



Departments of Mathematics and Computer Science, and the Center for Atmosphere-Ocean Science at New York University

## Percy Deift Elected to the National Academy of Sciences



**Pictured: Leslie Greengard, Percy Deift, Peter Lax**

Photo credit: Annemarie Poyo Furlong

On the morning of April 28th, together with 71 other new members, Percy Deift was elected to the National Academy of Sciences, joining an active membership of 2,150. The Courant Institute celebrated the election at a special reception in May, with a talk about Deift's work by Peter Lax. Gerard Ben Arous, Acting Director of the Institute, said that "Percy is the grand-master of a school of classical and spectral analysis which has a long history at the Courant Institute, where the tradition of the Riemann-Hilbert method is nurtured and enriched. He has successfully used this expertise in various domains ranging from Integrable Systems to Random Matrices Theory and to Combinatorics. In 2001, with Jinho Baik and Kurt Johansson, he solved one of the deepest conjectures of the field, the Ulam conjecture on the fluctuations of the longest increasing subsequence of a random permutation, and thus opened a rich new vein of results. We are honored to have a colleague of such an extraordinary caliber at the Institute, and very pleased to hear that he has, quite deservedly, received one of the highest levels of scientific recognition." ■

## iPhone Programming students receive "Best App" Award



The Institute's Computer Science Department is among the Nation's first to offer an iPhone Programming course. Led by Professor Nathan Hull, students developed applications such as "Crossroads," a social application that allows users to share content on a GPS-enabled map, and "Vinyl," an interactive MP3 interface that looks like a record player. A panel of judges attending the Spring Computer Science Demo Show, comprised of an Apple executive and Computer Science faculty, presented the pictured application, "Pet Wars," with the "Best App" award. Co-creators Ricky Cheng, Jamin Ma, and Andrew Saladino received scholarships from Apple to attend their June 2009 Worldwide Developers Conference in San Francisco. ■

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# Professor Amir Pnueli, Distinguished Computer Scientist, Passes Away at 68



Photo credit: © Dan Porges/Photo Schwartz

The NYU Department of Computer Science and the entire university community mourn the sudden passing of Professor Amir Pnueli, who died on November 2 of a brain hemorrhage. Professor Pnueli was an internationally recognized pioneer in the area of verification, the process of formally proving that systems, such as computer hardware and software, behave as intended by their designers.

This photograph was taken on the occasion of Amir Pnueli winning the Israel Prize, 2000

Professor Pnueli was the recipient of the 1996 Association for Computing Machinery Alan M. Turing Award, the highest distinction that can be bestowed on a computer scientist. He was also the recipient of the Israel Prize, the state's highest honor. He was a foreign associate of the National Academy of Engineering, a foreign member of the Academia Europaea (Informatics section), and a member of the Israel Academy of Sciences and Humanities. He received honorary doctorate degrees from the University of Uppsala, Sweden, Joseph Fourier University, Grenoble, France, and the Carl von Ossietzky University of Oldenburg, Germany, as well as numerous other professional accolades.

Amir Pnueli was born in Nahalal, Israel, on April 22, 1941. He received a B.Sc. degree in Mathematics from the Technion and a Ph.D. in Applied Mathematics from the Weizmann Institute of Science in 1967. After a post-doctoral fellowship at Stanford University and the IBM T.J. Watson Research Center, he became a senior researcher at the Weizmann Institute. In 1973, Professor Pnueli founded the Department of Computer Science at Tel Aviv University and became its first chair. In 1981, he returned to the Weizmann Institute as Professor of Computer Science. In 1999, he joined the Courant Institute's Department of Computer Science at NYU, and in 2006 he was appointed to a Silver Professorship. He supervised more than 30 Ph.D. theses during his career in Israel and New York.

Professor Pnueli is particularly noted for introducing temporal logic, a formal technique for specifying and reasoning about the behavior of systems over time, to computer science. The 1996 Turing Award citation reads,

"Amir Pnueli made a major breakthrough in the verification and certification of concurrent and reactive systems with his landmark 1977 paper "The Temporal Logic of Programs" which was a crucial turning point in the progress of formal methods for such systems. This paper triggered a fundamental paradigm shift in reasoning about the dynamic behavior of systems; the techniques it introduces have had extraordinary influence and

proved to be of lasting value. His work has been characterized as the most important contribution to program verification in the last twenty years and it has set the agenda for research and practice in the area."

Professor Pnueli was an extremely prolific and deeply creative researcher with over 250 widely-cited publications and 4 books. In recent years, he worked on compiler and translation validation, the verification of concurrent systems, and fairness of infinite behaviors, as well as the application of mathematical and logical methods to the formal specification, compositional verification, systematic development, and automatic synthesis of reactive, real-time, discrete, continuous, and hybrid systems.

Professor Pnueli always advocated applying theory to practice and was instrumental in founding two Israeli software firms. His work has influenced a wide range of scientific disciplines, including process control, databases, biological modeling, and computer hardware design as well as the avionics, transport and electronic hardware industries. He shared the 2007 ACM Software System Award for Statemate, a software engineering tool that allows developers to formally specify the precise desired behavior of their programs. The citation for the award reads:

"Statemate was the first commercial computer-aided software engineering tool to successfully overcome the challenges of complex interactive, real time computer systems, known as reactive systems. The ideas reflected in Statemate underlie many of the most powerful and widely used tools in software and systems engineering today."

Amir was a modest, kind, and warm person who was universally respected as a friend, teacher, colleague and distinguished leader. He is mourned by his colleagues and students around the world, who extend their deepest sympathy to his wife, Ariela, his three children, Noga, Shira, and Yishai, and his four beloved grandchildren. ■



Motion Capture sessions of subjects for a new "Body Language" study currently underway at the NYU Movement Group



## Chris Bregler: A Motion Capture Expert Who's Always on the Move by M.L. Ball

It makes perfect sense that Chris Bregler's career has focused on the mechanics and the art of human movement because he himself is always in motion. Whether describing his latest research project, or technology he has developed that has appeared in projects by Disney Feature Animation and films by Lucasfilm's Industrial Light & Magic, his hands gesture wildly as he bounces excitedly in his chair. And he's only getting started.

Originally from Germany, Chris received his M.S. in 1995 and Ph.D. in 1998 in Computer Science from U.C. Berkeley. His first project was developing computer vision to track the movement of human lips, followed by a Ph.D. thesis on full body tracking from head to toe, including motion capturing the well-known Eadweard Muybridge footage.

In 1998 he spent a year at NYU as a visiting scholar, then joined the faculty at Stanford University in 1999. In 2002 he returned to NYU and is now a tenured professor.

"Instead of starting at Stanford in '98, I negotiated to start the next year so I could come to NYU first," Chris said. "Working with graduate students, we came up with some new 3D reconstruction techniques applied to faces, human bodies, and all kinds of animals, which I worked on at Stanford and then pushed further when I came back here."

As well as introducing him to New York, his year at NYU was responsible for changing his career. "While I was here I took a class, 'Action Analysis,' on traditionally-drawn animation taught by John Canemaker in the film department," Chris said. "John is one of the best traditionally-trained animators and won the Oscar for Short Animated Film three years ago. He doesn't like to use computers at all which is why I was so attracted. I wanted to learn the art of taking abstract things – characters that don't look human at all, like Shrek – and bringing them to life."

Though Chris returned to the West Coast, New York was never far behind. Upon his arrival at Stanford, he immediately called his former animation teacher Lorie Loeb (who also taught in NYU's film department) and convinced her to join him at Stanford. "We co-founded this new thing called the Movement Group and immediately were the oddballs in the computer science department, attracting misfits who wanted to do animation, art, and dance. We created a lab, painted the walls orange and blue, and called it The Underground, which became this critical mass of art and technology collaboration," he said.

Prior to running the Stanford Movement Group, Chris was working at a company called Interval doing facial capture. Their best-known project was animating JFK's facial performance during a crucial speech in the midst of the Cuban Missile Crisis. When they showed the film at SIGGRAPH (the annual computer graphics conference), it caught the attention of Disney, which later started its own facial capture division and asked Chris to be a consultant.

Though collaborating with Disney was fulfilling, Chris had a life-long dream to work for the makers of Star Wars, Jurassic Park, Forest Gump and many other milestone movies – Lucasfilm's Industrial Light & Magic – which soon came to pass.

Describing George Lucas and the people at ILM, Chris said that they're smart, very generous, and thoroughly dedicated to quality. "Many other studios focus on making a short-term profit but Lucasfilm has long-term vision," Chris explained. "More than just making a film, they want to push the limits of technology."

Chris is just as enthusiastic in his praise for NYU and Courant.

"There are so many great research groups here, especially on this floor" he said. "The Vision, Learning, & Graphics Group (VLG) is one of the leading labs in graphics, animation, computer vision, and machine learning. And right on the other side of that wall," he said, pointing behind him, "is Tisch School of the Arts, which has one the country's leading film department, a new gaming center, and ITP (the Interactive

Telecommunications Program). I work with them a lot because as well as animation, my NYU Movement Group collaborates with modern dancers. And New York is the city of dance. Long term, I'm trying to figure out the secret of human motion, and the real experts in that are dancers and choreographers and animators. New York is the perfect place to do that, which is another reason I love New York and NYU."

In 2002, soon after his second arrival at NYU, Chris was granted National Science Foundation funding for a collaboration between Courant's computer science department and the Steinhardt School's Dance Education Department. In 2003, NYU funded the creation of a motion capture lab, the only one in Manhattan at the time, and Chris's group was off and running. "It's very hard to do human motion," Chris explained. "If you look at Pixar movies, there's a reason why most of the main characters are toys or animals. So for the NSF project, we over-exaggerated the motion capture so the animated characters looked more expressive."

It was at this stage of Chris's career that the U.S. military came calling.

According to Chris, "the Department of Defense is interested in surveillance and has already developed face recognition, but you can fool it very easily. One thing that is harder to disguise is your own motion signature. The Office of Naval Research has given us funding to create a computer system that can identify someone by the way they move.

"The other project we're planning for the Navy is to help them overcome the biggest problem they have right now, which is aiding coalition soldiers in peacekeeping operations. Soldiers get thrown into some culture they don't understand and since most human communication is non-verbal, there is the potential for serious misinterpretations."

With help from the Steinhart faculty, Chris put people from seven different nationalities in motion capture suits, including Italians, Russians, Germans, Trinidadians, Koreans, and Japanese. "We wanted to figure out what different body gestures mean, coming from different cultures," Chris said. "We recorded for several days but then realized we didn't have enough data to make generalizations." That's when Chris and his colleagues created GreenDot, a new way to track motion by assigning green dots to facial and body features, which they used to track politicians on YouTube.

"This is the first phase of a system that can automatically analyze body language," Chris said. "We can use it for biometrics, social science research, and military security, as well as the game and entertainment industries. There are all kinds of applications."

Never one to collect moss, in 2004 Chris agreed to chair the SIGGRAPH Electronic Theater and Computer Animation Festival in Los Angeles, attended by 30,000 people from all over the world.

"Half the floor here at NYU was part of the team that produced this festival. We decided to have five shows, one each night for 4,000 people, so we approached the main motion capture company, Vicon, to sponsor an interactive game which the audience could play while they were waiting for the real show to start."

That game was SquidBall, featured in the April 2 issue of BusinessWeek and in an online interview with Chris with BusinessWeek.com.

Last year, further recognition came his way when Chris was awarded the IEEE Longuet-Higgins Prize for "Fundamental Contributions in Computer Vision that have withstood the test of time," honoring a paper Chris published in 1998 with Jitendra Malik, his advisor at Berkeley, on motion capturing the Muybridge footage.

In addition to his current projects, what's next for Chris Bregler? Who knows, but one thing's for certain – he won't meet it sitting still. ■



# 50 YEARS and GOING: Three Courant Alumni Continue to Collaborate

by M.L. Ball



**Pictured: Gene Laska, Carole Siegel, Morris Meisner**

They met at tea.

Colleagues for more years than they wish to count, three Courant Institute alumni – Gene Laska ('63), Morris Meisner ('62), and Carole Siegel ('64) – forged their decades-long friendship and professional collaboration over tea and cake at Courant.

"When we were there," Carol explained, "it was a much smaller institute. They held daily teas, with real china cups and cake; it was very civilized. It was an opportunity for students to meet each other and chat with faculty."

**Morris added, "When we started at Courant, it was at 25 Waverly Place. I asked the head of the graduate math department, Lipman Bers, 'What is it I have to do?' He thought for a minute and said, 'There's a tea at 3:00 – your job is to be there.' And that was it."**

Almost 50 years later, their commitment to their work and to each other is as steadfast as ever.

"People who observe us working together are amazed at how insulting we are to each other," Carol explained. "I think we feel comfortable saying anything – to be brilliant or stupid. It's equally okay. And we each bring to bear something very different to any problem."

Since the '60s, these three have conducted national and international research at the Nathan Kline Institute for Psychiatric Research (NKI), one of the nation's premier mental health research institutes. At its Orangeburg, NY location, Carole currently directs the Statistics and Services Research Division (SSRD) and the Center of Excellence for Cultural Competent Mental Health. Gene is the Director of the World Health Organization Collaborating Center for Training and Research in Mental Health and in the Prevention of Substance Abuse, and is Head of SSRD's Statistical Sciences Laboratory. Morris is an active member of this group.

"I think the amazing thing is that we've worked together all these years," Carole said. "It wasn't planned at all. And we've remained friends."

So just how did this amazing triumvirate come about?

According to Morris, "Gene made it happen. After he graduated from Courant, he worked for IBM as a statistician. IBM came to the NKI (then called Rockland Research Institute) to sell a computer, and Gene was brought along as their technical advisor. Dr. Kline, head of the Institute in those days, bought the machine and also convinced Gene that he was needed at the Institute. When Nathan Kline made Gene the offer, he said he wasn't coming without colleagues. Gene enticed Carole and Morris to come shortly thereafter along with George Logemann, a Ph.D. who was one of the early computer science students at Courant."

"At that time," Gene continued, "Rockland researchers were collecting data on all kinds of measurements of psychiatric patients over time but didn't know how to analyze them." Although NKI was strong in clinical and biological research, it had no programs in statistics or mathematics – the particular strengths of Laska, Siegel, and Meisner. Having earned their doctorates in probability theory and theoretical and applied statistics, the three had plenty to do upon arrival. While Gene was setting up a computer system for psychiatric record keeping, Nathan Kline also asked him to do statistical consulting for the psychiatric researchers. "So we did a lot of clinical trial methodology and analysis. That was the start and has continued to this day," Gene said.

For three Ph.D.'s not long out of Courant, the chance to build their own department at a major psychiatric research institute provided a rare opportunity. As Gene remembered it, "There were miraculous events that happened that were clearly influenced by the gods, not us. For example, Nathan Kline came to us one day and said the hospital affiliated with Nathan Kline Institute had an inventory problem with its medicines. Remember, Rockland State Hospital had 9,000 in-patients when we first came. The hospital director said, 'I dispense drugs to the units here and have no idea what happens to them. Maybe you could capture the inventory.' So we did that, and then we asked if we could gather other data in order to understand why doctors prescribe particular drugs and what are the resulting patient outcomes."

What followed was the creation of a landmark computerized mental health information system. "We built this system," Gene said, "where a doctor filled out a set of structured forms and the computer produced narratives, for example, of a patient's mental status or developmental history. It became clear that the computer could emit the reports in any language – Russian, French, whatever."

IBM thought this was a fascinating application. In 1966, the European Congress of Psychiatry convened in Madrid, and IBM asked Drs. Laska, Siegel, and Meisner to exhibit their 'magical' computer system for patient record keeping.

"Doctors filled out a form and got the answer in whatever language they spoke," Gene explained. "IBM flew us to Madrid and helped set up a computer in the middle of a conference hall. One of the people who wandered through was the then head of the National Institute of Mental Health. He filled out one of the computer forms about a fictitious patient, was impressed with the output, and encouraged us to submit a grant to develop the system further and make it available nationally."

"Talk about serendipitous," added Morris.

"The NIMH gave us a pile of money to develop these things and an entire department was developed," Gene said. "It wasn't planned – it just happened. In the early years, no one in this field was funded as well as our group. That first grant which grew out of the European Congress in Madrid was the largest grant NIMH had ever given up to that time."

"We hired some 50-odd people," Morris said, "and the system was implemented in six states. Psychiatric hospitals sent us their data, which we processed for them. It lasted 10 to 12 years."

Carole added, "It was the genesis of the Statistics and Services Research Division here."

"It was the genesis of lots of things," echoed Gene. "For example, it led to automated reviews of drug orders, and computer generated diagnostic suggestions. Parenthetically, 40 years later the President of the United States is talking about a new initiative to automate all medical recordkeeping."

As well as maintaining close contacts with Courant, NKI has forged strong collaborative ties with NYU School of Medicine's Departments of Adult and Child Psychiatry, and the three are on the faculty of the Department

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**“As you wander around the world, see how often you arrive at industrial triplets, people who have worked together since their school days for this period of time. I think it’s pretty rare.”**

## – Gene Laska

of Psychiatry. Gene remarked, "There's more and more collaboration with other areas in the medical school in part because psychiatric research requires physics and mathematics in areas such as radiology, neurosurgery, and brain imaging."

One might think that after 50 years together these three would be slowing down, but nothing's farther from the truth. Their work is both theoretical and applied, stimulated by clinical research and mental health policy issues. Carole has recently authored two Medicare-related papers that use mathematical ideas generated with her colleagues: one on risk adjustment payment methods for psychiatric inpatients, and the other on the impact of the Medicare Modernization Act on the receipt of psychiatric medications for persons with Medicaid and Medicare coverage.

When the federal government wanted to count the U.S. homeless population as part of the 2000 census, Carole, Gene, and Morris learned of the counting methods and came up with a strategy to compensate for potential undercounting. Their idea, called 'A Plant-Capture Method,' is used by the City of New York every two years to count the homeless population.

The team has developed and published on other population size estimation methods (multiple list problems), including one used by New York State to estimate the number of people who annually receive services from the public mental health system based on data from a one week survey. They have developed a community well being index for the City of New York (an idea now in vogue in places such as France and Bhutan), and assisted the State in estimating mental health capacity requirements for persons experiencing post traumatic stress after disasters, such as 9/11. Collectively they have published over 200 papers, edited four books, and presented numerous talks here and abroad.

Can it be inferred that Courant was the incubator for their ideas?

"All three of us specialize in probability and statistics," Gene said, "and though Courant did not emphasize that when we were there, there were several professors willing to mentor Ph.D. candidates in these areas. Warren Hirsch mentored Morris and Carole, and Alan Birnbaum was my mentor."

Morris added, "Courant's motto was that there's no difference between pure and applied mathematics."

"The three of us have a common language so we can communicate very easily with each other," Carole said, "which comes out of the training received at Courant."

And yet for all their similarities, the three definitely differ in their approaches to a problem.

"Carole is the most applied," said Gene. "Her greatest skill is being able to bring the worlds of mathematics and mental health together. Morris is the most rigorous of the three of us."

"And Gene is the impressionist painter," Carole added. "His theoretical

ideas are very solid but they begin very impressionistically, with an overview of a situation."

Gene described another difference in the thinking style of the trio. "It's fascinating how differently people think. If you want to learn a new idea, one way is to understand the big idea and then see how it applies to small problems. Another way is to look at how it works in a small problem, generalize it, and discover the big idea behind it. I like to look at a small problem and see how it works. Then I'm ready to generalize. The two of them like it the other way."

After almost five decades of working together, doing research, analyzing data, and publishing papers, one has to wonder if they still like coming to work each day.

"Yes, very much so," said Carole, "because it's an evolving scene. What we're working on this year could be very different based on next year's policy issue."

Gene added, "As you wander around the world, see how often you arrive at industrial triplets, people who have worked together since their school days for this period of time. I think it's pretty rare."

When asked what the statistics are on that one, Gene replied, "I don't know – we'd have to study that!" ■

## Eugene Isaacson (1919-2008)



**Eugene Isaacson**, professor emeritus and one of the pioneers of modern numerical analysis, was one of two first hires by Richard Courant when the Mathematics Department was established in the mid-1930s. In a personal history, Isaacson wrote: “Richard Courant was certain that the large reservoir of people in New York City would ensure a supply of great students; he was right! Peter, Louis, Cathleen, Anneli, Harold G., Joe, Herb, etc.<sup>1</sup> But if Courant had

not come – and Kurt O. Friedrichs, and J. J. Stoker – then it is hard to see what NYU would be today.”

Isaacson, advised by Kurt O. Friedrichs, received his Ph.D. from the Institute in 1949 with the dissertation “Water Waves over a Sloping Bottom.”

When the Atomic Energy Commission brought the UNIVAC supercomputer to the Institute in the mid-1950s, the Institute was asked to calculate if a breach in the Grand Cooley Dam could inundate the Hanford reactor. Under the leadership of Isaacson, the numerical solution of shallow water equation helped to determine that the reactor was safe. According to a history written by Peter Lax and Seymour Parter, the Corps of Engineers adapted Isaacson’s method. In 1960 Isaacson was featured in a “Horizons of Science” program titled “The Mathematician in the River,” in which he talked about the power

of mathematics to measure and understand river depths and movements, and how floods can be predicted in advance. To conclude the program, Isaacson stated: “The mathematical equations cannot tame the river for us; that is up to the engineer. But mathematics has provided him a simple way to understand the dynamics of the river. Though mathematics is so abstract, so removed from the world of our sensory impressions, it is still the best way, in fact the only way we have, of precisely expressing and analyzing and applying the principals of the physical universe.”

Isaacson was the editor of *Mathematical Tables and Aids to Computation* (later *Mathematics of Computation*) for nine years and *SIAM Journal of Numerical Analysis* for approximately six.

In conclusion to SIAM’s oral history, Isaacson states: “I think that I’ve given you a smattering of an idea of my background and my joys. I have two sons [David and Eli] who are mathematicians, my wife [Muriel] was a math major, and my mother was very good at arithmetic.” ■

1. Peter Lax, Louis Nirenberg, Cathleen Morawetz, Anneli Lax, Harold Grad, Joe Keller, & Herb Keller.

On December 4th, 2009, the Courant Institute held a celebration of the lives and works of Herb Keller and Gene Isaacson. The day, organized by Courant Faculty Member Olof Widlund, featured talks by former colleagues, students, and family members.

## THE SECRET TO MARK SPITZNAGEL’S SUCCESS?

*Not Following the Crowd* by M.L. Ball



Mark Spitznagel can’t say for sure what’s next on the financial horizon. In fact, he claims to be “agnostic,” but if it’s bad – really bad – his strategies stand to make a lot of money.

Founder, owner, and Chief Investment Officer of Santa Monica-based hedge fund management company Universa Investments L.P. (named after the existence of universal power law distributions in market returns), Mark is that rare investor who’s willing to do what few others will: risk a little to make a

lot, and thus make infrequent profits, rather than the other way around. This counterintuitive, positively-skewed approach might seem odd until you examine the results: Universa posted 100% returns in 2008 and its overall assets have soared from \$300 million to \$6 billion in only its first two years of operation.

A Michigan native, Mark began his career as a pit trader at the Chicago Board of Trade after receiving his B.S. from Kalamazoo College. He later earned his M.S. in Mathematics from Courant Institute as a part of the Mathematics in Finance Program.

It was in those early years surrounded by screaming pit traders that Mark honed the investment approach that would characterize his career. As for

cartoon versions of reality. “They’re great for gaining intuition but become very dangerous the minute people start assuming that the real world is this cartoon, which people apparently assume a lot,” Mark said. “But I think I was particularly fortunate because I was immersed in trading and risk before being too exposed to the more theoretical side.”

“My plan was to take a learning sabbatical year or two at Courant,” he continued. But soon after his arrival, his plans changed as he got together with Nassim Taleb, a CIMS adjunct professor at the time (and now the author of “The Black Swan”), to launch Empirica Capital. Mark quickly became a part-time grad student. “I suppose it was inevitable that Nassim and I would collaborate because from the beginning we shared this very rare, even bizarre, positively-skewed approach to risk taking,” he said.

Courant was also where Mark met classmate Pallo Angsupun, now a Principal and Portfolio Manager at Universa. “He was easily the smartest guy in the class, and it was a great coup when I enlisted him to work with us. He, Nassim, and I have been together for a decade since. Universa is something of a Courant spinoff, so I indeed owe a great debt of gratitude to the place for bringing us together; the rest is history,” he said.

To obtain the discipline and focus required for Universa’s type of risk taking, Mark trains with a Chinese Chen-style Taijiquan expert, once or twice a week. “Risking a little to make a lot is a basic principle of successful investing, poker, and certainly martial arts,” he said. Mark’s self-described operating principle is the classic line from the Chinese philosopher Lao-tzu, the founder of Taoism: “The hard and stiff will be broken, the soft and supple will prevail.”

“This is really key to what we do,” Mark explained. “When you’re soft and resilient, there’s nothing anyone can do to you. Of course you also want to be very strong when you’re right, when you have the opening. I want to be resilient when I’m wrong, to embrace errors in parameters, and even benefit from them; I don’t want to fear them.

**“The idea is you can never really know what’s going to happen, and any forecast would have massive errors. So you structure your trading and management of risk such that you can’t blow up when you’re wrong.” — Mark Spitznagel**

his enormous success, he credits Everett Klipp, his strongest early influence. “He’s an old family friend,” Mark said, “and I was asking him questions as early as high school because I was so interested in pit trading. Pit trading is such a visual thing, it’s very easy for a kid to get turned on to it. It’s noisy, there are guys in colorful clothes, waving their arms, yelling...it’s bedlam, chaos, but there’s an elegant order in there.”

“Klipp was an old corn trader,” Mark added, “and I’d ask him, ‘Where’s the corn market going?’ And his response would always be, ‘I have no idea and I don’t care.’”

Mark explained, “The idea is you can never really know what’s going to happen, and any forecast would have massive errors. So you structure your trading and management of risk such that you can’t blow up when you’re wrong. This is really key. The one most important thing Klipp would say to me was, ‘You gotta love to lose money, to take small losses.’ And that’s what I’ve based my entire investment strategy on ever since.”

Following this approach, when do you make money? According to Mark, profits will take care of themselves. If you make sure you don’t have any big losers, and make sure you have an edge in your trading, invariably you’re going to have winners. “The hardest thing is to know when to take a profit,” Mark said. “When to take a loss is easy. In the pit, I was programmed to take a loss very quickly. This is why I have this deeply ingrained approach to trading because at a very young age, I was disciplined about taking very small losses. You’ll never have a big loss if you always cut them when they’re small.” In Mark’s view, this is the simplest way to create positively-skewed returns.

After several years in Chicago, Mark sought to put some rigor behind this methodology and enrolled in the Mathematics in Finance Program at Courant. “Courant was the ideal place for that,” he said, “and easily the number one applied math institution in the country.”

Exposing him to the more theoretical side of investing, his professors at Courant made it clear that the models used in math finance are really just

“With our approach, profits tend to be very large,” he added. “But most of the time you need to sit and wait. To just break even requires great discipline. Our aim is to break even 90% or so of the time.” But it is much easier to do the reverse. “Risk a lot to make a little, and thus make a little most of the time. Negatively-skewed returns are almost guaranteed to make you look brilliant for a while – at least long enough to establish a pretty good career. This is why almost everyone seems to want them,” he said.

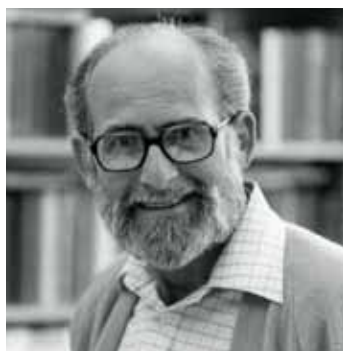
As to the future financial landscape, Mark doesn’t know what’s coming – inflation, deflation – but he thinks the world is increasingly unstable, particularly thanks to our government. “At Universa, we set ourselves up to do very well when there’s tremendous instability in the world; we don’t try to forecast crashes or panics (‘black swans’), but rather exploit how they’re priced and protect our investors from them,” he said.

When asked if he agreed with last year’s massive bailouts, Mark’s answer was immediate. “I absolutely do not. The fact that people don’t have to pay for their losses on Wall Street, this ‘too big to fail’ mentality, is a huge problem. I came from the Chicago pits where nobody would bail me out if I blew up. You know the consequences of bad decisions and you structure the way you operate based on those consequences. It’s a fundamental thing we teach our children, but somehow it’s not right for bankers? Nature doesn’t tend to have things so big that if they fail, we’d all go down. Nature breaks up its risks, which is what allows it to be more resilient.

“This should be a time of liquidating all the bad investments and slashing all the foolish leverage and debt that exploded due to the government’s credit expansion. We seem to be doing the opposite. Our leverage and debt has created a system that will break, not bend,” he said.

And what about the people who caused this mess one day getting their comeuppance? Mark laughed. “That would indeed be the mother of all ‘black swans.’ Don’t hold your breath.” ■

## Herbert B. Keller (1925-2008)



**Herbert B. Keller** was a part of the Courant Institute for nearly twenty years, until he joined the faculty at the California Institute of Technology where he remained through and past his retirement in 2000. Keller joined his brother, Joe Keller, at the Courant Institute (then called “the Institute for Mathematics and Mechanics”) in 1948 and he earned his Ph.D. in 1954, advised by Wilhelm Magnus and his brother.

Photo 1974. Courtesy of Caltech Public Relations

In a 1996 Caltech Oral history interview with Shirley K. Cohen, Keller

shares his history and memories, including his 1948 interview with Richard Courant: “for the first time in my entire career, I put on my navy whites. I wanted to make an impression. I had never had any occasion to wear my whites; but I put them on just to show Courant who he was dealing with. So I went and had this interview. And I remember Courant looked me up and down, and he saw how ignorant I was about mathematics. And he loved toying with people, so he said to me, ‘Well, let’s see now. I think we can find something for you to do.’ And then he looked up and down very pointedly at my uniform, and he looked out the window and he looked back at me, and he said, ‘Do you know how to wash windows? Oh, never mind, we’ll find something for you to do.’ [Laughter] That’s how he accepted me.”

Keller made numerous contributions to applied mathematics, including techniques for solving two-point boundary-value problems and developments in bifurcation theory. As stated in a memorial article in Caltech today, “Keller’s methods are the basis for computer software that is widely used to derive numerical solutions to nonlinear equations.” Together with Eugene Isaacson, he co-authored *Analysis of Numerical Methods*, one of the leading texts in Numerical Methods of its time. Before Keller joined Caltech, he was the Associate Director of the Atomic Energy Commission Computation and Applied Mathematics Center at Courant, under the Center’s Director, Peter Lax. Keller also served in several leadership roles and committees for the Society for Industrial and Applied Mathematics, including Vice President (1973-1974) and President (1975-1976).

A generous gift to the Institute by the Keller brothers established the Joseph and Herbert Keller Postdoctoral Fund at CIMS in 1999. As funding for the Institute’s Postdoctoral Program was becoming difficult to maintain, the Keller Fund helped provide stability to a tradition which has now brought many talented junior scientists to the Institute for the better half of a century.

Keller is survived by his brother Joseph; a son, Steve, who lives in Bainbridge Island, Washington; a daughter, Debra, in Sacramento, California; and four grandchildren. ■



# The Mathematics in Finance Workshop and Conference Center



**Robert Engle**, the Michael Armellino Professor of Finance at NYU Stern School of Business and Nobel Laureate in Economics, delivers his keynote presentation at the Algorithmic Trading conference on October 3, 2008.

The Mathematics in Finance Workshop and Conference Center at NYU's Courant Institute is increasingly becoming known as a "quant central", as it is considered the preferred university venue for students, the most venerated educators, and financial industry professionals to meet to develop and refine the science and practice of mathematical finance.

Petter Kolm, Deputy Director of the Mathematics in Finance M.S. program, says "the mission of the Center is to provide the finance community with continuous learning and networking opportunities, covering areas from foundations in quantitative finance to the most innovative and latest cutting-edge research. Our program's aim is to integrate theoretical concepts and practical applications — with the challenging goal of making them appealing to both practitioners and academics alike".

Over just the last 12 months that mission has been borne out by several highly successful workshops and conferences sponsored by Bank of America Merrill Lynch, Gerson Lehrman Group, ITG, J.P. Morgan, NVIDIA, Paris Europlace, Standard & Poor's, and Tethys. The workshop of June 10-12 on *High-Frequency Finance and Quantitative Strategies* was sold out, while the conference on *Algorithmic Trading: Dynamic Portfolios, Optimal Execution and Risk* on October 3, 2008 had 350 participants. This year's conference on November 13 was on the much in vogue theme, *the Future of Risk Management*, focused on past failures of model use and risk management, the importance of industry wide stress tests, desirable and probable changes in Basel standards, and lessons learned from the financial crisis, among other topics.

The Center finished off this exciting year with a workshop on *High-Frequency Finance and Quantitative Strategy* on December 11-12, and looks forward to kicking off the new year with a conference in February on *Algorithmic Trading* (details forthcoming at <http://www.cims.nyu.edu/~mathfcon/>). Events of this caliber continue to enhance the Courant Institute's reputation and visibility in mathematical finance. ■

## The Generosity of Friends

**Donations from friends and alumni of the Courant Institute greatly assist our educational and research missions.**

Your donations to the Courant Annual Fund are more important than ever. This unrestricted income supports students and their conference travel, enhances the activities of our student clubs, and helps fund the cSplash and WinC outreach programs. The Annual Fund provides matching funds to secure grants from other sources, enables the Institute to invite distinguished speakers for both technical and public lectures, and assists in creating improved public spaces in both Warren Weaver Hall and the Broadway building.

You will be eligible to join the Courant Director's Circle with a donation of \$1,000 and above. This entitles you to join special events at the Institute, including a Circle only event in the fall, and the exclusive Director's Toast before the holiday party.

Your donation will help support a truly extraordinary range of scientific and educational initiatives. ■

The Courant Institute recognizes with gratitude the following alumni, faculty, and friends who have made gifts since our last edition went to print:

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The Director's Circle is the Courant Institute's giving society for those making a contribution of \$1,000 or more in a given fiscal year. Members receive special invitations as guests of the Director to events of interest throughout the year, with complimentary access extended where applicable. Additionally, those giving at the \$5,000 level and above qualify for membership in the various university-wide giving societies.

Join the 2009-2010 Director's Circle with a gift of \$1000 or more! Contact Cheryl Sylivant at [sylivant@cims.nyu.edu](mailto:sylivant@cims.nyu.edu) or 212-998-3321 for details.

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**Alexander Hanhart**

Clinical Assistant Professor of Mathematics

Alex Hanhart's research interests include topological and

geometric methods in mathematical physics; specifically the relation between string topology and topological field theory. He also has worked in the fields of scientific computing and modeling in biological processes. In addition, he is interested in undergraduate mathematics education. He is the recipient of numerous research and teaching fellowships, and has lectured widely.

**Kiryl Tsishchanka**

Clinical Assistant Professor of Mathematics

Kiryl Tsishchanka's primary research interests lie in

number theory and include a broad spectrum of topics such as Diophantine approximation, multidimensional continued fractions and approximation in local fields. Over the last three years he has also been doing research in financial mathematics and quantitative finance. Tsishchanka's recent honors include a Deutscher Akademischer Austauschdienst Fellowship and a National Science Foundation Fellowship.

**Mark Tygert**

Assistant Professor of Mathematics

Mark Tygert's research interests include computational science and engineering,

particularly numerical analysis. Highlights are fast transforms and randomized algorithms for numerical linear algebra. He has been a visiting assistant professor at UCLA, and a graduate student, postdoctoral associate, and Gibbs assistant professor at Yale.

**Martin Hairer**

Associate Professor of Mathematics

Martin Hairer's main research interest are the ergodic properties of stochastic partial

differential equations and stochastic multiscale analysis. He has received several grants and research fellowships from the EPSRC and the Swiss NSF. He is the recipient of a 2008 Philip Leverhulme Prize and a 2008 LMS Whitehead Prize.

**Sam Roweis**

Associate Professor of Computer Science

Sam Roweis was a postdoc with Geoff Hinton and Zoubin Ghahramani at the

Gatsby Unit in London, and a visiting faculty member at MIT in 2005. Subsequently, Roweis was at the University of Toronto. He has also worked at several industrial research labs including Google, Bell Labs, Whizbang! Labs and Microsoft. His research interests are in machine learning, data mining, and statistical signal processing.

**Sourav Chatterjee**

Associate Professor of Mathematics

Sourav Chatterjee obtained his Ph.D. from Stanford, and has previously taught at

UC Berkeley. He is interested in various aspects of probability theory, mathematical physics and theoretical statistics. He was the recipient of a Sloan Research Fellowship in 2007 and the Tweedie Award in 2008 (given annually to the best young researcher in probability and statistics by the Institute of Mathematical Statistics).

## Fair Votes

by Dennis Shasha, Professor of Computer Science

A group of 100 students are competing for college scholarships. They come from 10 schools (10 students per school). From each school, one student has declared physics as a major; one has declared chemistry; one, biology; one, psychology; one, mathematics; one, economics; one, anthropology; one, linguistics; one, English; and one, history. So, there are ten students for each of these majors.

Each of three judges is going to rank the students in ten ranks from best (rank 1) to worst (rank 10). That is, each judge is to assign ten 1s, ten 2s, and so on up to ten 10s. So in the end, each judge will assign one rank per student. In previous years, some of the losing students have alleged that the judges were biased, so we want to enforce two "fairness" constraints that will require some planning on the part of each judge:

1. Each judge assigns all ten ranks to the students from each school
2. Each judge assigns all ten ranks to the students for each major.

So, among the economics majors for example, each judge should assign one 1, one 2, one 3, and so on up to one 10. Similarly, among the students from Pleasantown High School, each judge should assign one 1, one 2, and so on up to one 10.

The ranks assigned by the three judges will get averaged for each student.

Our problem is to ensure that each judge obeys the constraints without however knowing how that judge voted. That is, we want to know for sure that the judge obeyed the constraints but nothing more.

To show you that this is at least conceivable, suppose we imagine a variant of the Monty Hall Show using cards where all cards are worth zero except one that is worth \$10,000. The Master of Ceremonies begins the game by arranging the cards and lays them face down. The contestant chooses one which the M.C. then turns over and gives the corresponding reward. If the reward were zero, the contestant might then challenge the M.C. to show that there is in fact one card worth \$10,000. To prove this, the M.C. could take the cards, shuffle them and then reveal them.

The net effect is that the M.C. has proven that he has not cheated. At the same time, he has not revealed the position of the prize card.

1. Returning to the scholarship problem, imagine that each judge is given 100 opaque cards that are blank on one side and hold the name, school and major of the student on the other side.

Each judge also has 100 adhesives, ten identical 1s, ten identical 2s, and so on up to ten 10s. Can you design a protocol to ensure that each judge meets the constraints, but without allowing anyone to infer the judge's votes?

For the solution email: [courant.alumni@nyu.edu](mailto:courant.alumni@nyu.edu)

## Harry Hochstadt

(Courant '56)



Harry was one of the first students of Wilhelm Magnus, whom he met during a summer course in 1950. In remarks that Harry gave at Courant on the occasion of the 100th anniversary of the birth of Magnus, he characterized their relationship as changing over the years "from teacher to advisor to professional colleague and finally to close friend."

Dr. Jutta Nemeč, daughter of Wilhelm Magnus, remarked that Harry made it possible for her father to continue his academic career 4 years at Polytechnic after the mandatory retirement policy ended his faculty position at Courant. She added that Harry and his wife Pearl kept up a regular visiting schedule with her mother for the 15 years that Mrs. Magnus lived on after the passing of her father and summed it up that "he was a real mensch in every sense of the word."

His life was celebrated at a memorial service on Sunday, October 25 at the Brooklyn Heights Synagogue. He is survived by Pearl Hochstadt, his wife of 56 years; two children Julia Sweet and Jesse; and two grandchildren Nathaniel and Amalia Sweet. ■

**We are saddened to share that Harry Hochstadt, Courant Ph.D. (Math) '56, passed away on May 4, 2009 at the age of 83.** Harry published over 100 academic papers, and was a member of the Polytechnic faculty beginning in 1957, serving as Chair from 1963-1990.

## First CSO Student Conference

This April the Courant Student Organization, organizer of cSplash and several other Institute seminars and events, hosted its first Courant Student Conference. The Conference, intended as a friendly setting for students to present their research and also to encourage collaboration across Courant's disciplines, featured nearly twenty presentations on topics from "Step Evolution for Crystals of Finite Size: the ADL case" by poster prize-winner Hala Al-Hajj Shehadeh, to "Does Privacy Require True Randomness?" by recent Doctoral recipient Carlton Bosley. ■

## The Courant Institute Celebrates 75 Years

Founded in the mid-thirties under the leadership of Richard Courant, the Institute will be celebrating its 75th Anniversary over the course of the 2010-2011 Academic Year. Special events and activities will be planned to commemorate the occasion and to bring together CIMS and the broader scientific community. ■

## 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](mailto:alumni.news@cims.nyu.edu).

For current Alumni News, visit <http://www.cims.nyu.edu/alumni>

## Stay Connected to the Institute

### Join Courant's Social Networks!

The Courant Institute has an official Facebook page and two Linked In pages, which alumni are encouraged to join to stay connected to the CIMS community and informed about special events and activities.

Facebook.com:

Courant Institute of Mathematical Sciences Alumni

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Mathematical Finance MS Program at Courant Institute

### NYUniverse ([alumni.nyu.edu](http://alumni.nyu.edu))

NYUniverse is a new online community launched by NYU Alumni Relations, with networking and other resources for alumni.



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