow Rey to pursue whatever work she chooses.

Rey's work provided the theoretical underpinning for the development of the atomic clock and similar experimental devices, according to Joint Quantum Institute (JQI) Co-Director Charles Clark, an expert on ultracold atoms who was Rey's doctoral advisor. "Her theories have been proven correct by some of the most accurate atomic physics experiments that have ever been performed," says Clark.

Rey is an expert on atomic, molecular and quantum physics, known for her recent work in optical lattice clocks. These ultra-accurate devices are the next generation of precision time keepers, with atoms super-cooled to a few millionths of a degree above absolute zero—and trapped in a lattice made of intersecting beams of laser light. Rey's contribution was to develop a theoretical framework for quieting the "noise" generated by atomic collisions, thus eliminating tiny variations in the clock's ticks, Clark says. Her ideas also laid the groundwork for related work at NIST this summer, in which researchers set a record for the most accurate atomic clock ever produced. In a paper published this summer in *Science*, Rey and colleagues described an optical lattice clock built on atoms of the alkaline earth element strontium. The clock uses 100 stacked layers of about 20 strontium atoms each.



2013 MACARTHUR FELLOWSHIP WINNER ANA MARIA REY

A native of Colombia, Rey received her B.S. from the University of the Andes. In 2005, Rey was the first woman to win an international award from the American Physical Society for the best Ph.D. thesis in atomic, molecular and optical physics. She held a postdoctoral position at Harvard and is a professor at the University of Colorado, where she is a fellow at JILA (formerly known as the Joint Institute for Laboratory Astrophysics). She continues to collaborate with former UMD, NIST and JQI colleagues including JQI Fellow Alexey Gorshkov, a co-author on the *Science* paper. ■

CMNS FACULTY RECOGNIZED BY UMD

Several CMNS faculty members were recognized for their contributions to the university at the Faculty and Staff Convocation held in early October. They included:

- James A. Yorke, Mathematics and IPST, President's Medal
- Hanan Samet, Computer Science and University of Maryland Institute for Advanced Computer Studies (UMIACS), Distinguished University Professor
- Ben A. Shneiderman, Computer Science and UMIACS, Distinguished University Professor
- Raymond J. St. Leger, Entomology, Distinguished University Professor
- Doron Levy, Mathematics and Center for Scientific Computation and Mathematical Modeling, Distinguished Scholar-Teacher

Photo courtesy of the MacArthur Foundation

CREATING CHAOS

Founder of Chaos Theory Celebrates Stellar 50-Year Career at UMD

Distinguished University Professor and renowned Mathematician and Physicist ***James Yorke****, Ph.D. '66, mathematics, came to UMD in 1963 as a mathematics graduate student. Today, he is known worldwide for coining the term "chaos" for the mathematical study of nonlinear dynamic systems. The term was introduced in a paper he authored with Michigan State Distinguished Professor Tien-Yien Li titled "Period Three Implies Chaos." A founder and leader of the famed UMD nonlinear dynamics group, Yorke was honored this fall with the UMD President's Award, the highest honor the campus bestows.*

In 2003, he was awarded the Japan Prize, over which the Emperor of Japan presides. It is one of the most esteemed science technology prizes, ranked nearly on a par with the Nobel Prize and Fields Medal. He is a fellow of the American Physical Society, the American Association for the Advancement of Science (AAAS), the American Math Society and the Society for Industrial and Applied Mathematics. He spoke with Odyssey *on the occasion of his 50th year at UMD.*

What keeps you inspired?
I am inspired by the pursuit of new ideas. I love to come up with new and strange ideas; to discover something unknown and suddenly the idea becomes crystallized. After 50 years, my goal is still to come up with neat, strange ideas and tell people about them. That's what keeps me motivated.

What has been an important factor in your success?
I don't think of myself as being stuck in one area. I am now working in chaos with two graduate students and working in genomics with four senior postdoctoral researchers. About 15 years ago, I read in the newspaper that scientists had for the first time determined the genomic sequence of a bacteria. I had a good student and thought we could contribute to a project like that one. It has taken a few years, but now I believe our UMD team is better at determining DNA sequences than any other group. This year we assembled a pine tree genome that is about seven times bigger than the human genome. This is not related to chaos, it is just an interesting problem. I like interesting problems that I think I can have an impact on.

What advice do you have for young scientists today?
I would tell them to read about science, popular science to get an overview of areas. Find out what is going on in science as opposed to just taking courses in subjects. When you take a course, you follow someone else's lead at their pace, not at a pace that lets you think about things. Reading a great book is better than sitting in lectures because you can stop and think about each sentence, and go at your own pace. Pursue your own interests. As a student, you do what you are told by your professor. You don't have time to think about your own ideas. If you don't pursue your own interests, it is hard to develop an independent view. Still, students are faced with the problem: Are they going to be good students or good researchers?

JIM YORKE IN THE '70S, IN FRONT OF THE MATH BUILDING

What to do you consider your favorite achievement?
My favorite achievement will be the next idea that I get, not what I have already done. I have always aimed at investigating areas that are not well understood, that do not appear very often in the literature. Now that I am retired from teaching and committees, I have more time to pursue ideas full time. That is what drives me.

How has the pursuit of science changed in the last 50 years?
Computers are everywhere in science. I had a summer job working for IBM the summer following graduation from college, and it

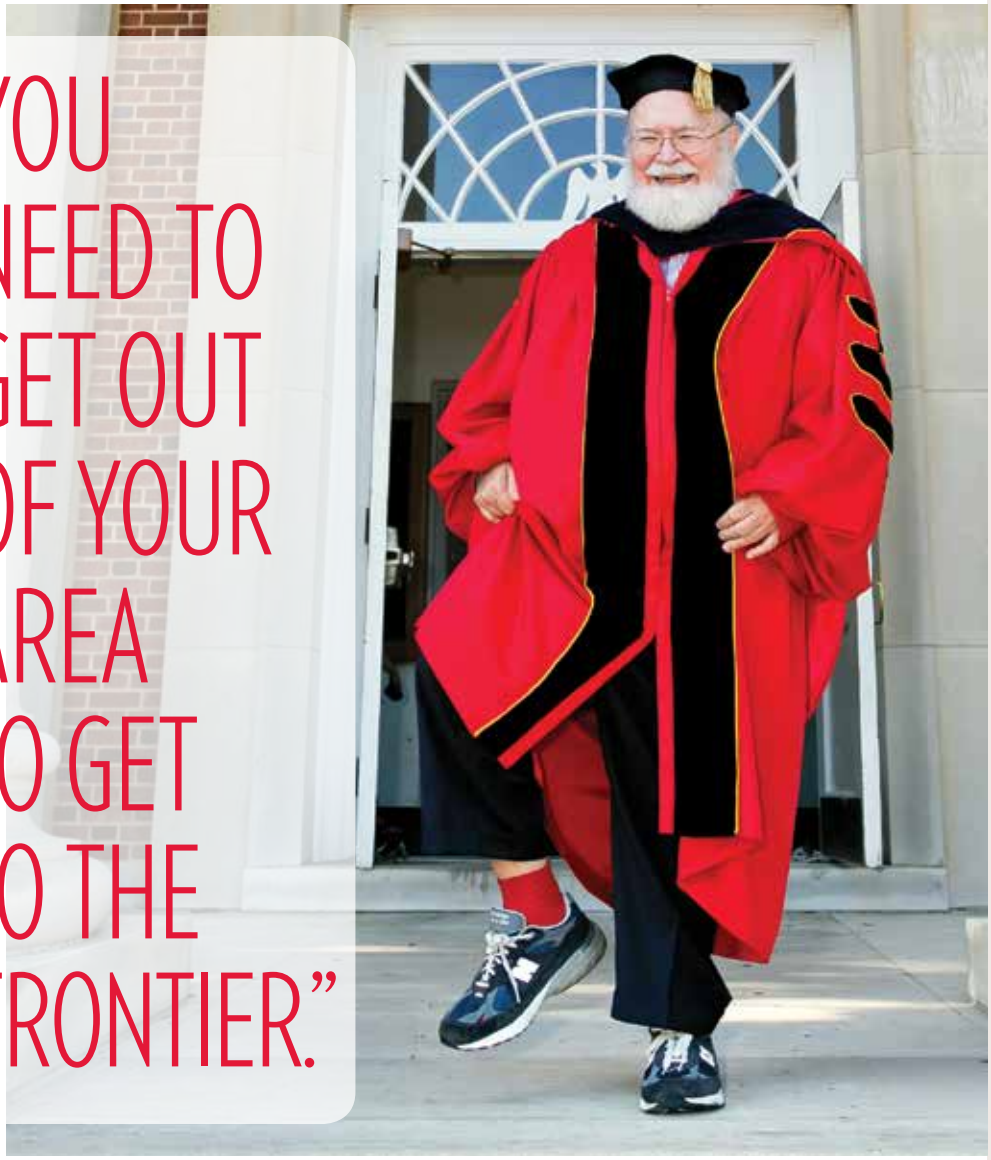
Photo by Mike Morgan

was like getting in on the ground floor of this revolution. People don't appreciate how the computer can reveal new situations that they were not aware of. Computation is so much easier, but you don't see students doing it. To sit in a corner and come up with a new idea purely from one's imagination is daunting. Computers give you opportunities to see things you don't expect.

How do you stay current?
I don't try to stay current. I try to move into new things and leave currency behind. When I started working in chaos, not many papers had been written in that area. I tried to come up with new ways of looking at it. You need to get out of your area to get to the frontier.

Why did you choose to stay at Maryland for your entire career?
One reason I stayed here for 50 years is that UMD has created a great environment where one could explore ideas of an interdisciplinary nature. I came to Maryland because of an interdisciplinary initiative called the Institute for Fluid Dynamics and Applied Math, which is now the Institute for Physical Science and Technology. It gave me a great opportunity to explore interdisciplinary ideas. When a new professor moved in down the hall from me, we started talking. Those discussions with Ed Ott led to a long collaboration, resulting in nearly 100 papers. ■

"YOU NEED TO GET OUT OF YOUR AREA TO GET TO THE FRONTIER."



JIM WEARS HIS SIGNATURE RED SOCKS EVERY DAY AND ON EVERY OCCASION.

Exploit Your Gifts, Change the World

Their career paths may be different, but **Stefanie Zaner**, B.S. '13 biological sciences, shares a love of the university with her father and brother, both UMD graduates and both dentists. Zaner, who plans to attend medical school, was the student speaker for the May 2013 CMNS Commencement. She reminded students of the challenges and responsibilities that await them. "We must exploit our gifts and never be afraid to explore the world around us," urged Zaner. "As scientists, we will build on discoveries, and we will make truly significant contributions to society."

Zaner has been making important contributions to the university and greater community for years. She was co-president and treasurer for the Charles R. Drew Pre-Medical/Pre-Health student organization and established the local branch of "Mentor Cares," a university-based outreach program. Under her leadership, the program grew from three to 200 supporters who collected canned goods for local food shelters. She also worked as head recruitment ambassador for the college, encouraging prospective students to attend CMNS.

A lifelong Terps fan, Zaner cherishes her experiences in the Mighty Sound of Maryland Marching Band and Pep Band, in which she played first clarinet. Among her greatest Pep Band memories: Playing at the men's NCAA Basketball Tournament in Spokane, Washington, and cheering the women's basketball team to a 2012 ACC Tournament win.

Zaner, a member of Phi Beta Kappa and The Primannum Honor Society, served as a teaching assistant for biometrics and mammalian physiology courses as an undergraduate. At the same time, she worked as a research assistant at the National Institute of Child Health and Development and as a radiology assistant at Washington Hospital Center. "I've known since I was young that I wanted to be a doctor. Working with kids in a health care field is definitely in my future," says Zaner, who will be applying to medical school in the next year. ■

Photo above by John Consoli / Photo top right by Angela Buck Photography

CELEBRATING 40 YEARS

DEPARTMENT OF GEOLOGY

THE DEPARTMENT OF GEOLOGY CELEBRATED ITS 40TH ANNIVERSARY, REUNITING FOUNDING FACULTY, ALUMNI AND CURRENT DEPARTMENT MEMBERS. FOUNDING GEOLOGY PROFESSORS BOB RIDKY (LEFT) AND ANTHONY SEGOVIA (RIGHT), WITH FORMER PROVOST AND FOUNDING AND CURRENT GEOLOGY PROFESSOR ANN WYLIE (SECOND FROM LEFT), AND FIRST GEOLOGY CLUB PRESIDENT GUILLERMO "WILLY" ACCAME, B.S. '80 (SECOND FROM RIGHT).

DEPARTMENT OF COMPUTER SCIENCE

THE DEPARTMENT OF COMPUTER SCIENCE HONORED A NUMBER OF DISTINGUISHED ALUMNI DURING ITS 40TH ANNIVERSARY CELEBRATION. PICTURED FROM LEFT: PAUL CAPRIOLO, B.S. '06; POOJA SANKAR, M.S. '04; MARTIN FARACH-COLTON, PH.D. '91; GLENN RICART, PH.D. '80; PATRICK JENKINS, B.S. '06, COMPUTER SCIENCE AND MATHEMATICS.

Nobel Prize Winner Addresses May Graduates

JOHN MATHER (RIGHT) RECEIVES THE CIRCLE OF DISCOVERY AWARD FROM DEAN BANAVAR AT COMMENCEMENT.

Nobel Prize-winning physicist **John C. Mather** delivered the Spring 2013 Commencement address to May CMNS graduates. Mather was awarded the Nobel Prize in Physics in 2006 for measuring the cosmic microwave blackbody spectrum, providing experimental confirmation of the Big Bang Theory.

A total of 918 candidates received their degrees following the spring 2013 semester. Some 780 students received their bachelor's degrees, 73 students received their master's degrees and 65 students received their doctoral degrees. Of the undergraduates, nearly 100 students completed their degree program with honors. In celebrating students' exceptional achievements, Mather said, "This is a great time to be thankful, humble and proud." He urged graduates to abandon their fear of failure—to take their choices and lives seriously, "but have a laugh about it." He described how his own scientific failures ultimately led to success. "If you are too afraid of failure, you cannot put your heart into something," he added. ■

"YOU PREDICT THE FUTURE BY SAYING **YES** TO OPPORTUNITY."

Geology photo by Hailong Bai / Computer Science photo by Joanna Nurmis / Mather photo by GradImages

Curiosity is Key

A Father of Major Physics Theory Marks 50 Years in the Field

Distinguished University Professor Emeritus and Regent's Professor ***Michael Fisher*** *is a father of the Renormalization Group Theory, one of the most important theoretical developments in statistical physics. For his work in this area, in 1980 Fisher was awarded the Wolf Prize in Physics with colleagues Ken Wilson and Leo Kadanoff. During his career he has received numerous awards and honors, including the first Lars Onsager Memorial Prize from the American Physical Society, the Hildebrand Award from the American Chemical Society, the Gibbs Lectureship from the American Mathematical Society, two John Simon Guggenheim Memorial Fellowships, the New York Academy of Sciences Award in Physical and Mathematical Sciences, and the Guthrie Medal and Prize of the Institute of Physics.*

Fisher was elected as a Fellow of the Royal Society in 1971 and has served as a vice president. He is also a member of the American Academy of Arts and Sciences, a Foreign Associate of the National Academy of Sciences, an honorary fellow of the Royal Society of Edinburgh and a member of the American Philosophical Society, among many other societies. During the course of his career, he has written a book, lectured worldwide and authored more than 400 original articles. On the anniversary of his 50th year in the field, he answered a few questions about science and teaching.

MICHAEL FISHER AND HIS WIFE, SORREL, AT THE FISHER SYMPOSIUM IN OCTOBER 2012.

What excites you about science?
I was born curious. From an early age, I always wanted to know how things worked, and, incidentally, often had my own ideas about how they might work. I always wanted to know what is around the next corner and how different roads connect.

What are key qualities of a good scientist?
Good scientists are known for the questions they raise; most have certain questions in mind. As a scientist, you must persist. You can put a question away, but you never stop thinking about it. That is a critical ingredient in science. Luck is also an important contributor to success in science. You hope for luck, but must always make the best of your opportunities. As a scientist, I tend to pride myself on what I do not know.

> "As a scientist, you must persist. You can put a question away, but you never stop thinking about it."

What do you consider your most significant contribution to the field of physics?
That is really up to others to decide. If you are talking about most influential, one of the most important pieces of my work was completed with a good friend of mine, Ken Wilson, at Cornell University. He was brilliant! My contribution was to make a concrete suggestion which led to a 1972 joint paper, "Critical Exponents in 3.99 Dimensions." This was a very influential paper that considered a four-dimensional world. A quite different set of my own ideas concerned how to think about finite size effects. This insight was gained relatively early in my career; today with computers the problem is more obvious to all.

What would you like your scientific legacy to be?
It is not a concern to me. The nature of science is similar to constructing a large building with many small pieces. You insert a brick or two and even name a few things. All scientists are aware of previous greats. In making our contributions, we all stand on the shoulders of those who came before us.

What does it take to be a successful teacher?
I have always liked teaching. I largely taught myself flamenco guitar and then taught others. Teaching someone to play a musical instrument is special because you are teaching one-on-one. You have to be sensitive to the individual; every student has different issues. Teaching science and math is easier since matters are more clear cut. In mathematics, especially, one is either right or wrong. Physics, chemistry and biology are a little more difficult. It is easy to teach technicalities; it is harder to teach the framework. I believe one must learn to think in terms of a landscape and then how concepts are placed within that landscape.

What advice would you give new teachers?
If you teach a new course or in a new environment, you need to look at who and what was successful before you. One colleague may use notes for a lecture, another rarely uses notes. Ask if you can borrow their lecture notes to learn about your students, their level of understanding, and the assumptions you may make about what they know. I am a great believer in taking advantage of what has been successful in the hands of others even though one's own style may differ significantly.

How do you continue to stay interested and engaged in the field?
Talk, listen, read! I talk with colleagues, listen to presentations, read *Physics Today* and *Physics World, Chemistry and Engineering News* and the *Mathematical Intelligencer*. I look at the titles of papers in scientific publications and at the abstracts, then I read those that have more to teach me. ■

Photos by Thai Nguyen

Massimo Bollasina, Ph.D. '10, Atmospheric and Oceanic Science, received the 2013 James R. Holton Junior Scientist Award from the American Geophysical Union. Bollasina is an assistant professor at the University of Edinburgh, Scotland.

Russell Butler, B.S. '83, Computer Science, has been named senior vice president of Global Research and Development for MICROS Systems. Previously Butler was vice president of messaging and collaboration at IBM.

Phyllis Kolmus, B.S. '72, Mathematics, is president of Women in Technology, an organization that supports women in the D.C. technology community. She is deputy group director for AT&T Government Solutions.

Rick Kuhn, M.S. '85, Computer Science, recently co-authored the book *Introduction to Combinatorial Testing*. Kuhn, a project leader in the Computer Security Division at the National Institute of Standards and Technology, co-developed the role-based access control model (RBAC) used throughout industry.

Jack Kustanowitz, M.S. '05, Computer Science, is founder and principal of Mountain-Pass Technology in Chevy Chase, which provides consulting for companies who need to create products on the web and on mobile devices.

Phillip Marucha, B.S. '74, Biochemistry, has been named the new dean of the Oregon Health & Science University School of Dentistry. Previously, Marucha was associate dean for research and director of graduate studies for the University of Illinois at Chicago College of Dentistry.

Steve Orndorff, Ph.D. '79, Microbiology, has been named the chief executive officer of MicroBiome Therapeutics, previously NuMe Health LLC. He is the former CEO of Ariel Pharmaceuticals.

Matthew Rainey, B.S. '85, Physics, is director of the Innovation Division at the World Intellectual Property Organization in Geneva. He joined WIPO in February 2012 after nearly 30 years of intellectual property law practice in the United States and Munich.

IN EARLY SPRING, DEAN JAYANTH BANAVAR VISITED THE MOUNTAIN VIEW, CALIF., HEADQUARTERS OF LINKEDIN, WHERE HE LEARNED MORE ABOUT THE CONNECTIONS PROMOTED THROUGH LINKEDIN AT A LUNCHEON HOSTED BY BRYAN HSUEH, M.S. '95, COMPUTER SCIENCE, AND SENIOR SOFTWARE ENGINEER AT LINKEDIN. BANAVAR, CENTER HOLDING TESTUDO, IS PICTURED WITH ALUMNI WHO WORK AT THE COMPANY, INCLUDING HSEUH, FAR RIGHT.

Glen Ricart, Ph.D. '80, Computer Science, was inducted into the Internet Hall of Fame for setting up the first Internet Exchange Point. He headed academic computing and networking from 1982 to 1993 at UMD, which became the first university to implement TCP/IP campuswide in 1984. Ricart is founder and CTO of US Ignite, a non-profit organization fostering the creation of next-generation Internet technology.

Rakesh Vohra, Ph.D. '85, Applied Mathematics, has been named Penn State's 15th Penn Integrates Knowledge Professor. He is the George A. Weiss and Lydia Bravo Weiss University Professor, with a joint appointment in economics and electrical and systems engineering.

Michael Wasserman, B.S. '74, Zoology, has been elected President of the Massachusetts Dental Society. He earned his D.D.S. degree from New York University College of Dentistry and maintains a private practice in Pittsfield, Mass.

Time magazine named **Don Yeomans**, M.S. '67, Ph.D. '70, Astronomy, one of the 100 most influential people in the world for 2013. His asteroid early warning project "is one of the reasons we can all sleep a little better at night," *Time* says. At the Jet Propulsion Laboratory, Yeomans is a senior research scientist, supervisor for the Solar System Dynamics Group, and manager of NASA's Near-Earth Object Program Office. He has received 15 NASA Achievement Awards including an Exceptional Service Medal and a Space Act Award. Asteroid 2956 was named 2956 YEOMANS to honor his professional achievements. ■

DAVID LEE, CEO OF GLOBAL SATCOM TECHNOLOGY, INC., SHARED HIS EXPERIENCES FROM IMMIGRANT TO ENTREPRENEUR WITH STUDENTS AND FRIENDS OF CMNS IN APRIL.

Lee photos by Thai Nguyen

FACULTY HIGHLIGHTS

The Maryland Compact Muon Solenoid team of physicists **Drew Baden**, **Alberto Belloni**, **Sarah Eno**, **Nick Hadley** and **Andris Skuja**, and their collaborators have been awarded the 2013 EPS High Energy and Particle Physics Prize for the discovery of a Higgs Boson, as predicted by the Brout-Englert-Higgs mechanism.

Professor **Bonnie Dorr** and Professor **Lise Getoor**, Computer Science and University of Maryland Institute of Advanced Computer Studies (UMIACS), have been elected fellows of the Association for the Advancement of Artificial Intelligence (AAAI). Dorr was recognized for her "significant contributions to natural language understanding and representation and development of the widely recognized methods for interlingual machine translation." Getoor's citation recognizes her "significant contributions to methods which combine probabilistic and logical representations in machine learning, knowledge discovery, graph mining, network analysis and database systems."

Alexander J. Dragt, Physics, received the Particle Accelerator Science and Technology Award from the IEEE Nuclear and Plasma Sciences Society for "substantial contributions to the analysis of non-linear phenomena in accelerator beam optics by introducing and developing a map-based approach."

Bill Fagan, Biology and SESYNC, has been elected a fellow of the Ecological Society of America for his outstanding contributions to the field of ecology.

Jon Froehlich, Computer Science and UMIACS, has won a 3M Non-tenured Faculty Award to further his research on the use of machine learning and intelligent sensing to promote activity awareness and modification. The 3M program provides opportunities for industrial and academic researchers to interact and encourages the pursuit of new ideas among younger university professors.

Eugenia Kalnay, Atmospheric and Oceanic Science, Institute for Physical Standards and Technology (IPST) and Earth Space Science Interdisciplinary Center (ESSIC), has been appointed to the UN Secretary-General's new Scientific Advisory Board. The board will provide advice on science, technology and innovation for sustainable development to the Secretary-General and executive heads of UN organizations.

C. David Levermore, Mathematics and IPST, and **James Yorke**, Mathematics, Physics and IPST, have been elected fellows of the Society for Industrial and Applied Mathematics. Levermore was recognized for his contributions to understanding how large-scale behaviors emerge from dynamics or structures on small scales and Yorke was honored for his contributions to the understanding and application of chaotic dynamics.

Former University of Maryland President and CMNS Board of Visitors Member **C.D. (Dan) Mote, Jr.** began a six-year term as president of the National Academy of Engineering (NAE) early this summer. Founded in 1964, NAE is a private, independent, non-profit institution that provides engineering leadership in service to the nation with more than 2,000 peer-elected members and foreign associates.

Ed Ott, Distinguished University Professor of Electrical Engineering and Physics, Institute for Research in Electronics and Applied Physics, and Institute for Systems Research, has been awarded the prestigious Lilienfeld Prize of the American Physical Society. Ott is recognized for "pioneering contributions in nonlinear dynamics and chaos theory that have been uniquely influential for physicists and scientists in many fields, and for communicating the beauty and unifying power of these concepts to remarkably diverse audiences."

Bill Pugh, Computer Science and UMIACS, received the first ACM/IEEE Supercomputing "Test of Time" award for his paper in *Supercomputing 91*, "The Omega test: a fast and practical integer programming algorithm for dependence analysis." The paper was selected from all papers published at the Supercomputing Conference between 1988 and 2003. The award, the first of its kind, celebrates the 25th anniversary of supercomputing.

Christopher Reynolds, Astronomy, received the Young Astronomer Lectureship Award, jointly presented by the National Central University and the Taiwan-based Delta Electronics Foundation.

Raymond St. Leger, Entomology, has been elected a fellow of the American Academy of Microbiology in recognition of his scientific achievements and original contributions that have advanced microbiology. ■

IN MEMORIAM

Herman Ammon, Chemistry and Biochemistry professor, passed away on August 2. Internationally known in the field of crystallography, he was an early pioneer in crystal structure predictions for organic compounds through the use of computational chemistry.

Robert A. Nelson, Ph.D. '90, Physics, died on April 28. Nelson had been an independent consultant through his company, Satellite Engineering Research Corporation, for clients that included Arinc, Naval Research Laboratory, Lockheed Martin, Ball Aerospace, NASA and Globalstar. He collaborated on the design of the orbits for the Sirius Satellite Radio constellation of satellites and was co-owner of a patent for this design.

Andrew Pearson, Ph.D. '11, Physics, died July 25. He was married to Renee Goertzen, Ph.D. '10, Physics, and the couple had recently returned to Maryland after postdoctoral appointments at Florida International University.

Andrew Reisse, B.S., '81, Computer Science, died May 30. Reisse co-founded Scaleform, then worked at Gaikai before co-founding the virtual reality company Oculus VR, where he was also lead engineer.

Professor Emeritus **Hugh Sisler**, B.S. '49, M.S. '51, Ph.D. '53, Botany, and former chair of the Department of Botany, died August 3. He taught graduate courses in fungal physiology and studied the effects on nucleic acid and protein in fungal cells and virus infected plants. As a leading authority in the field of fungi toxic mechanisms, Sisler authored numerous publications on metabolic inhibitions and co-edited the book *Plant Virology*.

Francis E. "Gene" Wood, Ph.D. '70, Entomology, and professor and extension entomologist, died on May 18. Wood helped educate the pest control industry and the public and also conducted applied research. Using his skill as a scientific illustrator, he produced scores of publications and drawings covering the identification, biology and control of pests.

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RECONNECT WITH CMNS

Mark your calendar now for upcoming spring events.
For a more complete list, visit cmns.umd.edu/alumni-friends.
For more information about all CMNS alumni events, please contact Andrea Morris at aemorris@umd.edu.

MARCH 13, 2014
CMNS Annual Alumni Association Chapter Meeting and Reception
G. Forrest Woods Atrium, Chemistry Building
Meeting 6:30 p.m., Reception 7:30 p.m.

MARCH 20, 2014
Third Annual Bay Area Alumni Networking Reception
Museum of Computer History, Mountain View, California
Speaker: Zoosk Founder Shayan Zadeh, M.S. '02, Computer Science
6:30–9 p.m.

APRIL 22, 2014
CMNS Board of Visitors Entrepreneurship and
Robert E. Fischell Lecture
Speaker: Robert E. Fischell, M.S. '53, Physics

APRIL 26, 2014
Maryland Day, College Park campus. Spend the entire day enjoying a host of activities and events that showcase the best UMD has to offer. For more information, visit marylandday.umd.edu.

MAY 22, 2014
Campus-wide Commencement Ceremony, Comcast Center

MAY 23, 2014
CMNS Commencement Ceremony

JUNE 12, 2014
Alumni Networking Reception
Museum of History and Industry, Seattle, Washington

Photo by John T. Consoli