The Norwegian Academy of Science and Letters awarded the 2009 Abel Prize to Mikhael Gromov, the Courant Institute’s Jay Gould Professor of Mathematics, “for his revolutionary contributions to geometry.” Gromov will receive the Prize from His Majesty, King Harald V of Norway, in Oslo on May 19th.

Gromov obtained his Masters degree (1965), his Doctorate (1969) and his Post-doctoral Thesis (1973) from Leningrad University. His doctoral advisor was Vladimir A. Rokhlin. Before joining Courant, Gromov held professorial positions at Leningrad University, the State University of New York at Stony Brook, and the Université de Paris VI, and he currently also holds a Professorship at the Institut des Hautes Études Scientifiques. He has received many other prestigious awards, recently including the János Bolyai Prize from the Hungarian Academy of Sciences (2005), the Frederic Esser Nemmers Prize in Mathematics (2004), the Kyoto Prize in Basic Sciences (2002), and the Balzan Prize (1999).

According to the Norwegian Academy, Gromov’s work has led to “some of the most important developments [in geometry], producing profoundly original general ideas, which have resulted in new perspectives on geometry and other areas of mathematics.” Courant Director Leslie Greengard said that Gromov “has been an inspiration to colleagues and students here and to mathematicians around the world. His unique viewpoint has revolutionized geometry, topology, group theory and their interplay. The honor is richly deserved.” “The work of Gromov,” writes the Norwegian Academy, “will continue to be a source of inspiration for many future mathematical discoveries.”

Gromov is the third Courant mathematician to receive the Abel Prize in five years; it was awarded to Professor Emeritus Peter Lax in 2005, and to Professor Raghu Varadhan in 2007.

The Story of the Poincaré Conjecture

Or when is a Proof a Proof?

by M.L. Ball

This has long been a source of puzzlement to many an undergraduate student; it can also be a deep philosophical question. Here, we take the pragmatic view that a proof is truly a proof when it is recognized as such by the mathematics community. This brings us to the tale of the Poincaré conjecture, explained with the help of Mathematics Professor Bruce Kleiner.

Kleiner joined the Courant Institute this September as a new faculty member. He is originally from Seattle and comes to Courant by way of Yale, the University of Michigan, and Berkeley.

Formulated approximately 100 years ago, the Poincaré conjecture was one of the most famous unsolved problems in mathematics. Not only was it a central question in topology, it was a question that many very well known mathematicians had tried to solve — unsuccessfully. Then in the 1980s came a breakthrough. A mathematician named Richard Hamilton introduced the Ricci flow, a completely new way to attack the Poincaré conjecture. If it was successful, he theorized, it would prove not just the Poincaré conjecture but also the geometrization conjecture, which among other things implies the Poincaré conjecture.

This was big news in itself, but in November 2002 something truly remarkable happened: Grigori Perelman, a widely respected Russian mathematician, posted a paper on a pre-print server. According to Kleiner, “When a mathematician writes a paper, instead of making it out to people, he or she now posts it on Arxiv, a central repository of pre-prints, which anyone around the world can access anytime. Overnight, a huge number of people became aware of the fact that Perelman had posted this pre-print. In it, he developed a number of new tools for studying the Ricci flow and claimed that by using these, he could prove the geometrization conjecture.

* This was really an extraordinary development in many respects because first of all, someone was claiming to prove the geometrization conjecture. Not only that, but since 1994, Perelman had been living in St. Petersburg following a fellowship at Berkeley. He had published essentially nothing and had virtually withdrawn from the mathematical community. In early 2003,
Fifteen Years of CAOS

Eric Vanden-Eijnden:
Understanding Molecules Through Complex Simulation and Statistical Mechanics

by M.L. Ball

“The Courant Institute is an ideal place for someone like me,” says Courant Institute Professor Eric Vanden-Eijnden. A citizen of Belgium, Eric earned his B.S., M.S., and Ph.D. in theoretical physics from the University of California, Santa Barbara. “I came here in 1996 after finishing my Ph.D., first as a postdoc and then I stayed. Not only do I like the scientific environment here but my family and I really like living in New York.”

One need spend only a few minutes with Patricio Vanden-Eijnden to appreciate his love of mathematics, but in school, he was first attracted to astrophysics. “Then I discovered statistical mechanics, a way of looking at a very large system from a probabilistic viewpoint,” he says. “In this framework, you don’t describe things in detail like you would in classical mechanics. It is not practical when you look at systems such as, say, a gas from a microscopic viewpoint. The number of atoms such a gas contains is just too big and their motion too complicated to focus on each and every atom individually. Rather, you must model global statements about the probability of finding atoms here or there and how this probability influences the bulk properties of the gas. I really fell in love with that topic and it’s roots in probability theory, and that led me here eventually.”

As well as teaching and managing a number of students and postdocs, Eric said that he is mostly working on molecular dynamics with applications to molecular biology and statistical mechanics perspective to developing techniques that accelerate the simulations and permit you to interpret the results probabilistically.

Eric sees many innovations on the horizon using this approach such as “the growth in computer power and recent discoveries in molecular biology have given new food to mathematics,” he explained. “Understanding the structure and functioning of complex macro-molecules provides applied mathematics with enormous new avenues and also new challenges. To give an example, it is believed that certain proteins – prions, for instance – become lethal only when they misfold into a certain shape. If they are not in this misfolded shape, they are actually pretty benign. It is therefore very important to understand how folding and particularly misfolding happen since it may eventually lead to curing certain diseases.” He continued, “Tackling such questions using an applied mathematics perspective is interesting for everyone, for mathematicians, it is a way to extend the realm of their field by confronting new problems; for chemists and biologists, it is a way to systematize what are a lot of ad hoc approaches like mathematical and computational tools that have proven very successful in many other settings.”

Working in concert with a host of colleagues, Eric focuses particularly on developing computational tools at Courant which are then applied globally. “I don’t work alone – I have many collaborators, not only mathematicians, but also people in chemistry, chemical engineering, and biology departments around the world. These collaborations are essential in enabling us to focus on the problems that are of actual interest in material sciences, chemistry, and molecular biology, and in ensuring that the algorithms developed here are useful in real applications.”

The techniques Eric described may have significant applications in the future in the fields of human health, such as in the context of the large system from a probabilistic viewpoint, and you're simulating a system that is very, very complicated. And so you have to use the statistical mechanics perspective to develop techniques that accelerate the simulations and permit you to interpret the results probabilistically.

When asked if the world looks to Courant, Eric’s answer was immediate. “Most definitely. The Institute is very strong overall, and it is arguably at the top in applied mathematics—not only because of the research being done here but also because of our very successful graduate and postdoc programs. You can go into any mathematics department in the country and find people who have been graduate students or postdocs here and remember it fondly. There is a Courant style of doing applied mathematics that is exported from here.”

As for the future of applied mathematics? “I am not worried. Mathematics is a universal language for understanding the world around us, and it will be fed by problems in this world for as long as we care to look at them.”

Jeff Han, who founded the high-tech startup Percusive Pixel and who developed a multi-touch screen while a Research Scientist at Courant, is the man behind CNN John King’s “Magic Wall.” The Magic Wall was developed by CNN for the 2008 Presidential election coverage, tallying votes, zooming in and out of states, and showing how swing states could change the election result – all with the touch of a few fingers. “It’s really helping what news production is for,” Han told NYU’s Alumni magazine: “to give clear, visual context to the data. You can’t say that a new drug is being designed by a pharmaceutical company which was based on first-principle numerical simulation, but it will come true in a day. In say that numerical simulation helps design airplanes, it will someday help design drugs.”

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In Memoriam: Jack Schwartz

Jack Schwartz, professor at the Courant Institute for forty two years and founder of its Computer Science department, passed away in his Manhattan home on March 2nd. In his lifetime, Professor Schwartz authored more than a dozen books, more than one-hundred papers and technical reports, led a variety of research projects, and advised over fifty Ph.D. students, several of whom became life-long collaborators.

Although he was retired when he passed away, Prof. Schwartz never stopped working. As Computer Science Professor Bud Mishra, to whom Jack was a mentor, remembers, “He never slowed down. He had so many of these interests— and he always was a role model for computing and mathematics in them. He was constantly learning.”

Two months before his passing, Schwartz decided to learn about optics, so he got a book on Newton’s optics and Mishra introduced him to Andrew Hicks, who builds mirrors. Before long, Jack invited Hicks to write a book with him. As Bud tells, “soon Jack was scanning every ying 3D in his apartment and making beautiful things. From early Roman History to Chinese music—whatever topic you had, he had an interest.

Not only was Schwartz constantly learning about very diverse topics, he was also teaching others. As Courant Professor Emeritus Peter Lax recalls, “When Jack switched from mathematics to the computer science department, he told that when he first came to the Courant Institute, he looked at our Bulletin and decided to give all the course listed that a “X”. When Lax asked if Schwartz had fulfilled his resolution, he said yes. “Surely,” Lax replied, “there must have been some subjects about which you knew very little.” “In those cases,” answered Jack, “I took out of the library the two or the six leader books on the subject and read them.”

Schwartz made major contributions to a wide range of areas: spectral theory of operators, numerical analysis, quantum field theory, parallel computation, computer time-sharing, high-level programming languages, compiler optimization, transformational programming, computational logic, motion planning in robotics, and multimedia.

His most widely recognized publication as a mathematician was Linear Operators, a three-volume work co-authored with Nelson Dunford. Published over three decades ago, it continues to be regarded as the definitive work in the field.

Professor Allan Gottlieb, who came to Courant through the advisement of Schwartz, states that he owes much of his academic success to the efforts, the example set, and the help given by Schwartz, whom everyone called Jack. “He was always accessible, and people could e-mail him and phone him, and he would always answer. I was able to learn a lot of math and programming from him.”

Ten years previously, while struggling on my math Ph.D. thesis, I hit a problem in functional analysis that I was unable to solve. I went to the library to seek out the famous text by Dunford and Schwartz, which I had shamefully never read. A trip to the city library and a few hours reading the book gave me the opportunity that led to their success.

Sudokill: a strategic variant of Sudoku

In the following example, use 0 to represent a blank.

In Sudoku, the row player can make any legal Sudoku move. Subsequently, the column player must move in the same column as the last move of the row player and the row player must move in the same row as the last move of the column player. If a player makes an illegal Sudoku move, then that player loses.

Consider the lower left box:

We know that the five five zeros present in the lower left box are redundant. (See rule 2.) Because the row player last moved a 3 in the third column and the seventh position from the top row, the only legal place for a 7 to the right of the 3, yielding a 7...

By contrast, the following would be illegal:

In Sudoku, players alternate moves where a move consists of replacing a blank by a number. The first player is called the row player, and the second is the column player.

The row player to make an illegal Sudoku move.

Here’s a harder one. Can the column player for a win in three moves given the following? (Again the column player can begin by moving anywhere.)

Here’s an invitation: If you can reduce a four move forced win or a forced six move win with more moves than assignments, please send it to me at shasha@cims.nyu.edu. Also, you can play Sudokill on the Web at http://chiswoc.math.curtin.edu.au/sudokill/SudokillWebGame

For the solution email: courant.alumni@nyu.edu
In 1965 Warren Weaver Hall was given a Bard Award for excellence in New York architecture by the City Club of New York. While the building's exterior, designed by Warner, Burns, Toan & Lunde, remains the same as it was for fifty-five years ago, its interior has recently undergone substantial renovation. Over the past two years, floors two through five have seen significant changes, including five new classrooms, new conference rooms, and a computer lab. Tab 2 renames floor two computer lab consolidates the two previous computer labs. A building renovation opened around $23m in AppLabs.

美丽乡村的未来

In renovations on the remaining floors (six through nine) are expected to be completed by the end of 2023.

In 2003 Sashi Reddi, Anand Subramanian, and A. Robert Cyborski started Transparent Materials LLC, then renamed Advantest Inc. in 2005. The company's vision was to develop games with Indian content. The company is backed by Sequoia Capital, which invested around $23m in AppLabs.

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2009 Courant Institute Student Prizes

Henning Biermann Award
Piotr Mirowski

Sandra Bleistein Prize
Antonina Mitrofanova
Sukbin Lim

Hollis Cooley Prize
Karol Kozioł

Janet Fabri Prize
Raia Hashell

Kurt O. Friedrichs Prize
Paul Hand

Max Goldstein Award
Matthew Nolin

Harold Grad Memorial Prize
Afshin Rostamizadeh

Moses A. Greenfield Research Award
Ignacio Rodríguez

Wilhelm Magnus Memorial Prize
Michael Damron
Diogo Arsénio

Bella Manel Prize
Lin Li

Matthew Smosna Prize
Manda Wilson

Stay Connected to the Institute

Keep in touch with colleagues and friends via two new web resources: There are several groups related to the Courant Institute on LinkedIn.com, a career networking site, namely, an all-inclusive Courant Network, an Alumni group, and a Mathematics in Finance group.

Also, University Development and Alumni Relations provides VioletNet, (violetnet.nyu.edu) a searchable directory of all NYU Alumni and an “interactive community designed especially for NYU alumni.”

Please keep us updated on your address and phone number. Email Courant.Alumni@nyu.edu.

Your News in the CIMS Newsletter

The Courant Institute invites all Alumni to keep colleagues and friends up-to-date on life events. All items submitted (such as career achievements and family milestones) will be considered for publication in the Newsletter or online.

Please send the details to alumni.news@cims.nyu.edu.

To join our community of Courant donors, please visit the new NYU online giving page at
www.nyu.edu/giving or contact Cheryl Sylivant at sylivant@cims.nyu.edu or call 212 998 3321.