Math Times

Letter from the Chair

Dear Colleague,

Much has been happening in our department in this new academic year.

One of our faculty members, **Jean Bourgain**, who joined us in 1985, received a Fields Medal at the International Congress in Zurich this summer. Professor Bourgain, who holds the **Joseph L. Doob** Chair of Mathematics, has a quarter time appointment at the UIUC campus and spends the rest of the year at the Institute des Hautes Etudes Scientifique in Paris and the Institute for Advanced Study in Princeton.

We are delighted to welcome four new faculty members who have joined us this fall: Professor **Joseph Rosenblatt**, and Assistant Professors **Douglas Bowman, Nick Firooyze**, and **Randy McCarthy**. We also have several excellent young mathematicians who are visiting assistant professors: **Renlin Jin, Norm Levenberg,** and **Kenneth Ono**.

As always in the department there is much mathematical activity. In addition to the colloquium talks which are given at least once a week, more than a dozen seminars meet weekly. The newly formed Committee on Applied Mathematics is sponsoring a series of talks on "Mathematics in Science and Society." These will be coordinated with the colloquium talks.

There is increased interest among our colleagues in strengthening and improving the ways that mathematics is taught. Several members of the department are working on new methods, some of which are described in this newsletter.

I am pleased to announce that **Philippe Tondeur** was honored by the College of Literature, Arts and Science for the excellence of his teaching. Last year Professor **Stephanie Alexander** received one of these prestigious awards which honor faculty members for their research as well as for their teaching. Each year only four are awarded by the College.

Also, **George Francis** received an Amoco Foundation Award for Innovation in Instruction.

We are always pleased to hear from you. We are especially eager to hear from any of you who are applying your mathematical training in non-traditional ways. Keep the letters coming.

Jerry Janusz

It is one of the most striking features of mathematics (perhaps alone among the disciplines) that the truth of propositions can actually be settled by abstract argument.

Roger Penrose

Truth exists, only falsehood has to be invented.

Georges Braque

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In the Mail

To the Editor:

I want to tell you how much I enjoy the math news from the University of Illinois. I was at the university when Professor David Blackwell was there. As a graduate student I lived in part of the duplex the Levys shared with Professor Bickford Shields and his wife. My room was on the third floor at the Shields. Lucretia Levy was raising chickens on her third floor. I could hear the noise they made in the morning....

Do you know when and who was the first woman to receive a doctorate at the University of Illinois?

Eleanor Ewing Ehrlich (A.B. 1941, A.M. Math 1943)

Editor's note:

The first woman awarded her Ph.D. in the mathematics department was Elizabeth R. Bennett who received her degree in 1910. Following her were Josephine Burns in 1913 and Jessie Jacobs in 1919. Beulah Armstrong, who later became a faculty member here, was awarded her Ph.D. in 1921. No other women received doctorates here until the 1930's.

Thanks to Emeritus Professor **Paul T. Bateman** for a copy of *The History of the Department of Mathematics at the University of Illinois*, an unpublished thesis, 1940, by Emma Cleo Stanford.

IMA Summer School at UIUC

Professors **Stephanie Alexander, Richard Bishop** and **Philippe Tondeur** announce that an Institute for Mathematics and Applications summer school for graduate students will be held here at UIUC on differential geometry, starting July 9.

The main topics for the 1995 summer program are to be Minimal Surfaces, Harmonic Maps, Gauge Theory, and Spaces of Bounded Curvature.

Each summer this IMA program brings together 30 to 40 mathematics graduate students selected by their universities to expose them to exciting topics in mathematics.

For each of the four weeks, one senior mathematician lectures every morning from ten to twelve. In the afternoon the students attend problem sessions and work on group projects. As, generally, no more than two students from any one university attend, the students meet and get to know others from different institutions.

The program is directed towards students who have completed a year of graduate courses and who have a preference for differential geometry but have not yet narrowed their focus to a specific research project.

Students are nominated by their department heads and must agree to participate for the full four weeks. In addition to the two nominated, each participating institution may also submit a ranked list of additional students who might be chosen for the program if places are available.
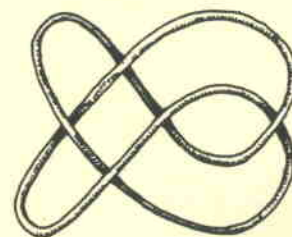
Notice

John Britton, who was a visiting assistant professor to our department in 1960-61 and who was a G.A. Miller visiting professor here in the spring of 1968, was killed in June in a fatal accident while walking in the Cuillin Hills on the Isle of Skye, in Scotland. An emeritus professor at King's College, London, his work had been in logic.

Lee Rubel in Hong Kong

Emeritus Professor **Lee Rubel** visited Hong Kong University of Science and Technology for two months last year, and while there was interviewed by S.H. Lui. Following are excerpts from the interview, published in the Hong Kong Mathematical Society Newsletter, March 1994.

The interviewer asked Rubel about his education. Rubel received a bachelor's degree from City College of New York, and a Ph. D. from the University of Wisconsin. For two years he was an instructor at Cornell University, then went to the Institute for Advanced Study in Princeton. After two years there he had three offers but chose to come to Illinois because it "had by far the most active professors."

Rubel: I think I made the right decision. In Illinois there is no mountain and no ocean nearby so one can concentrate on doing mathematics. It also has a very good library. In over 30 years, there were maybe five things that I couldn't find in the library, and you know I like to read original papers. Some of these were written more than a hundred years ago.

Lui: You have worked in so many areas of mathematics. What is your secret to learning a new field?

Rubel: Well, I'll tell you how not to learn a subject. You should not find a textbook and start reading on page one. If you are working on a problem and need to learn another field, just be utilitarian about it. Look up only parts that are related to your problem. Often, you'll find the guts of the subject in the first 50 pages of the book. The rest of the book is usually just an elaboration of the core material. Another good way to learn a subject is to teach it.

Lui: How do you do mathematics? How do you choose problems to work on?

Rubel: I can't really answer that. Mathematics is my life and I immerse myself in it totally. Doing mathematics is an organic process. I get ideas by talking and listening to people. I just work very, very hard. I've published 200 papers and say 25 of them are important papers. But every one of them has at least one idea. This is more than you can say about some papers today. The light weight papers have their place, too. Now that I'm retired I have more time to work on deeper theories.....

Lui: Do you have any favorite theorems or areas of mathematics?

Rubel: My favorite theorem is Nevanlinna's five value theorem. It says that if two meromorphic functions share five values in the complex plane, then the functions are identical. [By definition, f and g share the value a when, for all z, $f(z)=a$ if and only if $g(z)=a$.] I like function theory, logic and recently the mathematics of analog computers.

Lui: Would you care to comment about the direction of mathematics? We seem to be getting more and more specialized.

Rubel: I think that young mathematicians are getting too specialized too soon. People in the same department don't talk to one another anymore. Instead they talk to people in Princeton or Rome or Paris. I can talk to a mathematician in a field that I'm not familiar with, ask him questions and sometime later, help him solve a problem....

Mathematics has become too political. Nowadays which school you graduate from and your adviser are more relevant than the quality of your thesis. Some people are so powerful that they can declare that a certain field is dead and another field is alive. Nobody can say these things. Just look at the iteration of functions. It lay dormant for more than 50 years before the recent explosion of activities. Mathematics should be ruled by men, not politics.

New Faculty

Professor **Joseph Rosenblatt** joined our department this fall. He works in harmonic analysis, and also in ergodic theory as well as real and complex analysis. He received his Ph. D. from the University of
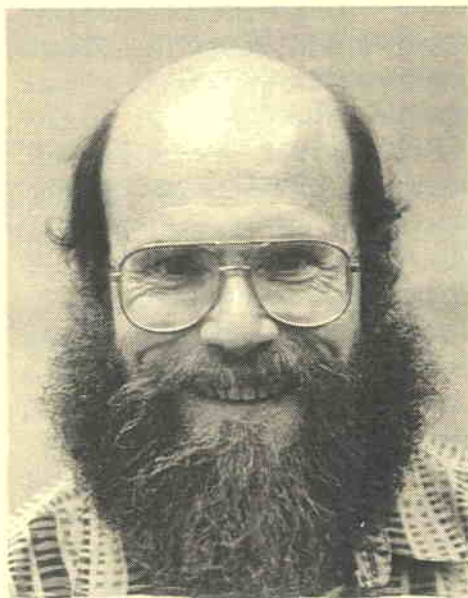
Joseph Rosenblatt

Washington in 1972, then went to the University of British Columbia for two years. In 1974 he went to Ohio State University where he stayed for 20 years until moving to Urbana, with his wife, Dr. Gaye Miller, who is professor of veterinary medicine and associate dean of academic and student affairs at the College of Veterinary Medicine.

The university wanted both Professor Miller and Professor Rosenblatt and offered them jobs in their respective departments. He and his wife moved here with their four daughters, who range in age from 10 to 15, and many animals, including cats, dogs, gerbils, horses, goats, and rabbits. From his house in the country, a few miles south of the university, he rides his bicycle back and forth to his math department office

Assistant Professors

Three new assistant professors have joined our faculty this fall.

Doug Bowman received both his M.A. and, in 1993, his Ph.D. from UCLA where he held a National Science Foundation Graduate Fellowship. Last year he was at Pennsylvania State

Douglas Bowman

University. Interested in number theory, including the theory of partitions and the transformations of q-series, as well as combinatorics, he has recently been focusing on the algebraic structure of q-series. At a young age, he was fascinated by codes and cryptography and also by physics. He realized in sixth grade that all his interests had mathematics in common and, on his own, began studying calculus and doing research.

Now, he says, he is interested in all branches of mathematics, and not prejudiced against any areas. While he loves working on mathematics and finds it easy to go home to his apartment and start working, he finds teaching math a great joy and says no mathematics is too elementary to be interesting. You look at it from different points of view, he says.

He finds the department to be friendly and welcoming, and enjoys the Thursday afternoon number theory get-togethers at Joe's where all members of the mathematics community are welcome.

Nick Firoozye received his M.S. and Ph.D. from the Courant Institute at New York University in August, 1990. His thesis title was Optimal Translations and Relaxations of Some Multiwell Energies. He

spent one year at the University of Minnesota's Institute for Mathematics and its Applications. While there he was awarded an NSF postdoctoral fellowship which he used in Scotland at Heriot-Watt University and the University of Edinburgh, in Germany at the University of Bonn., and back at the Courant Institute. Being in Germany, he says, made him improve his French.

Before coming to Urbana he lived for five years in New

Nick Firoozye

York, first as a student when he was poor and lived in places which, he says, were not nice. Later on as an associate research scientist at the Courant Institute he could afford to move close enough to

Central Park to take his dog walking there. That was better, he says. In Urbana he lives practically on campus.

He is interested in applications of mathematics. In Scotland he organized a month long conference on microstructures in crystals and participated in a number of seminars and colloquia in the United State and in Europe where he says there are many great analysts. Fluent in more than a dozen computer languages, among his interests are image processing, harmonic analysis, and phase transitions.

Randy McCarthy is not new to Illinois. In 1988, even before he received his Ph.D from Cornell, he visited Urbana, and he spent the year 1989-90 here as an Alfred P. Sloan Dissertation Fellow where he worked with Professor **Daniel Grayson**. He had been to Urbana often before he moved here this summer with his wife, Rosemary, and small son and daughter.

His thesis was titled Cyclic Homology of an Exact Category. After receiving his Ph.D. in 1990, he went to Brown University where he spent three years as a Tamarkin Assistant Professor and also to Germany for one year on a Humboldt Research fellowship at the University of Bielefeldt. In addition to a number of

Randy McCarthy

conferences and colloquium at which he spoke in the United States he has also participated in seminars and meetings in Poland, France and Germany.

Recently he has been using topological methods to study algebra. He likes working with questions he can visualize, he says, spatial pictures, not just equations. He is working now in algebraic topology and algebraic K-theory and recently has been studying a generalization of rings, which he refers to as Brave New Rings.
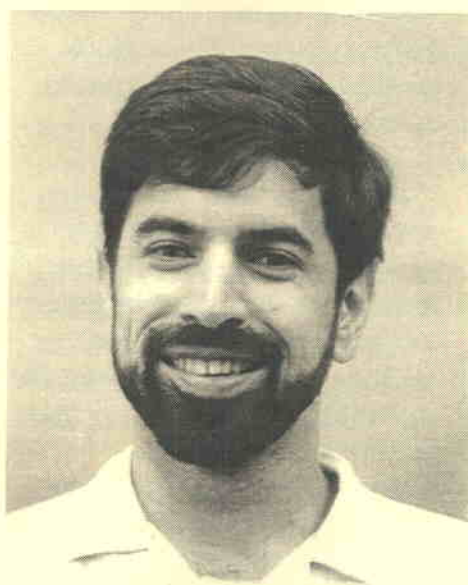
Points
Have no parts or joints.
How then can they combine
To form a line?

J. A. Lindon

Visiting Assistant Professors

This fall three new young visiting assistant professors in the department are members of the teaching faculty. **Renling Jin** will be here for the academic year. Now a

Renling Jin

permanent resident in the United States, he graduated from Shanghai Teacher's University, received his Ph.D. at the University of Wisconsin-Madison in 1992 in mathematical logic, and then went to the University of California-Berkeley as a Charles B. Morrey, Jr. Assistant Professor.

He has taught in China at two universities in Shanghai and in the United States at Madison and at Berkeley.

The title of his dissertation was Independence Relative to Nonstandard Analysis. He continues to be interested in nonstandard analysis, but also is interested in set theory, model theory, classical analysis, set theoretic topology and measure theory. He and his wife and nine year old son are living at Orchard Downs in Urbana

Norman Levenberg is here for this term and will be at Indiana University in the spring, but his permanent position is at the University of Auckland. He describes New Zealand as a very beautiful country; he stays in touch with what is happening through e-mail and the many mathematicians who visit.

He received his Ph.D. from
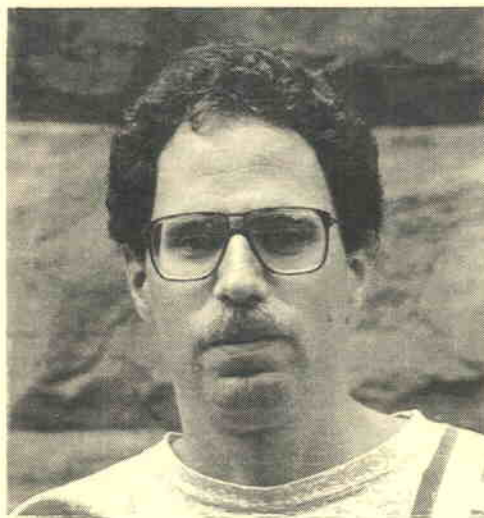
Norman Lewenberg

the University of Michigan in 1984. In addition to Auckland he has held visiting positions at the University of Michigan, the University of Kentucky, University of Toronto, and Indiana University, and at the Universite Paul Sabatier in Toulouse, France. From 1985 to 1991 he was an assistant professor at Wellesley College .

The title of his dissertation was Capacities of Several Complex Variables. Among the fields in which he has been doing research are approximation theory and potential theory; lately he has been doing applications of several complex variables to other fields.

Ken Ono, who is a number theorist interested in modular forms and in combinatorics, came here from the University of Georgia where he was a visiting assistant professor. He spent his undergraduate years in the midwest at the University of Chicago, then went to the University of California at Los Angeles where he received his M.A. and in 1993 his Ph.D. He wrote his thesis on number theory under Professor Basil Gordon.

His research interests include modular forms and combinatorial theory and right now he is focusing on elliptic curves and various aspects of representation theory. Like

Ken Ono

several of the other new faculty he is delighted with the library, a great library, he says, the best mathematics library he has ever seen.

He met his wife Erika in Chicago where they were both undergraduates. When they have time off, they go windsurfing and sailing on Clinton Lake.
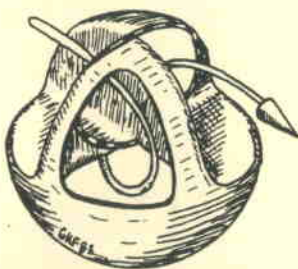
Pi goes on and on
And e is just as cursed.
I wonder. Which is larger
when their digits are reversed?
                    Martin Gardner

Faculty News

This July **Alex Tumanov** gave a talk on 'Complex Integral Transforms' in Trento, Italy and also visited the University of Padua. In August he participated and gave a talk in the Third Analysis Colloquium in Bern, Switzerland.

Derek Robinson gave a one hour invited talk at the conference in Infinite Groups in Ravello, Italy, May 23-25.

At the annual summer meeting of the American Mathematical Society and the Mathematical Association of America, in August, **Bruce Berndt** received the Ford Award from the MAA. Ford Awards are given annually for the best papers published in the American Mathematical Monthly during the previous year. At the annual SIAM meeting in San Diego in July, Professor Berndt gave an invited talk.

Carl Jockusch will go to New Zealand in January to do joint research with Rod Downey. He is being supported with a United States-New Zealand binational grant.

Julian Palmore served as chair of the Special AMS committee for the International Science and Engineering Fair last spring and as chair of the judges panel for the K. Menger awards. He also presented papers at several conferences

during the spring and summer and participated in a number of meetings and conferences.

This summer **Peter Loeb** gave a colloquium in Gothenberg, Sweden, and also at a number of places in Germany, including Frankfurt.

All generalizations are
dangerous, even this one.
                    Dumas fils

Undergrad TAs

Two seniors have been selected to receive the first Undergraduate Teaching Assistantship awards this year. Each recipient receives a stipend and, under the supervision of the professor in the course, teaches a recitation section of calculus. This is an important part of the program; the professors serve as mentors and help the students to develop their teaching ability.

Ten students who were going to be seniors this fall and who had records of high achievement in mathematics course work were interviewed last spring and asked to give a short lecture they had prepared on a calculus topic. The two selected for the award showed real teaching ability.The recipients of the awards this first year are Louis Beuschlein and Thomas Insel.

Harvard Calculus

Ward Henson answers student questions

In order to get students in elementary mathematics classes to think about the ideas, as well as to learn how to do calculations, Professors **Harold Diamond**, **Ward Henson** and **Tony Peressini** are trying a new approach in college algebra and some of the beginning calculus courses.

The calculus classes are taught differently from the usual way. The students learn the technique of differentiation, but what is emphasized is how to apply the ideas to real life. For one thing, the textbook is not recited back to the students. They are expected to read the material for the day's lesson before coming to class.

The instructor spends very little time lecturing. Instead, during class the students work together in small groups, trying to solve problems that illustrate the main ideas of that day's lessons. In many sections the faculty members are aided by undergraduate assistants who, along with the instructor, move through the classroom and help the students when asked.

The students are required to do one of their homework assignments each week as a group project with three other students. In the course they use hand graphing calculators extensively to work out the problems. Many ideas are illustrated in class on a projected view of a calculator generated graph.

During the term each student must take mastery examinations and score at least 90% to pass. All students who do not reach this level must retake the exam until they do. This assures that each student can do the basic calculations.

This course, called 'Harvard Calculus', is based on one

John Luker, Tony Peressini, Ward Henson and Harold Diamond are enthusiastic about new approach for beginning math classes

developed at Harvard University.

College Algebra

The instructional format for the college algebra course is similar. Here, too, the students work together in small groups interacting with each other to solve the problems. They use graphing calculators and can ask undergraduate assistants in the classroom for help any time they need it. The students must also pass the mastery exam with a score of 90.

This course explores basic functions from the algebraic, numerical and graphical points of view and uses them to set up problems the students might encounter in real life. Fewer repeated drills are stressed in the class than in traditional algebra courses; instead there are many more applications showing how algebra can help people in everyday life.

Nearly all of the students in these classes have taken a traditional algebra course in high school but have not retained the material well enough to go on to the more advanced mathematics courses required for their majors.

Many of them were bored in high school algebra classes and expect to have to sit through the same boring material again. But this course is quite different. It is based on *Functioning in the Real World* by Sheldon Gordon and Ben Fusaro. Unlike traditional texts, this book develops necessary algebraic skills by exploring situations that the students might encounter in their daily lives and presents the basic functions of algebra in a fresh and applications-oriented perspective, showing how to use algebra to solve problems in the real world.

Tony Peressini is assisted in appointed assistants for the Harvard Consortium calculus and college algebra classes. By being there and answering questions, the undergraduate assistant in each section helps the instructor to guide the work of the students taking the class while they work in small groups to solve problems on work sheets prepared by the instructor. The students taking the class work in small groups,
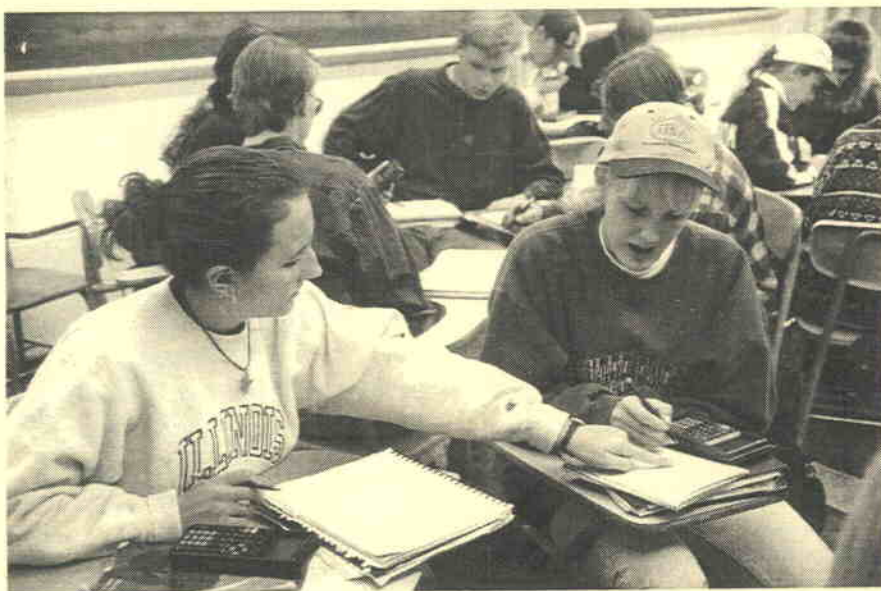
Students work together in small groups to solve calculus problems

the algebra classes by Teaching Asssociate **John Luker.** They say the results are good. The attendance is high, the students interested, and they are learning.

Undergraduate Assistants

Fourteen qualified undergraduates have been collaborating with each other to solve problems on worksheets prepared by the instructor.

Seek for truth in the groves of Academe.

Horace

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J. J. Uhl & Co.

Professor **Jerry Uhl** gave several invited presentations on Calculus &*Mathematica* recently in Puerto Rico, Florida, Maryland and South Africa. He says he was fortunate to be able to participate in the first annual meeting of the Association for Mathematics Education of South Africa, a group which unites all South Africans interested in mathematics education.

On his way to South Africa he had an unscheduled 24 hour delay on one of the Cape Verde Islands off the west coast of Africa and says he now knows what to say when folks ask him about doing math on a desert island.

He is very pleased that several alumni including **Elias Saab** and **Paulette Saab** (both 1979, Uhl) who are teaching at the University of Missouri, **Enid Steinbart** (1989, Bank) and **Lew Lefton** (1987, Kaufman), both teaching at the University of New Orleans, **Janice Malouf** (1994, Füredi) at the University of Nevada Las Vegas, **Judy Holdener** (1994, Grayson) at the Air Force Academy, **Rob Beezer** (1984, Weichsel), teaching at Puget Sound University, **Barry Turrett** (1976, Uhl) at Oakland University in Michigan and **Bill Emerson** (who received a master's degree in 1971) at

Lectures Delight Students

"How does one convey the beauty and power of mathematics to college students?" asks Professor **Philippe Tondeur**, who has taught mathematics at all levels, from beginners to the most advanced, and who recently has been given the LAS College's William Prokasy award for distinguished teaching. This highly competitive award is given each year to only four faculty members in the entire college. They are chosen because they have had a significant impact on their students inside and outside the classroom, inspiring them and stimulating their intellectual curiosity.

When Tondeur prepares a lecture, he says, he visualizes the audience, its level of sophistication and tries to present ideas at that level, but, frequently he changes his plans because of the class reaction. Because this is unplanned it brings a "desired spontaneity" into the classroom.

A former student writes that Tondeur's lectures were extremely clear and well

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Metropolitan State in Denver, have tried out or are planning to try out Calculus & *Mathematica* where they are teaching.

organized and that they often took unexpected turns that "challenged and delighted me." She was impressed with the way he showed the underlying simplicity in complicated areas.

Another student wrote that every week Professor Tondeur handed out notes which he'd clearly spent many hours developing outside the classroom. This student particularly liked the way Professor Tondeur would turn to the class at key junctures to ask what the next logical step should be. He writes "prompted by questions we could not yet answer, we would decide what needed to be done next." This gave the class, he says, a sense that they had "discovered the material ourselves instead of it being handed to us." Former students mentioned how concerned he was about their progress, how much time he took with them and how patient he was with all of them from the slowest to the most advanced.
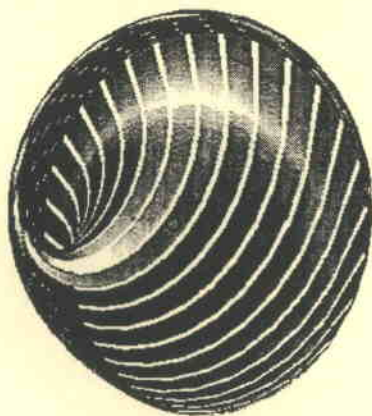
As one of his colleagues, another professor, writes, Tondeur communicates to his class the enthusiasm and curiosity about his subject which has made him a world class researcher.

In the CAVE

In a three-sided room in the Beckman Institute for Advanced Science and Technology on the north campus, Professor **George Francis**, wearing stereo glasses and holding a hand tracking wand, teaches a graduate course "Topics in Geometry". In this 10 by 10 foot room, called the CAVE after the cave in Plato's Republic, students, also wearing headsets, stand immersed in three dimensional virtual reality; here high resolution images, though projected onto the walls and floor, seem to float in space while four speakers add sound.

The CAVE combines computational science with the most advanced computer graphics. In the course Francis says the students write their own computer code and learn an appreciation for doing the geometry themselves. This latest computer graphics technology helps students to understand very complex surfaces. A simple example is a projective plane, which can be deformed, turned in different directions, made bigger or smaller and even entered into so the viewer can emerge out of the other side.

"We explore geometrical
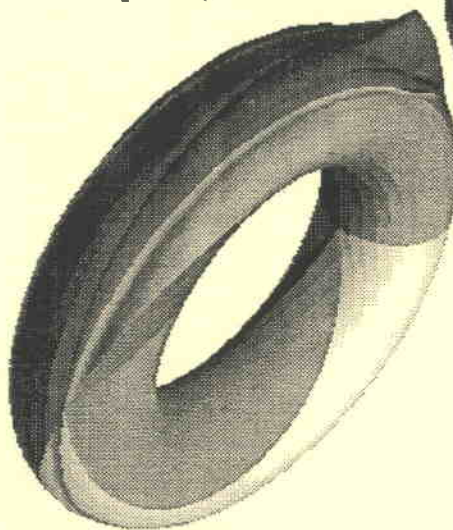
Computer Graphic by Paul McCreary

phenomena by walking into the data," he says. "You can step into a molecule and look at it." For teaching this course Professor Francis was recently awarded an Amoco Foundation Award for Innovation in Instruction.

Anything you can make a picture of can be studied in the CAVE, he says. In addition to helping to understand pure geometry, it is also being used for applications. Researchers are now going into the CAVE to study things impossible to see otherwise, such as the workings of the brain, or the saltwater content of Chesapeake Bay in different seasons, and companies are renting time on the CAVE so their engineers can use it to improve the design of such machines as backhoe loaders.

In late October Francis was the host at a conference at which a number of visiting mathematicians went into the CAVE.

Computer Graphic by George Francis

Chess problems are the hymn tunes of mathematics.

G. H. Hardy

Undergraduates

For several years undergraduate students have been laboratory assistants in the Calculus &*Mathematica* program, directed by Professors **Horacio Porta** and **Jerry Uhl**. This year undergraduates are teaching in more ways than ever before.

Although the Calculus & *Mathematica* campus program is led by faculty and graduate teaching assistants, well qualified undergraduate laboratory instructors do much of the day-to-day work. In the laboratory they answer most of the students questions about mathematics and computers. Professor Uhl says that without these undergraduate instructors the Calculus & *Mathematica* course could not exist. Thea Colwell, an undergraduate engineering major, is in charge and serves as head laboratory instructor.

The Calculus &Mathematica Distance Education Program, which serves 80 students in rural or inner city high schools, also depends heavily on undergraduate mentors who work via the internet with groups of five high school students who are taking calculus I or II courses that carry university credit. Led by Patricia Mills, a sophomore Math-Computer Science major, the mentors share *Mathematica* files with their students in real time, they grade homework and prepare their students for the examinations. Uhl says "They are teachers in the best sense of the word."