Department of Applied Mathematics
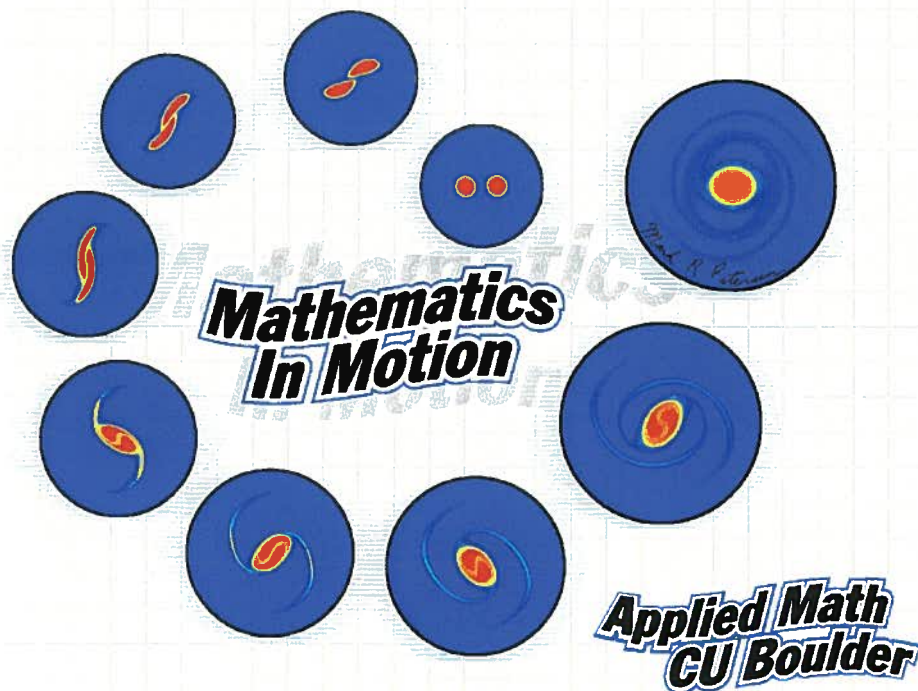
Mathematics In Motion

Applied Math CU Boulder

Annual Report
2003-2004

University of Colorado at Boulder
Boulder, CO 80309

James H. Curry, Chair
June 30, 2004

Cover Art: This year's images were produced by Applied Math graduate student, Mark Petersen.

The "Mathematics in Motion" T-shirt shows nine frames of an animation of two vortices merging. The colors show vorticity, or how fast the fluid is turning. Red is high positive vorticity and blue is zero vorticity. If two vortices of the same sign are near each other, they will rotate around each other. Close vortices, like those shown, will merge into one. This animation was produced by a computer program which represents the laws of fluid motion using differential equations. The model is used to study how real fluids, like water in the ocean, behave. In the ocean energy cascades from large scale vortices to eddies and finally to small scale turbulence. Vortices of different size and sign interact by merging, aligning, or translating. Using the computational fluid model, we can specify initial conditions and conduct experiments that would be impossible to do in the real ocean.

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OVERVIEW

The core mission of the Department of Applied Mathematics is teaching, research, and service. This core mission is carried out at several levels and involves undergraduates, graduates, postdoctoral associates and other colleagues. It involves problem solving, training and outreach. It can be summarized in the following four objectives: (i) *to teach our students well*; (ii) *to seek out and develop new, interesting applications of mathematics in other disciplines*; (iii) *to provide each student with a rich educational experience*; and (iv) *to create new mathematics*. As stated in previous annual reports, the success of the department can be judged by its success in achieving its four objectives. During the past year, the students, faculty and staff of Applied Math have addressed these core functions with admirable levels of engagement.

Last year the department successfully completed an internal and external review (called the PRP). By this internal and external (to the University) measure, APPM continues to maintain high levels of accomplishments. The prestige of the external review committee added significance to their positive assessment of the department. Other highlights from the past year include the fact that three faculty members were awarded University of Colorado-Boulder Council of Research and Creative Works Faculty Fellowships, with one faculty member also being selected to give the University's Distinguish Research Lecture during the 2004-2005 academic year, a first ever for the department. In additional to this exceptional performance, one faculty member was awarded a prestigious Sloan Foundation Award, one of only 116 in the nation. Congratulations to Assistant Professor Meredith Betterton for being awarded a Sloan.

The number of graduate students pursuing advanced degrees in the department increased, and students seeking an undergraduate minor in the department rose slightly. Another distinguished group of students are the "double majors", those students majoring in both Applied Mathematics and another discipline. This past year 22 students were self-declared double majors. This was unexpected, given the rigors of the applied mathematics major, and the College of Engineering experience more generally. However, even more surprising was the approximately 40% increase in the number of engineering students declaring Applied Mathematics as their major. The simple message of "take more math" seems to be producing results!

Both our graduate and undergraduate programs, discussed in §2A and 2B, continue to remain strong. And in the specific case of our undergraduate program, the department continues to provide students challenging projects both inside and outside of the classroom. A notable example of an outside of classroom experience is that the department fielded 4 three person student teams that participated in the International Mathematical Modeling Contest and two of the teams were awarded the highest designation: Outstanding. A second example is the Mathematical Visualization Toolkit project. That software project has now produced its first CD, attracted both applied mathematics and computer science students, and presents significant opportunities for students to get involved in longer term educational efforts within the department. A third example is the development of projects and software for calculus 2, which is part of our ongoing collaboration with Dillard University. (See §2H).

Since 1999, a department-wide NSF-sponsored VIGRE grant has supported many department functions. See §2G for more information about VIGRE. This past year the Department applied for a second large structural grant through the National Science Foundation, essentially a continuation of the VIGRE grant that has supported large numbers of students and significant parts of the teaching and research mission for the past 5 years. While the department's proposal was very favorably reviewed, the proposal was not funded. That grant would have, again, helped with the department's teaching, research, and service missions by supporting undergraduate and graduate students. It would have allowed the department to hire postdoctoral associates who would have, in turn, facilitated and participated in the teaching, research, and service missions of the department. This coming academic year a high priority for the department is to get a second VIGRE grant funded.

Finally, this past year the department saw changes in its staff. Both Laurie Conway and Catherine Larkins accepted other positions on campus. And, while they will be missed by the students and faculty in the department, we must sincerely wish them success in their new endeavors.

This has been an exciting and surprising year for the department. We believe that the University has been very well served by the students and faculty in the Department of Applied Mathematics at the University of Colorado. And while we now more fully understand what a challenge it is for any academic unit to respond to the winds that buffet it, we do look forward to the opportunities that the department must embrace to achieve its very bright future.

Jim Curry   Anne Dougherty
Chair   Associate Chair

1. ROLE AND MISSION

The objectives of the Department of Applied Mathematics at the University of Colorado at Boulder are summarized below:

a) Provide undergraduate and graduate students with a high quality education and training in applied mathematics and prepare them for careers in industry, laboratories and the academic professions;

b) Offer and monitor degree programs leading to BS, MS and PhD degrees in Applied Mathematics;

c) Nourish and maintain a professional environment in which excellence in teaching, learning, scholarship and creativity are of central importance;

d) Assure teaching and research expertise in a number of key areas of applied mathematics including the methodology of applied mathematics, computational mathematics and algorithms, industrial applications, applied probability and statistics.

2. DEPARTMENTAL ACTIVITIES

A. Undergraduate Education

Undergraduate education in the Department of Applied Mathematics provides students with broad-based preparation for the challenges and opportunities of today and tomorrow. Through courses, projects, research and other educational activities, the Department provides unique experiences to our majors and minors. The Department also has a large teaching commitment since most undergraduate engineering majors are required to take four courses in applied mathematics. The Department taught a total of 3414 undergraduate and graduate students in 2003-2004. See §6 for a detailed list of the courses taught.

We had 97 undergraduate majors in 2003-2004, an almost 40% increase over the previous year. We attribute this growth to an increasing appreciation among students for the value of applied mathematics. Fifteen students received their baccalaureate degrees this year. (See §2D for a list of our graduates.) We are proud that 34 students in the fall and 36 in the spring semester made the Dean's List for academic achievement, with grade-point averages of 3.5 or better. Our minor program continues to remain steady, attracting students from other majors with an interest in more in-depth training in applied mathematics. Forty-four students are pursuing minors in Applied Mathematics.

The student chapter of SIAM (the Society for Industrial and Applied Mathematics) is responsible for promoting interactions between applied math faculty and undergraduate majors.

It also sponsors activities and presentations that introduce undergraduates to the use of mathematics in engineering and the sciences. Events this past year included student presentations, invited speakers and the "ever-popular" mentor lunches. (For a complete list of presentations, please see §4H.) **Moorea Brega** served as Chapter President and was assisted by **Alejandro Cantarero** and **Sarah Macumber**. **Bruce Swihart** was the student representative to the Engineering Excellence Fund (EEF). The officers for the 2004-05 academic year will be **Alejandro Cantarero** (President), **Derrick Wildhaber, Brad Klingenberg, Lauren Anderson,** and **Sarah Macumber**. Anne Dougherty was the faculty advisor for 2003-04 and will continue in that capacity next year.

The art of creating and testing mathematical models of real-world problems is an important part of undergraduate training. Undergraduate students are given an opportunity to showcase their mathematical, computational and communication skills in the annual Mathematical Contest in Modeling, (MCM) an international contest sponsored by COMAP (The Consortium for Mathematics and its Applications). Students from all science, math and engineering majors are encouraged to enter. In 2004, the Applied Math Department entered four teams. The contest ran from 6:00 pm February 5, 2004 until 6:00 pm February 9, 2004 and drew entries from 742 teams from around the world. Over the past four years, the Applied Math teams have done very well, receiving an Outstanding designation three times. This year our teams outdid themselves, with two teams achieving an Outstanding, the highest possible designation. This designation was received by only 7 of the 742 teams! Our students' continued success in the modeling contest is a tribute to their abilities and CU's strong academic programs.

Twelve students from CU participated in the modeling contest. The MCM paper submitted by the team consisting of **Brian Camley** (Math and Physics double major), **Pascal Getreuer** (APPM major), and **Brad Klingenberg** (APPM major) was Outstanding on Problem A. In addition, they were selected as the MAA winner and invited to present their results at the national MAA meeting during the summer. Problem A involved developing and analyzing a model that assessed the probability that fingerprints are unique. The paper submitted by the team consisting of **Moorea Brega** (APPM major, physics minor), **Alejandro Cantarero** (triple major APPM, CSEN, ECEN) and **Corry Lee** (double major APPM and EPEN) was designated as one of the Outstanding Papers for Problem B. It was also the SIAM winner. All three team members presented their results at the SIAM summer meeting. In problem B, teams proposed and tested "Quickpass" systems for the popular rides at an amusement park. Both Outstanding papers will be published in the fall 2004 issue of the UMAP Journal. Congratulations are also due to:

> **Arian Lalezari** (APPM and ECE), **Sarah Macumber** (APPM and CS), and **Matt Martin** (APPM and ECEN) who received an Honorable Mention on Problem B.
>
> **Ian Derrington** (APPM and EPEN), **Donovan Levinson** (APPM) and **Karl Obermeyer** (APPM) who also received an Honorable mention on Problem B.

The VIGRE grant, from the National Science Foundation, has fundamentally changed the character of our undergraduate major. This past year, 15 of our more advanced undergraduates have participated in "tetrahedra", consisting of undergrads, grads, postdocs and faculty working together on a common research theme. See §2G for more information about VIGRE.

This year's class of graduating seniors was outstanding! **Corry Lee** graduated "with high distinction" (cumulative GPA must be at least 3.90) and **Bruce Swihart** graduated "with distinction" (cumulative GPA at least 3.75). **Moorea Brega** was selected as the Department's Outstanding Senior for Academic Excellence & Outstanding Achievement in Service. She will continue towards the BS/MS degree. Both Moorea and Corry received Henri-James Awards, a cash award given to outstanding Applied Math graduating seniors who are continuing on to graduate school. Further, Corry Lee was selected by the Colorado Engineering Council to receive its Silver Medal. The Colorado Engineering Council selects one graduate from each engineering school to be so honored. Corry will continue her graduate studies in Physics at Harvard University.

The members of the Undergraduate Committee were Anne Dougherty, chair, Bengt Fornberg, Steve McCormick, and Phillipe Naveau (fall 2003). The duties of this committee are to advise and recruit undergraduates to the major and the minor, and to supervise all aspects of the undergraduate curriculum. Special thanks to the undergraduate committee and especially Anne Dougherty for her successful efforts in working with undergraduate students.

B. Graduate Education

The role of the graduate program is to give students in-depth training in applied mathematics and to provide the skills necessary for success in industry, government laboratories, or academia. Different departments around the country use different definitions of "applied mathematics". In this department, the areas of mathematical expertise are: scientific computation, physical applied mathematics, dynamical systems, analysis, statistics/probability, and mathematical biology. In addition, the department maintains an active program of Affiliated Faculty. These are faculty members in other departments with an interest in applying mathematics within their own disciplines. (Currently, there are 41 Affiliated Faculty, see §3B.) A graduate student in APPM can pursue a doctorate in Applied Mathematics with an Affiliated Faculty member as the thesis advisor, along with an APPM co-advisor. In fact, 9 APPM graduate students are currently working under the supervision of Affiliated Faculty. A basic goal of this department is to seek out and develop new areas of application of mathematics, and our Affiliated Faculty members play a crucial role in that process.

The Graduate Committee for 2003-2004 consisted of Mark Ablowitz, Gregory Belykin, Jem Corcoran, and Tom Manteuffel (Chair). The main business of the committee is to advise the current

graduate students, recruit and admit students to the graduate program, and administer the preliminary exams. Special thanks to the graduate committee and especially Tom Manteuffel for his successful efforts in working with graduate students.

Some of the demographics of the graduate program in the Applied Math Department:

- In 2003-2004, the department had 75 graduate students.
- The entering class in fall 2003 had 21 new students. In spring 2004, we welcomed 2 new graduate students to our program.
- We continue to attract a large fraction of U.S. citizens: in 2003-2004, 88% of the incoming students with financial support were U.S. citizens.
- 16 of our graduate students are women.
- Our graduate program had 8 under-represented minority students in 2003-2004. Of these 8, 1 received a MS degree.
- 5 students completed their PhDs in 2003-2004. 11 students received MS degrees, with 5 continuing towards the PhD at CU. See §2D for a list of this year's graduates.
- Funding: Slightly less than half of our graduate students (32) were Teaching Assistants (TAs) in the fall semester (includes both full time and part time TAs). The teaching load was the same in the spring semester, when 33 served as TAs.

The department offers three formal interdisciplinary programs, all at the MS level.

1. *A Combined MA/MS with the Molecular, Cellular, and Developmental Biology Department (MCDB).* The combined MA/MS is a three-year interdisciplinary program designed to produce students trained both in applied mathematics and in molecular biology. A student who completes this program can begin a career in the biological sciences with a very desirable combination of skills, or can continue on to a PhD either in APPM or in MCDB.

2. *An MS with a Computational Science and Engineering Track.* This track is designed for a student in a participating department in science or engineering, with a strong interest in scientific computation and mathematical analysis. Under this plan, the student obtains an MS in APPM on the way to a PhD in the other department. Six other departments now participate in this program.

3. *Teacher-Licensure Option.* An APPM graduate student can fulfill the outside-sequence requirement in the School of Education. By also meeting the requirements of that School, a student can obtain both an MS in applied mathematics and a license to teach mathematics in a secondary school (i.e., in middle through high school).

More information about the graduate program is available at
<http://amath.colorado.edu/programs/grad.html>

C. Enrollment Statistics

Enrollment in the courses offered by the Department continues at extremely high levels. It is particularly noteworthy, given the faculty's small size, that the Department teaches so many students. The statistics over the past thirteen years are as follows:

Year	Total Enrollment in courses	Number of Graduate Students	Number of Undergraduate Majors	Number of Undergraduate Minors
1991-92	2781	27	50	
1992-93	2797	28	47	
1993-94	2809	33	47	
1994-95	2670	39	51	
1995-96	2734	40	54	
1996-97	2973	46	52	
1997-98	3108/**3323***	51	44	
1998-99	3172/**3566***	49	54	
1999-00	3166/**3529***	50	60	21
2000-01	3091/**3517***	61	63	28
2001-02	3275/**3701***	63	66	40
2002-03	3417/**3878***	70**	69**	44**
2003-04	3414/**3978***	75**	97**	44**

*The totals in bold include all Calculus I & II Work Study Groups, as well as Calculus III Labs & Differential Equations Labs. Enrollment in our upper division courses has continued to increase. With projected increases in undergraduate enrollment we continue to foresee enrollment increases in applied mathematics courses.

**Number of unduplicated students.

APPM Upper division Student Credit hours

11

APPM Grad Student Credit Hours
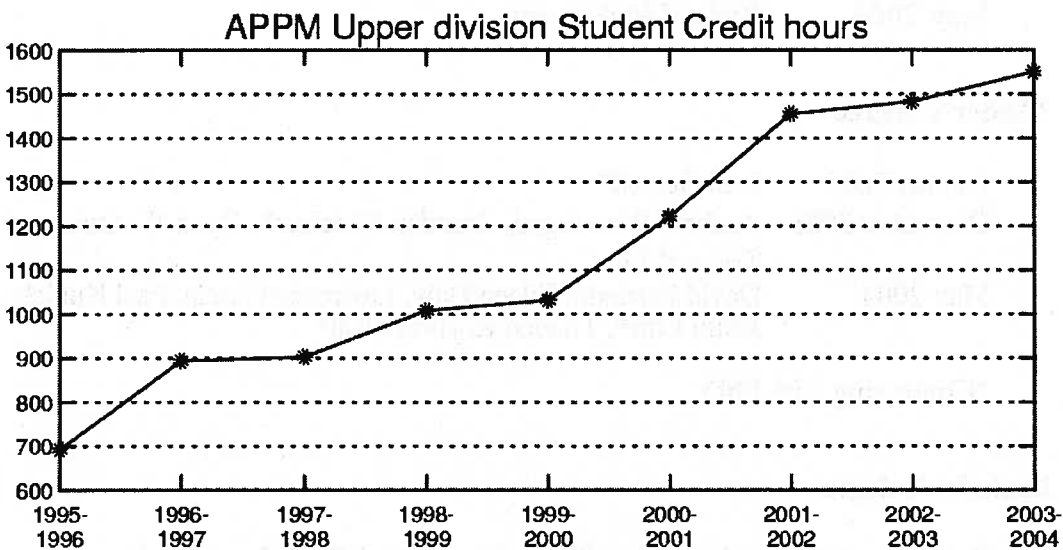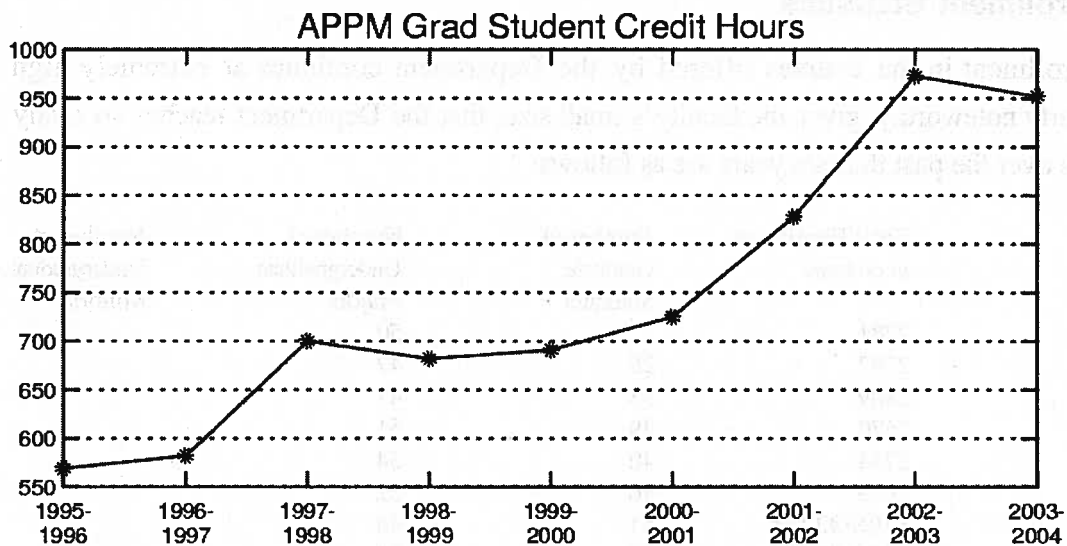
D. Graduates:

We congratulate our students who graduated this past year with a degree in Applied Mathematics. They are:

PhD degree (See §7D for thesis titles and advisors)

August 2003	Luke Olson, Kristian Sandberg, Ulrike Schneider
December 2003	Allison Baker
May 2004	Richard McNamara

Master's degree

August 2003	Neil Burrell*
December 2003	Andrew Braeutigan, Brendan Sheehan*, Ryan Watkins, Tracy White
May 2004	David Brannon, Eileen Daly, Lawrence Garcia, Paul Kunicki, JiSun Lim*, Thaned Rojsiraphisal*

*Continuing with PhD

Bachelor's degree

December 2003	Alicia Allen, Trang Ngo, Ishani Roy, Jason Underwood, Henry Yau

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May 2004   Benjamin Abell, Vanessa Brady, Chi Hoon Kim, Corry Lee, Kevin A. Martin, Hilary Snyder, Jarod Smilkstein, Jennifer Stephan, Bruce Swihart, Aaron Windfield

E. Faculty Awards and Honors

Mark Ablowitz: Named as one of the most highly cited people in the field of Mathematics by the ISI Web of Science, 2003.

Meredith Betterton: was selected as an Alfred P. Sloan Fellow. "The Sloan Research Fellowship is an extremely competitive award, involving nominations for most of the very best scientists around the country. In addition to providing a significant research grant, the award implicitly acknowledges the esteem in which Prof. Betterton's past and potential work are held by other scientists." -- from the Sloan Foundation award letter.
Awarded a Committee on Research and Creative Work Junior Faculty Development Award (CRCW-JFDA).
Selected as one of two University of Colorado nominees for Packard Fellowship.

Jem Corcoran: Received the Subaru Educator Spotlight Award, an award recognizing faculty for outstanding achievements in education, research, and service.

James Curry: Serves as the J.R. Woodhull/Logicon Teaching Professor in Applied Mathematics.
Awarded (along with Anne Dougherty) the International Conference on Technology in Collegiate Mathematics (ICTCM) Award for Excellence and Innovation with the Use of Technology in Collegiate Mathematics for the Mathematics Visualization Tool Kit (MVT). MVT is a JAVA based software tool whose development has been supported by Sun Microsystems for several years. MVT is used extensively in Applied Mathematics.

Anne Dougherty: 2003 ICTCM (International Conference on Technology in Collegiate Mathematics) Award for Excellence and Innovation with the use of technology in collegiate mathematics. Awarded for Applied Math's creation of the Mathematical Visualization Toolkit: Java-based technologies for teaching excellence in calculus (http://amath.colorado.edu/java/mvt).

Keith Julien: Awarded a Council on Research and Creative Work (CRCW) Faculty Fellowship.
Received (in collaboration with Dr. Dan Connors ECE) the Hewlett Packard Educational Gift Award.
Engineering Excellence Fund (EEF) grant.

Jeff Luftig: Recipient of the 2004 Proctor and Gamble Teaching Excellence Award, determined by a vote of all graduating seniors from the Leeds School of Business.

Tom Manteuffel: Received a highly competitive 2003 IBM Faculty Award recognizing the quality of his program and its importance to the industry – Biomechanical Modelling.
Appointed to the DOE Advanced Scientific Computing Research (ASCR) Advisory Committee.

Steve McCormick: Awarded a Council on Research and Creative Work (CRCW) Fellowship.
SIAM Computational Science and Engineering Award Committee.

Mary Nelson: Appointed to the Defense Advisory Committee on Women in the Services (DACOWITS) for a three year term.

Harvey Segur: Selected to give the Distinguished Research Lectureship for the 2004-2005 academic year from the Council on Research and Creative Work. The CRCW Lectureship acknowledges outstanding contributions "to your field, to the international scholarly community, and to the University of Colorado, as well as to the students and faculty of the University."

F. Research

During the 2003-2004 academic year the department completed an internal and external review (called the PRP). The PRP review focused on the department's research and teaching, but especially on its research and training of students. And by the internal and external committees' measures, APPM continues to maintain high levels of accomplishments. The prestige of the external review committee, both members of the National Academy of Sciences, added significance to their positive assessment of the department.

Three faculty members were awarded University of Colorado-Boulder Council of Research and Creative Works Faculty Fellowships (Keith Julien, Steven McCormick, and Harvey Segur) and Harvey Segur was also selected to give the University's Distinguish Research Lecture during the 2004-2005 academic year, a first ever for the department. In addition to this exceptional performance, one faculty member, Meredith Betterton, was awarded a prestigious Sloan Foundation Award, one of only 116 in the nation, and designated a Sloan Foundation Fellow. Meredith is both enhancing and shaping the department's vision of mathematical biology. Congratulations to Meredith for an outstanding past year.

Research interests in the department currently include scientific computation and especially "fast algorithms", physical applied mathematics, dynamical systems, analysis, probability and statistics, and mathematical biology. While advancing all these research areas, we are actively developing statistics and mathematical biology in the department.

The faculty published 43 journal articles or book chapters, gave 45 presentations, were principle or co-principle investigators on 42 grants and had another 13 grant proposals pending, and more than 90 scholarly works in progress. The faculty in the department have also done a significant share of service, both on and off campus. The faculty record over the past year has been collectively truly outstanding.

In spite of the instabilities in federal funding for academic research and training, the faculty are still receiving "their share of federal grants." The grant mix has been supplemented with funds from research and training in mathematical biology while our normal research programs in physical applied mathematics and computations are maintaining their traditional levels of success. We also note that the increased attention of granting agencies in K-12 education provided new funding and training opportunities and is leading the department in the direction of more student assessment of student learning and educational outcomes.

The environment in the department continues to be enhanced by visitors who provided, in some cases, seminars and colloquia. In addition to the Applied Mathematics Colloquium Series, run by Congming Li, the department regularly runs seminar sessions in applied mathematics, dynamics, probability/statistics, computational mathematics and a reading group in mathematical biology. These forums allow for students and external speakers to interact. External speakers are vital to keeping open lines of creative communication and to promoting national and international recognition for the department. §4 includes a listing of all colloquia and seminars for 2003-2004.

Editorships

An important aspect of the faculty's role in the national and international scholarly effort in applied mathematics is service as editors and advisory board members of archival journals and textbook series. During 2003-2004, the faculty in the department served in such capacities on 12 journals/periodicals, which include:

Applied and Computational Harmonic Analysis (Beylkin)
Cambridge University Press Texts in Applied Mathematics (Ablowitz)
Communication on Pure and Applied Analysis (Li)
Electronic Transactions in Numerical Analysis (Manteuffel)
Journal of Engineering Mathematics (Ablowitz)
Journal of Numerical Linear Algebra and Applications (Manteuffel)
Mathematical Association of America Monthly Journal (Curry)
Proceedings of the American Mathematical Society (Ablowitz)
SIAM Journal of Applied Dynamical Systems (Meiss)
SIAM Journal of Numerical Analysis (Manteuffel)
SIAM Journal Multiscale Modeling and Simulation (McCormick)
Studies in Applied Mathematics (Ablowitz)

Copper Mountain Conference - 2004

Tom Manteuffel and Steve McCormick organize the Copper Mountain Conference in the spring of each year. This year the conference was on Iterative Methods and was held during March 28-April 2. There were 185 participants and 131 lectures. A special feature of this conference is the support of students, which usually amounts to free lodging and registration, and travel assistance in some cases. This year 51 students attended the conference. Student participation has made the Copper Mountain conferences a central contributor to the fields of multigrid and iterative methods.

G. Department-wide Grants

VIGRE

Postdoctoral Fellows	Graduate Students	Undergraduates
Jeffrey Heys	Cory Ahrens	Ben Abell
Jamison Moeser	Deborah Batista	Lauren Anderson
Suzanne Nezzar	Marybeth Bleymaier	Brandon Booth
Michael Sprague	James Brannick	Moorea Brega
	Neil Burrell	Alejandro Cantarero
	Erin Byrne	Ian Derrington
	Matt Carroll	Rachel Danson
	Dan Cooley	Michael Franklin
	Terry Haut	Pascal Getreuer
	Mark Hoefer	Brad Klingenberg
	Paul Mullowney	Ashley Moore
	Matthew Nabity	Karl Obermeyer
	Josh Nolting	Kris Tucker
	Mark Petersen	Laura Waterbury
	Geoffrey Sanders	Mark Winter
	Brendan Sheehan	
	Srinath Vadlamani	
	Chad Westphal	
	Derin Wysham	
	Julia Zuev	

In 1998, the department was awarded a major grant by the National Science Foundation for vertical integration of research and education (VIGRE), totaling $2.3 million over a five-year period, beginning in the summer of 1999. The VIGRE program originally supported four *tetrahedral* research groups consisting of faculty, postdoctoral fellows, and graduate and undergraduate students in the areas of dynamical systems, multilevel computation, nonlinear waves, and fast algorithms. Similar groups with the tetrahedral structure are beginning to develop in statistics, analysis and mathematical biology. VIGRE has had a remarkable multiplier effect throughout the department, changing, for example, seminar structures from formal lectures to sessions during which undergraduate and graduate students, postdoctoral researchers, and faculty interact and discuss their research in both formal and informal ways. With the advent of VIGRE, new research seminars have formed and several grants in the department and the university owe their structure and success to the program.

Of course the strength of our program lies in the people, their hard work and their enthusiasm. In the past year the VIGRE grant supported four Postdoctoral Fellows, twenty graduate students, and fifteen undergraduates, listed here.

A number of people supported by VIGRE are moving on to better things next year. Among the post-docs, Jeff Heys has accepted a tenure-track position at Arizona State University in Tempe, Arizona. Two of our VIGRE-supported graduate students will go on to postdoctoral positions elsewhere: Neil Burrell at UNC-Chapel Hill and Chad Westphal at Wabash College.

The VIGRE program has been extended for a sixth year to end in May of 2005, and the Department is competing for a new grant in the NSF-EMSW21 program.

More information about the impact of VIGRE on the Applied Mathematics Department can be found at <http://amath.colorado.edu/vigre>.

H. Outreach

Outreach activities help to share the knowledge and enthusiasm of a department with others. The outreach efforts of the Department are an extension of its mission to provide education and training in applied mathematics. These efforts are focused in several areas: (1) professional development for secondary math teachers; (2) mathematical encouragement and enrichment for high school students; and (3) continuation and expansion of our collaboration with Dillard University.

The summer of 2004 marks the fifth summer in which the Department of Applied Mathematics offered content-based, professional development workshops for secondary mathematics teachers. These workshops are designed to offer a balance between in-depth review and technology-based activities that participants can take back to their classrooms. Three workshops were offered, one each in calculus, discrete mathematics, and probability/statistics. A fourth class on algebra is offered in conjunction with the School of Education on an every-other-year basis. It will be offered again in summer 2005. Twenty-two teachers completed the workshops this year. Several of these teachers have taken past workshops. We believe that this indicates strong support for the program from Colorado's secondary math teachers. The workshops are supported with major funding from a supplement to the department's VIGRE grant (see §2G). Additional funding comes from the CU-Boulder Outreach Committee.

In addition to the summer workshops, the Department is continuing its partnership with Boulder Valley School District (BVSD), which began in spring 2002. Seminars specifically designed for BVSD teachers are offered during the academic year. A seminar in discrete math was given in fall, 2003, and probability was offered in spring 2004.

Applied Mathematics also participates in a number of programs targeted towards high school students. The purpose of these programs is to encourage students to continue their study of mathematics. Each of the following programs was designed to give students some understanding of, and appreciation for, a specific mathematical application:

- Engineering Open House, October 23, 2003. Presenters were Michael Watson and Anne Dougherty.
- Women in Engineering Career Day programs for high school girls, March 6, 2004.
- High School Honors Institute; July 28 through July 30, 2003. Presenters were Bengt Fornberg, Moorea Brega, and Debbie Batista.

In 2002, the University of Colorado/Boulder and Dillard University (an historically black university in New Orleans) established a formal partnership, funded by the Carnegie Foundation. The PI on the Boulder campus is Associate Vice Chancellor Bobby Schnabel. The goal of this project is to develop and utilize a model that will improve collaboration between diverse, dissimilar institutions. This involves developing technologically-based, shared curriculum materials in calculus, literature and humanities. In Applied Math, these materials have taken the form of web-based, Java applets and labs that help students understand some of the more difficult concepts in Calculus 2. The materials are developed by students at CU Boulder under the supervision of Anne Doughtery and Jim Curry and by programmers at Dillard, working with Dillard professors Peter Frempong-Miraku and Hong Dai. These materials are then used in calculus classrooms at both universities. An extension of this project occurred during summer 2004, when Dillard student LaTosha Shephard spent the summer on the CU Boulder campus to continue work on these shared applets and CU students, Sarah Macumber and Jay Jones, spent a few days on the Dillard campus.

I. Changes in Personnel

This past year has seen significant changes in office staffing in the department. The office manager, Catherine Larkins, took a position in the Vice President's office and Laurie Conway, Student Coordinator moved to the Program in Atmospheric and Oceanic Sciences. They were replaced by Delvena Crist (Dena) and Karen Hawley respectively. Delvena comes to Applied Math from the History Department and Karen just completed her 10th year at the University, primarily in Germanic and Slavic Languages and Literature.

In August 2004 Jennifer Qualteri joined the department and filled the Accounting Tech/ Faculty Coordination role. We are very pleased that Jan Kaufman continues to provide continuity and perspective in the department. We are fortunate to have Jan.

As the VIGRE grant winds down we have seen the departure of VIGRE postdoctoral Associate Dr. Jeff Heys who accepted the position of Assistant Professor of Chemical Engineering at Arizona State University. We anticipate that VIGRE postdoctoral associate Suzanne Nezzer, working with Bengt Fornberg, will depart with the start of the spring semester, 2005.

3. FACULTY, RESEARCH ASSOCIATES, INSTRUCTORS, VISITORS, and STAFF

A. Core Faculty and Research Associates

Mark J. Ablowitz, Professor; PhD, Massachusetts Institute of Technology. Partial Differential Equations, Solitons, Nonlinear Waves.

Jerrold Bebernes, Professor Emeritus; PhD, University of Nebraska. Differential Equations, Reaction Diffusion Systems, Combustion Theory, Analysis.

Meredith Betterton, Assistant Professor; PhD, Harvard University. Mathematical Biology, Geophysical Modeling, Physical Mathematics.

Gregory Beylkin, Professor; PhD, New York University. Computational Methods, Wavelets, Geophysical Inverse Scattering.

Cathy Bishop, Instructor (Summer 2004); M.S., University of Colorado, Computer Science, Software Development and Training.

Marian Brezina, Postdoctoral Research Associate; PhD, University of Colorado at Denver. Multigrid Methods, Scalable Algorithms, Parallel Computing.

Vani Cheruvu, Postdoctoral Research Associate/Lecturer; PhD, I.I.T. Madras, India. Wavelets, Fast Numerical Algorithms.

Jem Corcoran, Assistant Professor; PhD, Colorado State University. Applied Stochastic Processes, Perfect Simulation, Statistical Physics.

Robert Cramer, Postdoctoral Research Associate; PhD, University of Colorado at Boulder. Numerical Analysis, Wavelets, Potential Theory

James H. Curry, Chair, Professor; PhD, University of California at Berkeley. Dynamical Systems, Numerical Methods, Nonlinear Equations.

Hans De Sterck, Postdoctoral Research Associate; PhD, K.U. Leuven, Belgium. Numerical Analysis, Plasma Astrophysics.

Anne Dougherty, Associate Chair & Senior Instructor; PhD; University of Wisconsin, Madison. Applied Probability, Stochastic Processes.

Joshua Downer, Professional Research Associate/Lecturer: M.Sc., University of Auckland. Biomathematics, Granular Dynamics.

Robert Easton, Professor Emeritus; PhD, University of Wisconsin. Dynamical Systems, Hamiltonian Mechanics.

Bengt Fornberg, Professor; PhD, Uppsala University, Sweden. Numerical Analysis, Computations of Wave Phenomena.

Jeffrey J. Heys, Postdoctoral Research Associate/Lecturer; PhD, University of Colorado at Boulder. Biomechanics, FOSLS, Modeling Elastohydrodynamics.

Boaz Ilan, Postdoctoral Research Associate/Lecturer; PhD, Tel Aviv University, Tel Aviv, Israel; Applied Mathematics, Nonlinear Optics, Nonlinear Waves.

Keith Julien, Associate Professor; PhD, Cambridge University, U.K. Mathematical and Computational Fluid Dynamics, Dynamical Systems Theory.

Judith Koslov, Lecturer; PhD, University of Colorado at Boulder, Time Series.

Congming Li, Associate Professor; PhD, New York University. Elliptic Partial Differential Equations.

Jeffrey T. Luftig, Senior Instructor, Leeds School of Business and Dept. of Applied Mathematics Adjunct Professor; PhD, University of Minnesota, Minneapolis/St. Paul. Applied Statistics, Business and Industrial Research, Statistical Methods in the Quality Sciences, Data Mining.

Thomas Manteuffel, Professor; PhD, University of Illinois, Urbana. Computational Math, Numerical Linear Algebra, Iterative Mathematics, Numerical Solution of PDE's, Parallel Computation, Computational Fluid Dynamics.

Stephen McCormick, Professor; PhD, University of Southern California. Computational Math, Numerical Partial Differential Equations, Multigrid Methods, Parallel Computation, Computational Fluids, Tomography, Electromagnetics. Biomathematics.

James D. Meiss, Professor; PhD, University of California at Berkeley. Dynamical Systems, Hamiltonian Mechanics, Plasma Physics.

C. G. Mendez, Lecturer; PhD, University of Colorado at Boulder. Real Variables, Probability and Statistics (Measure Theory), Financial Mathematics. Member, Board of Governors, Mathematical Association of America.

Jamison Moeser, Postdoctoral Research Associate/Lecturer; PhD, Brown University. Partial Differential Equations and Applications to Optical Communications.

Lucas Monzón, Postdoctoral Research Associate/Lecturer; PhD, Yale University. Harmonic Analysis, Wavelets.

Philippe Naveau, Assistant Professor; PhD, Colorado State University. Applied Probability and Statistics.

Mary Nelson, Lecturer; M.S., George Mason University.

Suzanne Nezzar, Postdoctoral Research Associate; PhD, University of California, Los Angeles. Image Processing, Radial Basis Functions.

J. Adam Norris, Instructor; PhD, University of Colorado, Boulder. Phase Change Kinetics, Perturbation Methods, Numerical Methods.

Fernando Perez, Postdoctoral Research Associate; PhD, University of Colorado at Boulder. Numerical field theory, Fast Numerical Algorithms.

Alexander Robertson, Lecturer; PhD, Colorado State University. Combinatorial Optimization, Heuristic Methods.

Michael Rother, Lecturer, Postdoctoral Research Associate in Chemical and Biological Engineering; PhD, University of Colorado. Transport Phenomena (Fluid Mechanics, Heat and Mass Transfer).

John Ruge, Postdoctoral Research Associate; PhD, Colorado State University. Algebraic Multigrid Methods.

Kristian Sandberg, Postdoctoral Research Associate; Ph.D., Dept. of Applied Math., CU at Boulder. Wave propagation, tomography, image processing.

Harvey Segur, Professor; PhD, University of California at Berkeley. Nonlinear Waves, Fluid Dynamics, Asymptotic Methods.

Michael Sprague, Postdoctoral Research Associate, Lecturer; PhD, University of Colorado at Boulder. Numerical Methods, Geophysical Fluid Dynamics, Fluid-Structure Interaction.

Lydia Trailovic, Lecturer; University of Colorado at Boulder.

John Williamson, Professor Emeritus; PhD, University of Minnesota. Statistical Methods in Genetics, Applied Probability, Mathematical Statistics.

B. Affiliated Faculty--Graduate Department

Steve C. Arendt (Colorado Research Associates), Theoretical Fluid Dynamics.

Mark Balas (Aerospace Engineering, Electrical Engineering), Control of large-scale and distributed parameter systems, system identification and adaptive control, Nonlinear PDE's, Numerical Methods for model reduction, controller synthesis and stability analysis.

Elizabeth Bradley (Computer Science), Scientific Computation, Artificial Intelligence, Nonlinear Dynamics.

Richard Byrd (Computer Science), Numerical Computation, Optimization Algorithms.

Xiao-Chuan Cai, (Computer Science), Numerical and Parallel Computations.

John Cary (Physics), Nonlinear Dynamics, Plasma Physics, Accelerator and Space Physics.

Claudio Cioffi-Revilla, (Political Science), Long-Range Analysis of War.

Senarath deAlwis (Physics), Theoretical Physics, String Theory, Quantum Gravity.

Thomas DeGrand (Physics), Numerical Methods for Quantum Field Theory.

Fred Glover (Graduate School of Business), Large-scale Systems, Applied Artificial Intelligence, Optimization Models.

Martin Goldman (Physics), Plasma Physics, Nonlinear Waves, Turbulence.

Vijay Gupta (Geological Sciences; CIRES), Hydrology, Stochastic Processes, Fluid Dynamics.

Ute Christina Herzfeld (INSTAAR, Geomathematics), Geostatistical Analysis of Remote Sensing Data, Applications in Glaciology, Marine Geophysics and Global Change Research.

Christine M. Hrenya (Chemical Engineering), Gas-Particle Fluidization, Granular Flow Mechanics, Turbulent Flows, Computational Fluid Mechanics.

Tissa Illangasekare (Environmental Science and Engineering Division, Colorado School of Mines), Mathematical Modeling of Flow and Transport in Porous and Fractured Media, Computational Methods, Numerical Modeling.

Elizabeth Jessup (Computer Science), Numerical Computation, Parallel Computation.

David Kassoy (Mechanical Engineering), Fluid Dynamics, Combustion Theory, Thermal Science.

Manual Laguna (College of Business), Exact and Heuristic Methods for Combinatorial Optimization Problems, Network Flow Programming, Applied Artificial Intelligence.

Michael Lightner (Electrical Engineering), VLSI, Discrete Mathematics, Graph Theory.

Oliver McBryan (Computer Science), Parallel Computation, Graphics and Visualization, Computational Fluid Dynamics.

Andrew Moore (Atmospheric and Oceanic Sciences; CIRES), Ocean-Atmosphere Modeling.

Douglas Nychka (National Center for Atmospheric Research), Geophysical Statistics.

Lev Ostrovsky (CIRES/NOAA Environmental Technology Laboratory), Nonlinear Waves, Fluid Dynamics, Oceanography, Acoustics.

K.C. Park (Aerospace Engineering) Parallel computation, Structural vibrations.

Scott Parker (Physics), Plasma Physics.

Carl Patton (Physics, Colorado State University), Solid State Physics.

Harihar Rajaram (Civil, Environmental and Architectural Engineering), Fluid Flow, Transport Phenomena and Reactive Processes in Geologic/Geochemical Phenomena.

Barbara Robles (Economics), Econometrics and Monetary Theory and Policy.

Thomas F. Rutherford (Economics), Formulation and Analysis of Large-Scale Economic Equilibrium Models.

Robert Sani (Chemical Engineering), Computational Fluid Dynamics, Free and Moving Boundary Problems, Stability of Systems.

Robert Schnabel (Computer Science – Associate Vice Chancellor for Academic and Campus Technology), Numerical Methods for Optimization, Nonlinear Equations, Parallel Scientific Computation.

J. Michael Shull (Astrophysical and Planetary Sciences), Theoretical Astrophysics.

Rex Skodj (Chemistry and Biochemistry; Joint Institute for Laboratory Astrophysics), Nonlinear Dynamics, Quantum Chaos, Molecular Dynamics.

Renjeng Su (Electrical Engineering), Nonlinear Dynamics Modeling, Control, Robotics.

Juri Toomre (Astrophysical and Planetary Sciences; Joint Institute for Laboratory Astrophysics), Astrophysics, Mathematical Modeling, Numerical Simulation.

Oleg Vasilyev (Mechanical Engineering), Computational Fluid Mechanics, Large Eddy Simulations of Turbulent Flow, Wavelet Methods for Modeling and Simulation of Complex Multi-Scale Phenomena, Thermal Convection Flows.

Thomas Warner (Atmospheric and Oceanic Sciences) Numerical modeling of mesoscal atmospheric phenomena; Marine meteorology.

Patrick Weidman (Mechanical Engineering), Hydrodynamic stability, solitary waves and their interaction, counter-rotating vortex rings, Stokes flow on dendrite models, similarity flows in natural convection, fluid sloshing in freely suspended containers.

Jeffrey B. Weiss (Astrophysical and Planetary Sciences; Atmospheric and Oceanic Sciences), Geophysical Fluid Mechanics, Turbulence, and Climate predictability.

Joseph Werne (Colorado Research Associates), Fluid dynamics.

Ellen Zweibel (Astrophysical and Planetary Sciences), Plasma Physics, Astrophysics.

C. Visitors, 2003-2004

Allard, Denis, Institut National de la Recherche Agronomique, Avignon France, June 1 – 8, 2004.

Andersson, Fredrik, Lund University, Sweden, October 13, 2003 – January 9, 2004.

Astumian, Dean, University of Maine, November 24, 2003.

Bakirtas, Ilkay, Istanbul Technical University, March 12 – September 12, 2004.

Biondini, Gino, Ohio State University, August 18 - 28, 2003 and January 16 - 22, 2004.

Buckmaster, John, University of Illinois, December 5, 2003.

Chen, Z., San Francisco State University, February 12 - 15, 2004.

Clarkson, Peter, University of Kent, Canterbury, UK, January 11 - 17, 2004, April 17 – 24, 2004.

DeLillo, Silvana, Universita de Perugia, October 25 - November 15, 2003.

de Pillis, Lisette, Harvey Mudd College, Claremont, CA, October 16 -17, 2003.

Docherty, Andrew, University of New South Wales, Sydney, Australia, April 4, 2003 – March 22, 2004.

Elcrat, Alan, Wichita State University, January 19 - June 30, 2004.

Grinevich, Piotr, Landau Institute for Theoretical Physics, Moscow, Russia, April 27-28, 2004.

Gui, Changfeng, University of Connecticut, February 25 - 29, 2004.

Hawkins, Stewart, University of Liverpool, April 5-6, 2004.

Herbst, Ben, University of Stellenbosch, South Africa, June 10 - July 19, 2004.

Hou, Thomas, California Institute of Technology, March 18 - 20, 2004.

Jomelli, Vincent, Centre National De La Recherche Scientifique, Bellevue, France, December 5 - 12, 2003.

Kerns, Gary (Jay), Bowling Green State University, March 17 - 19, 2004.

Kim, Sang Dong, Kyungpook National University, South Korea, August 17 - 31, 2003.

Knobloch, Edgar, University of Leeds, UK, April 6 – 9, 2004, June 21 – 25, 2004.

Kollar, Richard, University of Maryland, February 11 - 14, 2004.

Lax, Peter, New York University, Courant, October 5 - 7, 2003 and November 16 - 18, 2003.

Livne, Oren, Stanford University, May 17-21, 2004.

Lladser, Manuel, The Ohio State University, March 15 -17, 2004.

Lee, Jongwoo, Kwangwoon University, Seoul, South Korea, July 26 - August 21, 2003.

Malomed, Boris, Tel Aviv University, April 8, 2004.

Marsden, Jerrold, California Institute of Technology, November 17, 2003.

Maruno, Kenichi, Kyushu University, Kasuga Japan, July 5 - November 21, 2003.

Mohlenkamp, Martin, Ohio University, July 21 - August 26, 2003, and December 2 -10, 2003.

Musslimani, Ziad, University of Central Florida, February 12-15, 2004.

Oh, Hee-Seok, University of Alberta, Department of Statistics, Edmonton, Canada, June 16 – 20, 2004.

Papanicolaou, George, Stanford University, October 5 - 7, 2003.

Poncet, Paul, Ecole des Mines de Paris, France, May 3 – June 30, 2004.

Prinari, Barbara, Universite de Lecce, Italy, August 14 - October 4, 2003, January 7 – February 23, 2004, April 29 – May 2, 2004.

Roberts, Tony, University of Queensland, Australia, November 19 - 23, 2003.

Smith, Richard, University of North Carolina at Chapel Hill, April 27-29, 2004.

Trubach, David, U.S. Military Academy, West Point, NY, February 16 – 22, 2004.

Villarroel, Javier, Universidad do Salamanca, Spain, September 4 - 24, 2003.

Xin, Jack, University of Texas at Austin, November 23 - 26, 2003.

Zakharov, Vladimir, University of Arizona, April 20, 2004.

D. Staff

Dena Crist, Office Manager. (**Catherine Larkins** through May 7, 2004.)

Bruce Fast, Systems Administrator.

Karen Hawley, Student Coordinator. (**Laurie Conway** through March 17, 2004.)

Jan Kaufman, Office Coordinator.

Jennifer Qualteri, Accounting Technician/Faculty Coordinator. (**Aimee Parker** though June 8, 2004. **Marissa Contreras** through February, 2004. **Victoria Fernandez** through July, 2003.)

Robyn Sandekian, Outreach Coordinator through June, 2004.

Sichia Bell, part-time student assistant.

4. WEEKLY COLLOQUIA and SEMINARS 2003-2004

A. Applied Mathematics Colloquium, 2003-2004

Our Applied Mathematics Colloquium series continues to be held on Friday afternoons during the academic year at 3:00 p.m., with refreshments preceding at 2:30 PM outside the APPM conference room, ECOT 226.

Meredith Betterton, Dept. of Applied Mathematics, University of Colorado at Boulder, September 5, 2003, "Motor Proteins and Opening DNA".

Tom Manteuffel, Dept. of Applied Mathematics, University of Colorado at Boulder, September 12, 2003, "Modelling Coupled Fluid/Elastic Deformation with FOSLS".

Oleg Vasilyev, Mechanical Engineering, University of Colorado at Boulder, September 19, 2003, "Stochastic Coherent Adaptive Large Eddy Simulation (SCALES) Method".

Kamran Mohseni, Aerospace Engineering Sciences, University of Colorado, September 26, 2003, "Intrinsic Scalin Gin Vortex Formation".

Michael Dubson, Physics Department, University of Colorado at Boulder, October 10, 2003, "Electronic Audience Feedback in the Classroom: How Badly Do You Want to Know What Your Students are Thinking?".

L. G. de Pillis, Harvey Mudd College, Claremont, CA, October 17, 2003, "A Mathematical Model of Tumor Development and Immuno-Chemo Therapy".

Elaine Seymour, CARTSS, University of Colorado at Boulder, October 24, 2003, "I Wish I'd Known That Before I Wrote the Proposal".

Doug Nychka, National Center for Atmospheric Research, Boulder, CO, October 31, 2003, "Statistical Models for Models".

Junping Wang, Division of Mathematical Science, Colorado School of Mines, November 7, 2003, "Simulation of Surface and Subsurface Fluid Flow by Finite Element Methods".

Peter Lax, Courant Institute, November 17, 2003, "Multiple Eigenvalues".

Jerry Marsden, California Institute of Technology, November 17, 2003, "Averaged Fluid and EPDiff Equations."

Tony Roberts, University of Southern Queensland, Australia, November 21, 2003, "Rational Modelling Determines Boundary Conditions".

Dean Astumian, University of Maine, November 24, 2003, "Making Molecules into Motors: Learning to Walk in a Hurricane and Swim in Molasses".

John Buckmaster, University of Illinois, Urbana Chamaign, December 5, 2003, "Issues in the Modeling of Solid Heterogeneous Propellant Combustion".

Peter Clarkson, University of Kent, Canterbury, UK, January 16, 2004, "Rational Solutions of the Painlev\'e Equations and Associated Special Polymonials".

L. A. Ostrovsky, Zel/Tech/NOAA ETL, January 21, 2004, "Evolution Equations for Strongly Nonlinear Waves in Fluids".

Yungping Xi, Civil, Environmental and Architectural Engineering, University of Colorado, Boulder, January 30, 2004, "At what scale does a heterogeneous material appear homogeneous?".

Jamison Moeser, Dept. of Applied Math, CU Boulder, February 6, 2004, "Novel Solitons in Optical Fibers with Random Variations".

Richard Kollar, University of Maryland, February 13, 2004, "Existence and Stability of Vortex Solutions to Certain Nonlinear Schrodinger Equations".

Changfeng Gui, University of Connecticut, February 26, 2004, "Some Mathematical Problems in Phase Transition".

Annick Pouquet, National Center for Atmospheric Research (NCAR), February 27, 2004, "Scaling Laws in Geophysical and Astrophysical Flows".

Yang Kuang, Arizona State University, March 5, 2004, "Modeling Tumor Dynamics: An Ecological Perspective".

Sebastien Rodineau, University of Colorado, Boulder, March 12, 2004, "Spherical Lenses Modeling and Associated Feed".

Tom Hou, Applied & Computational Mathematics, California Institute of Technology, March 19, 2004, "Multiscale Modeling and Computation for Flows in Heterogeneous Media".

Jerry Bona, University of Illinois at Chicago, April 9, 2004, "Two and Three Dimensional Water Waves".

Hans de Sterck, Dept. of Applied Math, CU Boulder, April 16, 2004, "Least-Squares Finite Element Methods for Nonlinear Hyperbolic PDEs".

Robert Maier, University of Arizona, April 30, 2004, "Hypergeometric Transformations and Conformal Mapping".

B. Seminars in Applied Mathematics (Nonlinear Waves Seminar), 2003-2004

The Department maintained the Applied Mathematics Seminar, a weekly seminar series at 4:15 p.m. on Thursday afternoons in the fall and Tuesday afternoons in the spring. We are grateful to the Physics department for allowing us to use their facilities . A list of visiting speakers and the titles of their talks follows:

Nikos Efremidis, School of Optics/CREOL, University of Central Florida, October 30, 2003, "Lattice Solitons".

Boaz Ilan, Dept. of Applied Math, CU Boulder, January 27 and February 3, 2004, "Carrier-Envelope Phase Slip of Ultrashort Dispersion Managed Solitons", part I and II.

Barbara Prinari, University of Lecce, Italy, February 10, 2004, "Soliton Interactions in the Continuous and Discrete Vector Nonlinear Schrodinger Equations".

Andrew Docherty, Dept. of Applied Math, CU Boulder, University of New South Wales, Australia, February 17 and February 24, 2004, "Pulse Collisions in WDM Optical Fiber Communications Systems: An Analysis of Pulse Timing Shifts", Part I and II.

Thomas Silva, National Institute of Standards and Technology, March 2, 2004, "Large-Amplitude, High Frequency Magnetization Dynamics Induced by DC Current in a Magnetic Nanostructure".

Jeffrey Barchers, University of Colorado at Boulder, March 9 and March 16, 2004, "Linear Stability Analysis of the Correction of the Effects of Thermal Blooming in High Energy Laser Propagation", Part I and II.

Jamison Moeser, University of Colorado at Boulder, March 30 and April 6, 2004, "Diffraction Managed Solitons", Part I and II.

Boris Malomed, Tel Aviv University, April 8, 2004, "Multidimensional Solitons in a Low-Dimensional Periodic Potential".

V.E. Zakharov, Department of Mathematics, University of Arizona, April 20, 2004, "Free-Surface Hydrodynamics in Conformal Variables and the Origin of Freak Waves".

P. G. Grinevich, Moscow University and the University of Maryland, April 27, 2004, "Topological Charge of the Real Periodic Finite-Gap Sine-Gordon Solutions".

C. University of Colorado at Boulder/University of Colorado at Denver/Colorado School of Mines Joint Seminar in Computational Mathematics, 2003-2004

Because all of the organizers at CU-Denver and CSM are coincidentally on leave this year, there were no joint seminars. Most of the meetings this year consisted of the general discussion from 10 to 11:30 am surrounded by special research meetings. However, we continued to have an occasional lecture as shown below. All meetings were held at 1320 Grandview--on the northwest corner of campus near University and Broadway.

Brooke Steele, Stanford University, September 16, 2003, "A Simulation-Based Medical Planning System for Occlusive Cardiovascular Disease Using one Dimensional Analysis Techniques".

Stephen Thomas, NCAR, October 7, 2003, Informal discussion of computational problems at NCAR.

Manuel Torrilhon, ETH Zuerich, Switzerland, February 24, 2004, "Locally Constraint-Preserving Numerical Methods".

Francois Courty, Aerospace Engineeering, March 16, 2004, "Applications to Optimization to P.D.E., from Optimal Shapes to Optimal Meshes."

Randall J. LeVeque, University of Washington, April 19, 2004, "Immersed Interfaced Methods for Incompressible Navier-Stokes Equations".

Fred Wubbs, NCAR visitor, April 13, 2004, "Bifurcation Analysis of Ocean Flows".

Rich Lehoucq, Sandia National Laboratory, April 21, 2004, "A Comparison of Preconditioned Eigensolvers for Large-scale 3D Modal Analysis".

D. Dynamical Systems Seminars, 2003-2004

The weekly Dynamical Systems seminar is a research working group led by Meredith Betterton in the fall and James Meiss in the spring, held on Thursday afternoons at 2:00 pm. The following is a list of the speakers and the titles of their talks:

James Meiss, Department of Applied Mathematics, University of Colorado at Boulder, September 4, 2003, "Symmetries of Polynomial Mappings: To Involute or Not?".

Glen Stewart,, LASP, University of Colorado at Boulder, September 11, 2003, "Rossby Wave Instability in Protoplanetary Disks".

Javier Villarroel, Universidad de Salamanca, Spain, September 18, 2003, "Solution to the Cauchy for KP with Nondecaying Initial Data".

Matthew Tearle, Department of Applied Mathematics, University of Colorado at Boulder, September 25, 2003, "Optimal Pertubations in Atmospheric Shear Flows or: How I Learned to Stop Worrying and Love IVPs".

Dick McIntosh, MCDB, University of Colorado at Boulder, October 9, 2003, "A Cell Biologist Seeking Help from Mathematicians".

Neil Burrell, Department of Applied Mathematics, University of Colorado at Boulder, October 16, 2003, "A Novel Layered QG Model".

Avner Peleg, Los Alamos National Laboratory, October 23, 2003, "Effects of Pertubations on Collisions Between Optical Solitons".

Derin Wysham, Department of Applied Mathematics, University of Colorado at Boulder, October 30, 2003, "Computing the Stable and Unstable Manifolds of Invariant Tori".

Gerhard Dangelmayr, Colorado State University, November 6, 2003, "Isochronicity-Induced Bifurcations in Systems of Weakly Dissipative Coupled Oscillators".

Collin Starkweather, Economics Department, University of Colorado at Boulder, November 13, 2003, "Network Effects, Network Externalities and the Digital Economy: What do eBay and Microsoft Have in Common and What Should We Do About It?".

Tony Roberts, University of Southern Queensland, Australia, November 20, 2003, "Modelling Fluid Flows in Thin Domains".

Natalie Ahn, Biochemistry, University of Colorado at Boulder, December 4, 2003, "Functional Proteomic Analysis and Signaling Pathways".

David Albers, University of Wisconsin, Madison and Santa Fe Institute, January 22, 2004, " A Dynamics Stability Conjecture".

Terry Haut and **Brendan Sheehan**, University of Colorado at Boulder Applied Math, January 29, 2004, "The Snowflake, the Dragon and Space-Filling Curves" and "Chaotic Behavior of Newton's Method".

James Howard, CIPS, CU Boulder, February 5, 2004, "The Discrete Virial Theorem".

Scott Peckham, INSTAAR, CU Boulder, February 12, 2004, "How to Make a Fractal Tree With Applications to River Networks.

Paul Mullowney, CU Boulder, Applied Math, February 19, 2004, "An Introduction to Anomalous Diffusion and Levy Flights".

Changfeng Gui, University of Connecticut, February 26, 2004, "Some Mathematical Problems in Phase Transitions".

Rob Knight, MCDB, CU Boulder, March 4, 2004, "Markov Processes in Molecular Evolution".

Mark Petersen, CU Boulder, Applied Math, March 11, 2004, "A Study of Geophysical and Astrophysical Flows Using Numerical Models".

Rodney Anderson, Aerospace Engineering, CU Boulder, March 18, 2004, "The Role of Invariant Manifolds in Low Thrust Trajectory Design".

Bob Easton, University of Colorado at Boulder, Applied Math, April 1, 2004, "Economics: What Good is a Model?".

Josh Downer, University of Colorado at Boulder, Applied Math, April 8, 2004, "Modelling a Marginal Ice Zone as a Granular Material".

Iuliana Oprea, Colorado State University, April 15, 2004, "Wave Patterns in Anisotropic Systems, with Application to Nematic Electroconvection".

Alyn Rockwood, Colorado School of Mines, April 22, 2004, "The Singularities of Vector Fields".

E. Fast Algorithms Seminars, 2003-2004

Fredrik Andersson, Lund University, Sweden and visiting the Department of Applied Mathematics, University of Colorado at Boulder, October 21, 2003, "Inversion of the Radar Transform By Use of Log-Polar Coordinates".

Philippe Naveau, Department of Applied Mathematics, University of Colorado at Boulder, October 28, 2003, "A Skewed Kalman Filter".

Michael Sprague, Department of Applied Mathematics, University of Colorado at Boulder, November 11, 2003, "A Spectral-Element Method for Modeling Cavitation in Transient Fluid-Structure Interaction".

Suzanne Nezzar, UCLA and Department of Applied Mathematics, University of Colorado at Boulder (starting Spring 2004), December 2, 2003, "A Multiscale Image Representation Using Hierarchical $(BV,L2)$ Decompositions".

Martin Mohlenkamp, Ohio University, December 9, 2003, "Antisymmetric Functions in High Dimensions".

F. Probability and Statistics Seminars, 2003-2004

Several of our sessions this year were meetings of a Bayesian Statistics Reading Group. These sessions, along with special seminars were held on Wednesday afternoons at 3:30 pm. in the Applied Math Conference Room, ECOT 226. The following is a list of the speakers and the topics:

Jem Corcoran, Department of Applied Mathematics, University of Colorado at Boulder, September 24, 2003, "An Introduction to Bayesian Methods and Notation".

Jem Corcoran, Department of Applied Mathematics, University of Colorado at Boulder, October 8, 2003, "Bayesian Linear Regression".

Robert Lund, University of Georgia, October 16, 2003, "A Random Walk Through Climate Change".

Jem Corcoran, Department of Applied Mathematics, University of Colorado at Boulder, October 22, 2003, "Bayesian Model Averaging".

Alexander Robertson, Department of Applied Mathematics, University of Colorado at Boulder, October 29, 2003, "Mathematical Aspects of Intrusion Prevention in IP Networks".

Hari Iver, Department of Statistics, Colorado State University, November 6, 2003, "Generalized Confidence Intervals: Applications to Balanced Mixed Linear Models".

Steve Sain, Department of Mathematics, CU Denver, November 19, 2003, "Spatial Models for Multivariate Lattice Data".

Richard Smith, Department of Statistics and Operations Research, University of North Carolina, Chapel Hill, April 28, 2004, "Some Applications and Theory of Spatial Statistics".

G. Mathematical Biology Reading Group, 2003-2004

The reading group is organized by Meredith Betterton and met once a week. The main goal of this reading group is to bring participants up to date so they may begin research in mathematical biology. Participants take turns presenting a recent paper on the results of their research. This year's topics included basics of thermodynamics and statistical mechanics, DNA elasticity, motor proteins which move on nucleic acids (translocases), basics of protein biochemistry, computational methods for protein structure/dynamics, modeling protein transitions, and modeling cellular signalling pathways.

Participants in 2003-2004 included Meredith Betterton, Dave Clarke (CHEN), Josh Downer, Marcus Lanskey (CHEM), Jinyu Li, Hong Liu, , Stephanie Meyer (PHYS), Elizabeth Siewert, Laura Waterbury, and Josh Wysack.

H. Undergraduate and Graduate Seminars, 2003-2004

Undergraduate Seminars

September 4th, 2003, SIAM hosted its annual back to school get together.

September 18th, 2003, Graham DeJong of the US Census Bureau gave a talk focusing on current projects at the Census Bureau, the variety of work they conduct on a day-to-day basis and the application process.

September 27th, 2003 (12-1:30), **L. G. de Pillis**, who heads the modeling effort at Harvey Mudd, hosted an undergrad luncheon in the Applied Math conference room. Harvey Mudd is consistently among the schools with outstanding teams and Dr. Pillis may have some insight into strategies for the contest. Also, Dr. Pillis gave the Department Colloqium on Friday

October 30th, 2003, Undergraduate advising luncheon.

December 10th, 2003, Undergraduate VIGRE Talks, A set of three talks by undergraduate students supported under the VIGRE grant were given. Titles and abstracts for the talks follow:

> **Lauren Anderson and Ashley Moore**
> Topic: Non-linear Partial Differential Equations
>
> **Pascal Getreuer**
> Topic: Generating Wavelet Transforms
>
> **Ian Derrington and Mark Winter**
> Title: Behavior of Newton's Method as Applied to the Eigenvalue/Eigenvector Problem

February 23th, 2004, David Sterling from SomaLogic, Talk covered a general outline of the work done at SomaLogic in proteomics. He also discussed specific applied math problems in a simple ODE model for protein/aptamer binding and problems in statistical pattern classification.

March 11, 2004, Alejandro Cantarero, "Image Processing Using Linear Algebra and Wavelets".

April 1, 2004, Undergraduate Advising Luncheon.

April 22, 2004, Mathematical Contest in Modeling Talks.

QuickPass Systems:

Three teams will present their solutions to this problem:
1) **Arian Lalezari, Sarah Macumber, Matt Martin**
2) **Ian Derrington, Donovan Levinson, Karl Oberymeyer**
3) **Moorea Brega, Alejandro Cantarero, Corry Lee**

Are Fingerprints Unique?

One Team will present their solution to this problem:
1) **Brian Camley, Pascal Getreuer, Brad Klingenberg**

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5. FACULTY SERVICE TO THE UNIVERSITY, DEPARTMENT AND SOCIETIES, CALENDAR YEAR 2003

Mark Ablowitz:
- Member of APPM undergraduate committee, Spring 2003.
- Member of Civil Engineering Internal review committee.
- Member of APPM graduate committee, Fall 2003.
- Coordinating Editor of Proceedings of the American Mathematical Society-Applied Mathematics.
- Editor of Studies in Applied Mathematics.
- Editor of Journal of Engineering Mathematics.
- Editor of Cambridge University Press Texts in Applied Mathematics.
- Journal of Partial Differential Equations and Dynamical Systems.
- Reviewer for: NSF Grants.
- Reviewer for: Hong Kong Grants.
- Reviewer for journals: Physical Review Letters.
- Reviewer for journals: Journal of Engineering Math.
- Reviewer for journals: Physical Review E.
- Reviewer for journals: Optical Society of America: Optics Letter, Journal of the Optical Society of America.
- Reviewer for: Kuwait University Graduate School.
- Member: NSF Panel in Engineering, Communication Systems Dec. 11-12, 2003, Arlington, VA.

Meredith Betterton:
- Member of Graduate Committee, Spring 2003. Helped read folders of graduate applicants, selected applicants for admission and financial aid, and hosted students during recruiting visit.
- Dynamics Seminar Organizer, Fall 2003. Coordinated speaker invitations and publicity for weekly seminar series.
- Biophysics Supergroup participant. Attended and gave feedback to graduate students and postdocs who presented at monthly supergroup meetings.
- Perkins group meeting participant. Attended, presented, and gave feedback to graduate students and postdocs who presented at weekly Perkins lab group meetings.

- Colorado Initiative in Molecular Biotechnology Task Force Member. Helped determine future direction of interdisciplinary biotechnology research at the Boulder campus, recommended possible senior faculty candidates, and hosted faculty visits.
- Faculty hiring committee, Colorado Initiative in Molecular Biotechnology faculty search in bioinformatics. Helped develop hiring plan, read applicant folders, developed short list, coordinated candidate interviews, and selected candidate.
- Reviewer for Physical Review Letters. Reviewed approximately 2 manuscripts in 2003.
- Reviewer for Physical Review E. Reviewed approximately 5 manuscripts in 2003.
- Reviewer for the Princeton University Press. Reviewed 1 book manuscript in 2003.

Gregory Beylkin:
- Consultant for GeoEnergy, Inc.
- Consultant for Fast Mathematical Algorithms and Hardware, Corp.
- Hiring Committee (Spring) Graduate Committee (Fall).
- Member of the Advisory Editorial Board of Applied and Computational Harmonic Analysis.

Jem Corcoran:
- Co-organizer of departmental probability and statistics seminar series.
- Member of Program Review Panel (PRP) committee.
- Organizer of the "Bayesian Reading Group" which had weekly meetings drawing participants (faculty and students) from several departments on campus and scientist from NCAR.
- Member of graduate committee.
- Member of an instructor (prob/stat) search committee.
- Book reviewer for the Journal of the American Statistical Association.
- Referee for the Journal of Applied Probability.
- Referee for the Journal of Statistical Computation and Simulation.

James Curry:
- Member of the Ford Foundation Fellows conference planning committee, January 1 - June 30, 2003.
- Chair of the AMS regional selection committee, which identifies speakers for various AMS regional conferences.
- Serve on the national American Mathematical Society's Committee on Academic Freedom, Tenure, and Employment Security (CAFTES). This is a three-year term, 2002-2004.
- Manage the Afro Americans in the Mathematical Science listserve.
- Reviewed numerous NSF proposals related to the Math Science Partnership, STEM activities and Education Proposals for CREST.
- Chair for the Department of Applied Mathematics, July 1, 2003 to the present.
- Member of Applied Math's program review committee (PRP), November 2002 to January 2004.
- Member of Applied Math Department's search committees.
- Coordinator, with Anne Dougherty, of the calculus portion of the CU-Dillard Educational Technology partnership. This partnership is funded by a grant from the Carnegie Foundation and the PI on the Boulder campus is Bobby Schnabel. The goal of this project is to develop and utilize a model that will improve collaboration between diverse dissimilar institutions.
- Faculty sponsor of the Java-Java-Java programming club.
- Serve as an Associate Editor of the Mathematical Association of America (MAA) monthly journal.
- Department liaison between Sun Educational Services and Applied Mathematics. Coordinated and supervised student internships during 2003.

Anne Dougherty:
- Faculty advisor for the CU Boulder SIAM (Society for Industrial and Applied Mathematics) undergraduate chapter.
- Probability and Statistics prelim committee member in the Department of Applied Mathematics.
- Undergraduate committee member and undergraduate faculty advisor in the Department of Applied Mathematics.
- Associate Chair for Department of Applied Mathematics, July 1, 2000 to present.
- Member of Applied Math's PRP committee.
- Member of search committee for Statistics Instructor.
- Organized Applied Math's participation in several Engineering College programs: Engineering Orientation, August 20-21, 2003; Engineering Open House, October 18, 2003; Women in Engineering Career Days program, March 2003.
- Wrote an article on the Department of Applied Mathematics for CU Engineering, 2003 magazine.
- Applied Math's representative to Engineering's Undergraduate Education Council, September 2001 to present.
- Actuarial certificate committee member.
- CU campus representative for Goldwater Scholarship. Four CU undergraduate students, majoring in science, math, or engineering, are selected each year for the national competition.
- Coordinator, with Jim Curry, of the calculus portion of the CU-Dillard Educational Technology partnership. This partnership is funded by a grant from the Carnegie Foundation and the PI on the Boulder campus is Bobby Schnabel. The goal of this project is to develop and utilize a model that will improve collaboration between diverse, dissimilar institutions. This involves developing technologically based, shared curriculum materials in calculus and in humanities courses. In Applied Math, these materials have taken the form of web-based, java applets, and labs that help students understand some of the more difficult concepts in Calculus 2.
- Online tutoring coordination for the Department of Applied Mathematics. The online tutoring program is a system-wide collaboration to provide web-based tutoring for students in pre-calculus and calculus.
- Outreach activity: Summer Institute in Applied Mathematics. Organized three, 2-credit, and one 3-credit, two-week professional development classes for 42 high school teachers, July 2003. The classes were Calculus for Secondary Teachers, Statistics for Secondary Teachers, Discrete Math for K-12 Teachers and Algebra for middle school math teachers. These courses were supported by a supplement to Applied Math's NSF VIGRE grant. Additional funding comes from the J.R. Woodhull/Logicon Applied Mathematics Professorship and from the CU-Boulder Outreach Committee. The Outreach Committee is supported by the Office of the Chancellor, the Office of the Provost, and the Division of Continuing Education.
- Outreach activity: APPM/BVSD Partnership. Organized 3 seminars for Boulder Valley School District (BVSD) middle and high school teachers of mathematics. Amy Biesterfeld taught two 6-week (15 contract hour) seminars in calculus in spring 2003. Mary Nelson taught one 6-week seminar in discrete math in fall 2003. Future seminars are planned.

Bengt Fornberg:
- Member of the Undergraduate Committee. Advisor for freshmen and 5th year seniors (spring 2003) and sophomores (fall 2003).
- Faculty Advisor for EEF (Engineering Excellence Fund), College of Engineering.
- Regularly review proposals for NSF and its counterpart in some other countries (e.g. Sweden, South Africa, Singapore, Hong Kong).
- Refereed about a dozen articles for various journals as well as a book review for Cambridge University Press.

- Serving (with a 3-year appointment) on an NSF panel for awarding Postdoctoral Fellowships in the Mathematical Sciences.

Keith Julien:
- Member and Chair of Department's Computer Committee.
- Member of the Arts & Sciences Council.
- Member of Arts & Sciences Budget Subcommittee.
- Reviewer for Journal of Solar Physics.
- Grant Peer Review. NASA Living with a Star Program.
- Grant Peer Review. NASA Solar Heliospheric Program.

Congming Li:
- Graduate Committee.
- Hiring Committee.
- Colloquium Committee.
- Editor of: Communication on Pure and Applied Analysis.
- Reviewed papers for many professional journals.

Tom Manteuffel:
- Member of the Joint Policy board for Mathematics.
- Past-President Society of Industrial and Applied Mathematics.
- Chair, SIAM Committee on Science Policy.
- DOE, Office of Science, Advanced Scientific Computing Advisory Committee.
- Consultant for Lawrence Livermore National Laboratory.
- Spring 2003, Department Computational Math Prelim Committee.
- Spring 2003, Department Graduate Committee.
- Hiring Committee, Analysis.
- Fall 2003, Associate Chair for Graduate Studies
- Fall 2003, Department Analysis Prelim Committee.
- Computer Committee.
- Associate Editor: Electronic Transactions in Numerical Analysis.
- Editorial Board: Numerical Linear Algebra and Applications.
- Associate Editor: SIAM Journal on Numerical Analysis.
- Reviewed papers for Numerical Methods for Partial Differential Equations.
- Reviewed proposals for DOE.
- Reviewed proposals for NSF.
- Reviewed papers for SIAM Journal on Scientific Computing.
- Reviewed papers for SIAM Journal on Numerical Analysis
- Program Committee: 11th Copper Mountain Conference on Multigrid Methods, Copper Mountain, CO, March 30- April 4, 2003.

Steve McCormick:
- IMACS Conference Committee on CFD.
- Consultant for Lawrence Livermore National Lab.
- Computing Committee.
- Comp Math Prelim Committee.
- Program Review Committee.
- Undergraduate Committee.
- Associate Editor of the SIAM Journal Multiscale Modeling and Simulation.
- Reviewed many proposals for NSF and DOE.
- Reviewed many papers for SISC, SINUM, J. Comp. Physics, AMS Reviews, and Zentralblatt.
- Organizing Committee, 11th Copper Mountain Conference on Multigrid Methods, Copper Mountain, CO, March 30 – April 4, 2003.

- Editor, Multiscale Modeling and Simulation, SIAM Publications.
- Chair, AMG and FOSLS Summits, Lake City, CO September 30 – October 4, 2003.
- SIAM Computational Science and Engineering Award Committee.

James Meiss:
- SIAM Dynamical Systems Activity Group Web Site moderator for the "Dynamics Thesaurus" Web site, http://www.dynamicalsystems.org.
- Co-Organizer for a symposium, "Transport and Mixing in Three-Dimensions", for the May 2003 SIAM Dynamical Systems Meeting with I. Mezic.
- Preliminary Examination Committee, Jan. and Aug., 2003. Wrote and graded the PDE preliminary exam for MS and PhD. students.
- Associate Chair for Graduate Studies, Fall 2002 - Spring 2003. Advisor for our 1st and 2nd year students.
- Graduate Committee. Graduate applications and vetting.
- Departmental Technology Liaison to the FTEP program.
- Member Dean's Committee on Promotion and Tenure Fall 2002 - present.
- Center for Integrated Plasma Studies, Fellow.
- Colorado Center for Chaos and Complexity, Fellow.
- Associate Editor for SIAM Journal on Applied Dynamical Systems.
- Reviewer for 3 proposals for the National Science Foundation.
- Reviewer for Physica D.
- Reviewer for Physical Review E.
- Reviewer for Nonlinear Dynamics (Journal).
- Reviewer for Nonlinearity.
- Reviewer for Physical Review Letters.
- Reviewer for Discrete and Continuous Dynamical Systems.
- Reviewer for Journal of Physics A.

Phillipe Naveau:
- Convener and organizer of the session "Global, Hemispheric and Regional Climate Signals During the Last Millennium", American Geophysical Union (AGU) 2003 Fall Meeting, San Francisco.

Adam Norris:
- Outreach activity: Conducted a 1-day Calculus workshop for secondary teachers in Fall 2003 as a follow-up activity to the 2003 Summer Institute in Applied Mathematics.

Harvey Segur:
- Co-organizer of research session, American Math Society meeting, Boulder, CO, October 2-4, 2003.
- Chairman of Department, through June, 2003.
- Chairman of hiring committee in analysis, 2002-2004.
- Chairman of Departmental PRP Committee.
- Member of VIGRE Committee.
- Chairman of EMSW21 proposal team.
- Reviewer for J. Math Phys.
- Reviewer for ZAMP
- Reviewer for J. Phys. Oceanography.
- Reviewer for National Science Foundation (2 proposals).

6. TEACHING ACTIVITIES

6A. Courses Taught by Department Faculty, Academic Year 2003-2004

(i) Undergraduate Courses

APPM 1350	*Carvalho, Dougherty, Nezzar, Norris, Robertson, Sprague,* Calculus I for Engineers
APPM 1360	*Ablowitz, Ilan, Mendez, Norris,* Calculus 2 for Engineers
APPM 2350	*Fornberg, Naveau, Norris, Rother,* Calculus 3 for Engineers
APPM 2360	*Downer, Ilan, Julien, Li, Vadlamani,* Introduction to Linear Algebra & Differential Equation
APPM 2380	*Betterton, Felippa (Professor, Aerospace Engineering),* Introduction to Ordinary Differential Equations
APPM 2450	*Beltran del Rio, Braeutigam, Byrne, Sheehan,* Calculus 3: Computer Lab
APPM 2460	*Batista, Beltran del Rio, Jamroz, Kridler, Kurcz,* Differential Equations: Computer Lab
APPM 2480	*Piret, Zhao,* Intro to O.D.E. Lab
APPM 3010	*Moeser,* An Introduction to Nonlinear Systems: Chaos
APPM 3050	*Robertson,* An Introduction to Symbolic and Numerical Computation
APPM 3310	*Betterton, Dougherty, Curry,* Matrix Methods and Applications
APPM 3570	*Dougherty,* Applied Probability
APPM 4120	*Goodrich (Professor, Mathematics),* Introduction to Operations Research
APPM 4350	*Curry,* Methods in Applied Mathematics: Fourier Series and Boundary Value Problems
APPM 4360	*Moeser,* Methods in Applied Mathematics: Complex Variables and Applications
APPM 4380	*Fornberg,* Modeling in Applied Mathematics
APPM 4520	*Corcoran,* Introduction to Mathematical Statistics
APPM 4540	*Koslov,* Introduction to Time Series
APPM 4560	*Corcoran,* Introduction to Probability Models
APPM 4570	*Carvalho, Corcoran, Trailovic, Norris,* Statistical Methods
APPM 4580	*Luftig (Senior Instructor, Leeds School of Business),* Statistical Methods for Data Analysis
APPM 4650	*Fox (Professor, Mathematics), Heys,* Intermediate Numerical Analysis I
APPM 4660	*Heys,* Intermediate Numerical Analysis II

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(ii) Graduate Courses

APPM 5120	*Goodrich (Professor, Mathematics)*, Operations Research
APPM 5350	*Curry*, Methods in Applied Mathematics: Fourier Series and Boundary Value Problems
APPM 5360	*Moeser*, Methods in Applied Mathematics: Complex Variables
APPM 5380	*Fornberg*, Modeling in Applied Mathematics
APPM 5440	*Li*, Applied Analysis 1
APPM 5450	*Li*, Applied Analysis 2
APPM 5460	*Meiss*, Dynamical Systems, Differential Equations, and Chaos
APPM 5470	*Segur*, Methods in Applied Mathematics: Partial Differential and Integral Equations
APPM 5520	*Corcoran*, Introduction to Mathematical Statistics
APPM 5540	*Koslov*, Introduction to Time Series
APPM 5560	*Corcoran*, Introduction to Probability Models
APPM 5570	*Corcoran, Norris, Trailovic*, Statistical Methods
APPM 5580	*Luftig (Senior Instructor, Leeds School of Business)*, Statistical Applications Software and Methods
APPM 5600	*Julien*, Numerical Analysis 1
APPM 5610	*Beylkin*, Numerical Analysis 2
APPM 6610	*Manteuffel*, Introduction to Numerical Partial Differenital Equations
APPM 7100	*Meiss*, Mathematical Methods in Dynamical Systems
APPM 7300	*Ablowitz*, Nonlinear Waves and Integrable Equations
APPM 7400	*Beylkin, Li, Luftig, Garcia, Piret*, Seminar—special topics
APPM 8000	*Li, Moeser*, Colloquium
APPM 8100	*Ablowitz* Seminar - Nonlinear Equations
APPM 8100	*Betterton, Meiss*, Seminar - Dynamical Systems
APPM 8600	*McCormick, Manteuffel*, Seminar in Computational Mathematics

B. Summer Courses, 2004

APPM 1350	*Girard*, Calculus I for Engineers
APPM 1360	*Wysham*, Calculus II for Engineers
APPM 2350	*Rother, Wild*, Calculus III for Engineers
APPM 2360	*Cheruvu, Mullowney*, Intro. Linear Algebra and Differential Equations
APPM 2450	*Byrne*, Calculus III: Computer Lab
APPM 2460	*Piret*, Differential Equations: Computer Lab

APPM 2710	*Bishop,* JAVA I
APPM 4650	*Norris,* Intermediate Numerical Analysis I
APPM 5040	*Monzon, Ruzzo,* Calculus Applications for High School Teachers
APPM 5050	*Nelson, Thurderbuck,* Discrete Math for K-12 Teachers
APPM 5070	*Biesterfeld, Luhring,* Applied Statistics for High School Teachers

7. RESEARCH ACTIVITIES FOR CALENDAR YEAR 2003

A. Research Publications for Calendar Year 2003

Mark Ablowitz
- Dark and gray dispersion managed solitions, M.J. Ablowitz and Z. Musslimani, physical Review E, Rapid Communications, 109 (2003) 025601-1-4.

- Four wave mixing in dispersion managed transmission systems, M.J. Ablowitz, G.Biondini, S. Chakravarty, R.L. Horne, J. Opt. Soc. Am. B, 20 (2003) 831-845.

- On a two-phase free boundary problem, M.J. Ablowitz and S. De Lillo, Journal of Physics A: Mathematical and General, 36 (2003) 831-845.

- Incomplete collisions in strongly dispersion managed return-to-zero communication systems, M.J. Ablowitz and A. Docherty, Optics Letters, 28 (2003) 1191-1193.

- Discrete spatial solitons in a diffraction managed nonlinear waveguide array: a unified approach, M.J. Ablowitz and Z. Musslimani, Physica D, 184 (2003) 276-303.

- On the discrete spectrum of systems in the plane and the Davey-Stewartson II equation, J. Villarroel and M.J. Ablowitz, SIAM Journal on Mathematical Analysis, 34 (2003) 1253-1278.

- Integrable systems and reductions of the self-dual Yang-Mills equations, M.J. Ablowitz, S. Chakravarty, R.G. Halburd, Journal of Mathematical Physics, 44 (2003) 3147-3173.

- Quasi-linear optical pulses in dispersion managed fibers: propagation and interaction, M.J. Ablowitz and T. Hirooka, in Optical Solitons: Theoretical and Experimental Challenges, K. Porsezian and V.C. Kuriakose, Eds. (Lecture Notes in Physics 613), Springer-Verlag, 2003, pp. 227-246.

- On the IST for discrete nonlinear Schrodinger systems and polarization shift for discrete vector solitons, M.J. Ablowitz, B. Prinari, and David Trubach, Nonlinear Physics: Theory and Experiment II, Eds. M.J. Ablowitz, M. Boiti, F. Pempinelli, and B. Prinari, p. 3-16, World Scientific, Singapore, 2003.

- Discrete scalar and vector diffraction-managed nonlinear Schrodinger equations, M.J. Ablowitz and Z. Musslimani, Nonlinear Physics: Theory and Experiment. II, Eds. M.J. Ablowitz, M. Boiti, F. Pempinelli and B. Prinari, p. 319-332, World Scientific, Singapore 2003.

- Nonlinear waves and (interesting) applications, M.J. Ablowitz, T. Hirooka, and Z. Musslimani, Nonlinear dynamics from lasers to butterflies, Eds. R. Ball and N. Akhmediev, World Scientific, (2003).

Meredith Betterton
- M. D. Betterton and Frank Julicher, "A motor that makes its own track: Helicase unwinding of DNA", Phys. Rev. Lett. 91, 258103 (2003).

Gregory Beylkin
- Author: Sandberg, K.; Mastronarde, D.; Beylkin, G., Title: A fast reconstruction algorithm for electron microscope tomography Journal: Journal of Structural Biology, Date: 2003, Volume: 144, Pages 61-72.

- Author: Beylkin, G.; Sandberg, K., Title: Wave propagation using bases for bandlimited functions, Institution: Univ. of Colorado, Date: 2003, Type: APPM Preprint Number: 518.

- Author: Harrison, R.J.; Fann, G.I.; Yanai, T.; Gan, Z.; Beylkin, G., Title: Multiresolution quantum chemistry: basic theory and initial applications, Institution: Univ. of Colorado, Date: 2003, Type: APPM Preprint Number: 516.

- Author: Fann, G.I.; Beylkin, G.; Harrison, R.J.; Jordan, K., Title: Singular operators in multiwavelet bases, Journal: IBM Journal of Research and Development, submitted Univ. of Colorado, APPM Preprint number: 516, Dec. 2003.

- Harrison, R.J.; Fann, G.I.; Yanai, T.; Beylkin, G., Title: Multiresolution quantum chemistry in multiwavelet bases, Book Title: Lecture Notes in Computer Science, Computational science-iccs 2003, Date: 2003, Editor: P.M.A. Sloot et. al., Volume: 2660 Pages: 103-110, Publisher: Springer.

Jem Corcoran
- J.N. Corcoran and U. Schneider. Perfect Simulation for Bayesian Variable Selection in a Linear Regression Model. Journal of Statistical Planning and Inference, in press.

James Curry
- S. Wild J. H. Curry, A. M. Dougherty, Motivating Non-Negative Matrix Factorizations. Proceedings of the Eighth SIAM Conference on Applied Linear Algebra, July 15-19, 2003.

Anne Dougherty
- A. M. Dougherty, R. B. Corotis, A. Segurson (2003). Design Wind Speed Prediction. Journal of structural Engineering, ASCE, Volume 129, No. 9, 1268-1274.

- S. Wild, J. H. Curry, A. M. Dougherty, Motivating Non-Negative Matrix Factorizations. Proceedings of the Eighth SIAM Conference on Applied Linear Algebra, July 15-19, 2003.

Bengt Fornberg
- E. Larsson and B. Fornberg, A numerical study of radial basis function based solution methods for elliptic PDEs, Computers and Mathematics with Applications, 46 (2003), 891-902.

- J. Lee and B. Fornberg, A split step approach for the 3-D Maxwell's equations, Journal of Computational and Applied Mathematics, 158 (2003), 485-505.

- B. Fornberg, Some numerical techniques for Maxwell's equations in different types of geometries. In 'Topics in Computational Wave Propagation', Eds. M. Ainsworth, P.J. Davies, D.B. Duncan, P.A. Martin and B.P. Rynne, Lecture Notes in Computational Science and Engineering 31, Springer Verlag (2003), 265-299.

- N. Flyer and B. Fornberg, On the nature of initial-boundary value solutions for dispersive equations, SIAM J. Appl. Math., 64 (2003), 546-564.

- N. Flyer and B. Fornberg, Accurate numerical resolution of transients in initial-boundary value problems for the heat equation, Journal of Computational Physics, 184 (2003), 526-539.

Keith Julien

- Highly Supercritical Convection in Strong Magnetic Fields, (2003), K. Julien, E. Knobloch & S. M. Tobias. Chapter 7 in Advances in Nonlinear Dynamos, Eds. Ferriz-Mas and M. Nunez. (The Fluid Mechanics of Astrophysics and Geophysics Series). Taylor & Francis.

- Nonlinear Magnetoconvection in the Presence of a Strong Oblique Field, (2003), K. Julien, E. Knobloch & S. M. Tobias. Chapter 2 in Stellar Astrophysical Fluid Dynamics. Eds. M. J. Thompson and J. Christensen-Dalsgaard. (Cambridge University Press).

Congming Li

- Moving Planes, moving spheres, and priori estimates. Journal of Differential Equations, 195, (2003), pages 1-13, Joint work with Wenxiong Chen.

Thomas Manteuffel

- Multilevel first-order system least squares for nonlinear partial differential equations, with application to elliptic grid generation, SIAM J. Numer. Anal., Vol. 46, pp. 2197-2209, (2003). (A. Codd, T. A. Manteuffel, and S. F. McCormick).

- Multilevel first-order systems least squares for elliptic grid generation: ellipticity and computational results, SIAM J. Numer. Anal., Vol. 46, pp. 2210-2232, (2003). (A. Codd and T.A. Manteuffel, S.F. McCormick, and J. Ruge).

- Spectral element AMGe, SIAM J. Sci. Comp., Vol.25, No. 1, pp. 1-26 (2003). (T. Chartier, R. Falgout, J. Jones, V.E. Henson, T.A. Manteuffel, S.F. McCormick, J. Ruge, and P. Vassilevski).

- A moment-parity multigrid preconditioner for the first-order least-squares formulation of the Blotzmann transport equations, SIAM J. Sci. Comp., Vol. 25, No. 2, pp. 513-533, (2003). (P.N. Brown, B. Lee, T.A. Manteuffel).

- Improved discretization error estimates for first-order systems least-squares (FOSLS), J. of Numer. Math., Vol. 11, pp. 163-177, (2003). (T. A. Manteuffel, S. F. McCormick and C. Pflaum).

- First-order system least-squares (FOSLS) for coupled fluid-elastic problems, J. Comp. Phys., Dec. 3, (2003). (J. Heys, T.A. Manteuffel, S. F. McCormick and J. Ruge).

Stephen McCormick

- Multilevel first-order system least squares for nonlinear partial differential equations, SIAM J. Numer. Anal. 46 (2003), pp. 2197-2209 (with A. Codd and T. Manteuffel).

- Multilevel first-order system least squares for elliptic grid generation, SIAM J. Numer. Anal. 46 (2003), pp. 2210-2232 (with A. Codd, T. Manteuffel, and J. Ruge).

- Asynchronous fast adaptive composite-grid methods: Numerical results, SIAM J. Sci. Comp. 25 (2003), pp. 682-700 (with B. Lee, B. Philip, and D. Quinlan).

- Spectral element AMGe, SIAM J. Sci. Comp. 25 (2003), pp. 1-26 (with T. Chartier, R. Falgout, V.E. Henson, J. Jones, T. Manteuffel, J. Ruge, and P. Vassilevski).

- First-order system least squares (FOSLS) for coupled fluid-elasticity problems, J. Comp. Physics, to appear, web publication date 12/03/03 (with J. Heys, T. Manteuffel, and J. Ruge).

- Improved discretization error estimates for first order system least squares (FOSLS), J. Num. Math. 11 (2003), pp. 163-177 (with C. Pflaum and T. Manteuffel).

- Asynchronous fast adaptive composite-grid methods for elliptic problems: Theoretical foundations, SIAM J. Sci. Comp. , to appear (with B. Lee, T. Manteuffel, B. Philip, and D. Quinlan).

- First-order system least squares and electrical impedance tomography, SIAM J. Numer. Anal., to appear (with H. Macmillan and T. Manteuffel).

- Least-squares finite element methods and algebraic multigrid solvers for linear hyperbolic PDEs, SIAM J. Sci. Comp., to appear (with H. de Sterck, T. Manteuffel, and L. Olson).

- Adaptive smoothed aggregation (aSA), SIAM J. Sci. Comp. , to appear (with M. Brezina, R. Falgout, S. MacLachlan, T. Manteuffel, and J. Ruge).

- Adaptive algebraic multigrid (aAMG), SIAM J. Sci. Comp., in progress (with M. Brezina, R. Falgout, S. MacLachlan, T. Manteuffel, and J. Ruge).

- Analysis of first-order system least squares (FOSLS) for elliptic problems with discontinuous coefficients: Part I, SIAM J. Numer. Anal., submitted (with M. Berndt and T. Manteuffel).

- Analysis of first-order system least squares (FOSLS) for elliptic problems with discontinuous coefficients: Part II, SIAM J. Numer. Anal., submitted (with M. Berndt and T. Manteuffel).

- First-order system LL* (FOSLL*) for general scalar elliptic problems in the plane, SIAM J. Num. Anal. submitted (with T. Manteuffel, J. Ruge, and J. G. Schmidt).

- Numerical conservation properties of H(div)-conforming least-squares finite element methods for scalar conservation laws, SIAM J. Sci. Comp., submitted (with H. de Sterck, T. Manteuffel, and L. Olson).

- Spectral agglomerate AMGe, in progress (with T. Chartier, R. Falgout, V.E. Henson, J. Jones, T. Manteuffel, J. Ruge, and P Vassilevski).

- A robust approach to minimizing H(div) dominated functionals in an H1-conforming finite element space, J. Numer. Lin. Alg. App., to appear (with T. Austin and t. Manteuffel).

- First-order system least-squares functionals for the Oseen equations, in progress (with P. Bochev, S.-D. Kim, C.-O. Lee, T. Manteuffel, and O. Roehrle).

James D. Meiss
- R. D. Hazeltine and J. D. Meiss, Plasma Confinement, 2nd Edition (Dover Press, 2003), 480 pp. ISBN 0486432424.

- H.R. Dullin and J.D. Meiss, "Twist Singularities for Symplectic Maps", Chaos 13 1-16 (2003).

- A Gomez and J.D. Meiss, "Reversible Polynomial Automorphisms in the Plane: the Involutory Case", Physics Letters A 312 49-58 (2003).

- H.E. Lomeli and J.D. Meiss, "Heteroclinic Intersections between Invariant Circles in Volume Preserving Mappings", Nonlinearity 16 1573-1595 (2003).

- A. Gomez and J.D. Meiss, "Reversible Polynomial Automorphisms in the Plane", Nonlinearity 17 975-1000 (2003).

Philippe Naveau
- Naveau P., (2003) "Almost Sure Relative Stability of the Maximum of a Stationary Sequence", Advances in Applied Probability. Volume 35, Number 3. pp. 721-736.

- Oh, H. S., Ammann, C., Naveau P., Nychka, D., and Otto-Bliesner, B., (Volume 65, Issue 2, January 2003, Pages 191-201), Multi-resolution time series analysis applied to solar irradiance and climate reconstructions", Journal of Atmospheric and Solar-terrestrial Physics.

- Ammann C. and Naveau P., "Multi-decadal Periodicity in Tropical Explosive Volcanism", 2003, Geophysical Research Letters, Vol. 30, No. 5, 1210-1029, 2003.

- Naveau P. and Moncrieff, M., "A Statistical Formulation of Convective Mass Fluxes", Quarterly Journal of Royal Meteorology Society, Vol. 129, July, 2003, Part A, No. 592, pp. 2217-2233.

- Naveau P., Ammann, C., Oh, H. S., and Guo, W., (2003), "An automatic statistical methodology to extract pulse like forcing factors in climatic time series: Application to volcanic events", In: Robock A. (Ed.), Volcanism and the Earth's Atmosphere, Geophysical Monographs 139, pp 177-186.

- Naveau P., Furrer R., Keckhut P., "The spatio-temporal influence of the cortex on Arctic Total Column Ozone variability", The ISI International Conference on Environmental Statistics and Health. Editors: Jorge Mateu, David Holland, Wenceslao Gonzalez-Manteiga. 2003 Universidade de Santiago de Compostela. pp. 131-139.

Harvey Segur
- "Instabilities in the Two-Dimensional Cubic Nonlinear Schrodinger Equation", Phys. Rev. E 68, 045601, with J.D. Carter, 2003.

B. Invited Lectures and Meetings Attended for Calendar Year 2003

Mark Ablowitz

- Institute for Pure and Applied Mathematics, University of California at Los Angeles, Emerging Applications of the Nonlinear Schrodinger Equation, Feb. 3-7, 2003, "Discrete and continuous nonlinear Schrodinger systems", Feb. 5, 2003.

- Department of Mathematics, Loughborough University, England, Differential and Difference Equations in the Complex Domain, June 27-July 1, 2003; "Discrete and continuous nonlinear Schrodinger equations", June 27, 2003.

- Department of Applied Mathematics, Cambridge University, England, July 1-4, 2003. Research Investigations of Water Waves.

- Advanced NATO Research Workshop, Nonlinear Waves, Classical and Quantum Systems, Estoril, Portugal, July 12-19, 2003, "Discrete and continuous nonlinear Schrodinger equations". July 12, 2003.

- Department of Mathematics, Univ. of Missouri, Columbia, Missouri, March 6, 2003, "Solitons and Applications".

- Department of Mathematics, Univ. of Nebraska, Lincoln, Nebraska, Rowlee Lecture in Mathematics, April 24, 2003, "WWW: Waves Water and the Web".

Meredith Betterton

- Joint Central/Western Sectional meeting of the American Mathematical Society, October, 2003. Co-organizer of special session on Mathematical Biology (with Harvey Greenberg). Invited speakers and chaired special session on Mathematical Biology.

- Biophysical Society Annual Meeting, March 2003. Co-chaired session.

- American Physical Society March Meeting, March 2003. Chaired session.

- Siam Conference on Applications of Dynamical Systems at Snowbird, May 2003. Chaired session.

- Single Molecule Biophysics Workshop, Aspen Center for Physics, January, 2003.

- Materials Research Center Research Review, University of Colorado, Boulder, March, 2003.

- Condensed Matter Physics Lunch Seminar, University of Colorado, Boulder, May, 2003.

- Biophysics Seminar, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany, January, 2004.

- Colloquium, Department of Applied Mathematics, University of Colorado, Boulder, September, 2003.

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Gregory Beylkin

- Wave Propagation using Bandlimited Functions, Gregory Beylkin and Kristian Sandberg, Applied Inverse Problems Lake Arrowhead, CA, May 22, 2003.

- Separated Representations and Multiresolution Algorithms in Multiple Dimensions, Gregory Beylkin, Harmonic Analysis and Its Applications, in honor of Raphy Coifman and Yves Meyer, Orsay, France, June 19, 2003.

- Separated Representations and Multiresolution Algorithms in Multiple Dimensions, ORNL, July 15, 2003.

- Approximations, Separated Representations and Multiresolution Algorithms, Gregory Beylkin, Workshop: Integrated Multiscale Modeling of Molecular Computing Devices, ORNL, October 9, 2003.

- Separated Representations and Multiresolution Algorithms in Multiple Dimensions, Gregory Beylkin and Martin Mohlenkamp. SIAM Computational Science and Engineering, San Diego, California, February 13, 2003 .

- Adaptive Multiresolution Solvers for a Class of Advection-Diffusion Equations, Gregory Beylkin, Vani Cheruvu and Aime Fournier, SIAM Computational Science and Engineering, San Diego, California, February 13, 2003.

- Multiresolution adaptive models of geophysical fluids dynamics, Fournier, A., Beylkin, G. Cheruvu, V., EGS-AGU-EUG Joint Assembly, April, 2003.

Jem Corcoran

- "Methods in Bayesian Statistics", a series of five lectures in the Probability and Statistics Seminar Series in the Department of Applied Mathematics at CU Boulder.

- "Stochastic Summation of Hi-Order Feynman Diagram Expansions", Invited Talk at the National Center for Atmospheric Research, Climate and Global Dynamic Division.

James Curry

- MAA-NAM David Blackwell Lecture, "Cars, Faces, and Flowers 22.5 Degrees of Separation: What Can Matrix Factorization Tell You?", July 31, 2003.

Bengt Fornberg

- Four Colloquia, given in the following locations: NCAR (National Center for Atmospheric Research, Boulder, CO), Michigan State University (Lansing, MI), University of Dundee (Scotland, UK), and Colorado School of Mines (Golden, CO).

Keith Julien:

- Invited Speaker (April 2003) High Altitude Observatory, NCAR; Longitude-Latitude Spectral Galerkin Methods on a Sphere: Applications to Elliptic Equations (with Prof. Fornberg).

- Stably-Stratified and Unstably-Stratified Quasigeostrophic Flows: 2003 Rocky Mountain Workshop on Pattern Formation.

- Rotationally Constrained Flows; Snowbird, May 2003.

- Two Dimensional Solitons in Optically Modulated Waveguide Arrays: American Mathematical Society, University of Colorado.

Congming Li

- Colloquium, University of Toledo, December, 2003.

- Analysis Seminar, University of Oklahoma, November, 2003.

- Colloquium, University of Oklahoma, October, 2003.

Tom Manteuffel

- Past-President's Address, SIAM Annual meeting, Montreal, Canada, June 19, 2003.

- Colloquium Speaker, School for Computational Science, Florida State University, November 14, 2003.

Phillipe Naveau

- Oh H.-S., Ammann, C. M., Naveau, P., Thomas, R., and Joos, F., Statistical properties and spatial distribution of the low frequency solar signal in paleoclimate reconstructions and a coupled model American Geophysical Union (AGU) 2003 Fall Meeting, San Francisco, Invited talk.

- Naveau P., Amman C. and Oh. H. S., Stochastic simulation of large explosive volcanic eruptions and their impacts on climate, American Geophysical Union (AGU) 2003 Fall Meeting, San Francisco.

- Cooley D., Jomelli, V., Naveau P., Extreme value for paleoclimatic data sets with an application in lichenometry, American Geophysical Union (AGU) 2003 Fall Meeting, San Francisco.

- Jomelli V., Cooley D., Naveau P., The Little Ice Age in the tropical Andes, American Geophysical Union (AGU) 2003 Fall Meeting, San Francisco, Invited talk.

- Ammann, C.M., and Naveau, P., Oh, H. S., Joos, F., Gerber, S., Schimel, D. S., and Otto-Bliesner, B. L., Multiresolution methods for extracting fingerprints of external forcing during the last Millennium from model and proxy data, IUGG, Sapporo, Japan, Session MC14 invited presentation, International Union of Geophysics and Geodesy (2003).

- Ammann, C.M., and Naveau, P., A statistical study of explosive volcanism in the tropics: Stochastic evidence of an underlying physical process? IUGG, Sapporo, Japan, Session JSS01: Hagiwara Symposium, International Union of Geophysics and Geodesy (2003).

- Naveau P., A Statistical Methodology to Extract Pulse-like Signal in Climatic Times Series, Colorado-Wyoming Chapter American Statistical Association (Chapter meeting April 2003, Boulder).

- Ammann C., Robock A., Gao C. and Naveau, P., Ice cored derived volcanic forcing data set for general circulation model simulations, InterIce Workshop at the 7th International Symposium on Antarctic Glaciology, Milan, Italy, August 25-29 2003.

Harvey Segur

- "Stabilizing the Benjamin-Feir Instability", presented at 3rd International IMACS conference, Athens, GA, April 8, 2003.

- "Which Evolution Equations are Hamiltonian?", presented at BIRS (Banff International Research Station) conference on Differential Invariants and Invariant Differential Equations, Banff, Alberta, Canada, July 20, 2003.

- "Stabilizing the Benjamin-Feir Instability", presented at Workshop on Patterns in Physics, Fields Institute, Toronto, Ontario, Canada, Nov. 15, 2003.

- "Stabilizing the Benjamin-Feir Instability", presented at AMS (American Math Society) Regional meeting, Boulder, Colorado, October 4, 2003.

- "Transverse Instabilities in the Nonlinear Schrödinger Equation", presented at U. of North Carolina, Chapel Hill, NC, April 11, 2003.

- "Stabilizing the Benjamin-Feir Instability", presented at Duke U., Raleigh, NC, April 4, 2003.

C. Research Grants Active in 2003

Mark Ablowitz
NSF, Mathematics Division, 2000-2004, 2003-2006
AFOSR, 2003-2005
NSF, Engineering Communications, 1998-2003
CCHE, 1999-2003; Co-PIs, B. Fornberg, J. Curry
NSF, Collaborative Research, 2001-2004, Co-PIs W. Kath, C. Menyuk

Meredith Betterton
NIH, General Medicine, 2002-2005
Butcher Foundation, 2003-2004

Gregory Beylkin
NSF, Collaborative Research, 2000-2003, 2002-2004, Co-PIs L. Monzon,
M. Mohlenkamp
DOE, 2003-2004
NIMA, 2002-2004
UBatelle, 2003-2004

Jem Corcoran
Univ. of Georgia 2000-2004, Co-PI H.-B. Schüttler
UCAR, 2002-2003

James Curry
NSF, SCREMS, Co-PIs R. Clelland, M. Mohlenkamp, H. Segur
NSF, STEM-TP, PI R. McCray, Co-PIs V. Otero, C. Wieman, W. Wood

Anne Dougherty
CU Outreach Committee, 2003-2004, Co-PI M. Nelson, J. Curry
Carnegie Foundation, Dillard University Collaboration, 2002-2004, Co-PIs R. Schnabel, E. Pinkard

Bengt Fornberg
NSF, Mathematics Division, 2000-2004, 2003-2006
NASA, 2001-2004

Keith Julien
NSF, Collaborative Research, 2002-2005, Co-PI J. Werne
NWRA, 2003
Engineering Excellence Fund (EEF) grant

Tom Manteuffel
Sandia National Labs, 2001-2004, Co-PI S. McCormick
DOE, 2003-2006, Co-PI S. McCormick
IBM Fellowship, 2003-2004

Steve McCormick
NSF, Mathematics Division,1997-2000, 2000-2003; Co-PI's T. Manteuffel,
T. Russell
DOE, 2001-2004,Co-PIs T. Manteuffel, X. Cai
Lawrence Livermore National Labs, 2003-2004, Co-PI T. Manteuffel

James Meiss
NSF, Mathematics Division, 1999-2003, 2002-2005
NSF/VIGRE, 1999-2005; Co-PI's, H. Segur, J. Curry, B. Fornberg
NSF/VIGRE Outreach, 2003-2005

Philippe Naveau
NSF, 2003-2006
UCAR, 2003

Harvey Segur
NSF, Collaborative Research, 2002-2005. Co-PIs D. Henderson, J. Hammack,
B. Deconinck, J. Carter, D. Nicholls, W. Craig, C. Sulem

D. Dissertations for Academic Year 2003 – 2004

Allison Hoat Baker
"On Improving the Performance of the Linear Solver Restarted GMRES," Advisor: Tom
Manteuffel – Ph.D. December, 2003.

Richard McNamara
"Applications of Spanning Trees to Continuous-Time Markov Processes, with Emphasis
on Loss Systems," Advisor: Anne Dougherty – Ph.D. May, 2004.

Luke Nathan Olson
"Multilevel Least-Squares Finite Element Methods for Hyperbolic PDEs," Advisor: Tom
Manteuffel – Ph.D. August, 2003.

Kristian Hans Sandberg
"Forward and Inverse Wave Propagation using Bandlimited Functions and a Fast
Reconstruction for Electron Microscopy," Advisor: Greg Belykin – Ph.D. August, 2003.

Ulrike Schneider
"Advances and Application in Perfect Sampling," Advisor: Jem Corcoran – Ph.D. August,
2003.

Master's Theses for Academic Year 2003-2004

Eileen Daly
"A Comparison of Methods of Spectral Analysis of Nonstationary Time Series within a Spatial Framework," Advisor: Jem Corcoran – MS May 2004.

E. Miscellaneous for Calendar Year 2003

Mark Ablowitz
Complex Variables, Introduction and Applications by M.J. Ablowitz and A.S. Fokas, Second Edition, Cambridge Univ. Press, N.Y. 2003, 647 pp.

Meredith Betterton
Quoted as expert on suncup modeling in "The Wild File", Outside Magazine, December, 2003.

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8. PREPRINTS OF THE DEPARTMENT: Academic Year 2003-2004

The following is a list of preprints developed by Department faculty and visitors during this academic year. If you would like a copy of any preprint, please request a copy in writing from Jan Kaufman, Department of Applied Mathematics, 526 UCB, University of Colorado at Boulder, Boulder, CO 80309-0526 (janis.kaufman@colorado.edu).

508. *Improving Non-Negative Matrix Factorizations Through Structured Initialzation*, S. Wild, J. Curry, and A. Dougherty, July 2, 2003.

509. *Properties of de Rahm-Chaikin Fractals*, G. Goehle, J. Curry, A. Dougherty, July 15, 2003.

510. *Two-Dimensional Solitons in Optically Modulated Waveguide Arrays: An Optical Analog of Bose-Einstein Condensation*, M. Ablowitz, K. Julien, and Z. Musslimani, July 29, 2003.

511. *Instabilities in the Two-Dimensional Cubic Nonlinear Schrödinger Equation*, J. D. Carter and H. Segur, February 7, 2003.

512. *First-Order System Least Squares (FOSLS) for Coupled Fluid-ElasticProblems*, J. J. Heys, T. A. Maanteuffel, S. F. McCormick, J. W. Ruge, May 21, 2003.

513. *Behavior of Projected Newton's Method as Applied to Eigenvalue Problems*, K. Obermeyer and M. Winter, August 9, 2003.

514. *Multiresolution Quantum Chemistry in Multiwavelet Bases*, R. Harrison, G. Fann, T. Yanai, G. Beylkin, January, 2003.

515. *A Fast Reconstruction Algorithm for Electron Microscope Tomography*, K. Sandberg, D. Mastronarde, and G. Beylkin, October 14, 2003.

516. *Multiresolution Quantum Chemistry: Basic Theory and Initial Applications*, R. Harrison, G. Fann, T. Yanai, Z. Gan, and G. Beylkin, December 1, 2003.

517. *Singular Operators in Multiwavelet Bases*, G. Fann, G. Beylkin, R. Harrison, and K. Jordan, December 1, 2003.

518. *Wave Propagation Using Bases for Bandlimited Functions*, G. Beylkin, and K. Sandberg, December, 2003.

519. *Algorithms for Numerical Analysis in High Dimensions*, G. Beylkin and M. Mohlenkamp, February 18, 2004.

520. *A New Basis Class of Oscillatory Radial Basis Functions*, B. Fornberg, E. Larsson, G. Wright, February 18, 2004.

521. *Reduction of Collision-Induced Timing Shifts in Dispersion-Managed Quasi-Linear Systems with Periodic-Group-Delay Dispersion Compensation*, M. Ablowitz, C. Ahrens, G. Biondini, S. Chakravarty, and A. Docherty, June 17, 2004.

522. *Rotating Magnetoconvection with Magnetostrophic Balance*, Julien, K., Knobloch, E. and Tobias, S., June 23, 2004.

523. *Hierarchial Models for Spatially Anisotropic Rotationally Constrained Flows*, K. Julien, E. Knobloch, R. Milliff, and J. Werne, June 25, 2004.

526, 527, 528. *Hamiltonian Systems, Symplectic Maps,* and the *Standard Map*, J.D. Meiss, articles submitted to the Encyclopedia of Nonlinear Science, Fitzroy Dearborn, to be published 2004.

529. *Blinking Rolls: A Model for Three-Dimensional Chaotic Advection*, P. Mullowney, K. Julien, J.D. Meiss, April 12, 2004, in press 2004.