

Tangents

News from the Department of Mathematical Sciences
University of Massachusetts Lowell

Spring 2006

Fermat's Last Tango

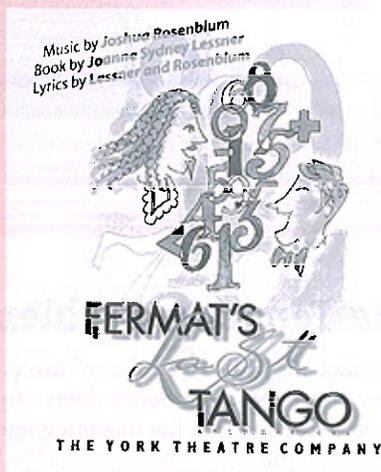
A Musical Fantasy by The York Theatre Co., 2001
Music: Joshua Rosenblum
Lyrics: Joanne Sydney Lessner and Joshua Rosenblum
100 minutes

REVIEWED BY GUNTRAM
MUELLER

Gödel's Incompleteness Theorem states (loosely) that there are some theorems that can't be proved in the usual axiom systems for arithmetic, even though they are true. Over the course of the last few centuries, there arose several cases of statements that seemed to be true, in the sense that no counterexamples could

be found, but that could not, or more precisely, had not, been proved. Among these were the 4-color problem (now proven), Goldbach's conjecture (open); and Riemann's hypothesis (open), but the most famous was the

Continued on page 3



New UML Mathematics Faculty, Part 2

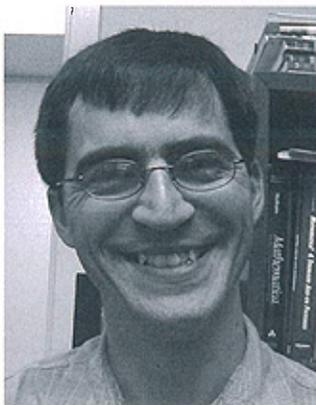
In our previous issue we profiled two of our new faculty members for 2005-6, Tibor Beke and Alina Stancu. In this issue we introduce you to Ravi Montenegro and Victor Shubov.

Ravi Montenegro Prof. Montenegro was born in Los Angeles but grew up in the small northern California town of Mendocino. He returned to LA for high school and college, where he received a Bachelor's degree in Mathematics with Honors from the California Institute of Technology. After completing a Master's degree from Yale University he spent a year studying Japanese in Japan, then returned to Yale and in 2002 received his Ph.D. in Mathematics under Prof. Ravi Kannan. Before joining UMass Lowell, Prof. Montenegro spent three

years as a VIGRE postdoctoral researcher at the Georgia Institute of Technology.

Prof. Montenegro's main research interest is on sharpening the mathematical tools used to study the speed with which a random walk approaches its asymptotic distribution. Of particular interest is the analysis of Markov chains for approximate counting of NP-hard combinatorial counting problems. He has also worked on isoperimetric inequalities for log-concave distributions, and geometric methods for bounding eigenvalues of Markov chains.

When not busy with work Prof. Montenegro enjoys reading (primarily Science Fiction and Fantasy), and occasionally goes orienteering, dabbles in programming, and enjoys trips to the countryside for hiking, camping or biking.



Ravi Montenegro

Victor Shubov Prof. Shubov originates from Russia and received his Ph.D. from the Steklov Mathematical Institute in St Petersburg in 1982 under the direction of Olga Ladyzhenskaya. After taking positions at the Institute and at St Petersburg University, he came to the US as an assistant professor at Texas Tech University in

2006 Alumni Reception/Awards Ceremony

The 2006 Alumni Reception/Awards Ceremony event will be on Friday, April 21. Once again, we will have it at the Brewery Exchange starting at 5:30. For more details visit the UML Math Alumni web page at www.uml.edu/Dept/Math/alumni.htm

Prior to the reception, there will be a showing of the musical fantasy *Fermat's Last Tango* in Olney Hall at 2:30 PM. Professor Guntram Mueller has contributed a review of the play in this issue of *Tangents*. All students, alumni, and friends are invited to attend.

Continued on page 3

Kiwi's Korner

Spring 2006—From the Chair ...The 2006 spring term has arrived and I am writing this at the end of the second week of the semester. It has been a hectic start, more so than usual because of an unusually large number of incorrect room assignments. We are slowly getting used to the new student scheduling software and it turns out that familiarity does indeed breed contempt (in the literal sense of that word). Even the simplest tasks often require a convoluted and perplexing sequence of steps.



James Graham-Eagle

Despite the fact that the four new full time faculty members have completed a full semester they have only just been given offices! The new offices were a long time coming and I am very thankful that our new colleagues suffered their temporary homelessness with good cheer. Their hiring has increased our numbers to twenty six and we are in the process of hiring at least

one additional member this year. The last edition of *Tangents* profiled Tibor Beke and Alina Stancu and elsewhere in this edition there is an article on Ravi Montenegro and Victor Shubov.

Partially as a result of an external review of the department done several years ago we have recently undergone an extensive overhaul of the mathematics major. This has been described in previous editions of this newsletter. Last semester this overhaul was extended to include a new Bachelor of Arts in Mathematics. A proposal for the new program was recently passed by the Faculty Senate and we hope to complete the process later this semester and have the degree in place by the fall. With this new program we hope to attract students in the Division of Arts of the College of Arts and Science to add mathematics as a second major and this is realistic (for most students) only when both majors reside in the same college.

If you received this newsletter before April 21, note that the Alumni Awards dinner is scheduled to start at 5:30 on that date at the Brewhouse Exchange in Lowell. For more information about this event or to sign up please visit the department's alumni web page at www.uml.edu/dept/math/alumni.htm. Also, if you have news which you think others would enjoy hearing please let us know—we would be glad to include it in future issues of this newsletter.

Kiwi
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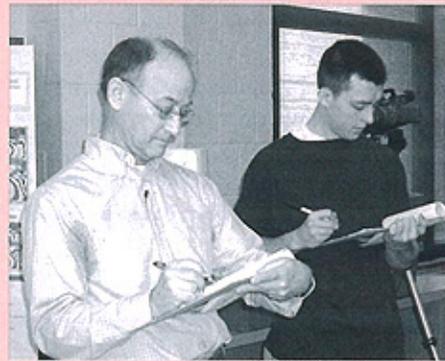
Mathematical Sciences Department participates in NSF Partnership

in the FoM districts are progressing through the program.

The centerpiece of the program for students is a Math Expo that is held annually at the Museum of Science in Boston. In 2005, there were 996 projects, of which 66 projects done by 116 students were on display in Boston, to 333 students, family and friends. The program has made a commitment to

involve all students in a mathematics research experience at least once in grades 6-12. This year, three UML students are helping teachers in Lawrence guide some of their students in developing their projects. Individual schools run their own Math Expos, with the help of judges from the universities and some of the projects from each school are selected for the event in

Boston. The 2006 Math Expo, which is open to the public, is scheduled for Saturday, June 10. We extend an invitation to UML math alumni to join us in the celebration. For more details on Focus on Mathematics, visit the web site at <http://www.focusonmath.org>.



Prof Marvin Stick and UML math major Andrew Larocque judge a Math Expo project at the Arlington School, Lawrence.

The *Tangents* Problem

An insulated window consists of two parallel panes of glass with a small spacing between them. Suppose that each pane reflects a fraction p of the incoming light and transmits the remaining light. (a) Considering all reflections of light between the panes, what fraction of the incoming light is ultimately transmitted by the window? (b) What fraction of the light is transmitted if a third identical pane is added behind the first two?

Four correct solutions from among all that are submitted by September 1, 2006 will earn a "Math Challenge" T-shirt. You can submit your solution online to mathematics@uml.edu.

Solution to the Winter 2005 *Tangents* problem.

The problem was

A young man and woman plan to meet between 5:00 and 6:00 PM, each agreeing not to wait more than 10 minutes for the other person. What is the probability that they will meet if they arrive independently at random times between 5:00 and 6:00?

This problem remain open—nobody submitted a correct solution as of the time of this printing.

Fermat's Last Tango

enigmatic Fermat's Last Theorem (ca. 1630). So tantalizingly simple to state, it has been proved over time for $n = 3$, $n = 4$, then *all* $n < 4,000,000$, but not for all n . Could it be one of those undecidable propositions Gödel talked about?

Adding to the allure and mystery was Fermat's beguiling statement that he had found a most "marvelous proof of this theorem", but that, alas, "the margin of this book is too small to contain it." So what is this enigmatic theorem? Here it is.

"The equation $x^n + y^n = z^n$ has no whole number solutions in x , y , and z for any integer $n > 2$."

That's it? This seems pretty pedestrian stuff, especially since everyone recalls Pythagoras' Theorem, which deals with this equation when $n = 2$, and $x = 3$, $y = 4$, $z = 5$ make perfectly good solutions. But of course Fermat said $n > 2$

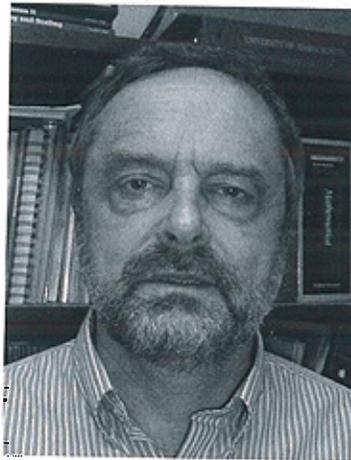
The great minds over the centuries, Euler, Kummer, etc., knocked heads with this conjecture, and managed to raise the n for which it is proved, until in 1993 Andrew Wiles announced that he had finally proved it for all n , after 7 years of hard work in his attic. In *Fermat's Last Tango*, the protagonist is the fictional Daniel Keane, but there is never any question that Joanne Sydney Lessner and Joshua Rosenblum had Wiles in mind. The ecstasy that accompanied the announced proof was as unbounded as the n for which it was proved: instantaneous entry into The Pantheon of

Mathematicians of All Time. (And he could finally reacquaint himself with his wife and children.) But, drat, there was a little fogginess, a little unclarity, a little glitch, a little gap: a big fat hole.

The ecstasy and the agony: only an opera of Italian proportions could suffice to render this story in anything close to justice. Well, instead of Puccini, we get something more like Claude Chabrol in the *Umbrellas of Cherbourg*, with the gas station attendant asking in earnest song: *super ou régulier?* A little hard to take, until you get the hang of it. But the pace and humor pick up dramatically with the entrance, during Wiles' reveries, of Fermat himself, as wily and adept at mental torture as he is at numbers. The interplay—all right, the battle—between the febrile Wiles and the wily Fermat follows Wiles' attempts to fill the big fat hole, and is carried off brilliantly. Fermat forces Wiles to play a nasty little game show called Prove My Theorem, consisting of an increasing sequence of intellectual and emotional traps. It's opera, it's musical, with dance numbers and elliptical curves, modular forms, Euler systems, the Taniyama-Shimura conjecture, and all that good stuff. It has a strong supporting cast of Wiles' long-suffering wife, and Pythagoras, Euclid, Newton, and Gauss from the Aftermath. And I won't tell you who wins.

My final rating: ★★★
(out of a possible 4)

New UML Mathematics Faculty, Part 2



Victor Shubov

Lubbock Texas where he was promoted in 2001 to full professor after publishing some fifty papers. He decided in 2004 that

Texas was too hot and he and his wife Marianna moved east. After a year visiting Colby College, Victor accepted a position here at Lowell.

Victor's research has touched on many different areas but the emphasis has been on the theory of evolution equations. In 1997 he won a substantial grant to work on tornado dynamics and since

then his interests have moved towards the study of turbulent flows and mathematical control theory.

The Mathematical Sciences Web Page

Have you visited Mathematical Sciences web page lately? The address is <http://www.uml.edu/dept/math>. You don't need to remember the address—just Google "uml math" and the first link should be ours.

Have you lost your past issues of *Tangents*? Go to the alumni section of the UML Math web page links to back issues.

James Graham-Eagle, Chair

Writers: Ken Levasseur,
Raj Prasad, Ann Marie Hurley,
Dan Klain, Guntram Mueller,
Marv Stick and Alex Olsen

Tangents is produced biannually by the Publications Office for the Department of Mathematical Sciences. Your comments are welcome.

Mathematical Sciences Department participates in NSF Partnership

For the past two years, the UML Department of Mathematical Sciences has been a partner in Focus on Mathematics (FoM), a five-year partnership funded by the National Science Foundation. The goal of FoM is to improve student achievement by providing mathematics teachers with the content knowledge and skills valuable in their profession. To this end, the project is developing a mathematics community running across several school districts, universities and educational organizations.

Professors Al Doerr, James (Kiwi) Graham-Eagle, Ken Levasseur and Marvin Stick have joined mathematicians from Boston University, Worcester Polytechnic Institute, and Education Development Center in this effort. Program

evaluation is conducted by a team from Lesley University. As part of the program, each mathematician works with teachers in a school in one of the FoM districts: Arlington, Chelsea, Lawrence, Waltham and Watertown. Under the guidance of mathematicians, teachers work in study

groups to explore various mathematical topics in order to deepen their mathematical knowledge. Mathematicians and teachers decide on the topic based on interests and needs of the teachers in each school. For example, a study group of middle school teachers in Lawrence

learned some calculus in order to better understand how their own curriculum builds toward calculus. A group in Watertown studied the geometry of voting and recently presented their work at a national mathematics

conference. In another group, teachers explored ways to integrate the Geometer's Sketchpad program into their courses.

Professor Ken Levasseur has developed an online mathematical problem-solving course as part of FoM. Besides discussing the educational issue surrounding the development of their students' problems solving skills, the teachers have an opportunity to refine their own skills through a variety of activities. Teachers from all of the FoM districts, together with some UML students, have taken the course in the past year. A mini-course on Fibonacci numbers has been developed and offered twice in order to introduce the teachers to the online education process.

Various activities such as seminars, colloquia, and summer institutes round out the activities that are open to all mathematics teachers in the districts. A graduate program leading to a Masters degree in professional development for mathematics has been established at BU and a strong contingent of teachers

Continued on page 2

The goal of FoM is to improve student achievement by providing mathematics teachers with the content knowledge and skills valuable in their profession.

Thanks For the Contributions!

Our thanks to all who have contributed to the Department of Mathematical Sciences over the past few years. Your generosity has allowed us to make purchases, award scholarships, and engage in activities that would otherwise have been impossible. Many of you have responded generously to UML phonathon and other fundraising contacts. These requests can benefit the Department of Mathematical Sciences directly if you specify that you wish to have your gift directed to Mathematics. Otherwise it will provide valuable assistance to the University at the College level.

What Are You Up To?

Want to keep your classmates up to date on what you're doing and where you are? Take a few moments to tell us where you are, and whatever else you might like to share. We'll add it to the UML Math Alumni page, <http://www.uml.edu/dept/math/alumni.htm>.

We can be contacted by mail at Department of Mathematical Sciences, North Campus, UMass Lowell, Lowell MA 01854.

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