Duke University Math News

November 1, 2001

Welcome

From the Chair:

First, a big welcome to all the newcomers—faculty, postdocs, visitors, graduate students, and to Shara Player, who replaces Janet Stockburger in the office. I hope you will all enjoy working and studying in the department.

A special welcome to Mark Huber, our new assistant professor who also has an appointment in the Statistics Department. Mark received his doctorate from Cornell, and comes to us from Stanford where he spent an NSF postdoc in the Statistics Department. He is a probabilist with interests in perfect sampling algorithms and Monte Carlo methods.

And congratulations to our undergraduates for their successes on the Putnam and Modeling competitions last spring. They are building up a formidable tradition and helping make our undergraduate program one of the best in the Nation. Thanks too to our own "Coach K," David Kraines, who helps recruit and organize the Putnam and Modeling teams.

This year the department looks quite different, both in terms of personnel and physical appearance. With many faculty on leave this year, we have a large number of visitors who are enriching the research and teaching environments of the Department. This large number of visiting positions has enabled the Department to dedicate this year as a special year in Integrable Systems, which is being organized by Xin Zhou and Stephanos Venakides. As part of this special year, Professor Percy Deift of the Courant Institute will give a series of Gergen Lectures in late October.

We are continuing the annual tradition of summer renovations, which never seem to be ready quite early enough to avoid the annual crunch at the beginning of the school year. This summer most of the remainder of the library space was renovated, creating three new offices for Mathematics, two new classrooms (one to be shared with Physics), a Mathematics-Physics Reading Room for all, especially undergraduates, and graduate student office space for Physics. The reading room will be opened with an informal ceremony with Physics in the near future.

Last year there were two significant conferences in the Department. Arlie Petters co-organized the 7th Annual Conference for African-American Researchers in the Mathematical Sciences Conference (CAARMS7) at Duke this past June. Jonathan Wahl and I co-organized the second Duke Mathematical Journal, IMRN Conference in April. Both received the generous support of outside sources and were very successful. You can find out more by visiting their web pages, which are accessible from the Department's home page.

Congratulations to Greg Lawler—on leave this year at the Mittag-Leffler Institute in Sweden in the fall, and Cornell in the spring—for being named A. Hollis Edens Professor of Mathematics. And congratulations to Harold Layton for his promotion to Full Professor, and to Xiaoying Dong for her promotion to Lecturer.

Herbert Edelsbrunner and Pankaj Agarwal, both Professors of Computer Science, were recently appointed to secondary appointments Mathematics. Their interests include computational geometry and topology. Our own John Harer was appointed to a secondary appointment in the CS Department. These joint appointments reflect the increasing interaction between the Computer Science and Mathematics Departments, especially in areas related to geometry and topology, a connection I hope and expect to deepen with time.

On the administrative front, there has been a changing of the guard. Les Saper has taken over as DGS from Bill Allard, and Mike Reed has taken over as Associate Chair from Greg Lawler. Thanks to Bill and Greg for their help as depart-

mental officers in recent years, and to Les and Mike for taking on new responsibilities.

Our VIGRE grant continues to stimulate activities. Particularly notable is CHISEL, our summer outreach program to North Carolina High School teachers, which debuted this summer under the direction of Jack Bookman; PRUV, our undergraduate summer research program; and a grant writing workshop for postdocs and final year graduate students.

I am looking forward to working with you all in the coming year, my last as Chair, and wish you all a productive and interesting year.

—Dick Hain, Chair

Events

Gergen Lectures

On October 22, 23, and 24, Percy Deift of the Courant Institute presented a series of lectures in the Math Physics building as part of the Gergen Lecture Series. The speaker gave a general introduction to Random Matrix Theory and described various applications of the theory to problems in pure and applied mathematics. Later in the week, he verified the Universality Conjecture and related the subject to Riemann-Hilbert problems and "Ulam's problem".

John Jay Gergen was chair of the Duke Mathematics Department from 1937 until shortly before his death in 1967. Once or twice a year, distinguished mathematicians present lectures to the community in his honor. For more information and a list of previous Gergen Lecturers, see `http://www.math.duke.edu/info/gergen.html`.

Conferences Held Last Spring

Last spring two major conferences were held here at Duke University.

The 7th Annual Conference for African-American Researchers in the Mathematical Sciences (CAARMS7) was held at Duke University last June. This conference was organized by Arlie Petters and CAARMS founder William Massey of Bell Labs. CAARMS highlights current research by African-American researchers and graduate students in mathematics, strengthens the mathematical sciences by encouraging increased participation of African-Americans and members of other underrepresented groups, facilitates working relations among them, and provides assistance to them in cultivating their careers. About 100 mathematicians participated in this very successful three-day conference. For more information regarding this conference see `http://www.cm.bel-labs.com/who/will/caarms7.html`

The Second Duke Mathematical Journal and IMRN Conference was held at Duke Friday, April 27 through Sunday, April 29, 2001. There were eight excellent talks by distinguished young speakers from Europe and the US. All talks were in areas represented by the two journals, and covered analysis, combinatorics, differential geometry, mathematical physics, number theory, probability, and representation theory. There were approximately 80 participants, many of them in early stages of their careers. The conference was generously funded by Duke Press, the National Science Foundation, the Mathematical Sciences Research Institute, and the Duke and UNC Mathematics Departments. It was a great success. Further details can be found at the conference web page: `http://www.math.duke.edu/conferences/dmj-imrn01`

Undergraduate News

DUMU

The Duke University Math Union, (DUMU), organizes activities including social events, such as picnics, movies, frisbee games with the Society for Physics Students, and our high-school math contest. Additionally, we invite speakers for the entertaining and informative Undergraduate Lecture Series. If you are interested in hearing about DUMU events and are not already on our mailing list, contact Mike Miller at `mkm14@math.duke.edu`. Read on to find out about our current plans.

The High School Math Meet

DUMU is planning to host a contest on Saturday, November 17, for high schools in North Carolina and nearby states, and we need problems and solutions for it. The more people who contribute, the more varied and interesting the contest will be. So, start thinking, and keep your eyes open for intriguing ideas. Math may be a tool and a subject, but it can also be a sport, a game, a kind of art, and thought-provoking fun.

We are looking for original problems of varying difficulty that can be solved in 2–10 minutes using pre-calculus mathematics only. The problems most likely to be used are those that reward insight more than experience. We will also need a few very easy problems.

Send submissions to David Arthur at `dga2@duke.edu`. See `http://www.math.duke.edu/dumu` for more information about the contest and last year's problems.

Competitions

The following contests are open to all undergraduates. They take place on Saturdays and are held in a math classroom in the Physics Building. If you are interested in participating in one of these competitions, or if you would just like more information, contact David Kraines at `dkrain@math.duke.edu`.

- November 3. The Virginia Tech math contest will be held from 9:00 until 11:30 in Math-Physics 120. Last year 229 students from 37 institutes participated in the 22nd annual contest. Duke students Carl Miller '01, Nathan Curtis '02, Kevin Lacker '02, and David Arthur '04 finished first through fourth respectively, and six other Duke students placed in the top 27. See `http://www.math.vt.edu/events/` for more information and past tests.

- December 1. The W. L. Putnam Mathematical Competition is given in two sessions of three hours each. Success in this challenging competition requires ingenuity and mathematical rigor rather than advanced mathematical knowledge. The Duke team of John Clyde '01, Nathan Curtis '02,

and Kevin Lacker '02, won the December 2000 competition. These students and Carl Miller '01 each ranked among the top 15 of the 2,818 participants. Since 1990, two other Duke teams have won the competition and two have finished in second place. For more information, see `http://math.scu.edu/putnam/`.

Undergraduate Awards

Melanie Wood '03 has been named winner of the 2001 Alice T. Schafer Award for Excellence in Mathematics by an Undergraduate Woman. Wood was chosen on the basis of her outstanding research in mathematics including a paper submitted for publication, her excellent performance in several graduate level mathematics courses from her freshman year on, superior scores on national mathematical competitions including Honorable Mention on the 1999 Putnam Competition, and her invaluable help in organizing and preparing students for other math competitions. The Schafer Prize was established in 1990 by the Executive Committee of the Association for Women in Mathematics and is named for AWM former president and one of its founding members, Alice T. Schafer, who has contributed a great deal to women in mathematics throughout her career. Wood will receive a substantial cash prize at the annual Joint Mathematical Society meetings in San Diego this January. Previous Duke awardees have been the winner, Jeanne Nielsen Clelland in 1991, and second prize winner Sarah Dean in 1999. For more information, see `http://www.awm-math.org/schaferprize.html`

Samuel W. Malone has been named Faculty Scholar for 2001–02. Malone is a math and economics major who plans a career in mathematical finance. He has published papers in areas of mathematics and its applications ranging from operations research to molecular biology to financial markets. This, the highest honor awarded by Duke faculty to our undergraduates, was given to four seniors who have best demonstrated significant achievement in independent scholarship. Since 1991, nine math majors have received this prestigious award.

PRUV Fellows

The PRUV Program matches undergraduates who are going into their third or fourth year with faculty mentors. Through the mentor relationship, the students plan and carry out original research projects, on which they will base their senior theses. The students currently participating in the PRUV Program, Matt Atwood '03, Thomas Finley '02, Carl Pearson '03, Tristan Tager '02, and Melanie Wood '03, discussed their summer work at seminars on October 4 and 8.

Applications for the 2002 PRUV Fellowships are being accepted. For further information, please contact Dr. David Kraines at `dkrain@duke.edu` or see `http://www.math.duke.edu/vigre/pruv`.

Faculty News

New Faculty

The following professors and research associates have joined the department this fall.

- **Peter Berman** (PhD NC State Univ.), Lecturing Fellow. *Algebra*.

- **Anda Degeratu** (PhD MIT), Assistant Research Professor. *Differential Geometry/Mathematical Physics*.

- **Christian Haase** (PhD Technical Univ. of Berlin), Assistant Research Professor. *Discrete Geometry/Polytopes/Toric Varieties*.

- **Mark Huber** (PhD Cornell), Assistant Professor. *Operations Research/Mathematical Programming*.

- **Chisup Kim** (PhD Texas A&M Univ.), Research Associate. *Numerical Analysis*.

- **Brian Rider** (PhD Courant), Research Associate. *Probability/Integrable Systems*.

- **Monica Romeo** (PhD Brown Univ.), Research Associate. *Dynamical Systems and Ergodic Theory*.

- **Talitha Washington** (PhD Univ. of Connecticut), Research Associate. *Partial Differential Equations*.

- **Ilia Zharkov** (PhD Univ. of Pennsylvania), Assistant Research Professor. *Algebraic Geometry*.

Visiting Faculty

Current visitors:

- **Karl Glasner** (PhD Univ. of Chicago), Visiting Assistant Professor. *Fluid Dynamics/Solidification/Interface Dynamics*.

- **Dino Lorenzini** (Univ. of Georgia), Visiting Associate Professor. *Arithmetic Geometry*.

- **Alexander Tovbis** (Univ. of Central Florida), Visiting Associate Professor. *Nonlinear Dynamical Systems*.

- **Arthur Vartanian** (PhD Université de Bourgogne), Visiting Assistant Professor. *Partial Differential Equations*.

Spring visitors:

- **Andy Bernoff** (Harvey Mudd Univ.), Visiting Professor. *Applied Math*.

- **Nikolai Saveliev** (Tulane), Visiting Assistant Professor. *Manifolds and Cell Complexes*.

- **Walter Strauss** (Brown Univ.), Visiting Professor. *Partial Differential Equations, Mathematical Physics*.

Promotions

Harold Layton has been promoted to Professor of Mathematics and Xiaoying Dong to Lecturer. Layton received his doctorate from Duke in mathematical physiology under the direction of Michael Reed. He enjoys reading American history and the listening to the symphonies of Anton Bruckner. Dong, the Associate Director of Undergraduate Study, received her doctorate from Rochester University. She studies mathematical finance and enjoys ballet dancing.

Joint Appointments

Arts & Sciences Professor Herbert Edelsbrunner and Earl D. McLean, Jr. Professor Pankaj Agarwal in the Computer Science Department were given secondary appointments in mathematics. Their research areas include Computational Geometry and Topology. See `http://www.cs.duke.edu/cgi-bin/csl/people-show.cgi?display=pict&choose=faculty` for more information.

Grants

Professor and Vice Provost John Harer has received a grant to work on applications of Geometry and Topology to Robotics and Structural Biology.

Professor Michael Reed has been awarded a grant of $382,508 for a 5 year study "Hyperacuity in the Auditory System."

Other News

To read about other news, honors and events concerning mathematics at Duke, visit `www.math.duke.edu/news/`. The on-line calendar at `www.math.duke.edu/cgi-bin/mcal` lists both regular and special seminars and colloquia for the upcoming weeks. The department maintains video archives of talks, lecture series and special conferences at Duke, many of which are available, on-line. See `www.math.duke.edu/computing/broadcast.html` for more information.

News From The Graduate Program

New Graduate Students

- **Melanie Bain**, Tulane University

- **John Dunavent**, Eastern Kentucky University

- **Thomas Laurent**, University of Paris

- **Michael Nicholas**, University of Utah

- **Kevin Player**, Wright State University

- **Nicholas Robbins**, Swarthmore College

- **Davin Serpa**, University of Toronto

- **Rene-Michel Shumbusho**, University Nationale du Rwandarmshum

- **Eng Siang Tan**, Denison University

Graduate Topics Courses for Spring 2002

- **Math 248** Topics in Integrable Systems and Scattering Theory (Zhou)

- **Math 263** Topics in Topology (Topological K-Theory) (Morrison)

- **Math 268** Topics in Differential Geometry (Symmetric Spaces) (Saper)

- **Math 283** Topics in Nonlinear Partial Differential Equations (Strauss)

Graduate Awards

The winners of the 2000–2001 L. P. and Barbara Smith for Excellence in Teaching are Christian Benes, Michael Kozdron, and Ted Welsh. This recognition carries with it both a permanent record engraved on the Smith Plaque in the lounge and also a substantial monetary award.

This teaching award was made possible by a generous donation from Captain L. P. Smith and Barbara Smith, who established a fund in 1981 for this purpose. Captain Smith had been Supervisor of the First-year Instruction in the Mathematics Department from 1973 until his retirement in 1982. The Smith's goal was to reward those graduate students who work hard to become teachers.

The award is presented annually to graduate students who have demonstrated a long-term commitment to teaching and whose teaching has reached a consistent level of excellence. We are grateful to the Smith's for making this recognition possible, and we congratulate Christian, Michael, and Ted on their excellent achievements in teaching.

There is a complete list of previous winners at the web site `http://www.math.duke.edu/first_year/lpsmith.html`. Our congratulations to Ted on this outstanding achievement.

—Lewis Blake

Problem Corner

New Problems

1. Find all solutions, if any, in positive integers to
$$a + b = c$$
where c is the least common multiple of a and b.

2. Let i be the square root of -1 and let n be a positive integer. Prove that the polynomial
$$f(x) = (x + i)^n - (x - i)^n$$
has only real roots. Must they all be distinct?

3. Let n be a positive integer. Define the ordered set of positive integers, S, to be *quaint* if the sum of the elements in S plus the number of elements in S is n. For example, if $n = 6$, then the quaint sets are $< 5 >$, $< 3, 1 >$, $< 2, 2 >$, $< 1, 3 >$, and $< 1, 1, 1 >$. Let $f(S)$ denote the product of the elements in S. Compute the sum of $f(S)$ as S ranges over all *quaint* sets.

Submit solutions or suggestions for new problems to Problem Editor Dave Arthur `dga2@duke.edu`

Your Editors

The Duke Math News is published several times a year and is distributed to those in the Duke mathematics community by campus mail. For previous editions and other news, see `www.math.duke.edu/news/`. We welcome items of interest for our next issue. Send them to `splayer@math.duke.edu` or `dkrain@duke.edu`

The Problem Corner editor, Dave Arthur '04, takes over from Carl Miller '01 and his challenging contributions. Dave has offered three problems this issue of varying degrees of difficulty. Give them a try! We are especially grateful to Staff Specialist Shara Player who has been able to put this edition together after only a few weeks on the job. We appreciate her professional work.

—David Kraines, DMN Faculty Sponsor