The University of Arizona
MATHEMATICS
Winter 2003

A VIEW FROM THE CHAIR

Nicholas Ercolani
Department Head and Professor of Mathematics

In this Issue

We are pleased, in this issue, to report on awards honoring the careers and achievements of two of our most distinguished colleagues. **Professor Vladimir Zakharov** received the prestigious Dirac medal for his accomplishments in the field of Mathematical Physics, particularly in regard to the theoretical understanding of turbulence.

Professor David Lovelock has received numerous national, as well as local, awards for his many contributions to the development and improvement of mathematics instruction at all levels. On the occasion of his retirement this January, the Department is establishing an award that, each year, will recognize an individual whose accomplishments are making a significant contribution to the learning of Mathematics.

Dr. Lovelock was a leader in introducing educational software into the UA Mathematics curriculum. He helped design our first computer classrooms, and in a related article about those classrooms and their recent renovation, Jim Cushing describes the evolution of the Department's technological innovations in instruction. Thanks to your contributions and the efforts of faculty, we have been able to improve our computer classrooms to state-of-the-art facilities.

This issue of our newsletter also contains a number of stories about both former and current students. We have a report on a new pre-semester workshop for first year graduate students, and I think you will be interested to read, in Bill Vélez's article, about the impressive range of research activities being pursued by our Mathematics majors.

This semester the Department unveiled its new website. So in closing, I'd like to encourage you to connect and get to know us better at **http://math.arizona.edu/**

Contact us at:
http://www.math.arizona.edu/~mcenter/alum
or http://www.dept.@math.arizona.edu

Integration Workshop

by Doug Ulmer
Associate Head, Graduate Program

This August we introduced a new element into the graduate program: a workshop to quickly integrate new graduate students into the Department.

The goals of the Integration Workshop were:

- to prepare students for core classes by getting them to think about undergrad material from a "graduate" point of view;
- to establish an esprit de corps among the students; and,
- to acquaint students with a few faculty and senior grad students.

The workshop took place during the second week of August, before class meetings and other obligations started. The two main elements of the workshop were a series of lectures coupled with problem sessions and significant projects for small groups of new students.

The lectures were tied to the topics of the first-year core courses and the qualifying exams: algebra and linear algebra, analysis and calculus, and topology and complex variables. The projects cut across subject areas and integrated the various lecture series.

Dan Bartlett, Gabe Harris, Brad Weir, and Fred Leitner.

During the first part of the day, students alternated between listening to a lecture and working on the associated set of problems.

The projects cut across subject areas and integrated the various lecture series.

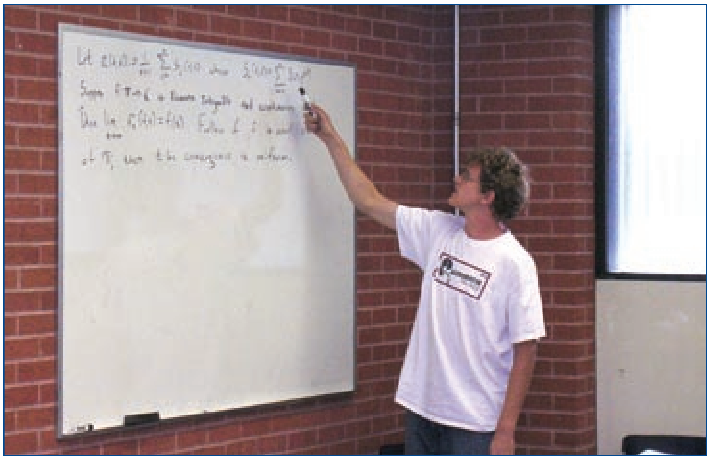
During the evenings, they worked on larger scale projects which typically combined different subject areas. For example, one of the projects was to learn a proof of the Weyl equidistribution theorem for irrational rotations, which combines Fourier analysis and number theory. Another was on two constructions of the p-adic numbers, which combines topology and algebra. At the end of the workshop, each team of students presented their project findings in a one-hour lecture.

One of the workshop lectures.

The schedule was quite demanding—sessions ran from 9:00 am to 10:00 pm every day for five days. On the last day, the evening session was replaced by a much-needed party. Three faculty members and six senior graduate students were on hand at all times to assist with problems, fill in details on lectures, and generally lend moral support. To break things up a bit, there were also a couple of sessions on practical matters such as typical trajectories through the program and internship opportunities.

Feedback from students was quite positive and we expect that the Integration Workshop, possibly tweaked a bit, will become a permanent part of our graduate program.

For many more details, including outlines of lecture series, project descriptions, the schedule, participants, and photos, see the graduate program web site: **http://math.arizona.edu/gradprogram/workshops/integration/**



Ben Dyhr.

Tom Hoffman, Josh Chessler, McKenzie Lamb, and Derek Habermas.

Geometry and Physics at IPAM

by Virgil Pierce
Graduate Student

The Institute for Pure and Applied Mathematics (IPAM) at UCLA, ran a six-month series of workshops on Symplectic Geometry and Physics. With the help of both VIGRE and support directly from IPAM, Arlo Caine and I were able to attend two of the workshops. I attended the workshop, *Geometry and Physics of G2 Manifolds* in May, then Arlo Caine and I returned in June for the *Symplectic Geometry and String Theory* workshop.

The institute is located at the top of one of the hills on the UCLA campus. The building, designed by Frank Gehry and originally used as a placement center for UCLA undergraduates, has been remodeled to suit IPAM's needs. The highlight of the building is the lobby. This spacious room includes chairs, tables, whiteboards, and computer terminals, and was used for receptions almost daily at the workshops. The real benefit of such a room was the interaction that took place within it; people asked questions of each other for the benefit of all who cared to listen.

The institute's other main physical feature is a collection of offices. Professors and graduate students who attend the entire series of workshops have these offices available to them. When workshops are not in session, the professors teach short courses to the graduate students to prepare them for the next workshop in the schedule. A small library, the main lecture room, and a dining room (which doubles as a large lecture room when needed) complete the building.

The workshops are well run. There is an effort to run the more basic presentations earlier in the week. The organizers encourage speakers to provide the audience with printed material that appears on the web after the workshop.

The *Geometry and Physics of G2 Manifolds* workshop was, without a doubt, a working conference. The main focus of the geometry part of the workshop was: What is the correct form of the existence conjecture for G2 Manifolds? Dr. Leung ran a series of four lectures on the first two days to bring students and others up to speed with the known geometry of G2 Manifolds. He highlighted their natural appearance as a generalization of Calabi-Yau Manifolds. The culmination of the geometry part of the workshop was a talk by Dr. Yau.

The physics talks also began with the basics. The main focus of these talks was how G2 manifolds appear naturally in M-theory. M-theory is a "larger" version of string theory, and G2 manifolds are appearing there as the "target spaces" that Calabi-Yau manifolds are in string theory.

The *Symplectic Geometry and String Theory* workshop focused more on physics. The talks dealt with string theory and its generalizations. We were introduced to concepts such as duality, mirror symmetry, and branes. Arlo Caine and I spent much of the time trying to work out these concepts. The background of people attending this workshop was more varied than the specialists who attended the previous one, so we learned how string theory was appearing in a variety of research areas.

In the evenings we enjoyed the restaurants of Los Angeles, explored the botanical gardens at UCLA, and took a walk along the beach. My personal suggestions for people visiting Los Angeles are the restaurants on the Third Street Promenade and the rye beer at "B.J.'s Pizza and Grill" (I have never found a rye beer anywhere else).

Upcoming programs at IPAM include: *Proteomics: Sequence, Structure, Function; Multiscale Geometry and Analysis in High Dimensions; Grand Challenge Problems in Computational Astrophysics; Estimation* and *Control Problems in Adaptive Optics; Automorphic Forms, Group Theory and Graph Expansion; and Geometric Flows.*

Additionally, there are a number of interesting summer programs: *Research in Industrial Projects for Students* and *Mathematics in Brain Imaging*. I encourage other students to take advantage of the wonderful environment available to us through the VIGRE program and IPAM.

For more information, see **http://www.ipam.ucla.edu/**

The Complex Panorama of Undergraduate Mathematics

by William Yslas Vélez

Industrial Liaison for the Mathematics Department

Associate Head for Undergraduate Programs

The Mathematics Major requires around 35 units of course work in mathematics. After taking the three-semester sequence in calculus, and introductory courses in differential equations, linear algebra and introduction to analysis, the student is then ready choose an option. High school teaching, economics and finance, computer science, applied mathematics, probability and statistics, or the comprehensive option (see http://mcenter.math.arizona.edu for details) are the choices presently offered to our students. In each of these options, students take an additional five or six mathematics courses.

When you think about it, this is not a great deal of coursework, yet our students have exhibited an amazing ability to apply the ideas they learn in our courses, along with their innate intelligence and curiosity, to a variety of projects. It is not enough simply to absorb mathematical ideas. In our department, we take pride in, and have been recognized for, the integration of research and education. The Department maintains a complex portfolio of activities in research, teaching, outreach and service (both locally and nationally). In the short time our undergraduate students are with us, they participate in many activities that make up being a mathematician. As this article will show, there is so much more to being an undergraduate mathematics major than simply enrolling in mathematics courses.

David Brown graduated from Catalina Foothills High School (Tucson, AZ) in May 2000 and will graduate with a B.S. degree in mathematics in December 2003. He spent the Spring 2002 semester at the Budapest Semesters in Mathematics Program at the College International of Budapest, Hungary. This intensive study program in mathematics allowed David to advance in his mathematical knowledge and enroll in graduate courses upon his return to our department. The following year he accepted an opportunity to apply new ideas toward education. He accepted a CATTS (Collaboration to Advance Technology and Science) Fellowship, funded by the National Science Foundation. As a CATTS fellow, David worked at Ha:San, a Tohono-O'odham preparatory and leadership school, to integrate mathematics and inquiry into their classes.

Even with all of this activity, David still managed to work on research projects with Professors Daniel J. Madden and William McCallum, both of this department, and with Professor Ubirajara van Kolck of the Physics Department. In the summer of 2003, he participated in the Summer Research Experiences program at the University of Notre Dame.

David explains his work over the summer:

Last summer, I was a participant of The University of Notre Dame's Research Experience for Undergraduates in South Bend, Indiana. I worked with a Notre Dame mathematics student, Andrew Rupinski, under the supervision of Dr. Daniel Isaksen on a project titled "Counting a Certain Type of Graph With a Given Euler Characteristic". This is a problem in enumerative combinatorics; there is a specific class of graphs that arises when studying the outer automorphisms of the free group on n generators, and our goal was to enumerate this class of graphs. We have significant results toward the solution of this problem and are submitting, for publication, a paper presenting these results. There are a few questions that we weren't able to answer satisfactorily that I plan to address in the future. The experience had a positive impact on my life, showing me that I have the capacity to do mathematical research. In addition to research, the REU participants gave weekly talks on their research and we each gave a talk at a mathematics conference, both of which I valued highly. Most of all, the experience was a lot of fun—I was paid to spend a summer doing mathematics in an environment with other mathematicians who love mathematics as much as I do.

David plans to begin his graduate studies in mathematics in Fall 2004. However, after graduating in December, he will return to Budapest for another intensive semester of mathematics.

Ajit Divakaruni graduated from Saguaro High School (Scottsdale, AZ) in May 2001. His plan of study is to graduate in May 2006 with triple majors in Biochemistry, Molecular & Cellular Biology, and Mathematics. He is well on his way to reaching these goals. He has been a research assistant to Professor Nancy Horton (Biochemistry) and to Professor Secomb (Physiology). He is currently a CATTS fellow, working at Ha:San. He has volunteered to be a math tutor twice a week at Rincon High School and spent a couple of months in Romania volunteering at a children's hospital and at a center for minors. The College of Science initiated an Ambassador program in Fall 2003, and these College of Science ambassadors will serve as role models for current and future University of Arizona students. Not surprisingly, Ajit submitted his application for this volunteer position and was selected by the mathematics department to participate in this program.

Ajit described his research experiences in the following words:

In my 2 ½ years as an undergraduate, one of my most worthwhile endeavors has been undergoing an independent research project. For a little over a year, I've been working with Dr. Timothy Secomb, director of the Arizona Research Laboratories, Microcirculation Division, trying to develop a mathematical model of the Crabtree effect—the inhibition of aerobic respiration by glycolysis in certain tumor cell lines. This experience has been extremely beneficial to me, in that it has opened my eyes to what science and research is from the perspective of a scientist with a task, as opposed to a student with a textbook.

I was talking to a professor of mine just the other day about how I felt that studying was a saturable process: if you put in 5 hours, you might get 80% of the material, but another 5 hours will net you only about 90% or so. I've found this analogy doesn't hold when it comes to research, which is why I'm beginning to enjoy it so much. What always strikes me is simply the sheer volume of information and unanswered questions out there and how much work can (and must) actually be put into a problem in order to come to some reasonable conclusion. You're nowhere near the asymptote, to borrow my earlier analogy. I've found it is very easy for me to read about a discovery in a science book or a formula in a math *text, caring little for the actual thought process or experiment conducted to carry it out.*

But working on my own research problem has solidified my love of science and mathematics. I've learned that good research only comes with good effort from good scientists and mathematicians. Oftentimes I've tried to accomplish certain tasks associated with the project at the last minute or pushed them to the proverbial back burner, and the quality and rate of progress suffered. I've also put in a good amount of effort sometimes and simply hit a brick wall, having to ask Dr. Secomb for another route to take. Yet oddly enough, this has only made me want to devote more time and energy to the project. At the risk of sounding cliché, I've learned that science and math is about more than learning facts from a book or a particular process. Real science comes from effort, thought, and spending hours surveying the dark and dusty catacombs of the Science and Engineering Library hoping that one of your hunches doesn't lead to a dead end. I think it is basically like fumbling your way around a dark room until you get a general idea of what the room feels like, and, if you're lucky, possibly finding the light switch.

I must say that our project is anything but complete and nowhere near publishable in the foreseeable future, but I think I may have learned more about the scientific process and science itself from dead ends and stalled progress than I have from any final exam.

Ivan Barrientos graduated from Salpointe Catholic High School (Tucson, AZ) in May 2002. His plan is to graduate in May 2006 with degrees in Optical Sciences and in Mathematics. Even though this is only Ivan's third semester at the University, he has already participated in several activities. He has over 100 hours of volunteer tutoring in algebra and calculus. In Fall 2003, he helped Professor Jim Cushing (Mathematics) to check over problems in the solutions manual for a new book on differential equations.

In the summer of 2003, he accepted a summer internship and he describes his experience:

This summer I embraced the great opportunity of attending Rice University's Summer Institute in Statistics (RUSIS), headed by Dr. Javier Rojo. At first I was skeptical about studying and doing research in statistics for a good chunk of my summer but soon realized that this was a golden opportunity to work at one of the best universities in the country.

My arrival on campus was an aesthetic treat due to its lush surroundings. The stage was set for me to go out and do work in an inviting environment. The first three weeks in the program were dedicated to getting to know my fellow students and grasping as much advanced probability and statistics as possible. One of the first things I noticed about the program was its rich diversity in student cultures and backgrounds. Yet, the common denominators were excitement and benevolence. As for the technical aspect, Dr. Rojo was the head professor and provided an admirably clean and rigorous presentation of the material. In essence, he shaped my appreciation and understanding of pure and applied statistics. For example, I was impressed by his lectures on Moment Generating Functions (mgf's), especially his description of them as the "fingerprints" of probability distributions. This analogy aided my visualization of what mgf's portray in the spectrum of statistical analysis.

After the first three weeks of the program it was time to start my research project. I joined the only group in the program to define its own topic. My group's area of research was astrophysics and statistics. The four of us set out to estimate the mass of the Milky Way and Andromeda Halos. One of the biggest lessons I learned was that when starting a research project it is essential to set out explicit goals. Dr. Rojo was quick to point out that our group needed better definition, especially in our treatment of statistics. Although we struggled in targeting our goal, I believe we found a good prize, much in part due to the guidance of Dr. Rojo. As the weeks progressed, I also came to realize that our solid group communication allowed the four of us to enjoy our work and progress at a decent rate. I was able to experience some real-world situations in doing research.

To conclude, the city of Houston, the students (my friends), the lectures, Dr. Rojo, and the research provided for a fun and prolific summer. Luckily, everyone I came into contact with at Rice was nice and helpful. Also, I was able to learn the equivalent amount of statistics in this program as I would have in a typical upper level college course. Moreover, I felt extremely fortunate in having Dr. Rojo not only as my prime professor and mentor but also friend. One of the best memories I took with me was organizing a dinner for him, with my friends, at a quality seafood restaurant at the close of the program. Finally, I had always considered doing research in graduate school but was not completely sure. After doing this work I am confident in pursuing research in the coming years.

These comments from the students provide a vibrant picture of the undergraduate mathematics experience. Some students are fascinated by mathematics itself and will pursue graduate study in order to better understand mathematics. Others are interested in applying mathematics or statistics to understand the world around them. Actually, this sounds just like our own Mathematics Department.

This experience is not an impersonal one. We see over and over again the involvement of dedicated and concerned faculty, who give tremendously of their time. We see students actively engaged in the knowledge/creation process. And we see students who are involved with the community, anxious to share their own excitement with mathematics and its applications. Here again we see our Mathematics Department mirrored in the activities of these students.

One important lesson that jumps out in reading these comments is the impact that research and internship opportunities have on students. These experiences will shape their lives and change the direction they will take. It takes many professionals to help in this work, and we hope that you will join us in educating this next generation of mathematical scientists.

As industrial liaison for the Department I am constantly on the lookout for more opportunities for our students. If your firm has openings for our mathematically trained undergraduate students, please contact me at **velez@math.arizona.edu**, so that I can send you some resumes of our undergraduates.

As Associate Head for Undergraduate Programs I also see the need to find financial support for our students. This is now even more important as the recent tuition increases have been very substantial. The Department has several scholarship programs for our undergraduate students and we would very much like your support.

If you would like further information, please contact me, or visit our website at **http://math.arizona.edu.undergrads**.

Computer Classrooms for the 21st Century

by Jim Cushing
Associate Head for Computing

GCM Marchant Electronic Calculator

By the time the Mathematics building was completed in the late 1960s, delays and inflation had cost a classroom wing and two floors (the sixth and seventh floors were added several years later). An "electronic" classroom, however, survived the losses. At each student seat in classroom 101 was a GCM Marchant Electronic Calculator (model cogito 240 SR). An example can be seen in the glass display case near the main entrance of the Mathematics building. These desktop calculators performed basic arithmetic calculations (and could even take square roots—by an iteration procedure!). Room 101 and these calculators were used for instructional purposes for over a decade, primarily for statistics classes.

During the 1980's the Mathematics Department became actively involved in the introduction of technology into the undergraduate mathematics curriculum. Highlights of the Department's activities at that time included an Algebra Tutoring Laboratory, containing 35 PC's with locally developed software (that helped algebra students do "drill and kill" exercises) and a popular "Are You Ready for Calculus" program, created by David Lovelock, (see related article on page 10) distributed free to all incoming calculus students and made available to universities, colleges, and high schools at no cost.

The desktop calculators in room 101, which by this time were hopelessly out of date, were replaced by 15 "bare bones" Zenith PC's equipped with a limited amount of software (e.g., Pascal, Basic, Eureka) for use as an undergraduate resource computer lab. These efforts in utilizing computer technology in the mathematics curriculum were conceived and implemented by the Department with no outside support, except some financial assistance from the University administration.

A significant step forward in the Department's initiative to develop curriculum and classroom technology was stimulated in 1987 by the National Science Foundation's "Instrumentation and Laboratory Improvement" (ILI) program. The goal of that program was "to improve the quality of the undergraduate curriculum by supporting projects to develop new or improved instrument-based undergraduate laboratory and/or field courses in science, mathematics, or engineering." A group of faculty and staff members submitted a proposal to the NSF ILI program to renovate room 101 and create a special purpose computer-aided classroom for use by the Mathematics Department. The co-principal investigators on the grant were David Lovelock and David Lomen. Also involved with the proposal were the Department's coordinator of academic/research computing facilities (Robert Condon) and a large group of Departmental faculty (Jim Cushing, Hermann Flaschka, David Gay, Larry Grove, Daniel Madden, William McCallum, Alan Newell, Frederick Stevenson, Richard Thompson, William Vélez). In 1989 NSF awarded $75,000 to the Department under the ILI initiative and the UA College of Science provided matching funds. To make the computer-aided classroom a reality, David Lovelock, Robert Condon, and Faye Villalobos, the Department's Operations Manager, dealt, virtually without assistance, with the arduous details involved in the specification and purchase of equipment; the installation and testing of computers; and the physical remodeling of room 101 (wiring, lighting, new desks, whiteboards, projection facilities, etc.). This effort required a creative mix of dealing with the often odd and frustrating world of contractors and sometimes, simply doing the work themselves.

In 1990, classes were held in the UA computer-aided classroom, one of the first of its kind in the world.

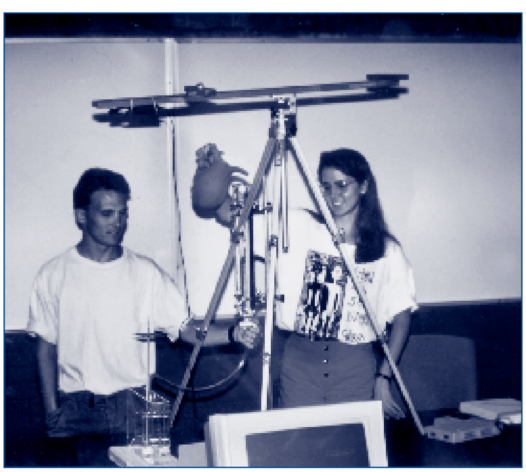
The computer equipment funded by the ILI grant provided for 30 PC's, one for each student, networked to a SUN file server, on which resided the software to be used in the classroom. A stand-alone computer controlled by the instructor projected computer images on a whiteboard for use in classroom presentations. The instructor's computer was equipped with an IBM Personal Science Laboratory (PSL) that gathered and displayed experimental data in real time. The purpose of the computer-aided classroom 101, one of the first of its kind in the world, was to incorporate computers into undergraduate mathematics courses, not for drill and practice, but as an innovative tool for discovery, enrichment, and deeper understanding. The first classes were held in the room in 1990. For half the day, undergraduate classes in calculus, linear algebra and differential equations classes met in the room, and during the other half of the day, the room became an open access lab for mathematics students.

In the next few years, the Department considerably expanded its library of home-grown software by creating commercial level programs for use in (and out of) the mathematics classroom. The development and writing of software programs was led by David Lovelock and David Lomen. Much of the actual programming was carried out by undergraduate and graduate students in a Mathematical Software course. Faculty were encouraged to submit ideas for new software and many did—including Clark Benson, Jim Cushing, Hermann Flaschka, Helmut Groemer, Larry Grove, David Gay, Daniel Madden, William McCallum, Stephen Tellman, and William Vélez. The programs were designed to have an educational impact:

- by addressing computational and graphical needs for focused topics in specific classes;
- by targeting students learning mathematics; and,
- by being user-friendly.

In order to enhance their distribution and use, the programs were designed to run on computers with minimal specifications and were distributed free of cost. Over 100 programs were eventually written, across a wide variety of topics in the high school and university undergraduate curriculum.

The Department's special purpose computer-aided classroom gained national recognition. The facility was visited by dignitaries from the University, the Arizona Board of Regents, and from Arizona State government, and also by mathematicians from around the country and abroad (including visitors from Australia, Canada, New Zealand, and the United Kingdom). David Lomen and David Lovelock gave innumerable talks in and out of the country on the facility and its design and use in undergraduate mathematics instruction. The room inspired the creation of similar facilities at other schools (e.g., Harvey Mudd College, Tarrant County Junior College).



Michael Flores and Pauline Palko work with IBM's PSL and a P.C. under a grant that designed experiments for calculus.

In response to increased interest in computer-assisted instruction in the undergraduate curriculum, the Department (again led by David Lovelock and David Lomen) successfully obtained further support from NSF and the College of Science at the University of Arizona for the creation of another special purpose classroom. In 1993 the Department renovated room 102, which at that time housed the Department's computer facilities, and created a second computer-equipped classroom with facilities and design modeled after that in room 101.

The facility was visited by dignitaries from the University, the Board of Regents, and from Arizona State government, and also by mathematicians from around the country and abroad.

The computer-equipped classrooms 101 and 102 saw considerable use during the next decade, not only for instruction in calculus, differential equations, and linear algebra, but also for a variety of other special events and activities. By 2003, the rapid evolution of the computer and software world and the ongoing financial difficulties of the University resulted in the facilities in these rooms falling distressingly behind the times. However, the Department is very pleased to announce, that as of the fall semester this year, the computer facilities in both classrooms have been significantly upgraded and modernized. At each of the sixty student seats in these two rooms is a Dell computer (with CPU speed of 2.4gHz, 512MB of 333mHz DDR RAM, and a 40GB hard drive) with a flat panel LCD color monitor and optical mouse. Each room also has a larger and faster version of these machines, connected to projection equipment, for the instructor's use. Each station is individually connected at 100Mbps to the new building local area network and to the worldwide web. In addition, two "behind the scenes" machines are dedicated to the administration of the rooms. The current operating system is Windows XP (Professional Service Pack), although plans are eventually to have dual boot capability with Linux. This upgrade of our computer assisted classrooms was carried out by the Department's computer staff (Robert Borys, Karl Newell, Rosario Molina, Chris Orringer, Alex Perlis, Rene Bernal, Noah Simmes) who, despite the severe pressure of time and deadlines, managed to have both rooms ready for the start of the semester.

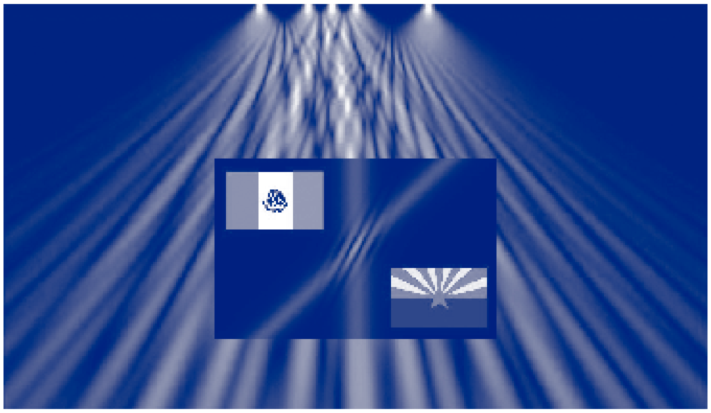
David Lomen and his Math 112 class in the newly-equipped Room 101.

The Department extends its thanks to several people who helped make the upgrade of our computer-equipped classrooms possible. The funding for these latest computer upgrades came from the generous gifts of those who have responded to the needs described on our Wish List (see page 8), and an Information Sciences & Information Technology Grant awarded to Joceline Lega as part of the Prop 301 initiative. This grant will support the development of new computational curriculum for our senior-level Mathematical Modeling course, designed to give math majors a hands-on modeling experience emphasizing both the theoretical and numerical aspects of mathematical modeling.

The Department intends to use these state-of-the-art computer classrooms as laboratories to develop the broad application of technology in the classroom. This includes the incorporation of modern software tools such as MatLab®, Maple™, and Mathematica®, but also training students to give oral presentations with programs such as PowerPoint, which has been done in the Department's innovative Business Math courses.

The Binational Consortium of Optics and the Nonlinear and Stochastic Optics Winter School

by Ildar Gabitov
Professor



The University of Arizona, together with the Instituto Nacional de Astrofísica, Optica y Electrónica (INAOE), Centro de Investigación Científica y de Educación Superior de Ensenada (CICESE), and the Centro de Investigaciones en Optica (CIO), have formed the **Binational Consortium of Optics**, directed by Professor James Wyant of the Optical Sciences Center at the University of Arizona, and Professor Fernando Mendoza Santoyo of the Centro de Investigaciones en Optica (CIO).

Arizona has a well-deserved and excellent reputation in optics, and in the last few years Mexico has built significant strength in optics. It is natural that, as neighbors, we build on our mutual strengths and interests. As the first official activity, the consortium will hold a winter school in **Nonlinear and Stochastic Optics** supported by the College of Science of the University of Arizona. This school, hosted by the Department of Mathematics, will take place from January 10 through January 13, 2004 on the campus of the University of Arizona. This winter school will be a chance for post-graduate students from three Mexican institutions to join with post-graduate students from the University of Arizona, and learn from distinguished speakers who will present an overview of the current state of nonlinear and stochastic science in optics.

This workshop will bring together leading experts in critical fields of optics and photonics to present current developments, key directions, and future perspectives in this rapidly developing area. Invited lecturers will represent industrial and academia and will cover experimental, theoretical, and computational aspects of Nonlinear and Stochastic Optics. The winter school will cover such subjects as nonlinear and stochastic photonics, optics and information technologies, nano-optics and ultra-short pulse/high energy phenomena. Among the lecturers are world leaders in the field: Dr. Joseph H. Eberly (University of Rochester), Dr. James P. Gordon (Bell Labs), Dr. Linn Mollenauer (Bell Labs) and Dr. Alan Newell (The University of Arizona).

DEPARTMENT OF MATHEMATICS

WISH LIST

December 2003

Mathematics East (Newly renovated space)

- **Balcony Commons Area (off 2nd floor)**
  - Railing - $2,000
  - Shade Structure - $2,500
  - Furnishings - $1,000
- **Math (Majors) Center (Rm 144A)**
  - Scanner - $250
  - Reception Area (Rm 146)- Framed posters - $500
  - Commons Room (Rm 140)
    - Furnishings & Framed Posters - $1,500
    - 2 Computer - $2,000
  - Reference Room (Rm 142)
    - Mathematics materials/publications - $1,000
- **Seminar/Classrooms (Rm 246)**
  - Electronic Blackboard - $2,500

Mathematics Building

- ~~**Tiered Computer Classroom (Rm 101)** – UG Courses~~
  - ~~Flat panel monitors - $18,000 ($600 ea)~~
  - ~~30 networked computers - $24,000 ($800 ea)~~
  - ~~Software licenses [Maple, Matlab, MS Office] - $10,000~~
- ~~**Tiered Computer Classroom (Rm 102)** Statistics/Probability/Math Ed Courses~~
  - ~~Flat panel monitors - $15,000 ($600 ea)~~
  - ~~25 networked computers - $20,000 ($800 ea)~~
- **Graduate Student Commons Rm (702)** Furnishings - $1,000
- **Seminar/Classroom (Rm 402)**
  - Electronic Blackboard - $2,500
  - Computer Projection Equipment - $5,000
- **Computer Server Rooms (Rms 231, 233)**
  - Raised floor - $15,000
  - Racks - $2,500
- **Seminar/Classroom (Rm 501)**
  - Electronic Blackboard - $2,500
  - Computer Projection Equipment - $5,000
- **Faculty Commons Rm (Rm 226)**
  - Furnishings - $1,000
  - Whiteboards - $500
- ~~**Staff Commons Rm** - Furnishings - $500~~

Scholarships

- **Clay Travel Fund** - For graduate travel to meetings - $400 ea
- **Pierce Memorial Fund** - UG Math Majors - $1,000 ea
- **Lusk Scholarship in Mathematical Sciences** UG Math Majors - $1,000
- **Lovelock Teaching Award** - Faculty teaching excellence - $1,000

Math Teaching Lab

- **Full walls for offices** - $10,000
- **Re-routing Cooling Systems** - $10,000

Other Wishes

Construction of new Space (60,000 sq. ft.) $20,000,000

Note: Items crossed off list indicate donations received.

From Student to Professor

by Barbara Shipman
Assistant Professor
University of Texas at Arlington

In making the transition from being a graduate student of mathematics at the University of Arizona to being a professor of mathematics, first at the University of Rochester and now at the University of Texas at Arlington, I still do what I did as a graduate student—teach mathematics, talk about mathematics, learn mathematics, and discover new mathematics. Indeed, the reason we go to graduate school and want to be professors of math, is that this is what we enjoy doing. Yet, making the final step from student to professor did bring some changes. As a professor I was able to see what happens behind the stage in department committees, in Deans' offices, and in the University administration, and I began to realize both the power and the limitations that faculty have in setting policies that affect both faculty and students. I also became aware of the sometimes strong and somewhat political differences in opinion that can exist among the faculty in a single department on issues concerning standards of teaching and grading, graduate affairs, tenure, and much more. My approach to these things has always been to be collegial with everyone, even if I might have different opinions on issues, and just try to be the best teacher, researcher, and member of a department that I can be.

I believe this approach will put any new professor on the right path in any tenure-track position. While research output and quality is still the one major criterion for promotion, it is the practice of many departments that each current faculty member gets a secret vote on whether a professor up for tenure should be granted tenure or not! After tenure, you may be more aggressive about making changes that you feel would improve the department.

As a new professor (and even as a graduate student), I recommend that you become acquainted with people who work in your area. To do this, attend conferences, give talks, and don't be afraid to talk to the experts! A good way to start is to have some questions for them about something you may be working on. This is also a great way to keep up with work that others are doing in your field. Most of the papers I have published were greatly influenced by something I learned about at a conference, and might have been just a reference to a paper I was unaware of.

With regard to giving talks: people appreciate a talk they can follow and understand, even if not in every detail, and they will be happy to invite you back if you succeeded in teaching them something or igniting their interest. Think carefully about how to present your work to people who do not already know it, within the (always too short!) time allotted for you to speak. For example, think about what you would tell a colleague in your office one-on-one.

Looking back, I realize that one of the most valuable things I still use is the mathematical understanding I found while working on problems as a graduate student. There were many things that I did not understand, even when presented very clearly, until I struggled, sometimes for a long time, to grasp them (although I admit that Polar, my little white bear, helped me out—I got him when I was trying to figure out the Riemann curvature tensor). Most of all, at any stage in your mathematical career, remember to keep enjoying the mathematics, whether teaching it or trying to understand it, and to appreciate the freedom you have, in an academic career, to work on what you want, to arrange your own activities during the summers, to travel (to conferences), and to be paid for doing what you enjoy

Faculty Profiles

David Glickenstein was born in Philadelphia, PA, earned his BA in Mathematics and Computer Science from Cornell University and his MA and Ph.D. from University of California, San Diego. His research interests include geometric evolution equations (especially Ricci flow), Riemannian geometry, and metric geometry. He is additionally interested in combinatorial evolution equations, Euclidean, hyperbolic, and spherical geometry

Dave moved to Tucson with his fiancée, Tricia, who is beginning postdoctoral work in the Psychology Department. He enjoys theater, hiking, tennis, cheesy humor, playing sports badly, and cheering on his favorite baseball, football, and hockey teams.

Daniel Ueltschi was born in the French part of Switzerland. He received his Ph.D. from Ecole Polytechnique Lausanne. He also received a grant from the Czech Republic Foreign Ministry to study at Charles University, Prague. He then spent one year at Rutgers, two years at Princeton, and two years at UC Davis in postdoc positions.

His research domain is mathematical physics. He has studied models such as the Hubbard and Falicov-Kimball ones; these models are relevant for the description of electronic properties in condensed matter. The mathematical description of quantum systems with a huge number of particles is at the crossroad of Physics Thermodynamics and Quantum Mechanics) and Mathematics (Analysis, Functional Analysis, and Probability Theory).

He says "the stars always made me dream as a kid, and I am very happy to settle in this paradise for astronomers. Hiking possibilities here are also very tempting." He is also a fan of classical music, especially operas.

The David Lovelock Award

by Nick Ercolani
Department Head & Professor

After 30 years with the University of Arizona Department of Mathematics, David Lovelock will retire in January of 2004. As a testament to his remarkable contributions to the University of Arizona, The Department of Mathematics, and to the community, an award has been established in his honor.

Lovelock received his formal education at the University of Natal in South Africa, including B.Sc. degrees in Mathematics/Physics and Applied Mathematics, and Ph.D. and D.Sc. degrees in Mathematics. He taught at the University of Bristol, England for seven years and the University of Waterloo, Canada for five years before coming to Arizona in 1974. He is the coauthor of five undergraduate textbooks and one graduate textbook, and has published over thirty research articles, mostly in the area of general relativity, and more recently, several dealing with Mathematics Education.

He is a recipient of the Distinguished Teaching Award, the Burlington Northern Faculty Achievement Award for Outstanding Teaching and High Scholarly Standards, the MAA Regional Award for Distinguished University Teaching of Mathematics, and was twice a Five Star Faculty Award finalist. He was the driving force behind the very successful development of UA educational software. These programs focused on a specific mathematical topic and/or class, fit on the smallest capacity disk, and ran bug-free and crash-proof on the simplest computers. They were so user-friendly that even a computer novice could learn the program within one class period.

During the middle 1980s and early 1990s David spearheaded our successful efforts to obtain two NSF equipment grants to develop and equip our two computer classrooms (see related article: “Computer Classrooms for the 21st Century”). He was also a Co-PI on several NSF grants to develop and disseminate both undergraduate course materials and mathematical software, and gave workshops on the use of computer technology in teaching Mathematics, as well as in setting up computer classrooms. Lovelock was also one of the developers of a computer program, in use worldwide, for Search and Rescue operations. He has given workshops on its use, and has participated in many rescue efforts.

More recently Lovelock obtained an NSF grant to create a model program that increases interest in Science, Mathematics, Engineering, and Technology for physically disabled students from middle school to graduate school. The results of this grant far surpassed the original version and drew rave reviews from advocates for handicapped students. (See article in Fall 2001 newsletter: A Myopic View of Program ACCESS.)

About the Award

This award seeks to recognize and reward innovation and creativity in mathematical education in the provision of mathematical experiences for undergraduates and is to be presented at the Spring Commencement.

The selection panel will be proactive in soliciting nominations. On the average, an award of $1,000 will be made every two years, beginning in the spring of 2005.

Eligible contributions can include:

- **New ways of teaching old subjects**
- **Software development which complements learning**
- **The building of synergistic relationships with client disciplines via course development**
- **Ideas not yet imagined.**

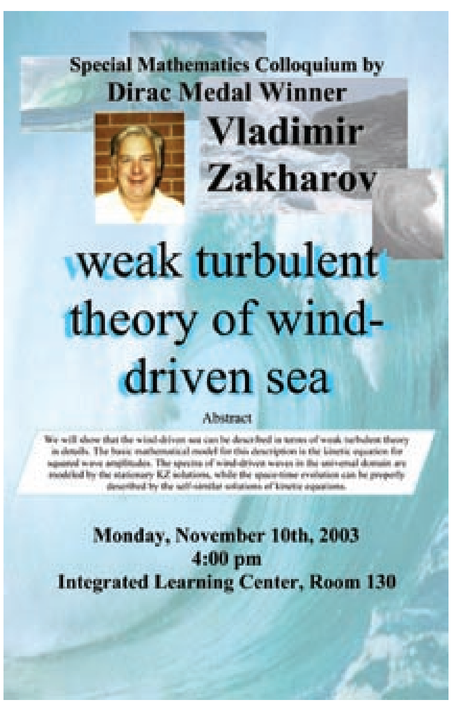
In short, the panel will be interested in all activities that are successfully implemented, and contribute in a novel way to the learning of Mathematics.

Nominations should include no more than five pages describing the idea and activity, and providing evidence of its successful implementation. They should include CV’s and other documentation relevant to the case.

Award eligibility is open to all faculty and staff in the Mathematics family at the University of Arizona, including tenured, non-tenured and adjunct faculty members, and may be shared between mathematicians and colleagues from other disciplines.

Zakharov Receives the 2003 Dirac Medal

In August of 2003, the Abdus Salam International Centre for Theoretical Physics in Trieste, Italy announced that Professor Vladimir Zakharov, along with R.H. Kraichnan, had been awarded the 2003 Dirac Medal. According to the Selection Committee, Zakharov put "the theory of wave turbulence on a firm mathematical ground by finding turbulence spectra as exact solutions and solving the stability problem, and in introducing the notion of inverse and dual cascades in wave turbulence."



The poster for Zakharov's Special Colloquium, given in the new ILC auditorium.

Founded in 1964 by Nobel Laureate, Abdus Salam, the Centre, in Trieste, Italy, operates under the aegis of two United Nations Agencies: UNESCO and IAEA. Awards from the Abdus Salam International Centre for Theoretical Physics honor and encourage high level research in the fields of physics and mathematics. The Dirac Medal is awarded each year on the birthday of P.A.M. Dirac who won the Royal Medal in 1939, the Copley Medal in 1952, and shared the Nobel Prize for Physics with E. Schrödinger in 1933.

To celebrate, The University of Arizona College of Science held a reception to honor of Dr. Zakharov on November 10, 2003. The reception was held at the Arizona Inn and celebrated Dr. Zakharov's achievement and contributions both to the Mathematics and Physics communities, and to The University of Arizona.

For additional information please see: **http://www.elsevier.com/locate/physd**, Special Issues Volumes 152-153, Issue 1-4, 15 May 2001 and **http://math.arizona.edu/~mcl/zak/zakhome.htm.**

Zakharov Celebration at Arizona Inn

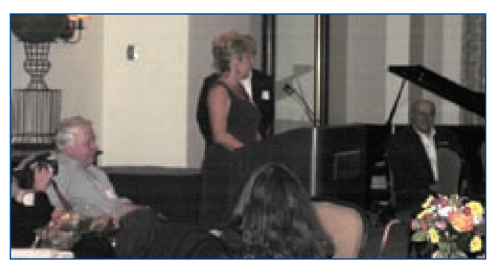
Vladimir Zakharov.

Assoc. Professor Bruce Bayly with Catacoustic Groove.

Fred Stevenson and Alan Newell.

Dr. Brenden Phibbs, Nick Ercolani, and Zakharov.

William Vélez and Robert Maier.



Deborah Gaines reads Zakharov's poetry in English.

Presentations, Symposia, Workshops

Jim Cushing's book (co-authored with R.F. Costantino, Brian Dennis, R.A. Desharnais, and Shandelle M. Henson) ***Chaos in Ecology: Experimental Nonlinear Dynamics*** was published this year, and his book ***Differential Equations: an Applied Approach*** will appear in January 2004. Professor Cushing will be the plenary Speaker for the International Conference on Mathematical Biology in Kanpur, India February 19-21, 2003 and he has been invited to speak at the International Symposium: Dynamical Systems Theory & its Applications to Biology & Environmental Sciences in Shizuoka, Japan March 14-17, 2004.

Nick Ercolani, Professor and Department Head, is one of the principal organizers of the year-long Thematic Program on Partial Differential Equations, being held at the Fields Institute. The spring program is: Nonlinear Waves, Kinetic Theory, and Hamiltonian Partial Differential Equations. (Details can be found at **www.fields.utoronto.ca/programs/scientific/03-4/pde/.**) He is also an invited speaker for the Special Session on Random Matrix Theory and Growth Processes at the AMS Western Section meeting in Albuquerque, New Mexico in October 2004.

Lennie Friedlander, Professor, will speak at the Geometry and Spectral Theory conference in Haifa, Israel in December.

Donald Myers, Professor Emeritus, gave an invited talk "Directional Dependence and Radial Basis Functions" at the International Workshop on Meshfree Methods in July 2003, and will give an invited presentation for the Department of Mathematics, University of Nevada-Las Vegas, in February 2004.

Moshe Shaked, Professor, gave an invited talk at the EURO/INFORMS Istanbul 2003 Conference in July 2003.

Douglas Ulmer, Professor was an invited speaker at a conference at Princeton University on the Conjecture of Birch and Swinnterton-Dyer in November 2003, and in February 2004 will participate in a Special Week on Ranks of Elliptic curves and Random Matrix Theory at the Isaac Newton Institute for Mathematical Sciences in Cambridge, England.

William Yslas Vélez, Professor, gave the Founder's Celebration Keynote Address at the 30th anniversary of the founding of the Society for Advancement of Chicanos and Native Americans in Science (SACNAS) in October 2003.

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