



Math Times

University of Illinois at Urbana-Champaign

Spring 1997

Letter from the Chair

Dear Colleagues and Friends,

It is a pleasure to write to you about the exciting times in mathematics at the University of Illinois at Urbana-

Champaign. An intellectually vigorous group of faculty and students is pursuing mathematical visions, inventing new structures, elaborating proofs and developing methodologies, as they study and learn at all levels.

Our faculty and graduate students, past and present, continue to receive honors and recognition for their work. Now they will be joined by an unusually large number of new faculty members. **Susan Tolman**, who accepted a position last year, will join us as a tenure track assistant professor after a year at Princeton. We are also delighted to announce the appointment of four new tenure track assistant professors: **Michael Bennett**, **Richard Laugesen**, **Renming**

Song and **John Sullivan**, as well as two new postdoctoral J.L. Doob assistant professors for three year non-renewable terms beginning Fall 1997: **Tibor Szabo** and **Tadashi Tokieda**.

Three of our long term faculty members who together have been here a total of 110 years were honored at a reception April 20 at Levis Center on the occasion of their retirements this year. They are: Professors **Richard Bishop** who was appointed in 1959, **Robert Carroll** whose appointment was in 1964, and **Lester Helms** who came in 1958, They will be missed by their colleagues.

Mathematics is an exhilarating field, constantly reinventing itself by adding to the wonderful treasures of the past. The mathematical productivity of the current period is unexcelled in history.

The impact of the computer is growing, with more digital and

symbolic experimentation taking place. Mathematical investigations are guided by purely intellectual evolutions as well as by the natural sciences, to which mathematics furnishes the language and concepts for descriptions, analysis, modeling, and simulation. Mathematics further provides design and simulation for engineering and technology and for the decision processes in industry.

All this adds to the incredible richness of our science. It is easy to overlook this aspect of the current development in light of the financial crisis in higher education which affects all academic departments, including mathematics and the department from which I am writing this.

But the fact that the resources we have to do our work are extremely limited does not detract from the reality that mathematics is bursting with

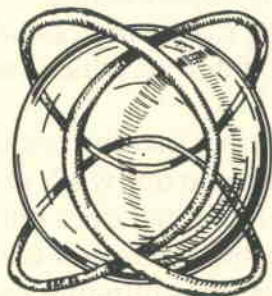
intellectual health.

One of the questions facing us is how the Internet will change the way we teach mathematics. There is a proposal our people are working on to deliver mathematics instruction over the internet.

With all the excitement and changes, it is important for graduate students in today's world to become computer literate, if they are not already, and also to have a broad knowledge of mathematics, not just a narrow single focus. Another quality that will help young mathematicians is to have good communication skills.

We must help the public to continue to be aware of the importance of education for the country's economic future. As long as the the nation renews its historical commitment to scientific research and education, the practitioners of mathematics will continue to have interesting and enjoyable lives.

Yours,
Philippe Tondeur



Doctoral Examinations

The department has agreed in principle in a straw vote to change the comprehensive examinations in the doctoral program. At present there are three examinations, each covering two courses, with algebra and analysis required. The Graduate Affairs Committee is now setting up a list of fourteen courses, two in each of four areas and one in each of six more areas. Doctoral students will have to take six of these courses with good grades, and pass a comprehensive exam on any three of them.

In addition, it is proposed that all entering students will take a diagnostic examination before their first semester which will cover undergraduate analysis and algebra. The results will be used to counsel students on whether to take beginning graduate courses, advanced undergraduate courses, or possibly new catch-up courses intermediate between these two levels.

The faculty would like all students to begin graduate work with a command of undergraduate algebra and analysis, and for doctoral students to be exposed to a sufficient breadth of material during their first two years to make an educated choice of a research area.

Fewer TAs

The number of graduate teaching assistants in the department will decrease as a result of decisions as to how teaching requirements will be met. One change that has been made is that over a period of three years the number of postdoctoral positions will be increased to six positions. Each year two three-year post-doctoral appointments will be made; this will continue indefinitely. As a result of this and other changes, the number of teaching assistants will decrease by about fifteen to 120.

As a further result, to get to the new level of TAs there will be an unusually small entering group of graduate students in the fall of 1997. We will admit just twenty new students next year, instead of the usual forty or more. This is a one-time change, and we expect to return to just slightly less than the previous intake in subsequent years.

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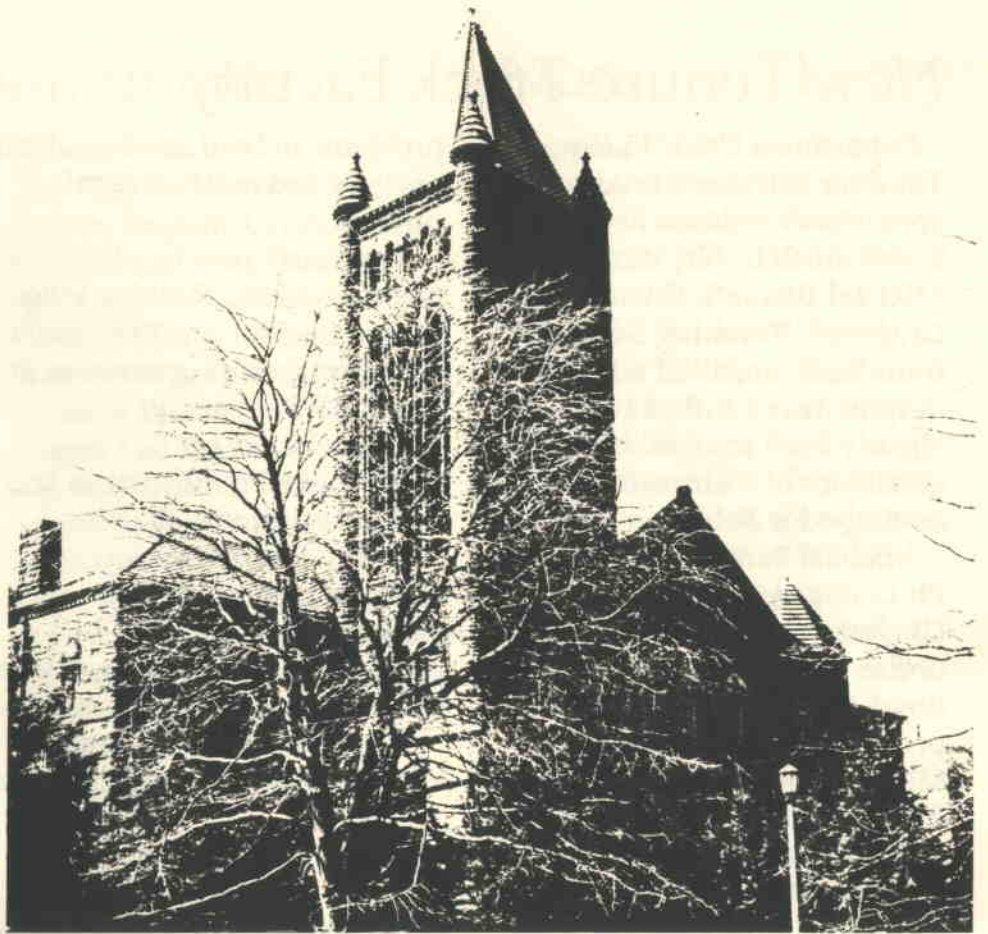
Retirements

Colleagues and friends attended a reception in April at Levis Faculty Center in honor of three of our professors who are retiring at the end of this academic year.

Richard Bishop received his Ph.D. from MIT in 1959 and joined the UIUC faculty that year. His undergraduate degree was from Case Institute of Technology. His area is differential geometry.

Robert Carroll, who has given many invited talks in the United States and abroad and been a visiting professor at many universities, joined our department in 1964. He came from Rutgers University where he had been an associate professor. Carroll received his B.S. degree from the University of Wisconsin in 1952, worked as an aeronautical research scientist and then served with the U.S. Army Security Agency as a linguist. He received his Ph.D. from the University of Maryland in 1959. His interest is partial differential equations.

Lester L. Helms received his Ph.D. from Purdue University. He served in the U.S. Air Force from 1945 to 1948, then attended Bradley University and Purdue where he also received an M.S. An analyst, he has been on the UIUC faculty since 1958.



Altgeld Hall is one hundred years old. Officially dedicated June 8, 1897, it was first known as Library Hall. In 1956 the mathematics department took over the building.

I believe that mathematical reality lies outside us, that our function is to discover or observe it, and that the theorems which we prove... are simply our notes of our observations.

G. H. Hardy

Mathematical objects are just concepts; they are the mental idealizations that mathematicians make.

Roger Penrose



I was an undergraduate in Brussels at the same time and the same year as Jean Bourgain. He was the first boy I met who was smarter than I was.

Ingrid Daubechies, speaking at UIUC on "How I Became a Mathematician."

New Tenure Track Faculty

Department Chair Philippe Tondeur has announced the appointment of four new tenure track faculty members: Michael Bennett, Richard Laugesen, Renming Song, and John Sullivan, all of whom, despite their youth, have already been recognized for the excellence of their research in cutting-edge fields.

Michael Bennett earned his Ph.D. degree in 1993 at the University of British Columbia under the supervision of David Boyd. Currently an assistant professor at the University of Michigan he specializes in diophantine approximation and number theory.

Richard Laugesen who earned a Ph.D. in 1993 at Washington University in St. Louis under the supervision of Albert Baernstein II, comes to us from Johns Hopkins University where he is now as assistant professor. An analyst with interests in applied mathematics and mathematical physics, his initial work was on extremal problems in complex analysis and potential theory.

Renming Song earned his Ph.D. in 1993 at the University of Florida under the supervision of Joseph Glover. Currently an assistant professor at the University of Michigan, his research interests are in stochastic analysis and related

problems in hard mathematical analysis and mathematical physics.

The fourth new faculty member is John Sullivan who earned his Ph.D. in 1990 under Fred Almgren's supervision at Princeton University. Recognized for his experimental mathematics and mathematical visualization Sullivan does theoretical research with numerical experimentation. He is currently an assistant professor at the University of Minnesota.

In addition Susan Tolman, who accepted an appointment a

year ago and is spending the current year at Princeton University under the sponsorship of Raoul Bott, is coming this fall. She earned a Ph.D. in 1993 at Harvard University. Her research interests are symplectic geometry and topology.

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To doubt everything or to believe everything are two equally convenient solutions; both dispense with the necessity of reflection.

Poincare



Photo by Chris Marx

Stonework on the outside of Altgeld Hall shows the wear of one hundred years on some of the beautiful detail on the original building.

Postdoctoral Appointments

Department chair **Philippe Tondeur** announces with great pleasure the appointment of the first two J.L. Doob Assistant Professors in the mathematics department. They are **Dr. Tibor Szabo** and **Dr. Tadashi Tokieda**.

Tibor Szabo received his Ph.D. in 1996 from Ohio State University under the supervision of Professor Akos Seress. Dr Szabo, whose area of interest is extremal combinatorics, with a special interplay with algebra and number theory, is currently a member of the Institute for Advanced Study in Princeton. He has a diploma with distinction from the Eotvos Lorand University in Budapest, has won many honors in Hungary and received a 1995 Presidential Fellowship from Ohio State University.

Tadashi Tokieda has a 1996 Ph.D. from Princeton University where his adviser was Professor William Browder and where he also received a master's degree. Currently a postdoctoral fellow and lecturer at McGill University in Montreal, Tokieda is interested in symplectic topology and Hamiltonian dynamics. A 1989 classics graduate from Jochi University in Tokyo, he received a bachelor's degree in mathematics from Oxford

University in 1991.

Dr. Tokieda knows Japanese, French, English, Greek, Latin, classical Chinese, Finnish, Spanish and Russian.

The J.L. Doob Assistant Professorships are named in honor of Emeritus Professor **Joseph Leo Doob** who joined our faculty in 1935 and remained here until he became Professor Emeritus in 1978.

Doob was president of the American Mathematical Society in 1963 and 1964, and was a member of the AMS executive committee, and the editorial committees of the *Bulletin*, *Transactions*, *Memoirs* and *Mathematical Reviews*. Among his other honors he is a member of the National Academy of Sciences and of the American Academy of Arts and Sciences and has been president of the Institute of Mathematical Statistics. His major interests are probability and potential theory.

Doob Assistant Professorships are three-year visiting positions and are non-renewable. With two more postdoctoral appointment in 1998 and an two additional appointments in 1999 there will be six such positions permanently funded in the department of mathematics.

Number Theory

During the last weekend in March and the first in April a festival of number theory took place at the UIUC mathematics department. On Saturday, March 29, the 4th Midwest Algebraic Number Theory Day was held here. Key speakers included Richard Taylor of Harvard and Chris Skinner of Princeton. Taylor, along with Andrew Wiles, was the co-solver of Fermat's Last Theorem. Skinner is a student of Wiles and is a co-author with him. Individually he is extending the methods that solved Fermat's Last Theorem.

Then on April 4 and 5 the 1997 Illinois Number Theory Conference took place on campus. Twenty-two talks were given, mainly in the area of analytic number theory. The invited speakers included Kannan Soundararajan, Princeton University, **Mihail Kolountzakis**, UIUC Mathematics department, Ken Ono, from the Institute for Advanced Study and Pennsylvania State University, and **John Selfridge**, formerly at UIUC and now an emeritus professor from Northern Illinois University. Four faculty members, Professors **Bruce Berndt**, **Harold Diamond**, **Heini Halberstam** and **Adolf Hildebrand** were the principal organizers.

Prize to Lacey

The mathematics department is pleased to announce that former graduate student **Michael Lacey** who received his Ph.D. from the department in 1987 has been awarded the 1996 Salem Prize in mathematics along with **Christoph Thiele** of the University of Kiel. The Salem Prize Committee cites "their remarkable work on Calderon's bilinear Hilbert transform and a new method of phase space analysis."

The Lacey-Thiele analysis was directly inspired by the proofs of the theorem of **Lennart Carleson**, which asserts that the Fourier series of every square integrable periodic function converges almost everywhere

The Salem Prize, established in 1968 is awarded annually to young mathematicians for outstanding work in the fields of interest of the late **Raphael Salem**, primarily Fourier series and related topics.

Michael Lacey's thesis director here was Professor **Walter Philipp**. He is currently an associate professor at the Georgia Institute of Technology in Atlanta. He began the work which led to the Salem Prize more than five years ago while he held an NSF Postdoctoral Fellowship.

Graduate Student News

Two of our graduate students who are finishing their Ph.D.s this year have just won National Science Foundation Postdoctoral Fellowships, which are for two to three year appointments. They are **Robert Bauer**, whose adviser is Professor **Donald Burkholder**, and **James Colliander**, whose adviser is **Jean Bourgain**. **Bourgain**, now at the Institute for Advanced Study, spent part of each year at UIUC for several years.

These awards are very competitive. The NSF awards only between 30 to 35 each year throughout the country.

Trjitzinsky Lecture

In April, **John Lewis**, of the University of Kentucky, gave this year's **Trjitzinsky** lectures. These lectures have been funded by friends, associates and family to honor the late **Waldemar Trjitzinsky**, a distinguished member of the department for many years.

Professor **Lewis** received his Ph.D. from UIUC in 1970 under **Maurice Heins**. He is a function theorist who writes that he "has branched out into partial differential equations, harmonic analysis and quasi-regular mappings in space."

Seven UIUC mathematics graduate students attended the 5th semi-annual meeting of the Canadian Number Theory Association held in Ottawa last August. Professor **Bruce Berndt** commented that five of the students, **Dennis Eichhorn**, **William Galway**, **Sen-Shan Huang**, **Soon-Yi Kang** and **Seung Hwan Son**, all presented excellent papers.

Cyberfest Here

As part of the Cyberfest Celebration at the UIUC campus this March, Professor **Roger Howe** of Yale University spoke on "Computation, Mathematics and Philosophy,"

His visit here was sponsored by Phi Beta Kappa and the department of mathematics. Cyberfest was a celebration of the birthday of HAL, the too-clever computer who was born in Urbana and went bad in **Arthur C. Clarke's "2001."**

Roger Howe has been a professor at Yale since 1974 and was recently elected to the National Academy of Science.

He discussed how the availability of cheap, powerful computers is changing the way we think about mathematics and even how we think about thinking.

News of the Faculty

Professor **Bruce Reznick** has been chosen to receive one of the 1996-97 William F. Prokasy Awards for Excellence in Undergraduate Teaching given by the College of Liberal Arts and Sciences. He, along with a few other other superior teachers, was honored at the annual Awards Banquet April 13. This honors individuals who have made outstanding contributions to the college.

For the excellence of his teaching, LAS Dean Jesse Delia wrote to Reznick, he will receive a cash prize and an increment to his annual salary.

Emeritus Professor and former head of the department **Heini Halberstam** was a visiting professor at the University of Colorado in Boulder during the fall 1996 semester. In March he was an invited colloquium speaker at the University of Oklahoma and will be an invited speaker at a Number Theory Conference held in Poland in June.

Swanlund Professor **Anand Pillay** was the organizer of a workshop in Geometric Model Theory at the Fields Institute in Toronto in January 1997. Pillay gave an invited colloquium talk at Vanderbilt University, Nashville, in April.

Adjunct Professor **James Glazebrook** presented a talk entitled "Reduction of the

Hermitian-Einstein Equation" at the University of Florida Institute of Fundamental Theory "Workshop on Moduli Spaces in Geometry and Physics" in February.

Two of our department faculty members, Professors **Wolfgang Haken** and **Lou van den Dries**, are invited speakers at the Workshop on Geometry and Complexity being held in May at the Fields Institute in Toronto, Canada. The workshop is part of the on-going program on Singularity Theory and Geometry and is intended to bring together researchers in various aspects of geometry, topology, and geometric group theory.

Last fall Emeritus Professor **Franz Kamber** visited Japan and southeast Asia for two months. He lectured at Tohoku University, University of Hokkaido, Ryukoku University, Ritsumeikan University, and the University of Kagoshima in Japan, the National University of Singapore and the University of Malaya in Malaysia.

This spring **Julian Palmore** is the chair of the AMS Menger Prize committee and in May will attend the International Science and Engineering Fair for the AMS in Louisville. In May he will also be a presenter in the National Technological University.

Undergraduates

Two undergraduate students have received the Greenwood-Trjitzinsky prize for outstanding mathematical papers.

They are **Tameka Carter**, whose papers was "Fibonacci Sequences and other Second Order Linear Recurrences" and **Mark Schmitt**, "On the Partitions of S_n into Distinct Parts from $\{S_n\}$."

They will receive cash awards and recognition at departmental and college ceremonies. The Greenwood-Trjitzinsky competition is now three years old. Work done by our undergraduate students here or elsewhere over the summer or fall will be eligible for next years competition. Conditions for entries for next year's competition will be posted next fall.

LAS sophomore **Brad Friedman** was the highest ranked UIUC participant in the 57th annual William Lowell Putnam Intercollegiate Math Examination. Out of the 2407 students who entered, Friedman's score of 39/120 put him in 77th place. Six of our students placed in the top 20%; the UIUC team ranked 40th out of 407 teams.

Coaches for the teams were Professors **Harold Diamond** and **Adolf Hildebrand**.

Boone Remembered

In December Prof. Paul Schupp gave a talk on the life and work of Prof. William W. Boone, a noted member of this department who died in 1983 at the age of 63. His most important contribution to mathematics concerned the word problem.

The word problem for groups was first posed in 1912 by Max Dehn, and is: if G is a finitely presented group, is there an algorithm, using an ideal calculating machine, which

when given an arbitrary word w in G decides whether w equals the identity of G ? If no such algorithm exists, then the problem is called unsolvable.

Alan Turing and Alonzo Church had proved in 1936 that certain problems are unsolvable, but these were not regarded as 'real' mathematical problems. Boone was one of the two mathematicians who proved independently around 1955 that the word problem for groups is unsolvable, thus bringing the

idea of unsolvability into the main stream of mathematics. He continued after that to make important contributions to the field of mathematical logic.

Bill Boone was not only a mathematician of the first rank, he was the subject of many 'Boone stories', which described his highly original approach to everyday life. He also left a lasting impression on the department in the people who came to Illinois largely because of his efforts, including Kenneth Appel, Wolfgang Haken, Paul Schupp and Gaisi Takeuti.

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