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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 Other Friends of APAM:

Welcome to the second year of the APAM Newsletter!

In this issue, the spotlight on faculty activities is on the summer schools and workshops organized by Chris Wiggins and Guillaume Bal. We are also very pleased to welcome two new faculty members to our department, Latha Venkataraman in applied physics and Matias Courdurier in applied mathematics, and to report on honors received by several faculty. David Keyes and Jerry Navratil won major awards from professional societies for their respective work on high performance computing and fusion plasma physics, and Chris Wiggins won the SEAS award for promoting diversity.

This issue closes with a retrospective on the nuclear reactor that was built on campus in the late 1960's, as part of the Nuclear Science and Engineering program. Our department was created in 1978 by combining the Division of Nuclear Science and Engineering and the interdepartmental plasma physics doctoral program.

Thank you to our alumni and other friends of the department for letting us know what you are doing. (Check out the awards won by our alumni and current students!)

Best,

Irving P. Herman
Chair, APAM

2007 Commencement: Medical Physics Degree Candidates
(left to right) Stephen Glennon, Bradley Pollard, Aaron Svoboda, Owen Clancey

In this Issue

The APAM Newsletter is published twice a year. To request a hard copy, please contact the APAM Department (see page 8).

Dr. Jane Faggen, Prof. Thomas Pedersen, and Dr. Remi Lefrancois

Remi Lefrancois Wins the 2007 Simon Prize

The Robert Simon Memorial Prize is awarded annually by the APAM Department to the graduate student who has completed the most outstanding dissertation. This year's recipient was Dr. Remi Guy Lefrancois.

Remi received his Ph.D. in plasma physics in December 2006. During his studies, he worked with his advisor, Prof. Thomas Pedersen, on a number of theoretical, computational, and experimental projects as part of the Columbia Non-neutral Torus (CNT) experimental effort. His main contribution was the successful investigation of the nature of equilibria of pure electron plasmas confined on magnetic surfaces. Remi developed a computer code that solves the theoretically derived equilibrium equation in full 3-D geometries, including the rather complicated geometry of the CNT. Using his code, he discovered that a pure electron plasma in force balance will have a large variation in density along magnetic field lines, even the magnetic axis. This is in sharp contrast to neutral plasmas, which have essentially no variation in their densities along the magnetic axis. His result is similar to one obtained in Penning traps, but there are substantial differences as well - the variation in density predicted in the CNT is much larger than that predicted from the Penning trap theory. Remi explained this difference with a simple yet accurate analytic model, which showed that it is the special geometry of the CNT's magnetic surfaces that is responsible for the larger density variation. He has also created a 3-D numerical model of equilibria in the CHS stellarator in Japan, and has provided crucial input to the CHS group in their interpretation of pure electron plasma measurements. In February 2007, the CHS group published a paper showing experimental verification of some of Remi's most important predictions - the variation of plasma potential on a magnetic surface.

Remi received a bachelor's degree in Mechanical Engineering in 2000 and a second bachelor's degree in Physics in 2002, with honors, both from University of Alberta, Canada. He entered APAM in fall 2002, passed the written Doctoral Qualification exam with distinction, and started working with Prof. Pedersen in 2003. While at Columbia, Dr. Lefranois first authored two articles in *Physics of Plasmas*, including one Letter, and is a co-author on 7 other papers. Since his graduation, Remi worked as a postdoctoral associate in the CNT group. He is currently the Assistant Vice President in the IT Derivatives Department at Credit Suisse.

Robert Simon (1919-2001) spent a lifetime making valuable contributions to the field of computer science. Starting in 1953, 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 spent a year working 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. Between 1969-1973, he was a partner with American Science Associates, a venture capital firm. He as a founder and VP of Intech Capital Corporation, served on its board from 1972-1981, and was a founder and member of the board of Leasing Technologies International, Inc. from 1983-1995. The prize was established in 2001 by Dr. Jane Faggen with additional support from friends and relatives of Mr. Simon.

Undergraduate Award Winners

Applied Mathematics Faculty Award

Sohrab Shahshahani

Sohrab Shahshahani (AM B.S. '07) began college at Wesleyan University in Middletown, CT, and came to Applied Mathematics at Columbia as a part of the 3-2 program.

He has explored different aspects of applied math and participated in an REU program in biomedical engineering at Rutgers last summer. He has strong interests in topology, geometry, and analysis, and is attending graduate school in mathematics at the Univ. of Pennsylvania.

Applied Physics Faculty Award

Stephanie Stattel

Stephanie Stattel (AP B.S. '07) came to Applied Physics at Columbia as a combined plan student (3-2 program) from the College of the Holy Cross.

She has strong interests in plasma and nuclear physics, and maintained a GPA above 4.0 all her semesters at Columbia. She was admitted to many fine graduate programs, including the one at MIT, and she decided to go to graduate school in physics at UCLA.

Congratulations '06-'07 Grads

APPLIED MATHEMATICS, B.S.

Cyrus Aghili, Michelle Bettelheim, Ali Causer, Lawrence Chow (AM/AP), Taedoo Chung, Steven Dubey, Julien Dumoulin-Smith, Benjamin Jack, Joseph Jailer-Coley, D vid Kim, Yongseok Ko, Kenneth Lee, Zhixi Li, Jonney Liu, Casey Longmier, Nishant Mittal, Devin Nambiar, Nhan Phan, Sonali Phatak, Diego Pontoriero, Ashwin Prabhu, Sohrab Shahshahani, Waqas Shaikh, Michael Silberman, David Stenning, Lingfeng Tang, Zichuan Tang, Anna Vasileva, Sergey Voronin, Richard Wong, Wing Ki Wong, Emmi Yonekura

APPLIED PHYSICS, B.S.

Nathan Arnold, Lawrence Chow (AM/AP), Ying Yi Dang, Sarah Goler, Jeremy Goren, Christopher Hwang, Alexander Kocsis, Nicholas Litombe, Stephanie Stattel, Pavithra Sundar, Xin Wang, Ryan Weed

MATERIALS SCIENCE & ENGINEERING, B.S.

John Esterhay, Eddie Krule, Gavin Kuangparichat, Anna Liveris, Jarod Were

APPLIED MATHEMATICS, M.S.

Aron Ahmadia, Skender Cilka, Daniel Lang, Jeehyun Lee, Howard Maile, Nicholas Nahas, Priyanka Verma

APPLIED PHYSICS, M.S.

Paul Brenner (Plasma), Bryan DeBono (PP) Benoit Durand (PP), Michael Frei (SS), Jie Gao (SS), Matthew Lanctot (PP), Jeffrey Levesque (PP), Daisuke Shiraki (PP), Yuri Zuev (SS)

MATERIALS SCIENCE & ENGINEERING, M.S.

Adrian Chitu,Teresa Fazio, Gabriel Ganot, Zhang Jia, Irina Kalish, Bob Kemmerer, Li Li, Daniel Noval, Christopher Rumer, Chih-Chen Wang, Lixin Yu

MEDICAL PHYSICS, M.S.

Junguk Choi, Hsiu-Wen Hsieh, Spiro Kartsonis, Zhi Liang, Manuel Orlanzino, Erwin Ruff III, Ying Zhou

APPLIED MATHEMATICS, APPLIED PHYSICS, AND MATERIALS SCIENCE & ENGINEERING, M.Phil.

Yikang Deng (MSE), Yongfeng Guan (SS), Ozgur Kalenci (SS, Quinn Marksteiner (PP), Jenna Pike (MSE), Joan Raitano (MSE), Nicolai Stillits (PP), Francesca Terenzi (AM), Xiao Wei (PP)

APPLIED MATHEMATICS, Ph.D.

Matthew Wittman

APPLIED PHYSICS, Ph.D.

Rui He (SS), Kristi Hultman (SS), Oksana Katsuro-Hopkins (PP), Jason Kremer (PP), Remi Lefrancois (PP), Timothy McDonald (SS), Ryan Roth (SS)

MATERIALS SCIENCE & ENGINEERING, Ph.D.

Yinyan Gong, Sharona Hazair, Jenna Pike

Fulbright France by Chad Husko

A quick examination of labs around Columbia, or just about anywhere in the U.S., reveals people from many different cultures researching side by side. Though the labs are multicultural in name, the environs are shaped largely by their host country. As a U.S. citizen, I often wondered what it might be like to research under a different set of cultural norms and social values. This past year I successfully competed in the Fulbright grant competition and was awarded the opportunity to immerse myself in the scientific culture of France.

For the '07-'08 academic year, I will be working with colleagues at Thales Research and Technology, a pan-European industry consortium in Palaiseau, France (~17 miles south of Paris). Together we will be examining optical properties of semiconductors for communication applications. An interesting side note, Thales works closely with Alcatel, which recently purchased the well known Bell Labs. The Thales campus is conveniently located adjacent to L'École Polytechnique, one of the most prestigious science and technology universities in France, as well as the Charles Fabry Institute of Optics. The proximity of these resources will no doubt allow further intercultural scientific dialog. APAM has been successful in past Fulbright competitions. MSE graduate Stephanie Grancharov (Ph.D. '05) conducted part of her studies at the Max Planck Institute in Germany in '04-'05.

An exciting year of research and culture à la Française lies ahead of me. Look for a follow-up story next year! Deepest appreciation to my adviser, Prof. Chee Wei Wong, of the CU Nanophotonics lab, and the continuing support of all of my friends and mentors in APAM.

IBM Internship by Jennifer Evans

Aron Ahmadia, originally from Hilo, Hawaii, is working on his Ph.D. under Prof. David Keyes, specializing in computational science with applications in high performance computing. Working with IBM's computational scaling team for a 3-month term, he tackled the task of redesigning lithography optimization algorithms and code to run on the world's fourth fastest supercomputer, Blue Gene W at the Thomas J. Watson research facility in Yorktown.

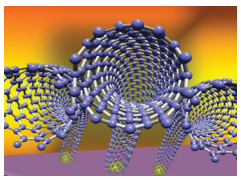
"I worked on computational techniques to improve the mask design process for semiconductor chips," he says, "taking current technology levels and advancing them so IBM can pack denser and denser chips and make a more complicated and faster processor."

Lithography, as Ahmadia explained, is similar to a photographic process. You have a light source and a mask which blocks or transmits certain parts of the light source. A photo sensitive material then captures the image of what the mask produces.

"One way to think about what I did is if you have finger puppets on the wall and you're using a flashlight to cast a finger puppet. Your hand is the mask and the shadow on the wall is the final image being printed on the computer chip."

Ahmadia explained that just as you can vary what your hand is doing to get the shadow you want on the wall, he and his team are trying figure out what the optimal mask is to get the ideal chip. "Of course, in computational lithography, there are several trillion fingers to wiggle."

Spotlight on Current Students



Zhang Jia (MSE graduate student) and Dr. Limin Huang (MSE postdoctoral research scientist) and Prof. Stephen O'Brien published a feature article, "Orientated assembly of single walled carbon nanotubes and applications" in the *Journal of Material Chemistry*, Issue 37, 2007. Zhang's image (left) was featured on the cover.

Jeffrey Levesque (PP graduate student) was awarded an appointment in the U.S. Department of Energy (DOE) Fusion Science Fellowship Program sponsored by the Office of Fusion Energy Sciences (OFES) and administered by the Oak Ridge Institute for Science and Education (ORISE) for 07-08. The fellowship, which is renewable up to three consecutive years, was awarded in recognition of his academic excellence and his research interests in fusion energy science.

The Institute of Physics (IOP) Publishing chose the article by Gideon Simpson (AM graduate student), Prof. Marc Spiegelman and Prof. Michael I. Weinstein, titled "Degenerate dispersive equations arising in the study of magma dynamics" published in *Nonlinearity*, Vol. 20, 2007, for inclusion in IOP Select, a special collection of journal articles selected by IOP Journal editors. IOP select articles are chosen based on one or more the following criteria: substantial advances or significant breakthroughs, a high degree of novelty, and significant impact on future research. Simpson is a 4th year gra uate student working with Prof. Spiegelman and Prof. Weinstein on microscopic and macroscopic modeling of fluid-solid dynamics in the earth's interior. Initially, funded by the APAM's IGERT Fellowship Program, Simpson and this collaboration are now supported by the NSF's Collaboration in Mathematical Geosciences (CMG) Program.

Andrew Ying (MSE graduate student) was awarded a full scholarship to attend the National School on Neutron and X-ray Scattering from August 12-25, 2007 at the Argonne National Laboratory, supported by the U.S. Department of Energy, Office of Science and the Office of Basic Energy Sciences.

Alumni News

Netta Cohen (Applied Physics, B.S. '92) completed her Ph.D. in biophysics at Technion (Israel Institute of Technology) and now heads the BioSystems group at the School of Computing at the Univ. of Leeds in England. She is married to Sam Braunstein and they have a daughter, Yael.

Yi Gu (Applied Physics, Ph.D. '04) is an Assistant Professor in the Department of Physics and Astronomy at Washington State University.

Jennifer Ellsworth (Applied Mathematics, B.S. '02) is a Ph.D. student, studying Applied Plasma Physics at MIT. She recently married Michael Hohensee in Nashua, N.H.

Bahram Jalai

Bahram Jalali (Applied Physics, Ph.D. '89) is a Professor of Electrical Engineering at UCLA. He is a Fellow of the IEEE and the Optical Society of America, and the Chair of the Los Angeles Chapter of the IEEE Lasers and Electro Optics Society (LEOS). His research interests include silicon photonics and techniques for ultra fast data generation and capture. He has published over 200 scientific papers and holds 6 US patents. He is the recipient of the 2007 R.W. Wood Prize from the Optical Society of America. In 2005, he was chosen by the *Scientific American* Magazine as one of the 50 Leaders Shaping the Future of Technology. His work in demonstration of the first silicon laser was cited by the MIT Technology Review magazine as one of the top 10 technology trends in 2005. While on leave from UCLA from '99-'01, he founded Cognet Microsystems, a Los Angeles based fiber optic component company. He served as the company's CEO, President and Chairman, from its inception through acquisition by Intel Corporation in '01. From '01-'04, he was a consultant for Intel Corporation. Dr. Jalali serves on the Board of Trustees of the California Science Center. He has received the BridgeGate 20 Award for his contributions to the southern California economy.

Artem Ponomarev (Applied Physics, Ph.D. '98) is currently a Senior Research Scientist at the NASA Johnson Space Center. He specializes in radiation protection for astronauts and is working on developing biophysical models of DNA damage from space radiation. He is a consultant for the spacecraft design for the new Lunar and Mars Mission Projects. Additionally, he works with astronaut-physicist Franklin Chang-Diaz's Plasma Rocket group on radiation issues and astronaut-physicist Jeffrey Hoffman's group on the magnetic shielding of a spacecraft.

New APAM Faculty Members: Matias Courdurier and Latha Venkatarman

Matias Courdurier

Matias Courdurier has been appointed as the new Chu Assistant Professor of Applied Mathematics, a non-tenure 2-year position in the APAM Department.

Prof. Courdurier received his Ph.D. in Mathematics, in 2007, from the Mathematics Department at the University of Washington, under the supervision of Prof. Gunther Uhlmann. His work focused on the study of the X-ray transform and the Radon transform under truncations. The study of this inverse problem is of particular interest for the medical imaging techniques of Computerized Tomography (CT), Positron Emission Tomography (PET) and Single Photon Emission Computed Tomography (SPECT). The improvement of such imaging techniques is heavily related to a better understanding of the mathematical elements that appear in the model. Courdurier collaborates in such research with professors from universities in the U.S., Belgium and Japan.

He completed his undergraduate studies with the professional degree of Mathematical Engineer in 2001 in the Mathematical Engineering Department of Universidad de Chile, Santiago, Chile. He received the 2002 Marco Orrego Puelma Award for the best engineer of Universidad de Chile graduating in 2001. During his Ph.D. studies at the University of Washington he received a Microsoft Scholarship (2002), an Academic Excellence Award (2003) and the McFarlan Fellowship Award (2005).

During his first semester in the APAM Department, he will be teaching a class in Applied Functional Analysis, APMA E4150, for beginning Ph.D. students or senior undergraduate students with interest in the mathematical area of analysis and its applications.

Latha Venkataraman

Latha Venkataraman joins the APAM Department as a new Assistant Professor of Applied Physics.

Prof. Venkataraman's research involves exploring the electronic transport and mechanical properties of materials on the nanometer scale. The motivation to study the properties of materials at this scale is based partly on the developments in the integrated circuit industry. The size of components has been dropping rapidly over the past few decades, following a trend originally identified by Gordon Moore. In recent decades, developments in nanotechnology, including the invention of the scanning tunneling microscope and other scanned probe techniques, have enabled the study of materials in these previously inaccessible length scales. Venkataraman says, "My research will use these tools to study the electronic and mechanical properties of single molecules and novel nanowire materials".

Prof. Venkataraman received a bachelor's degree in Physics from the Massachusetts Institute of Technology, and an M.S. and Ph.D. in Physics from Harvard University, where she also received an Applied Physics Fellowship and the White Prize for Excellence in Teaching. Following her doctorate, she spent three years at Vytran Corporation as a research scientist, developing new technologies for fusion splicing of optical fibers.

Prior to joining SEAS faculty, Prof. Venkataraman was a research scientist and executive committee member at Columbia's Nanoscience and Engineering Center.

The new APAM website will be launched later this term!
For updates, please see: www.apam.columbia.edu

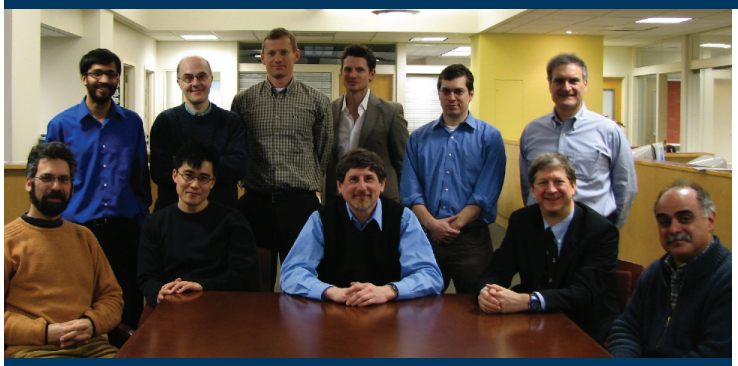
David Keyes

Keyes Wins 2007 Sidney Fernbach Award

David Keyes, the Fu Foundation Professor of Applied Mathematics, received the IEEE Computer Society's 2007 Sidney Fernbach Award at the November Supercomputing'07 Conference in Reno, NV. The award is given annually to an individual for an outstanding contribution in the application of high performance computers using innovative approaches. Keyes' citation reads: "for outstanding contributions to the development of scalable numerical algorithms for the solution of nonlinear partial differential equations and exceptional leadership in high-performance computation."

Keyes has pushed simulations of fluid dynamics, combustion, radiation transport, and magnetohydrodynamics onto parallel computers from the first commercially available systems in 1985 to IBM's currently world-leading BlueGene systems, concentrating on the scalability of solution algorithms as the number of processors heads towards the millions. For one such effort in computational aerodynamics, Keyes shared the ACM's Gordon Bell Prize at Supercomputing '99. He has led NSF-, NASA-, and DOE-sponsored teams in the prototyping of research software and the maintenance of freely available libraries. He currently directs the DOE SciDAC software project "Towards Optimal Petascale Simulations" (TOPS), and the international scientific organization "ddm.org" which promotes the development and analysis of algorithms for solving differential equations on distributed-memory parallel computers. For the past eight years, Keyes has directed the Institute for Scientific Computing Research, an academic outreach center operated by Lawrence Livermore National Laboratory. He is also the Vice President-at-Large of SIAM, and has edited several federal agency reports on large-scale scientific simulation.

The Sidney Fernbach Award has been made nearly annually since 1993 to a computational scientist whose contributions range from the mathematics of simulation, to computer architecture and software issues, to the physical applications, themselves. Keyes is the 14th recipient. Previous recipients include Profs. Marsha Berger and Charles Peskin of the Courant Institute at NYU. Sidney Fernbach directed some of the Department of Energy's most significant efforts in scientific computing from the establishment of Lawrence Livermore National Laboratory in 1952 through 1982. The award was established following his death in 1991.



Prof. Siu-Wai Chan was invited by the Chinese Academy of Sciences' Institute of Physics in Beijing to give an invited lecture at the Zhong-Guan-Cun Forum on Condensed Matter Physics. The title of her talk was "Twin Boundary Engineering in YBCO, Nano Ceria and Ceria-Zirconia".

Prof. David Keyes was the chair of the organizing committee for the Scientific Discovery through Advanced Computing (SciDAC) 2007 Conference in Boston from June 24-28. SciDAC, which is operated by the Department of Energy Office of Science. It is a unique program that has brought together computational scientists, applied mathematicians, and computer scientists from across application domains and from universities and national laboratories across the U.S.

Prof. Michael Mauel was invited by the National Research Council (NRC) to serve a 3-year term as a member of the Plasma Science Committee under the auspices of the Board on Physics and Astronomy. The Plasma Science Committee is responsible for overseeing projects and advising the NRC on initiatives in the field of plasma science that strengthens plasma science as a discipline.

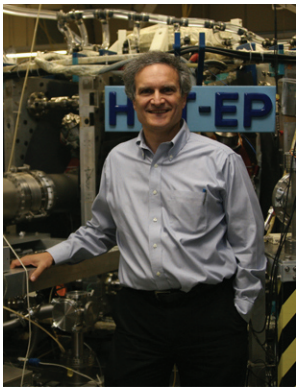
Prof. Horst Stormer led the kickoff ceremony in Roone Auditorium in Lerner Hall along with James Whaley, President of the Siemens Foundation, for the Columbia/Siemens Science Day on campus this past October. University faculty, Siemens staff, and members of many local science organizations came together to support science teaching and learning in New York City. Children in grades 4-8 attended interactive workshops lead by Columbia's own faculty and graduate students, as well as by presenters from New York City Office of the Medical Examiner, Bank Street College Science faculty, World Conservation Society, and the New York Aquarium.

Prof. Chris Wiggins was named the 2007 recipient of the Janette and Armen Avanessians Diversity Award. The Avanessians award honors faculty members who have made a significant contribution to the diversity of the School of Engineering and Applied Science.

Dr. Marco Zaider, Senior Lecturer of Environmental Health Sciences at the Mailman School of Public Health and Attending Physicist of Medical Physics at Memorial Sloan-Kettering Cancer Center, and Dr. Eva K. Lee, Georgia Institute of Technology, received the Edelman Award for Achievement in Operations Research for work entitled "Operations Research Answers to Cancer Therapeutics." They devised sophisticated optimization modeling and computational techniques to implement an intra-operative 3D treatment planning system for brachytherapy (the placement of radioactive "seeds" inside a tumor) that offers a safer and more reliable treatment. The work improves the survival rate of patients with prostate cancer, reduces the side effects of treatment, and reduces costs to the health care system.

Navratil Appointed as Interim Dean of SEAS

President Lee Bollinger announced that Gerald A. Navratil, the Thomas Alva Edison Professor of Applied Physics, will serve as interim dean of The Fu Foundation School of Engineering and Applied Science for the 2007-08 academic year.



Gerald Navratil, Interim Dean of SEAS

Prof. Navratil assumes this new post with strong support from the engineering faculty. Having earned international acclaim for his scholarship applying plasma physics to the development of thermonuclear fusion energy, he currently directs research on fusion energy science funded by the U.S. Department of Energy.

Prof. Navratil joined the Columbia faculty in 1977 as an assistant professor of mechanical engineering. One year later, he helped establish what is now the Department of Applied Physics and Applied Mathematics, where he served as department chair from 1988 to 1994 and from 1997 to 2000. He served as acting vice dean in 1995. He earned his bachelor's degree in physics from the California Institute of Technology and his Ph.D. in plasma physics from the University of Wisconsin. In 1989, he was named a fellow of the American Physical Society.

President Lee Bollinger and Provost Alan Brinkley organized a search committee in September, with the goal of announcing a new permanent dean for SEAS during the spring 2008 semester.

Navratil & Garofalo Win 2007 APS Dawson Award

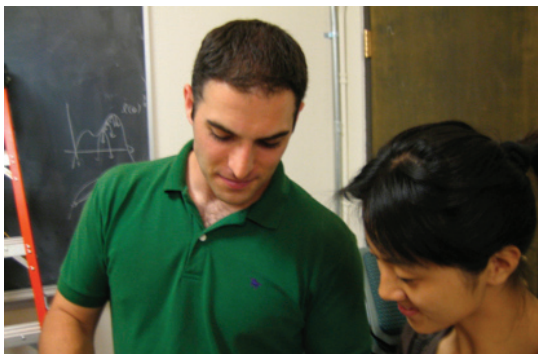
Prof. Gerald A. Navratil and Dr. Andrea M. Garofalo share the 2007 APS Dawson Award for Excellence in Plasma Physics with Dr. Edward J. Strait of General Atomics and Dr. Michio Okabayashi of Princeton Plasma Physics Laboratory. The recipients received the award for "Experiments that demonstrated the stabilization of the resistive wall mode and sustained operation of a tokamak above the conventional free boundary stability limit" this November in Orlando, FL.

Below: SEAS Interim Dean Gerald Navratil, left, and Dr. Andrea Garofalo, in front of a cross-section model of the DIII-D Tokamak fusion energy experiment at General Atomics in San Diego.

Chris Wiggins: What I Did This Summer

Summer School in Boulder, CO

Prof. Chris Wiggins



Jake Hofman

This past summer was dominated by a summer school for graduate students and postdocs I co-organized, which took place over the entire month of July in Boulder, CO. In fact, much of the last 2 years has been impacted by planning for it. I think it was a huge success, introducing a number of graduate students and postdocs from around the world to modern methods and research topics in the field of quantitative biology which they would otherwise not have encountered in their home departments. The experience of a school, where scores of people live, play, eat, and discuss science together was a very intense one. Also unusual was spending 4 weeks living in a dorm like an undergraduate, complete with undergraduate cafeteria food. My graduate student Jake Hofman was there as well; I encourage you to contact him for a fair, balanced, and independent review of the experience. Do so while you can though, as, if all works according to plan, he should graduate (my 3rd student) this spring.

Additional summer events included the SciFoo conference (a truly unusual invite-only, multidisciplinary "un-conference", with Nobel prize winners, scientists, and at least 3 members of the Dyson family), teaching at yet another summer school in Los Alamos, and delivering a talk at "The First q-bio Conference on Cellular Information Processing" in Santa Fe, where I presented work done by my student Andrew Mugler.

These trips were useful also for identifying future speakers and collaborators: Marko Djordjevic, who was at the Santa Fe q-bio conference, spoke at the Applied Mathematics Colloquium on October 16. Aleksandra M. Walczak, who was at the Boulder summer school, spoke on September 18, and we have initiated a collaboration on the stochastic description of regulatory networks.

Now that the semester is back in full swing, my students banded together and managed to initiate regular group meetings. We've been somewhat thwarted by travel so far (recently, students Xuejing Li, Jake Hofman, and Jon Landers were all presenting their work at the NYAS Machine Learning meeting downtown while, at the same time, students Andrew Mugler and Anil Raj were presenting their work at the 4th Annual RECOMB Satellite on Regulatory Genomics at the Broad Institute of MIT and Harvard), but I'm looking forward to hearing a lively exchange among the group on a variety of applications of mathematics in biology.

Jake's work has been in applications of machine learning and statistical inference to biological data, particularly movie data coming from cellular biology (in close collaboration with biologists, Profs. Mike Sheetz and Mike Dustin, my Co-PIs in the NIH-funded Nanotechnology Center for Mechanics in Regenerative Medicine). More recently, Jake has been applying the same mathematics to inferring modules (a.k.a. "communities") in real-world networks. This work has been posted on arxiv.org, submitted for publication, and presented at the NYAS as well as in the APAM research conference. Xuejing Li is applying machine learning to infer transcriptional regulatory networks by integrating microarray data and sequence data to build predictive, statistically valid, and interpretable models. Anil Raj is working on information-theoretic approaches to quantifying modularity and identifying modules in biological networks; en route, he has developed some novel and successful statistical approaches for relating DNA sequence information (associated with the regulatory regions of the genes which form the nodes in these networks) to topological information describing the network. Andrew Mugler's work is on using information theory to provide quantitative understanding of evolvability and robustness in small synthetic transcriptional regulatory networks; he is working in collaboration with Jonathan Bronson (Chemistry) who has begun building synthetic genetic networks to test predictions made by these mathematical models.

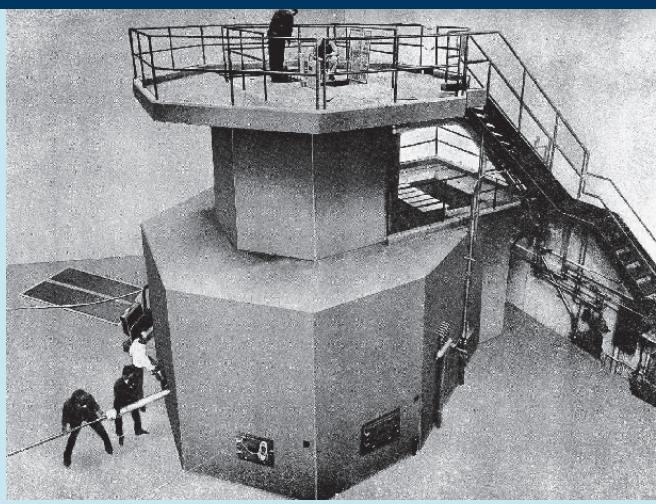
Guillaume Bal: Inverse Problems Workshop

A workshop on Inverse Problems and Imaging at Columbia University was held on May 3-4, 2007 in the Davis Auditorium on the Morningside campus. Funded by the National Science Foundation and the APAM Department and organized by Prof. Guillaume Bal and Dr. Kui Ren (with a special session on systems biology organized by Prof. Chris Wiggins), the workshop brought together about 50 participants to hear 16 Columbia researchers talk about their latest achievements in areas related to inverse problems and imaging.

Inverse problems and imaging methods are ubiquitous throughout applied sciences. The objective of the workshop was to have researchers coming from different backgrounds expose their problems, methodologies, and solutions and exchange ideas with the hope that this would result in cross-pollination and research collaborations. Many (though not all) areas of inverse problems and imaging at Columbia were represented at the workshop, with speakers coming from APAM, Biomedical Engineering, Computer Science, Industrial Engineering and Operations Research, Lamont-Doherty Earth Observatory, and the Medical School. Covered applications included climate and cyclone prediction, computer graphics, plasma physics, numerous modalities in medical imaging, optimization, financial mathematics, biological sciences, chemistry, and materials science.

Inverse problems and imaging in their various applications share many similar mathematical and computational challenges. Collaborations will undoubtedly help us to find and disseminate robust solutions to such challenges. It is with this belief in mind that the workshop was organized and that courses on inverse problems were taught at APAM in recent years (by Guillaume Bal in the Spring of '04 on theoretical inverse problems and by Kui Ren in the Spring of '07 on theoretical and computational inverse problems). It is the wish of the organizers that more interactions between Columbia researchers will be made possible in the near future within this essential field of applied sciences.

A Step Back in Time



The history of the nuclear reactor at Columbia University was recently featured in the Environmental Health and Radiation Safety/Environmental Health and Safety (EH&RS/EH&S) Spring 2007 "Safety Matters" publication. As part of the Nuclear Science and Engineering program (which later helped lead to the APAM Department) the nuclear reactor, was built for education and research purposes in the Engineering Terrace building. However, the reactor was never fueled and was never radioactive. The related instruments were donated to other institutions and today, the only thing that remains at Columbia is the concrete shell of the reactor. Prof. Michael Mauel's CTX plasma experiment now resides on top of this shell.

1960: Columbia received a quarter of a million dollar grant from the National Science Foundation to purchase and install a TRIGA Mark II reactor.

1963: Columbia's application for construction was accepted by the Atomic Energy Commission (AEC).

1964: Construction and installation of the reactor began.

1967: The building project was completed that April at a total cost of approximately one million dollars.

1968: In January, Columbia applied to the AEC for an operating license. In March, when the AEC filed notice to the Federal Register of its intention to issue the license, they received numerous petitions for intervention from residents and activists. Due to the prevailing climate at that time (student unrest and community opposition), Columbia asked AEC to place a hold on the application for the operating license.

1969: That summer, Columbia reactivated the application for the operating license. The AEC announced that a hearing would take place before the Atomic Safety and Licensing Board (ASLB). The ASLB denied the University's application based on (1) lack of site criteria specific to research reactors, and (2) conflicting estimates of the amount of radioactive material that would be released in a postulated accident. The University appealed the ALSB's decision.

1971: Radioactive material release estimates were measured again in the laboratory of the reactor manufacturer, General Atomic. Based on the new data, the Appeal Board overturned the original ASLB decision and recommended issuance of a license to Columbia.

1972: Interveners filed a petition in the U.S. Court of Appeals for a review of the decision, which the Court later denied. The interveners then petitioned the Supreme Court for review of the Appeal Court decision.

1974: The Supreme Court denied the petition that June and Columbia's position was upheld. The University only needed to reapply to the AEC in order to receive the operating license. At that time, Columbia was in the process of re-evaluating the Nuclear Science and Engineering program and the need for the nuclear reactor. With changes in upper management and financial considerations, the project was put on indefinite hold.

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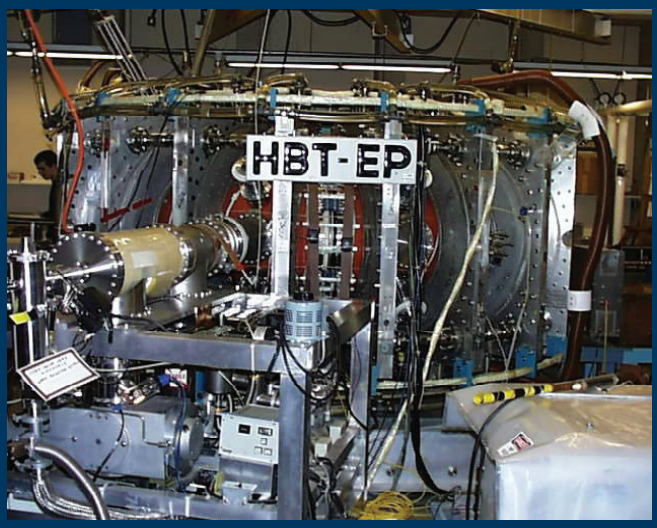

HBT-EP Experiment in the Plasma Physics Lab

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