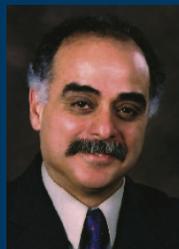


APAM NEWS

THE DEPARTMENT OF APPLIED PHYSICS & APPLIED MATHEMATICS

THE FU FOUNDATION SCHOOL OF ENGINEERING & APPLIED SCIENCE, COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK



Dear Alumni and
Friends of APAM:

Another school year is over. We have turned in our grades and celebrated our students who graduated this academic year. Our first year graduate students are now past their qualifier examination and have selected their advisors. We are ready to put in another summer of hard work, excellent research, and a bit of recreation.

In this issue we highlight our graduates and award winners as well as the achievements of our faculty and alumni during the last semester. The spring semester has been a busy time, with lots of activities and many awards. Prof. Mark Cane was elected to the National Academy of Sciences. Prof. Chris Marianetti received the Fame Research Grant Award, and the 2013 Kaul Foundation Prize of Princeton University was awarded to Prof. Steve Sabbagh. Our colleagues, Professors Christman and Nickoloff, retired after years of selfless service to our Medical Physics Program.

For the summer of 2013, we at APAM extend our warmest greetings to our friends and alumni and hope to keep in touch.

Best,

I. Cevdet Noyan
Chair, APAM



Prof. Simon Billinge and APAM grad student, Eric Isaacs, traveled to Ethiopia to take part in a 2-week program developed by the Joint US-Africa Materials Initiative (JUAMI). Here they are joined by other African and US faculty and students after the JUAMI soccer match.

In This Issue

- **Message from the Chair**
- **Student News**
 - Undergraduate Student Award Winners
 - 2013 Simon Prize Winner: Monica Chahal
 - Aradhya Wins MRS Graduate Student Gold Award
 - Ganot Wins Student Life Award
- **Alumni News**
 - 2012-2013 Graduates
 - Isaac Greenbaum (B.S. '06, Applied Mathematics)
 - Michael Stamatelatos (Eng.Sc.D. '70, Nuclear Engineering)
- **Faculty News**
 - Mark Cane Elected to the National Academy of Sciences
 - New Faculty: Nanfang Yu
 - Faculty Updates
 - NYC/Long Island AMS Chapter Seminars
 - Chris Marianetti Awarded FAME Research Grant
 - Adjunct Faculty News: Steven Sabbagh Honored by Princeton University
 - Photo: NYC Next Idea
- **Special Focus on Faculty Activities**
 - Simon Billinge & the Joint US-Africa Materials Initiative
- **Department News**
 - Nowick Memorial Symposium
 - Medical Physics Program Honors Edward Christman & Edward Nickoloff
- **Contact Us**

Undergraduate Student Award Winners

Outstanding seniors were recognized at the APAM Senior Dinner on May 8. Award winners received a plaque and a check for \$500, have their names inscribed on plaques in the Department, and are listed on the APAM web site.

Timothy Foreman, Applied Mathematics Faculty Award

Timothy, a C.P. Davis Scholar, majored in applied math and minored in economics. He played trumpet in Columbia University's Wind Ensemble for four years, served on the executive board, and was the Vice President of Making Music Matter (an after school band program for NYC elementary school students). He was an intern with Hazen and Sawyer Environmental Engineers and Scientists and a research assistant in the Departments of Chemical Engineering and Economics, as well as the National Bureau of Economic Research. He is on the Dean's List, has completed 146.50 points, and has a 3.8316 GPA. He is also a recipient of a CUSP Summer Enhancement Fellowship and a National Merit Scholarship. Next year, he will be attending Columbia's School of International and Public Affairs as a part of the Ph.D. program in Sustainable Development. He hopes to work in international economic policy after the completion of his Ph.D.

Dillon Liu, Applied Physics Faculty Award

Dillon is the first SEAS student to ever receive a Marshall Scholarship — an award which provides funding for graduate study in the U.K. Dillon, who majored in applied physics, has completed 137 points and has a 3.9078 GPA. He worked for the Office of Residential Programs for three years and was the community advisor for East Campus Residence Hall. He was also a teaching assistant for the Departments of Physics and Mathematics, and hopes to continue being involved with science education and outreach. After graduation, Dillon will attend the University of Oxford to earn a D.Phil. in theoretical physics, with a focus on condensed matter physics.

Annabel Chew, Francis B.F. Rhodes Prize

Annabel is also a 2013 Wendell Medal Finalist, for exemplifying great character, scholarship, and service. She majored in Materials Science and Engineering, and worked with the Herman Lab on photovoltaics. She was an intern at the Institute of Materials Research and Engineering in Singapore, was a participant in the National Nanotechnology Infrastructure Network REU Program, and has served on the board of editors and reviewers for the *Columbia Science Review*, a peer-reviewed science publication featuring articles written by Columbia students. Currently, she is having a paper published on her work with the Herman group involving P3HT nanowires in photovoltaic devices. She will be attending Stanford University in the fall to pursue a Ph.D. in Materials Science.

Two other APAM seniors were also honored at other events this Spring.

Marla Lipsyc (Applied Mathematics)

King's Crown Leadership Excellence Award for Health and Wellness (with the Dean's Award for Leadership Excellence in her category)

Noah Whitehead (Applied Physics)

SEAS Class Day Scholar Athlete Award

Aradhya Wins MRS Graduate Student Gold Award

Sriharsha Aradhya, current Ph.D. candidate in the Venkataraman lab, won a Graduate Student Gold Award during the Materials Research Society's Spring 2013 meeting in San Francisco, CA. He received \$400 and a Gold Award presentation plaque.

2013 Simon Prize Winner: Monica Chahal



(left-right) Prof. Aron Pinczuk, Dr. Jane Faggen, Dr. Monica Chahal, and Prof. I.C. Noyan

The Robert Simon Memorial Prize is awarded annually by the APAM Department to the graduate student who has completed the most outstanding dissertation. Dr. Monica Chahal was the recipient of this year's award.

Dr. Chahal received her M.Sc. in Physics from Panjab University, India in May 2004. After graduation, she spent a year as a Research Assistant at Panjab University and worked on Supersymmetric Grand Unified Theory in High Energy Physics. In September 2005, she joined Temple University as a Teaching Lab Assistant where she worked for a year. She started her studies at Columbia University as a Ph.D. student in the APAM Department (Material Science & Engineering) in September 2006 and completed her M.S. degree in May 2008. She joined Prof. James Im's group in May 2007 as a Graduate Research Assistant to study beam-induced crystallization of thin Si films.

Her Ph.D. thesis, "Mixed-phase Solidification of thin Si films on SiO₂," proposed a new unique method that can produce defect-free, large-grain polycrystalline Si films with strong (100)-surface texture (>99%) on SiO₂. Such a combination of microstructural attributes makes the resulting MPS material well-suited for high-performance electronic and photovoltaic applications. She used laser and flash-lamp annealing systems to melt and solidify thin Si films and studied the resulting microstructure using various analytical tools. An *in situ* microscopic viewing system to directly observe and understand melting and solidification during the MPS process was employed. In the course of her thesis, she identified the optimal processing conditions for obtaining such a microstructure, as well as the physical factors that control the process. Based on experimental observations, she proposed a (continued on page 7)



Gabe Ganot

Ganot Wins Student Life Award

Gabriel Ganot (Ph.D. October '12, Materials Science and Engineering) was the recipient of the May 2013 Student Life Award. The award was presented during the SEAS Class Day Ceremony on Monday, May 20th.

The APAM Department nominated Dr. Ganot for his overall academic achievement, but most importantly, for his commitment and dedication to the SEAS community. He greatly contributed to the development of student life, recruitment, and departmental activities.

Dr. Ganot is currently an Associate in Exponent's Materials and Corrosion Engineering practice Menlo Park, CA. His areas of expertise include failure analysis, materials science, and semiconductor processing with an emphasis on thin film technologies, particularly laser crystallization and defect formation in thin films.

2012-2013 Graduates

October 2012

B.S. - Shazia Dharssi (AM), Harris Efron (MSE)

M.S. - Mohammed Ansari (AM/CVN), Christopher Belk (AM/CVN), Noel Berry (AM/CVN), Zhaoyi Li (MSE), Nan Shi (MSE), Hanyu Zhang (MSE)

M.Phil. - Bryan Debono (AP), Yan Yan (AM), Xiang Zheng (AM)

Ph.D. - Monica Chahal (MSE), Min Hwan Choi (MSE), Gabriel Ganot (MSE), Jeffrey Levesque (AP)

February 2013

B.S. - Chao Wang (AM)

M.S. - Brandon Boswell (MP), Ian Broderick (MP), Jia Ming Chen (AM), Elizabeth Crites (AM), Ximin Du (MP), Brian Helbig (MP), Eric Isaacs (AP), Jie Jin (AM), Andrew Kirby (AM), Yiran Lu (MSE), Shannon McKinney (MP), Nicholas Mykins (AM), Steven Palefsky (MP), Eli Pincus (AM), Adi Robinson (MP), Gary Shymkiw (AM/CVN), Xiaosi Sun (AM), Qi Zhang (AM), Jing Zhang (MP)

M.Phil. - Arunabh Batra (AP), Iva Vukicevic (AM), Ningyao Zhang (AM)

Ph.D. - Nikolaus Rath (AP)

May 2013

B.S. - Abhaya Aravind (AM), Lily Robin Amadeo (AM-CC), Nicolas Biekert (AP), Michael Carroll (MSE), Nicholas Chan (AM), Oliver Chan (AM), Eric Chen (MSE), Annabel Chew (MSE), Jeffrey Cochran (AM), Gerald D'Arco (AP), Nathan Epstein (AM), Timothy Foreman (AM), Sean Francis (AP), Bradley Goldstoft (AM), Julian Haimovich (AM), Alexandra Hammerberg (MSE), Jiho Han (AM), Alison Harmon (AP), Kristina Harris (AM-CC), Omar Hayes (AM-CC), Carlos Hernandez (AM), Derek Huang (MSE), Myles Jackson (AP), Aymar Jauad Handem (AM), Ezra Kebrab (AM), Jacob Keith (MSE), Prashanta Kharel (AP), Yeun Ji Kim (AM), John Koehler (AM), Claire Kuang (AM-CC), Timothy Leone (AM), Rayleigh Lei (AM-CC), Marla Lipsyc (AM), Dillon Liu (AP), Scott Massidda (AP), Benjamin Mayersohn (AM), James McGugan (AP), Giulio Meille (AM), Juan Mendoza (AM), Thomas Meyer (AM), Paul Mueller (AM), Abhimanyu Ramachandran (AM), Timothy Reichmann (AP), Tristan Renaud (AM), William Robson (MSE), Marshall Rogers-Martinez (AP), Viktor Roytman (AP), Anthony Ruda (AM), Eric Sacks (AP), Kamran Salari (AM), Kyle Schmidt (AM-CC), Kasey Strawbridge (AM), Kathleen Tatem (AP), Deanna Tufano (AM), Noah Whitehead (AP), David Xu (AM), Michael Yoon (AP)

M.S. - James Anderson (AM/CVN), Peter Bullen (AP), Anthony Clark (AP), Pierre Desjardins (AP), Montacer Essid (AP), Lee Klippel (AM), Yang Kou (AM), Haixing Li (AP), Xiaomeng Liu (AP), Apisak Meesrisom (MSE), Peijie Ong (AP), Hasan Ozen (AM), Daniel Shaevitz (AM), Nina Sinatra (MSE), Maxwell Terban (MSE), Vernon Wong (MSE), Chuteng Zhou (AP)

M.Phil. - Brian Capozzi (AP), Yi Li (MSE), Hande Ozturk (MSE), Thomas Roberts (AP)

Ph.D. - Matthew Davis (AP), David Goluskin (AM), Clara Orbe (AM), Neil Tandon (AM), Matthew Worstell (AP)

Certificate - Lee Goddard (MP)



Plasma Physics students with Prof. Michael Mauel after the Ph.D. Convocation



Isaac Greenbaum

Isaac Greenbaum, B.S. '06, Applied Mathematics

Greenbaum was recently featured in the article, "Data-Driven Alumni: The Faces behind Data Sciences", by Nicole Dyer, originally published in the Spring 2013 *Columbia Engineering Newsletter*.

Problem solving comes naturally to Isaac "Yitzi" Greenbaum. As a kid growing up in Los Angeles, he and his father would take long walks to the synagogue and do math problems along the way. "Math is something I've always done," he says. "I was inculcated from a very early age." When he earned his degree in applied math in 2006 from the APAM Department, he didn't just graduate; he was valedictorian.

Greenbaum, now 29, has parlayed his aptitude for numbers into a thriving career in big data, a field born to help wrangle meaning from the 2.5 quintillion bytes of information created daily. In 2010, he landed a coveted job at the booming tech start-up Chartbeat, an innovative analytics company that helps clients like *The New York Times*, Gawker, and Fox News turn vast oceans of online user data into useful charts and graphs.

As Chartbeat's lead data scientist, Greenbaum finds imaginative ways to improve the company's signature tool, a browser-based dashboard that give clients an at-a-glance visual reference to the relative performance of individual articles on their websites. Resembling an instrument panel in a pilot's cockpit, the dash can tell you in real time which stories are attracting the most clicks, how long readers spend on each story, how readers found the stories (from social media or a search engine, for example), and how often those stories have been shared, among other vitals. When clients want a new metric, Greenbaum steps in to make it happen. Take click-through rates. Sometimes just knowing how many clicks a particular link generates is not always enough, Greenbaum explains. "Clients may want to know why a particular link is attracting more clicks than others," he says. Is it because the link is displayed prominently on the homepage, or is the content itself attracting attention? So he's developed computer models that capture and analyze many different datasets to find out. "We just try to provide our clients with the tools they need to make good decisions," he says.

Greenbaum is pleasantly surprised to find himself in the start-up scene. He was sure his lifelong love of numbers would lead to a career on Wall Street. In fact, before earning his master's degree in computer science from SEAS in 2010, he was structuring credit derivatives at Citigroup. "My original intention was to go into finance," he says. That changed during his master's studies, when Applied Mathematics Associate Professor Chris Wiggins introduced him to the idea of going to work for a tech start-up. Greenbaum began meeting up with entrepreneurs from Columbia Business School and learning about new opportunities in the tech world. "Professor Wiggins got me excited about options I didn't even know existed," he says.

So far, Greenbaum is thrilled with his career change. "Ultimately, I didn't want to regret missing my opportunity to take a bigger risk and do something new and untested while I was still young," he says. "The idea of starting my own company or joining one in the very early stages really appealed to me. It still does."

Michael Stamatelatos, Eng.Sc.D. '70, Nuclear Engineering

Dr. Stamatelatos, student of Prof. Leon Lidofsky, has been the director of the Safety and Assurance Requirements Division in the Office of Safety and Mission Assurance at NASA Headquarters since October 2003. Michael is a recognized expert in risk and reliability assessment. He joined NASA in 2000 as manager of risk assessment in the Office of Safety and Mission Assurance. In that position, he was responsible for the development and application of probabilistic risk assessment (PRA) policy as well as for coordinating, overseeing, and integrating PRA programs and activities across the agency. He has developed, organized, and taught courses on quantitative risk assessment and risk-informed decision for managers and practitioners. He has lectured throughout NASA and to universities and government and industrial organizations. Michael is author or coauthor of more than 100 technical papers and reports. He is coauthor of "NASA Procedures Guide for Probabilistic Risk Assessment," "NASA Fault Tree Handbook," "NASA Risk Management Handbook," and "NASA Accident Precursor Analysis Handbook." He is also coauthor of two book chapters on probabilistic risk assessment. (*Spring 2013 Columbia Engineering Newsletter*)



Mark Cane

Mark Cane Elected to the National Academy of Sciences

by Melanie Farmer, *Columbia Engineering News*

Leading climatologist Mark Cane, professor of applied physics and applied mathematics, has been recently elected to the National Academy of Sciences (NAS). Cane is one of 84 new members and 21 foreign associates from 14 countries to join the prestigious

academy that recognizes distinguished and continuing achievements in original research and is one of the highest honors accorded to a U.S. scientist or engineer.

Cane is widely recognized in the international scientific community for a model he developed with former student and now a fellow Lamont Doherty colleague, Steve Zebiak, to predict the movement of warm water across the tropical Pacific Ocean in a cyclical phenomenon known as the El Niño Southern Oscillation, or ENSO. The Zebiak-Cane model successfully made the first physical forecasts of El Niño in 1985 and has since been the primary tool used by many researchers to enhance understanding of ENSO.

Cane's additional research interests include tropical oceanography, climate modeling, and data analysis methodology. A distinguished scholar and researcher, he holds multiple appointments at Columbia in addition to his professorship at the Engineering School. He is G. Unger Vetlesen Professor of Earth and Climate Sciences at Lamont-Doherty Earth Observatory, professor and chair of earth and environmental sciences, and associate director at the Earth Institute. He also is the founder of a highly successful master's degree program in Climate and Society that prepares students to understand and cope with the impacts of climate variability on society and the environment.

Most of Cane's current work relates to the impacts of human-induced climate change and natural climate variability on people around the world, with a focus on agriculture and health.



Nanfang Yu

New Faculty: Nanfang Yu

The APAM Department is pleased to announce the appointment of Nanfang Yu as a new assistant professor of Applied Physics (Solid State Physics).

Prof. Yu studies light-matter interaction in the subwavelength scale and its implications for solid-state devices. His lab designs and builds novel infrared optical components

and optoelectronic devices to address today's challenges in security, energy and health care. His research relies on physical intuition and simulations for device design and involves nano-/micro-fabrication and device characterization. His research uses a few key concepts and materials including optical antennas, plasmonic metamaterials and meta-surfaces, semiconductor quantum wells, and active materials such as graphene.

Recently, he has been interested in creating ultra-thin, flat optical components that can instantaneously mold optical wavefronts with subwavelength resolution and fast speed. He and his students are investigating miniature optical scatters ("optical antennas") that allow for abrupt and adjustable changes of the amplitude, phase and/or polarization of the scattered light and techniques to assemble such antennas with spatially inhomogeneous optical response into arrays.

Prof. Yu is also interested in biophysics. He is collaborating with biologists to conduct a research project to study the physical mechanism of insects' perception of infrared light. The motivation is to understand how certain insects detect broadband thermal radiation with high sensitivity or detect "fingerprint" infrared radiation from certain chemicals with high specificity. It is his hope that scientific and engineering lessons learnt from this program will provide insights in building novel infrared detectors, energy harvesters, and communication systems.

Prof. Yu received his Ph.D. degree in Engineering Sciences from Harvard University in 2009, and his B.S. degree from the Department of Electronics at Peking University, China, in 2004. He was a research associate in the School of Engineering and Applied Sciences at Harvard University from 2009 to 2012. He has worked extensively on plasmonics, metamaterials, and mid-infrared and terahertz semiconductor lasers.

Faculty Updates



Daniel Bienstock (APAM and IEOR) and Gil Zussman (Electrical Engineering) "received a 3-year \$1.05 million grant from the Defense Threat Reduction Agency (DTRA), the Department of Defense's agency in charge of countering weapons of mass destruction. Working with MIT Professor Eytan Modiano, the researchers will be investigating the vulnerability and resilience of the U.S. power grid to geographically correlated failures." (*Columbia Engineering News*)



Philip Kim was featured in the article, "Nanotech's Next Frontier: Initiative Brings Disciplines Together for Pioneering Discoveries," by *Columbia University News*. "Kim, a professor of physics and applied physics, is one of the first researchers in the world to focus on graphene, a super-strong membrane that is the thickness of a single carbon atom. It has captured the imagination of scientists, who want to develop practical applications for touchscreens, solar cells and sensors."



Chris Wiggins discussed his involvement in Columbia's new Institute for Data Sciences and Engineering in *The New York Times* article, "Data Science: The Numbers of Our Lives." Wiggins, co-investigator for the NYC Regional Innovation Node (NYCRIN) and co-founder of hackNY, was also featured in the *Columbia Engineering News* articles, "Fueling Start-Ups: NSF Grant Helps Advance the School's Entrepreneurship Initiatives" and "Hack Around-the-Clock."



Lorenzo Polvani & Philip Orton

NYC/Long Island AMS Chapter Seminars

Prof. Lorenzo Polvani and Dr. Philip Orton (alumnus of the Department of Earth and Environmental Sciences at Columbia University and current Research Scientist at the Stevens Institute of Technology) re-awakened the long-dormant public seminar series of the New York City/Long Island Chapter of the American Meteorological Society. One or two events will take place each semester at Columbia covering topics ranging from atmospheric science, physical oceanography, meteorology, climate, and hydrology.

The first seminar, which took place on Thursday, November 15, 2012, featured Kerry Emanuel, Professor of Atmospheric Science at Massachusetts Institute of Technology. He presented a talk on "Assessing Storm Surge Risk at New York City" to a packed auditorium.

Prof. Emanuel is member of the National Academy of Sciences, and winner of the Carl Gustaf Rossby Research Medal from the American Meteorological Society, its highest honor. He is most well-known for his work on ocean heat and tropical cyclones, and more recently on relating this to climate change. (Continued on page 7)



Chris Marianetti

Chris Marianetti Awarded FAME Research Grant

Chris Marianetti, Associate Professor of Materials Science and Engineering, was recently awarded a \$850,000 grant for his contribution to the Function Accelerated nanoMaterial Engineering (FAME) center.

This \$30M center, jointly funded by DARPA and the Semiconductor Research Corporation (SRC), is lead out of UCLA. Other participating universities include: Columbia, Cornell, UC Berkeley, MIT, UC Santa Barbara, Stanford, UC Irvine, Purdue, Rice, UC Riverside, North Carolina State, Caltech, Penn, West Virginia and Yale.

"The new Focus Center (FAME) aims to incorporate nonconventional materials and nanostructures with their quantum properties for enabling analog, logic and memory devices for beyond Boolean computation. The Center's main focus is nonconventional material solutions ranging from semiconductors, dielectrics and metallic materials as well as their correlated quantum properties. The mission of FAME is to create and investigate new nonconventional atomic scale engineered materials and structures of multi-function oxides, metals and semiconductors to accelerate innovations in analog, logic and memory devices for revolutionary impact on the semiconductor and defense industries." <http://fame-nano.org>

Industrial corporations including IBM, Intel, Micron, and others have recognized the relevance of the techniques that Marianetti has helped develop over the past decade which had been previously confined to predominantly fundamental scientific inquiry.

"I was brought into this center for my expertise on predicting the behavior of transition metal oxides from the first-principles of quantum mechanics, particularly those displaying strongly correlated electron behavior," said Marianetti. "Strongly correlated electron systems display a dizzying array of exotic properties including high temperature superconductivity, colossal magnetoresistance, Mott transitions, and many others. There is hope that a new generation of electronic devices could be realized by harnessing the sensitive properties of strongly correlated electron systems. Unfortunately, our "standard theory" of materials science, Density Functional Theory (DFT), sometimes qualitatively breaks down when addressing strongly correlated electron systems. Fortunately, there are more advanced theories, such as the dynamical mean-field theory (DMFT), which can remedy the shortcomings of DFT and unlock the behavior of strongly correlated systems. One of the major focus points of my research is developing the DMFT method and merging it with DFT to create a robust hybrid theory DFT+DMFT which will give us predict power over strongly correlated electron systems. Due to these theoretical and computational developments, we will be able to design new materials at the atomic scale and work with experimentalists to realize novel phenomena and functionality."



Steven Sabbagh

Adjunct Faculty News: Steven Sabbagh Honored by Princeton University

by Steven Sabbagh & John Greenwald, photo by Elle Starkman

Princeton University presented its 2013 Kaul Foundation Prize for Excellence in Plasma Physics Research and Technology Development to physicist Steven A. Sabbagh (APAM Alumnus, Ph.D. '90, Plasma Physics). He received the award for his work on advancing the understanding, and enhancing the stability, of high-performance tokamak fusion plasmas.

The award was presented by Princeton Plasma Physics Laboratory (PPPL) director Stewart Prager immediately following his May 28th State-of-the-Laboratory Address.

Sabbagh, a senior research scientist and adjunct professor of applied physics in the APAM Department, is the first PPPL collaborator to receive the Kaul Prize, whose charter needed to be formally changed to allow the prize to be awarded to a long-term collaborator resident at PPPL. Former PPPL Director Ronald Davidson endowed the prize by giving Princeton University a portion of the gift he received as the 1993 recipient of the Award for Excellence in Science, Education and Physics from the Kaul Foundation in Tampa, Florida. Sabbagh has worked as a research scientist and has led a group of Columbia University researchers conducting experiments at PPPL for more than two decades. He has mentored students doing research at the Laboratory as well. "We're very pleased to make this award to Steve," said Michael Zarnstorff, PPPL deputy director for research. "We deeply value his contributions to the Lab and to the U.S. fusion program through the facilities here, and to the role that he's played as a leader of experimental programs."

Sabbagh began work as a full-time, on-site collaborator at PPPL after earning his Ph.D. from Columbia in 1990. He first created plasmas on the Tokamak Fusion Test Reactor (TFTR) that significantly exceeded previous limits for a crucial factor called "beta"—the ratio of the pressure of the plasma to the strength of the magnetic field that confines it. The higher the beta, the more cost-effective the confinement. Sabbagh evolved this line of research to produce some of the highest fusion power in the eventual deuterium-tritium operation of TFTR.

Sabbagh next moved to the National Spherical Torus Experiment (NSTX), where he investigated ways to stabilize plasma at high beta by controlling phenomena called resistive wall mode instabilities. His research produced record beta values that surpassed a stability milestone called the "no-wall limit" by as much as a factor of two. He plans to continue to advance such research when the NSTX upgrade is completed next year.

Sabbagh conducts complementary experiments on the KSTAR superconducting tokamak in South Korea and the DIII-D tokamak in San Diego, and has been awarded a number of honors. He received the International Atomic Energy Agency Nuclear Fusion Award in 2009, and was elected an American Physical Society Fellow in 2010. He lives in Warren, NJ with his wife, Mary Lepore-Sabbagh, who has worked in information technology for Bell Labs and Lucent Technologies.



NYC Next Idea: Prof. Chris Wiggins (2nd from the left) stands with the winners and finalists of the NYC Next Idea 2012-2013 Competition. The final round of the competition took place on Wednesday, March 13, in Davis Auditorium.

The competition, sponsored by New York City Economic Development Corporation (NYCEDC) in partnership with the Engineering School, encourages students and recent alumni from universities around the world to consider New York City as the natural place to start their new venture.



Simon Billinge

Simon Billinge & the Joint US-Africa Materials Initiative

Prof. Simon Billinge and APAM Ph.D. candidate, Eric Isaacs, were featured in the following article, "Connecting Globally, Materials Scientists Seek Sustainable Energy Solution," by Holly Evarts, originally published by *Columbia Engineering News*.

Over the winter break, Simon Billinge, Professor of Materials Science, Applied Physics, and Applied Mathematics, and two second-year Ph.D. students — Eric Isaacs (APAM) and Benjamin Frandsen (Physics) — traveled to Ethiopia to take part in a two-week program developed by the Joint US-Africa Materials Initiative (JUAMI). This Materials Research School is the first program to be offered by JUAMI, a new initiative targeted at building materials science research collaborations between the United States and Africa and to link young materials scientists in both regions in a school taught by top researchers in the field.

"We created JUAMI to connect researchers in Africa and the U.S. to tackle problems in research and graduate education together," says Billinge, principal investigator of the National Science Foundation grant that funds this initiative. "This school focused on energy sustainability, which is a world problem, a human problem. Only by understanding each other's difficulties, and by building relationships and sharing resources, will we find robust solutions that take the world as a whole towards a sustainable energy future."

The program in Ethiopia, which ran from December 9-21, 2012, drew more than fifty Ph.D. and early career materials researchers from across the U.S. and East Africa. They joined fifteen internationally recognized instructors for two weeks of lectures, problem solving, and cultural exchange in historic Addis Ababa. The tutorials and seminar topics ranged from photocatalysis and photovoltaics to fuel cells and batteries.

"As a Ph.D. student working to develop improved materials for energy storage, I benefitted enormously from this opportunity and feel honored to have been a part of JUAMI," says Isaacs. "Although I came in with little to no experience in the topics outside my Ph.D. research at Columbia Engineering, by the end of the two weeks, I felt knowledgeable and excited about all of these renewable energy technologies."

The students and researchers hailed from the U.S, Ethiopia, Uganda, Kenya, and Tanzania in East Africa, with others from South Africa and Zambia.

"To travel halfway across the world to Ethiopia and find materials scientists and engineers trying to tackle the renewable energy problem just like us was remarkable," Isaacs adds. "Although we all came from such different backgrounds and cultures, we were united in our desire to use science and engineering to make a significant contribution towards a sustainable energy future."

A typical day included morning lectures from 9:00 a.m. to 1:00 p.m.

"These lectures," Frandsen notes, "provided a thorough but accessible introduction to a variety of topics in energy materials."

After lunch, the students took part in hands-on activities, including group problem-solving sessions and basic experiments, which enabled them to apply the material presented from the morning lecture. For dinner, they broke into small groups, each with Ethiopian students as guides, and sampled the local cuisine. Evenings were spent either working on group projects or going out with their newfound friends.

"The group excursions we took were great," Frandsen adds. "One of our journeys took us straight across the Great Rift Valley, where many of the most important discoveries relating to early hominid species were made. And diving into the hot springs was fun, as we were able to swim in the naturally warm water and watch the antics of the wild monkeys living in the area."

Another highlight was the big soccer game among the students and instructors.

"The teams were evenly divided among all the different nationalities," says Frandsen, "since it would have been completely one-sided (not in our favor!) if it had been Africa versus the U.S."

Both Frandsen and Isaacs agree the most rewarding part of the school was seeing sixty strangers from around the globe become a close-knit group of friends and collaborators.

"We learned so much not only about materials science, but also about each other and our backgrounds," Frandsen says.

Adds Isaacs, "It was an astounding and humbling experience to see firsthand some of the challenges faced by the African scientists. Although the school only lasted two weeks, I am confident that the friendships and collaborations we developed in Addis Ababa will continue for a very long time."

JUAMI was organized by Prof. Billinge along with Peter Green, Professor of Chemical Engineering at the University of Michigan; Sossina Haile, Professor of Materials Science and of Chemical Engineering at Caltech; Teketel Yohannes, Chair of the Africa committee and Professor of Chemistry at the University of Addis Ababa; Bernard Aduda, Principal of the College of Biological and Physical Sciences at the University of Nairobi; Tom Otiti, Professor of Physics at Makerere University; and Joseph Tesha, Director of Research and Associate Professor of Engineering Materials at the University of Dar es Salaam.

Billinge and his colleagues are already working on a JUAMI online "collaboratory" where researchers and students can share their expertise as well as their questions and research problems. He notes that a number of scientific collaborations that grew out of the Ethiopia school will be the first projects hosted on this new site. Meanwhile, the group will continue to seek funding to support future programs across the globe and expand the range of topics covered.

"The school exceeded all of our expectations," Billinge says. "The energy and good will generated by the participants was infectious and we are strongly motivated to keep it going."



Above: Ben Frandsen and Eric Isaacs (3rd and 4th from left) pose with students from the JUAMI school. For more firsthand accounts from the school participants, read their blog entries at:

<http://juami2012.blogspot.com>

NYC/Long Island AMS Chapter Seminars

(Continued from page 4)

Prof. Emanuel currently works on various aspects of moist convection in the atmosphere, and on tropical cyclones. He is interested in fundamental properties of moist convection, including the scaling of convective velocities and the nature of the diurnal cycle of convection over land. His group has developed a promising technique for inferring tropical cyclone activity from coarse-grain output of climate models or re-analyses.

The second seminar, which took place on January 31, 2013, featured James Doyle, the Head, Mesoscale Modeling Section, Naval Research Laboratory, who spoke on the "Predictability of Tropical Cyclones – Perspectives from Sandy and Irene."

James Doyle is the head of the Mesoscale Modeling Section of the Marine Meteorology Division of the Naval Research Laboratory, and a Fellow of the American Meteorological Society (AMS). He has been recognized for his contributions to the science of mountain meteorology and mesoscale predictability, significant scientific advancement in our understanding of terrain-induced gravity waves, micro-structure of leeside rotors, numerical methods, and adjoint-based mesoscale predictability. He has served in leadership roles in several field projects, and is an accomplished modeler as the chief scientist for the Navy's Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS), as well as its tropical cyclone version (COAMPS-TC) that has been one of the best-performing hurricane intensity forecast models over the last several seasons, including particularly accurate forecasts for Irene and Sandy.

For information on 2013-2014 NYC/Long Island AMS Chapter Seminars and other APAM colloquia, please see:

<http://apam.columbia.edu/seminars-0>

2013 Simon Prize Winner: Monica Chahal

(Continued from page 2)

thermodynamic model to explain the microstructural evolution and extracted the hierarchical order of the Si/SiO₂ interfacial energies as a function of grain orientation, which is otherwise difficult to measure experimentally.

In her undergraduate studies, Monica was awarded gold medal for her outstanding academic achievement. While at Columbia, she worked in close collaboration with Interuniversity Microelectronics Centre (IMEC, Belgium) and National Renewable Energy Laboratory (NREL, Colorado) on various projects to obtain high-efficiency thin-Si-film solar cells. She published four papers including one in the *Journal of Crystal Growth*, and two others in *IEEE PVSC*. She also presented at many material science/solar cell conferences where her work was nominated three times as one of the top ten presentations. She is currently working as a Senior Reliability Engineer at Intel Corporation in Oregon.

Robert Simon (1919-2001) spent a lifetime making valuable contributions to the field of computer science. He received a B.A. degree cum laude in Classics from CUNY in '41 and an M.A. in Mathematics from Columbia in '49. He was a Lieutenant in the U.S. Armed forces serving in England, France, and Italy. He worked for 15 years at Sperry's Univac Division in various capacities including marketing, planning, systems engineering, systems programming and information services. He also worked at the Fairchild Engine Division as Director of the Engineering Computer Group. He personally directed the establishment of several company computer centers at sites throughout the U.S. He was a partner with American Science Associates, a venture capital firm. He was a founder and Vice President of Intech Capital Corporation and served on its board and a founder and member of the board of Leasing Technologies International, Inc. until his retirement.

The Simon Prize was established in 2001 by Dr. Jane Faggen with additional support from friends and relatives of Mr. Simon. Due to the generosity of Dr. Faggen, the prize will be doubled next year.

Nowick Memorial Symposium

The Arthur S. Nowick Memorial Symposium took place in Kyoto, Japan, on the afternoon of June 7, 2013, in conjunction with the 19th International Conference on Solid State Ionics (SSI-19). Nowick, who earned his master's and Ph.D. at Columbia University, was a Professor of Metallurgy and Materials Science in the Henry Krumb School of Mines from 1966-1993. Nowick, author of more than 200 publications in a wide range of fields in materials science and solid-state physics, was the 1994 recipient of the David Turnbull Lectureship, bestowed by the MRS in recognition of career contributions to the fundamental understanding of the science of materials.

The Symposium highlighted the impact of Nowick's work and included contributions from former colleagues, students, as well as from others who have been positively influenced by his publications and research. The Symposium program and information about SSI-19 can be found online at: <http://www.ssi-19.net>.

DEPARTMENT OF APPLIED PHYSICS & APPLIED MATHEMATICS FUND

Yes, I want to support the APAM Department with my gift of:

\$1,000 \$500 \$250 \$100 Other: _____

I have enclosed my check in the above amount made payable to Columbia University. Please direct my gift to:

APAM Special Projects Fund Other: _____

Name _____

Address _____

City _____ State _____ Zip Code _____ Email _____

This gift is tax deductible as allowed by law. Please return this form and your check to:

Prof. I. Cevdet Noyan, Chair

Department of Applied Physics & Applied Mathematics, Fu Foundation School of Engineering & Applied Science, Columbia University
500 W. 120th Street, 200 Mudd, Mail Code 4701, New York, NY 10027



On March 15, 2013, on the occasion of their retirement, the Medical Physics Program honored Prof. Edward Christman and Prof. Edward Nickoloff. Their colleagues thanked them for their outstanding contributions to the Program and for their many years of selfless service. Photo: seated (right-left) Jerome Meli, Howard Amols, Edward Nickoloff, and Edward Christman; back row (right-left) I.C. Noyan, Marlene Arbo, Peter Esser, Cheng-Shie Wu, Stephen Ostrow, Marco Zaider, Lawrence Rothenberg, Thomas Morgan, and John Arbo

Contact Us

The Applied Physics & Applied Mathematics Department
The Fu Foundation School of Engineering & Applied Science
Columbia University in the City of New York
500 W. 120th Street, Room 200 Mudd, MC 4701
New York, NY 10027
Phone: 212-854-4457
Fax: 212-854-8257
www.apam.columbia.edu

Please stay in touch. Send your news to:
seasinfo.apam@columbia.edu

Find us on Facebook at:
Applied Physics & Applied Mathematics Department,
Columbia University

Follow us on Twitter at:
APAMMSECU

Editors: I. Cevdet Noyan, Dina Amin, Christina Rohm

Contributing Authors: Monica Chahal, *Columbia Engineering News*, *Columbia University News*, Nicole Dyer, Holly Evarts, Melanie Farmer, John Greenwald, I. Cevdet Noyan, Steven Sabbagh

Photos/Images: Eileen Barroso, *Columbia Engineering News*, Timothy Fisher, Wesley Hattan, Philip Orton, Elle Starkman

Design: Christina Rohm