

DEPARTMENT OF MATHEMATICS

Report to the Board - Fall 1999

PERSONNEL

Six new faculty join us this fall: **David Finn** (Assistant Professor, Ph.D. Northeastern University), **Jeff Leader**, (Associate Professor, Ph.D. Brown University), **Tanya Leise** (Assistant Professor, Ph.D. Texas A&M), **Doug Limmer** (Visiting Assistant Professor, Ph.D. Oregon State University), **Jerry Muir** (Assistant Professor, Ph.D., U. of Kentucky), and Ralph **Wojtowicz** (Visiting Assistant Professor, U of Illinois).

John Kinney and **George Berzenyi** retired, both moving to Colorado. **Matt Hopkins** left to work at Sandia Labs, **Nacer Abrouk** has left to form a consulting partnership Xander International, and **Jarek Lech** left to return to his native Poland.

Yosi Shibberu has returned from his sabbatical at the Center for Molecular Design, Institute for Biomedical Computing, Washington University, St. Louis, Missouri. **Aaron Klebanoff** and **Kurt Bryan** will be on sabbatical at the Naval Academy and Rutgers University, respectively. **Robert Lopez** will be taking a special leave during the 1999-00 year, during which he expects to complete his book. **LeRoy Franklin** will be on leave during winter and spring on a Fullbright Scholarship to Iceland.

GRANTS AND CONTINUING GRANT ACTIVITIES

Allen Broughton and **John Rickert** conducted this summer's portion of the NSF-REU program. This is the eleventh year of the REU; one more summer remains on the current installment of the grant. Three draft technical reports were produced.

STUDENT ACTIVITIES, PRESENTATIONS, PUBLICATIONS and AWARDS

Reports

Jim Belk (REU 1997), *Tilings which Split at a Mirror*, MSTR 99-02.

Dawn Haney, **Lori McKeough** (REU 1997) and **Brandi Smith** (REU 1998) with **Allen Broughton**, *Divisible Tilings in the Hyperbolic Plane*, MSTR 99-04.

Talks

Matt Lepinski, *Algebraic Numbers and Triangle Iterations*, MAA Mathfest, Providence, RI.

FACULTY and STAFF ACTIVITIES

Allen Broughton worked with four students during this summer's NSF-REU program, two technical reports are expected. He supervised the completion of the technical report *Tilings which Split at a Mirror*, MSTR 99-02 by Jim Belk. In addition he completed the technical reports *Splitting Surfaces with Abelian Conformal Tiling Group*, MSTR 99-03 and (jointly with students) *Divisible Tilings in the Hyperbolic Plane* MSTR 99-04. He attended the International Symposium on Engineering Education: Global Accreditation, at KIT in Kanazawa, Japan and presented a talk *Tilings, Finite Groups, and Hyperbolic Geometry at the Rose-Hulman REU* to the math faculty. He served as chief columnist of the department's newsletter the *Rose Polygon*. He continues to serve as departmental webmaster and was also an instructor in Laptop Orientation.

Kurt Bryan has continued work with Lester Caudill at the University of Richmond, on inverse problems related to thermal imaging. He has also continued work with Michael Vogelius at Rutgers University, and is spending the 1999-2000 academic year there on sabbatical. During the late spring and summer, Dr. Bryan also refereed papers for several journals, reviewed a textbook for Addison-Wesley, another text for Springer-Verlag, and served on two master's thesis committees.

During late spring and summer of 1999, **Stephan Carlson** continued working with John Wiley and Sons, Inc., on his textbook *Topology of Surfaces, Knots, and Manifolds: A First Undergraduate Course*. Carlson attended MathFest 99, the summer meeting of the Mathematical Association of America, where he began his three-year term as the Governor of the Indiana Section of the MAA. In his service to the MAA, he continues as a member of the national Committee on Sections and was appointed to the MAA Task Force on Special Interest Groups. On campus, Carlson's work includes academic advising of senior mathematics majors, coordinating the ISU-RHIT-SMWC Mathematics Colloquium series, and serving as Consulting Editor of the Mathematics Department's new newsletter, the *RosePolyGon*.

David Finn attended the MAA Mathfest in Providence RI. He continued writing reviews for Mathematical Reviews, in addition to reviewing a new differential equations and linear algebra textbook for Addison Wesley. His paper *The behavior of positive solutions to $\Delta_g u = u^q + Su$ with prescribed singularities* was accepted by the Indiana University Mathematics Journal. He has been appointed as departmental liaison to the Indiana section of the MAA for the academic year. He will co-organize (with Gary Sherman) the 17'th Annual Undergraduate Conference in Mathematics, to be held in March.

Leroy Franklin spent a large part of the summer moving his office from ISU to Rose and completing 3 large consulting jobs: 1. Working with Eli-Lilly in teaching *Process Thinking* (a four-session workshop). 2. Working with Hormel Foods Corporate Headquarters in Austin, MN to teach several short, intensive courses on Introductory Statistics & Advanced Statistical Concepts, and working with several specific projects that needed statistical expertise. 3. Working with Pfizer, Inc. in Terre Haute in the setting up and qualifying of a new filling line and dealing with a wide assortment of statistical issues and requirements. He also worked on rewriting, resubmitting, and then to going over the page proofs of five journal articles that have been accepted over the last eight months. These articles will appear over the next eight months.

Elton Graves received the 1999 Distinguished Service Award from the Indiana Section of the MAA. Dr. Graves continues to be the State Director of the American Mathematics Competitions and Director of Fast Track Calculus. This summer Dr. Graves attended the Annual Meeting of ASEE in Charlotte

NC and was reelected to the Board of Directors of the Mathematics Division of ASEE. Professor Graves and Professor Lautzenheiser taught this summer's session of Fast Track Calculus in which 37 students were enrolled.

Professor **Ralph Grimaldi** was on campus where he taught Calculus III during the first summer session. In addition he also taught the material on discrete mathematics to the middle and secondary school teachers who were attending the two-week program on Mathematics for the 21st Century. For the Fast Forward Program Professor Grimaldi once again lectured on the role of graph theory in recreational mathematics and computer science. Lastly, he spent three days at Indiana State University at a symposium on statistics in institutional research.

Aaron Klebanoff is on a sabbatical leave in Annapolis, MD to collaborate with Professor Erik Bollt of the United States Naval Academy during the 1999-2000 academic year. Dr. Klebanoff spent the summer learning about a technique developed by Dr. Bollt for encryption with chaotic dynamics. In addition, he has been using a brand new method for locating (and controlling) all of the unstable periodic orbits (limited only by time and memory) of various chaotic attractors. Dr. Klebanoff and John Rickert were awarded the 1999 George Polya award recognizing excellence in mathematical exposition, presented annually by the Mathematical Association of America at the MathFest summer meeting, for their paper *Studying the Cantor Dust at the Edge of the Feigenbaum Diagrams*.

In addition to teaching in the Mathematics Department's Summer Fast Track Calculus Program, Professor **Roger Lautzenheiser** worked on creating a mathematics journal for undergraduate authors. The journal, called the *Rose-Hulman Institute of Technology Undergraduate Mathematics Journal*, will contain papers related to mathematics written by undergraduates from any university. There will be a formal review process, and the papers will be published electronically at the web site <http://www.rose-hulman.edu/mathjournal/>. He also attended the *International Symposium on Engineering Education: Global Accreditation*, at KIT in Kanazawa, Japan and presented a talk, *The Conjugate Gradient Method*, to the KIT math faculty. Earlier in the summer he attended a Chautauqua short course on CD-ROM and web-based publishing.

As a funded participant, **Tanya Leise** presented a poster entitled *Dynamically accelerating cracks along a bimaterial interface* at the Olga Taussky-Todd Celebration of Women in Mathematics, organized by the Association of Women in Mathematics, at the Mathematical Sciences Research Institute, Berkeley, CA. She also presented a seminar entitled *Dynamic fracture and the Dirichlet-to-Neumann map*, as part of the Research Experiences for Undergraduates at Indiana University, Bloomington, IN.

Robert Lopez will be on Special Leave for Academic Year 1999-2000, during which time he will work to complete his text *Advanced Engineering Mathematics*. He has spent the past two years writing the first eight chapters. In June, he received the ASEE Mathematics Division Distinguished Educator and Service Award.

Jerry Muir has submitted two papers for publication. The first, titled *Holomorphic Idempotents and Retracts in the Unit Ball of a Commutative C^* -algebra with Identity*, contains elements from his dissertation at the University of Kentucky and was submitted to the Journal of Mathematical Analysis and Applications. The second, co-authored with Ted Suffridge of the University of Kentucky and titled

Linear Fractional Transformations in Complex Euclidean Space, was submitted to the Michigan Math Journal.

David Rader has submitted the paper *Complexity results for facets of quadratic 0-1 knapsack polytopes* for publication in *Discrete Applied Mathematics*, and another paper, *Maximally disjoint solutions to the set covering problem*, co-authored with P.L. Hammer, was accepted for publication in the *Journal of Heuristics*. He also presented the above mentioned *Complexity results...* paper at the *Discrete Optimization '99* conference during the last week of July. He also attended a series of statistical seminars at Indiana State University during July, where he was introduced to many advanced statistical techniques. During the middle of August, he was coordinator of Jump-Start, a program for incoming freshmen who may require additional review on some topics in mathematics. Finally, in addition to continuing work on other research projects, he began work as Assistant Editor of *Rose-Hulman Institute of Technology Undergraduate Mathematics Journal*.

Professor **John Rickert** spent the summer as part of Rose-Hulman's NSF-REU team, mentoring four students working in number theory. He is aiding them in their preparation of the paper summarizing their work, *Ramanujan-like Congruences of the Distinct Partition Function*. He and Aaron Klebanoff were awarded the 1999 George Polya award recognizing excellence in mathematical exposition, presented annually by the Mathematical Association of America at the MathFest summer meeting, for their paper *Studying the Cantor Dust at the Edge of the Feigenbaum Diagrams*. He assisted Dave Rader in the Jump-Start program. He administered the Freshman Mathematics Diagnostic Exam, taken by all freshmen during orientation week. He is working with Gary Sherman to remedy the deficiencies of students who performed poorly on the diagnostic exam and is analyzing the results of this and past diagnostic exams. He served as a coach to the teams representing the state of Indiana that placed 19th in Division A and 75th in the B division at the *American Regions Mathematics League* meet. He helped organize the upcoming 34th annual *Rose-Hulman High-School Mathematics Competition*. He will be serving as a freshman advisor. He was a part of the team for freshman computer orientation.

Gary Sherman spent part of the summer refereeing papers, editing a very long technical report from the 1998 Summer REU, and reading mathematics. Professor Sherman has begun to organize the 17'th Annual Undergraduate Conference in Mathematics, to be held in March.

Yosi Shibberu Professor Shibberu returned from a 1-year sabbatical leave at the Center for Molecular Design, Institute for Biomedical Computing, Washington University, St. Louis, Missouri. He did research work in Dr. Garland Marshall's group on the protein folding problem - a fundamental problem in biochemistry with important applications in bioinformatics and rational drug design.

FACULTY AWARDS, HONOURS AND SOCIETY OFFICES CURRENTLY HELD

Steve Carlson, Governor of the Indiana Section of the MAA

Leroy Franklin, Treasurer of the Quality and Productivity section of the American Statistical Association.

Elton Graves, Distinguished Service Award, Indian Section of the MAA.

_____, Board of Directors of the Mathematics Division of ASEE and Indiana Coordinator of AHSME and AJHSME.

Ralph Grimaldi, MAA Mini-course Committee.

Aaron Klebanoff, (with John Rickert): awarded 1999 George Polya Award recognizing excellence in mathematical exposition, Mathematical Association of America for their paper *Studying the Cantor Dust at the Edge of the Feigenbaum Diagrams*.

Robert Lopez, awarded 1999 ASEE Mathematics Division Distinguished Educator and Service Award.

John Rickert, (with Aaron Klebanoff), awarded 1999 George Polya award recognizing excellence in mathematical exposition, Mathematical Association of America for their paper *Studying the Cantor Dust at the Edge of the Feigenbaum Diagrams*.

_____, Coordinator Indiana American Regions Mathematics League (ARML).

Gary Sherman, MAA Allendoerfer Committee and SIAM Visiting Lecturer Program.

PAPERS, PUBLICATIONS AND TECHNICAL REPORTS

Papers and Publications

David Finn, *The behavior of positive solutions to $\Delta_g u = u^q + Su$ with prescribed singularities* Indiana University Mathematics Journal, accepted.

Jerry Muir, *Holomorphic Idempotents and Retracts in the Unit Ball of a Commutative C^* -algebra with Identity*, Journal of Mathematical Analysis and Applications, submitted.

_____,(with Ted Suffridge of the University of Kentucky) *Linear Fractional Transformations in Complex Euclidean Space*, Michigan Math Journal, submitted.

David Rader, *Complexity results for facets of quadratic 0-1 knapsack polytopes*, Discrete Applied Mathematics, submitted.

_____,(with P.L. Hammer) *Maximally disjoint solutions to the set-covering problem*, Journal of Heuristics, accepted.

Mathematical Sciences Technical Report Series

S. Allen Broughton, *Splitting Tiled Surfaces with Abelian conformal Tiling Group*, MS TR 99-03.

_____, Dawn M. Haney, Lori T. McKeough and Brandy M. Smith *Divisible Tilings in the Hyperbolic Plane*, MS TR 99-04.

PRESENTATIONS, SEMINARS and COLLOQUIA

Off Campus

S. A. Broughton, *Tilings, Finite Groups, and Hyperbolic Geometry at the Rose-Hulman REU*. KIT, Kanazawa Japan.

Leroy Franklin, *Process Thinking* (a four sessions workshop); Eli-Lilly

_____, *Introductory Statistics & Advanced Statistical Concepts*, Hormel Foods Corporate Headquarters

Tanya Leise, *Dynamic fracture and the Dirichlet-to-Neumann map*, Research Experiences for Undergraduates at Indiana University, Bloomington, IN.

_____, *Dynamically accelerating cracks along a bimaterial interface* Olga Taussky-Todd Celebration of Women in Mathematics, Mathematical Sciences Research Institute, poster session.

Roger Lautzenheiser, *The Conjugate Gradient Method*, KIT, Kanazawa Japan.

David Rader, *Complexity results for facets of quadratic 0-1 knapsack polytopes* Discrete Optimization '99 conference, July 1999.

On Campus

Dennis Eichhorn (from U. of Illinois), *Gap Theoretic Study of Partition Functions*, presentation to faculty and REU.

PROGRAMS (more details of programs in various locations above)

Professors Elton Graves and Roger Lautzenheiser taught this summer's **Fast Track Calculus** program to 37 students. The intensive five-week course covers Calculus I, II, and II. All 37 students successfully completed and were awarded credit for Calculus I, II, and II.

The **RHIT NSF-REU**, coordinated by Allen Broughton and John Rickert, ran from June 6 through July 24, 1999. Two research groups, Tilings (SAB) and Number Theory (JHR), each had four students, producing a total of three draft technical reports.

Jumpstart, a program for incoming freshmen who may require additional review on some topics in mathematics. David Rader and John Rickert.

The **Laptop Orientation** Instructors from the Mathematics Department were: Allen Broughton, Elton Graves, Roger Lautzenheiser, David Rader, and John Rickert.