
A f t e r m a t h

Welcome!

The Aftermath is edited by Peter Alfeld and Angie Gardiner. Please contact either one of us if you have an idea or article to submit. (Issues of the newsletter will be archived on the web at: www.math.utah.edu/newsletter.)

We'd like to extend a warm welcome to those who are new in the department this year.

We have eleven new Assistant Professor (Lecturers): Alexander Aue (University of Cologne, Probability and Statistics); Marian Bocea (Carnegie Mellon, PDE); Suneal Chaudhary (UCLA, Applied Math); Bo-Hae Im (Indiana University, Number Theory); Kyeong-Hun Kim (University of Minnesota, PDE); MunJu Kim (Brown University, Math Biology); Laura Miller (Courant, Math Biology); Kim Montgomery (Northwestern, Math Biology); Francois van Heerden (USU, PDE); Michael van Opstall (University of Washington, Algebraic Geometry); Oana Veliche (Purdue, Commutative Algebra).

We also have several new graduate students. Our new masters students are: Lindsay Crowl, Wilfred Edwards, Curtis Elifritz, Michael Giessing, Geoffrey Hunter, Giau Huynh, Haimanot Kassa, Molly Kelton, Sarah Kitchen, Pejman Mahboubi, Benjamin Murphy, Russell Richins, and Yuan Zhang. Our new Ph.D. students are Berton Earnshaw, Hankun Ko, and Karin Leiderman.

We'd also like to welcome our visitors: Bori Mazaag (William and Mary College, Math Biology); Eric Sharpe (University of Illinois, Urbana-Champaign); Vincenzo Nesi (University of Rome, Composites); Michah Sageev (Technion, Israel, Topology); Janet Andersen (Hope College, Math Biology); Hsiang-Ping Huang (National Center for Theoretical Sciences, Taiwan, Functional Analysis); Razvan Veliche (Purdue, Algebraic Geometry).

Please don't hesitate to ask either one of us if you wonder how things work here, or what to do. We may not know ourselves, but we can point you to the right person to find out.

Personality!



Mladen Bestvina is a professor here in the math department. His research interests are in topology, and more specifically geometric topology and geometric group theory.

Mladen and his wife, Cynthia, are proud parents of their beautiful three month old baby girl Isabella.

Mladen enjoys photography, especially nature photography. He takes photos of wildflowers, birds, and southern Utah landscapes. In the last three months he has also taken a lot of photos of Isabella. In his spare time he enjoys biking City Creek Canyon and hiking.

Service Awards

Cindi Phillips and Paula Tooman both recently received service awards for their years of full-time service at the university.

Cindi received an award for her twenty years of service at the university. She has been with the math department as an accountant for the last five years, and before that she worked at the hospital.



Paula has been with the university (and the math department) for five years. Her friendly manner welcomes students, faculty, and visitors to the math department.

We are all very grateful for the work Paula and Cindi do to keep the math department running smoothly.

Undergraduate Students:

If you are interested in serving on the USAC (Undergraduate Student Advisory Committee) this year, please contact Chris Roberts at chris@design-corps.com.

Summer Report

Mini-course on the Weil-Petersson Metric by Ken Bromberg

This spring, through the support of the VIGRE grant, the department held a mini-course on the "Synthetic Geometry of the Weil-Petersson Metric". The course was designed to introduce graduate students to the Weil-Petersson metric on Teichmüller space. The main speaker was Jeff Brock of the University of Texas. Brock gave twelve lectures discussing topics such as the behavior of geodesics, the visual sphere and connections with hyperbolic 3-manifolds. Before Brock's talks introductory lectures were given by Bob Bell, Mladen Bestvina, Ken Bromberg and Dan Margalit. These lectures introduced students to Teichmüller space and the mapping class group.

The course was well attended. Graduates students came from Texas, Harvard, Columbia, Chicago and Michigan along with many local students from Utah. A number of post-docs from other universities also attended the course. The quality of the lectures was outstanding as was evidenced by the students active participation in the lectures and in informal discussion afterwards. There was also time for the students to explore Salt Lake City.

Commutative Algebra Mini-Course by Paul Roberts

This summer Florian Enescu and I ran a Minicourse on Classical Problems in Commutative Algebra. The aim of the course was to introduce graduate students to a set of conjectures in the field that have been in the forefront of research for the past thirty years or so. Many of these conjectures originated from Serre's algebraic theory of intersection multiplicities, and their status was summarized in a set of notes by Mel Hochster in 1975. Since then there has been a lot of progress, and a second aim of the mini-course was to give an up to date account of what has been happening since that date.

The course was organized by having an introductory week with background talks given by young mathematicians; in addition to Florian, there were talks by Sandy Spiroff, Sean Sather-

Wagstaff, and Claudia Miller. The idea was to give the students the necessary background as well as to introduce them to some of the questions. The second week was devoted to a more advanced program on the current state of many of the problems. We had four speakers: myself, Mel Hochster, Ray Heitmann, and Sankar Dutta.

The program was quite ambitious, but from the reactions of the students it appears that they enjoyed the Minicourse and got a lot out of it. We believe that we fulfilled our aim of introducing graduate students to this important area of Commutative Algebra.

REU: Inverse Problems and Applications by David Dobson

The Summer 2004 REU Program on Inverse Problems and Applications was held during the six-week period June 1 through July 9, 2004. The goal of this REU was to introduce participating students to some of the basic ideas underlying inverse problems and to quickly transition to work on individual research projects. The program was conducted by David Dobson and Ken Golden, with assistance from postdoc Grady Wright, and graduate student Frank Lynch.

A total of ten students participated in the program. Six students were from the University of Utah, the remaining four were from other institutions across the country (UC Berkeley, Rose-Hulman, SUNY Geneseo, and Colby College). Students ranged widely in rank from freshman to finishing seniors, and just as widely in backgrounds and interests.

The basic format of the program was to meet as a group twice daily, Monday through Friday: two hours in the computer lab each morning, and two hours in the classroom each afternoon. The first two weeks of classroom time were devoted to background lectures covering relevant concepts from linear algebra, basic functional analysis, differential equations, and a variety of examples of inverse problems in applications. Initially, the morning sessions in the computer lab were devoted to introductory projects in Matlab and LaTeX, and to familiarization with internet based research resources. These labs were run by Grady Wright and Frank Lynch. After the first two weeks, focus of the program turned gradually to individual student mentoring as they began to work on their research projects. Each student was provided with help, references, and

direction each day. Parts of the morning and afternoon meetings were also devoted to student presentations.

Two milestones were set for the students. First, after the first three weeks, each student was to have chosen a research problem, and prepared a short oral presentation describing the problem and background material. Second, at the end of the program, students were to have prepared final oral and written reports. All students met the first milestone, although a few did not turn in a final written report.

Some students entered the program with good ideas for research topics, and chose projects right away. Several other students were able to identify appropriate problems after some nudging in the right direction. And several other students chose problems which were presented in class as possible course projects.

The program appears to have been a success for all involved. Lack of time was a problem. Some student projects were showing promise for developing interesting (publishable) results, but the six weeks were over too quickly (on the other hand, most participants were exhausted after six weeks). Some students planned to continue working on the projects. In retrospect, some of the time pressure may have been alleviated by focusing more on group projects. Student surveys were collected at the end of the program. Overall, responses were nearly uniformly positive. One point we could improve upon in the future would be to provide a meal plan and more social/recreational activities for the out-of-state students. Much of the material from the Summer 2004 REU program can be found at <http://www.math.utah.edu/vigre/reu/summer04/>.

Summer High School Program by Jim Carlson

I returned from Cambridge, Massachusetts this June to run the summer program for high school students, now in its fifth year. Twenty students participated, fifteen from the Salt Lake City area, one from Vernal, two from Cedar City, one from Ferron, and one from far away Florida. The VIGRE program provided almost all of the support, notably student tuition and stipends for the graduate assistants: Maria Bell, Drew Butcher, and Rex Butler. Maria, Drew, and Rex did an outstanding job.

The program ran for three weeks, four days a week, 8:30 am to 4 pm. In the morning students worked on number theory, learning about Diophantine Equations, modular arithmetic,



Participants of the summer REU program

properties of the primes, continued fractions, etc. The students especially enjoyed the two contests. The first was to break secret messages sent using RSA cryptography. The second was to find the parameter N for Pell's equation $x^2 - Ny^2 = 1$ with the "best" ratio $R = (\text{digits of } x)/(\text{digits of } N)$, where (x,y) is the smallest solution with positive coordinates. Think of R as measure of the complexity of the solution. To even get close to the winning entry, you will have to find an N with $R > 200$, obtainable with a 6 digit N and minimal positive solution with x having over a thousand digits. For this you will have to use both theoretical and computational tools. For the latter we used Python, which has an elegant syntax and can handle arbitrarily long integers.

After lunch students attended a colloquium whose topics ranged widely indeed: Peter Alfeld, Infinity is Different; Aaron Bertram, Pythagoras vs the Elliptic Curve; Klaus Schmitt, Fractals; Jim Carlson, Mathematics of Google; Fred Adler, Cicadas; David Dobson, Inverse Problems; Peter Trapa, It's a Small World; Davar Khoshnevisan, Normal Numbers, Sandra Spiroff, Unique Factorization; Jim Carlson, Some Unsolved Problems in Mathematics. Our thanks to all of the colloquium speakers. The students enjoyed the talks, learned a lot, and were inspired (which is what this program is all about).

The day ended with a 90 minute computer lab in which the students learned to program in Python and do experimental number theory with it. Some typical problems they solved: Find a 100-digit "industrial prime." Solve the equation $123456789x - 235711y = 1$. Let $p = 10^{100} + 267$. Compute 2 to the power $N \bmod p$, where $N = 3^{100} + 7^{100}$. All of these are warmups for RSA.

The program ended with the traditional picnic and frisbie game in Reservoir Park. We all had

fun and learned a lot. We'd like to thank Marilyn Keir and Angie Gardiner for their superb work in publicizing the program and screening applicants. Special thanks are due to Angie for her thoughtful professionalism — it is a major ingredient of the program's success.

Math Center Information

The T. Benny Rushing Mathematics Center is open for business. The drop-in tutoring center serves all math department classes at the 1000 and 2000 level, as well as 3070, 3080, 3150, and 3160. We will also arrange weekly group tutoring by student request. The computer lab is located next to the tutoring center, and all students enrolled in a math class should have an account on our system. The tutoring center and computer lab are open from 8:00 a.m. - 8:00 p.m. Monday - Thursday and from 8:00 a.m. - 6:00 p.m. on Friday. They are closed on weekends and university holidays, however, students wanting to work in the computer lab after hours or on the weekends may use the lab in 205 South Physics, which is open from 8:00 - 3:00 on Saturdays. If you have any questions or would like more information about the math center, please contact Angie Gardiner at 585-9478.



A view of the study space in the math center.

Calendar

Sept. 28 - Oct. 1: Distinguished Lecture Series featuring David A. Vogan, MIT.

Oct. 7 - 8: Fall Break - no classes.

Oct. 22: Last day to withdraw from classes.

Tuesdays 12:55: Undergraduate Colloquium, LCB 222.

Tuesdays 4:00: Graduate Colloquium, JWB 335.

Thursdays 4:15: Departmental Colloquium, JWB 335.