

Department of Applied Mathematics



Annual Report 2004-2005

University of Colorado at Boulder
Boulder, CO 80309

James H. Curry, Chair
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Cover Art: This year's images were produced by Applied Math graduate student/PhD recipient, Paul Mallowney.

The twisting structure seen in the cover image represents an invariant torus in a three dimensional fluid flow. The flow of interest is known as the Kuppers-Lortz instability which arises in a rapidly rotating thin fluid layer heated from below (Rayleigh-Benard convection). If the temperature difference exceeds a critical value, convection cells form in various patterns. One example is rolls which are a stable solution of the Boussinesq equations. However, if the rotation rate of the layer exceeds a threshold value, then the rolls are unstable to rolls rotated 120 degrees with respect to the original. These rolls are also unstable to another set at 240 degrees. The 240 degree rolls are unstable to the original set at 0 degrees and the pattern continues indefinitely.

This behavior can be described simply by a set of nonautonomous ordinary differential equations. The structure is interpreted as tracer particle trajectories (like a dye in a fluid) following a complicated toroidal structure. The torus is embedded in a chaotic sea where the mixing of dye is thorough. However, inside the torus the behavior is uniform and simple (less complicated) where no mixing occurs.

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OVERVIEW

As we stated in the overview to last year's Department of Applied Mathematics' Annual Report: The core mission of the Department is teaching, research, and service. Our core mission is carried out at multiple levels and leads to significant interactions between students, faculty and postdoctoral associates. We believe that we are honoring the time established precept that education should be transformative.

As expected, the department pursued many avenues of research innovation, taught and transformed some of its courses, and educated its students well, and it did so in the presence of decreasing resources. If we were to single out one important transformative activity it would be our faculty meeting at the end of the academic year. This year the department had a retreat where it reflected on the past year and began to establish principles, policies and procedures that we hope and expect will facilitate it becoming a top 10 department in the mathematical sciences. Among the results of this day long faculty meeting were the following revisions of the Vision, Mission and Objectives statements of the department:

Vision:

The vision of the Department of Applied Mathematics at the University of Colorado is to be an internationally leading department in Applied Mathematics in research and education.

Mission

The Department of Applied Mathematics at the University of Colorado strives to provide excellent teaching, research, and service to the university community and to the world in the application of mathematics to other disciplines.

Objectives:

The Department of Applied Mathematics has four primary objectives:

- *to teach our students well;*
- *to seek out and develop new, interesting applications of mathematics in other disciplines;*
- *to provide each student with a rich educational experience; and*
- *to create new mathematics.*

Faculty felt that the above Vision and Mission and the list of Objectives better described how the department views itself and wants others to view it.

Last year we submitted two proposals to the National Science Foundation (NSF) for departmental enhancement. The proposals were not successful. This was a major disappointment for the department and for me personally. However, support for NSF programs has been drastically reduced and competition is fierce.

The department is continuing to make progress, possibly minimally impacted by the cloud of "bad press" that the University has experienced over the past year. Students in the department continue to distinguish themselves through exceptional achievement. Specifically, not only did we

have three student teams (with a total of 9 students) participate in the Mathematics Modeling Contest, but again this year we had a team designated as outstanding. This ranks the department with some of the best and most distinguished departments in the world based on the achievements of its students.

I am pleased to report that the department continues sending some of its undergraduate majors to some of the best graduate schools and professional schools in the nation: Berkeley, Stanford, UCLA, USC, etc. Furthermore, three of our students (2 undergrads and 1 grad) were also awarded prestigious graduate fellowships from the National Science Foundation for their excellence. NSF awarded 1200 awards across all disciplines, and with only 31 of these awards made in the mathematical sciences, we consider it quite an honor to have received nearly 10% of the total number awarded in the mathematical sciences. The combined five year BS/MS degree effort continues to make gains as undergraduate students realize the advantages of gaining a Masters degree with just one more year of study. The quality of the graduate program remains high and students who complete both the Masters and the PhD have been successful in advancing their career goals by taking positions at colleges, universities, research laboratories or private companies.

I am also pleased to announce that the department successfully recruited three new faculty members. Dr. Manuel Lladser and Dr. Per-Gunnar Martinsson were both hired as assistant professors. Dr. Mary Nelson joins the department as a new instructor, after having been associated with the department for several years as she worked on her Ph.D. in educational research. On another happy note, Jem Corcoran has been promoted to Associate Professor with tenure starting August, 2005. Congratulations to Jem!

This past year saw Bruce Fast, the department's IT professional return to Informational Technology Services where he will be overseeing the campus-wide faculty computer purchase program and mathematical and statistical software licensing, among other duties. This year we also hired two new staff members: Jennifer Qualteri, was hired as our Accounting Tech/Faculty Coordinator and Marcia Flynt was hired as our new Office Manager. Marcia joined the department after many years in the private sector. Welcome Jennifer and Marcia!

Having completed my second year as Chair I admit that this has been a surprising year for me. Again, I believe the University is being well served by the students, faculty, and staff in the Department of Applied Mathematics at the University of Colorado. And while I now more fully understand more of the challenges or misperceptions that any academic department must respond to, I also realize it requires agility and a strong sense of vision, mission, and objectives to achieve departmental goals. I look forward to the opportunities that the department must embrace to achieve its very bright future.

Jim Curry
Chair

Anne Dougherty
Associate Chair

1. ROLE AND MISSION

Mission:

The Department of Applied Mathematics at the University of Colorado strives to provide excellent teaching, research, and service to the university community and to the world in the application of mathematics to other disciplines.

The objectives of the Department of Applied Mathematics at the University of Colorado at Boulder, (reaffirmed at the 2005 retreat) are summarized below:

- a) to teach our students well;
- b) to seek out and develop new, interesting applications of mathematics in other disciplines;
- c) to provide each student with a rich educational experience;
- d) to create new mathematics.

We interpret this to mean:

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;

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

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

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 3187 undergraduate and graduate students in 2004-2005. See §6 for a detailed list of the courses taught.

We had 108 undergraduate majors in 2004-2005, an 11% increase over the previous year and a 64% increase over the past two years. This is quite remarkable and we attribute it to an increasing

appreciation among students for the value of applied mathematics. Twenty-five students received their baccalaureate degrees this year, our largest class ever. (See §2D for a list of our graduates.) We are proud that 41 students in the fall and 40 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 who are interested in more in-depth training in applied mathematics. Forty-three students have declared an Applied Math minor, and even more are taking at least some of the upper division courses towards it.

The undergraduate student chapter of SIAM (the Society for Industrial and Applied Mathematics) is responsible for promoting interactions between applied math faculty and 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 §4G.)

The primary activity of the undergraduate SIAM chapter this year was the organization, together with the SIAM chapters of CU-Denver and CU-Colorado Springs, of the Front Range Applied Mathematics Student Research Conference. This conference was held on March 5, 2005. Professor Stan Osher, from UCLA, was the keynote speaker. The conference had 45 attendees including 22 student speakers from 6 universities along the Front Range. **Alejandro Cantarero** served as Chapter President and was assisted by and **Derrick Wildhaber, Brad Klingenberg, Lauren Anderson, and Sarah Macumber**. The officers for the 2005-06 academic year will be **Brad Klingenberg** (President), **Kris Tucker, Rachel Danson, Lauren Anderson** and **Brandon Booth**. Anne Dougherty was the faculty advisor for 2004-05 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 our 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 2005, the Applied Math Department entered three teams. The contest ran from 6:00 pm February 3, 2005 until 6:00 pm February 7, 2005 and drew entries from 828 teams from around the world. Over the past six years, the Applied Math teams have done extremely well, receiving an Outstanding designation six times. This year, one team achieved an Outstanding, the highest possible designation. This designation was received by only 13 of the 828 teams! Our students' continued success in the modeling contest is a tribute to their abilities and CU's strong academic programs.

Nine students from CU participated in the modeling contest this year. The MCM paper (which led to a publication) submitted by the team consisting of **Brian Camley** (Math and Physics double

major), **Pascal Getreuer** (APPM BS-MS student), and **Brad Klingenberg** (APPM major) was Outstanding on Problem B. Problem B involved developing and analyzing a model to determine the optimum number of toll booths on a heavily-traveled toll road. The team constructed their solution to account for the number of lanes, the amount of traffic flow, and the geometry of the merging lanes just after the toll booth plaza. Their Outstanding paper will be published in the fall 2005 issue of the UMAP Journal. Congratulations are also due to:

Thomas Josephson (APPM and CSEN), **Edmund Lewis** (APPM and CSEN), and **Laura Waterbury** (APPM and PSYC) who received a Meritorious (top 15% of all papers submitted) on Problem B.

Rachel Danson (APPM and PSYC), **Kristopher Tucker** (APPM) and **Brandon Booth** (APPM and CSEN) who received an Honorable mention (top 35-40%) on Problem B.

The VIGRE grant, from the National Science Foundation, has fundamentally changed the character of our undergraduate major. This past year, 11 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! **Moorea Brega** and **Jesse Lefcourt** graduated "with high distinction" (cumulative GPA must be at least 3.90) and **Stefan Awad**, **Alejandro Cantarero**, **Sarah Macumber**, **Justin Whitten** and **Todd Wieck** graduated "with distinction" (cumulative GPA at least 3.75). **Jesse Lefcourt** was recognized as the College of Engineering and Applied Science's Outstanding Senior for Academic Excellence and **Alejandro Cantarero** was selected as the Department's Outstanding Senior for Service Excellence. **Alejandro Cantarero**, **Sarah Macumber** and **Karl Obermeyer** received Henri-James Awards, a cash award given to outstanding Applied Math graduating seniors who are continuing on to graduate school.

Our students also received recognition from agencies outside of the university. **Ashley Moore**, a double major in Applied Math and Aerospace, received a Goldwater Scholarship for the 2005-2006 academic year. **Moorea Brega** and **Alejandro Cantarero** each received prestigious NSF Graduate Research Fellowships. Moorea will use her fellowship as she continues her education at Berkeley. Alejandro will study at UCLA.

The members of the Undergraduate Committee were Anne Dougherty, chair, Mark Ablowitz, Bengt Fornberg, James Meiss and Adam Norris. 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 44 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, 6 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.

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

- In 2004-2005, the department had 73 graduate students.
- The entering class in fall 2004 had 20 new students. In spring 2005, we welcomed one new graduate student to our program.
- We continue to attract a large fraction of U.S. citizens: in 2004-2005, 86% of the incoming students with financial support were U.S. citizens.
- 20 of our graduate students are women.
- Our graduate program had four under-represented minority students in 2004-2005. Of these four, one received a MS degree.
- 11 students completed their PhDs in 2004-2005. 19 students received MS degrees, with 11 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 (39) were Teaching Assistants (TAs) in the fall semester (includes both full time and part time TAs) and 32 served as TAs in the spring.

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>

The Graduate Committee for 2004-2005 consisted of Jem Corcoran, Manuel Lladser, Tom Manteuffel (Chair) and Harvey Segur. 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!

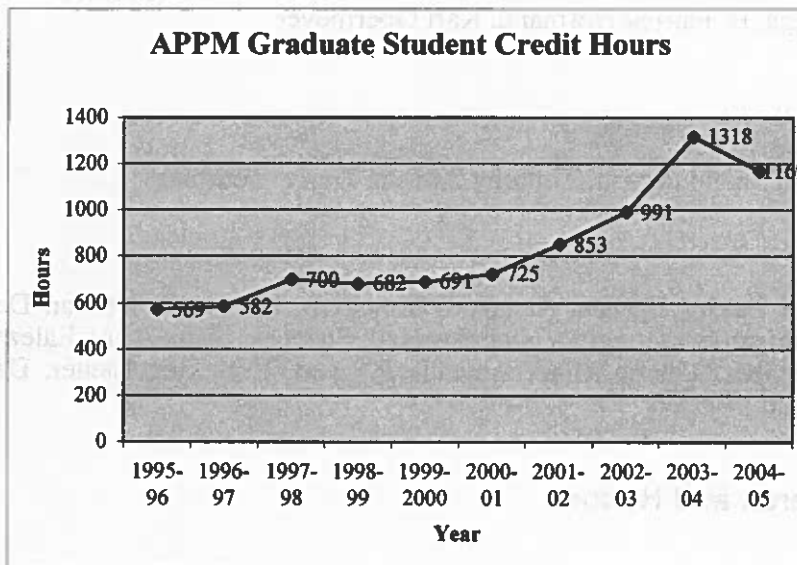
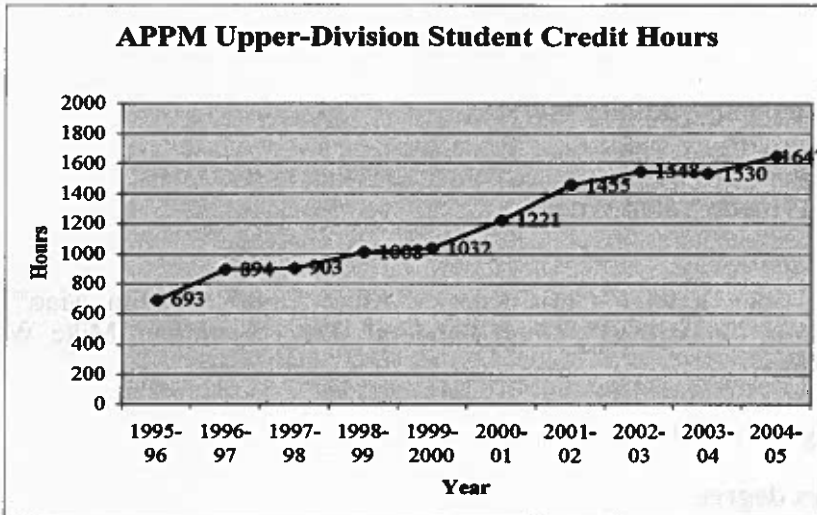
C. Enrollment Statistics

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**
2004-05	3187/3664*	73**	108**	43**

*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.



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 2004

Neil Burrell, Scott MacLachlan, Oliver Roehric, Matthew Tearle, Eric Thaler, Chad Westphal

December 2004

Feng-Nan Hwang, Paul Mullowney, Mark Petersen

May 2005

Marcio Carvalho, Srinath Vadlamani

Master's degree

August 2004

Santhosh Heddese*, Joshua Wysack

December 2004

Susan Jean Hovde*, Jian Wang*

May 2005

Erin Alwon, Nick Kridler, Chris Kurcz*, Mike Levy*, Wenjin Mao*, Josh Nolting*, Jennifer Perletz, Cecile Piret*, Geoff Sanders*, Davy Sparkman, Mike Watson*, Xiao-wei (Sherwin) Zhao

*Continuing with PhD

Bachelor's/Masters degree

May 2005

Moorea Brega, R. Patrick Hofmann, Karl Obermeyer

Bachelor's degree

December 2004

Philip Kent, Shane Passon, Timothy Satrom, Pierre Tournier

May 2005

Stefan Awad, Patrick Boylan, Alejandro Cantarero, Shaun Davies, Ian Derrington, Michael Franklin, Christopher Guggino, Nicholas Hall, Shannon Horn, Arian Lalezari, Jesse Lefcourt, Sarah Macumber, Valerie Mino, Amanda Plappert, Eric Ringelstetter, Derek Smith, Justin Whitten, Todd Wieck

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, 2004.

The International Conference on Nonlinear Waves, Integrable Systems and Their Applications was held on the occasion of Mark Ablowitz's 60th birthday, in recognition of his contributions to the field of applied mathematics. It was held at University of Colorado at Colorado Springs, June 4-7, 2005 and University of Colorado at Boulder June 8, 2005.

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).

Jem Corcoran: Promoted to Associate Professor with tenure beginning August, 2005.

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. Trustee of the CU Foundation.

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: Chair of the Review panel of the Computational Sciences Program of the Helmholtz Association of National Research Centres, Germany (Equivalent to Germany's DOE).

Member of the Review Panel, DOE ASCI Alliance Center, C-SAFE, University of Utah.

Mary Nelson: Teaching Excellence Award through the residential life organization.

Appointed to the DACOWITS committee in 2004 (Defense Agency Committee on Women in the Services).

Adam Norris: Awarded Marinus G. Smith award from the CU Parents Association.

Harvey Segur: Selected to give the Graduate School's 97th 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." Harvey spoke on the fluid dynamics of ocean waves on March 9th, 2005. He described research on several types of ocean waves, including common, wind-driven waves and much rarer tsunami waves, like those that killed more than 225,000 people and caused billions of dollars in destruction in 11 Indian Ocean nations on Dec. 26.

F. Research

This has been a year of significant accomplishment in research both by the faculty and students in the Department.

Two undergraduate students and one graduate student were awarded National Science Foundation Graduate Research Fellowships: Moorea Brega and Alejandro Cantanero, who will continue their graduate studies at UC Berkeley and UCLA respectively, and Maribeth Bleymaier, who will continue her graduate studies here at the University of Colorado-Boulder.

Not only did one faculty member receive a prestigious Sloan Foundation award (Meredith Betterton), but two faculty members received the Boulder campus Faculty Fellowships as an acknowledgment of outstanding performance in research. Both Keith Julien and Steve McCormick used their Fellowship time for international travel, to establish new research collaborations so that they can prepare students for the international stage. Congratulations to them.

But, there is more! Harvey Segur gave the University's Distinguish Research Lecture, part of the most prestigious series that the University has to offer (for more details see below). Congratulation to Harvey.

The year ended with an international conference recognizing career contributions of Professor Mark Ablowitz (for more details, see below). Congratulation to Mark!

In addition to the accomplishments highlighted above let me also note that the faculty in Applied Mathematics were fully engaged in research and report that they were principal investigator or co-principal investigator on 44 funded grants, produced 69 refereed journal articles or research/technical reports, and gave 60 colloquium or professional presentations. They were also dissertation advisors to 33 students and members of 40 dissertation committees. This summary is very impressive given our small faculty size.

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 2004-2005, the faculty in the department served in such capacities on 13 journals/periodicals, which include:

Applied and Computational Harmonic Analysis (Beylkin)
Cambridge University Press Texts in Applied Mathematics (Ablowitz)
Cambridge University Press Combined Editorial Board in Applied Mathematics (Monographs Series, Text Series, and Computational Math Series) (Ablowitz)
Communication on Pure and Applied Analysis (Li)
Dynamics of Partial Differential Equations (Ablowitz)
Electronic Transactions in Numerical Analysis (Manteuffel)
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 Multiscale Modeling and Simulation (McCormick)
SIAM Journal of Numerical Analysis (Manteuffel)
Studies in Applied Mathematics (Ablowitz)

Copper Mountain Conference, April 3 – 8, 2005

Tom Manteuffel and Steve McCormick organize the Copper Mountain Conference in the spring of each year. This year the conference was on Multigrid Methods and was held during April 3- April 8. There were 105 participants and 53 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 42 students attended the conference. Student participation has made the Copper Mountain conferences a central contributor to the fields of multigrid and iterative methods.

Graduate School's 97th Distinguished Research Lecture, March 9, 2005

The Graduate School's 97th Distinguished Research Lecture was presented by Harvey Segur on March 9. Harvey's work with waves was of particular interest to the public in light of a recent disaster. His topic was about ocean waves, including their role in the deadly Asian tsunami of December 26. A reception followed the lecture.

*International Conference on Nonlinear Waves, Integrable Systems and Their Applications
University of Colorado at Colorado Springs June 4-7, 2005 and
University of Colorado at Boulder June 8, 2005*

The conference focused on recent developments in the fields of nonlinear waves and integrable systems. International experts presented their current research in applied areas such as nonlinear optics and Bose-Einstein condensates as well as in theoretical areas, which included inverse scattering theory and connections of soliton equations with geometry. The conference was held on the occasion of Mark Ablowitz's 60th birthday, in recognition of his contributions to the field of applied mathematics. Please see <http://math.uccs.edu/~soliton> for additional details.

G. Department-wide Grants

VIGRE

In 1998, the department was awarded a major grant by the National Science Foundation for vertical integration of research and education (VIGRE), totaling \$2.5 million and beginning in the summer of 1999. The VIGRE program has 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. 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.

2004-2005 VIGRE Fellows		
Postdoctoral Fellows	Graduate Students	Undergraduates
Jamison Moeser	Cory Ahrens	Lauren Anderson
Suzanne Nezzar	Maribeth Bleymaier	Brandon Booth
Michael Sprague	James Brannick	Alejandro Cantarero
	Erin Byrne	Rachel Danson
	Dan Cooley	Tom Josephson
	Terry Haut	Sarah Macumber
	Mark Hoefer	Pascal Getreuer
	Holly Lewis	Brad Klingenberg
	Josh Nolting	Laura Waterbury
	Mark Petersen	Todd Wieck
	Geoffrey Sanders	
	Brendan Sheehan	
	Derin Wysham	

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 three Postdoctoral Fellows, thirteen graduate students, and eleven undergraduates, listed in the table above.

A number of people supported by VIGRE are moving on to better things next year. All of the postdoctoral fellows are leaving: Jamison Moeser is job hunting in the Boston area, Suzanne Nezzar is living in Montreal and job hunting in that area, and Michael Sprague has accepted a tenure-track position at the new University of California at Merced. Three of our VIGRE-supported graduate students will go on to postdoctoral positions elsewhere: Paul Mallowney at University of Canterbury in New Zealand, Mark Peterson at Los Alamos National Laboratory, and Derin Wysham at UC Davis. Maribeth Bleymaier won a prestigious NSF Graduate fellowship to continue her studies here.

The VIGRE program is now in its final year and will finish in April of 2006. 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 2005 marks the sixth 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, high school algebra, and probability/statistics. Nineteen 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 statistics seminar was taught by Amy Biesterfeld in fall, 2004, and Adam Norris taught a seminar on incorporating mathematical software into high school algebra and calculus classes in spring 2005. Both classes were well-received.

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, 2004. Presenters were Maribeth Bleymaier, Erin Byrne, and Jim Curry.
- Engineering Career Day programs for high school students, March 12, 2005. The presenter was Anne Dougherty.
- High School Honors Institute; August 2-4, 2004. Presenters were Maribeth Bleymaier, Stefan Wild, Geoff Sanders, Tyler Hartung, Terry Haut, and Anne Dougherty.

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 Dougherty 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. The portion of this project supported by Carnegie concluded in May 2005 although both universities plan to continue to use the curriculum materials developed during the first three years of the collaboration. Additional funding is being sought for future work.

I. Donor Activities

We would like to express our most sincere appreciation to all of our donors, alumni, friends, and colleagues who continue to support the Department of Applied Mathematics with their thoughts and their gifts. We are getting very close to achieving one of our departmental goals which is funding the Faculty Lecture Series endowment.

This year we extend a special thank you to Dr. Charles Case, who has very generously donated vintage scientific instruments jointly to the Department of Applied Mathematics and the Physics Department. These instruments will be housed and displayed in cases located in the Physics Building. Within the next year, the display will be ready for public viewing and we welcome you to come to Boulder and view these wonderful scientific instruments. If you don't have the opportunity to personally visit, please check out our website where we will soon have information and photographs of the exhibit. The Department will also explore the possibility of developing a course that will introduce students to these instruments. Again, we express a special thank you to Dr. Case ("call me Charlie") for his generosity.

J. Changes In Personnel

We are very fortunate to have had two new office staff members join the department this past year. Jennifer Qualteri joined us in August, 2004 in the accounting technician/faculty coordinator role, and Marcia Flynt joined us in January, 2005 after several years in the private sector, as our new office manager. We welcome both of them!

Bruce Fast moves from the departmental information technology position back to Information Technology Services (ITS) as of July 1, 2005. He will be overseeing the campus-wide faculty computer purchase program and mathematical and statistical software licensing, among other duties. Thank you to Bruce for all of his hard work and efforts over these past several years. He will be missed!

We are pleased to welcome three new faculty members in August. Manuel Lladser will move from an instructor position to assistant professor. Manuel's area of expertise is in probability and its applications, especially to mathematical biology. Per-Gunnar Martinsson, formerly a postdoctoral fellow at Yale, will be an assistant professor with areas of expertise in both analysis and numerics. Mary Nelson joins the department as a new instructor. Mary has been associated with the department for several years as she worked on her PhD in educational research, which she completed in summer, 2005. Her research area involves assessment and the mathematical transition of students to university-level mathematics. Philippe Naveau resigned his position as assistant professor to pursue other interests in France. However, we are happy that he has been appointed adjunct assistant professor and will continue to work at CU and NCAR on an occasional basis.

Last, but not least, how exciting that many of our postdoctoral associates have moved on to new positions. Scott Maclachlan accepted a position at the University of Minnesota in Minneapolis. Jamison Moser returned to the Boston area in search of a position and Suzanne Nezzar is job hunting in the Montreal area. Oliver Roehrle accepted a postdoctoral position at the Bioengineering Institute at the University of Auckland, New Zealand. Michael Sprague and Boaz Ilan have accepted tenure track positions at the University of California at Merced. We wish each and all of them the best as they pursue these new positions.

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

A. Core Faculty, Instructors, 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 (Spring, 2005); 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.

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

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

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.

Susan Hallowell, Lecturer, PhD, University of Pennsylvania, Transportation and Telecommunications Operations and Service Design, Network Optimization.

Berend Herbst, Visiting Professor/Lecturer, University of Stellenbosch, South Africa, Mathematical and Computational Analysis of Nonlinear Waves.

Jeffrey J. Heys, Postdoctoral Research Associate/Lecturer (spring, 2004); 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.

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

Manuel Lladser, Instructor, PhD, The Ohio State University. Probability Theory.

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.

Scott MacLachlan, Research Associate/Lecturer; PhD, University of Colorado at Boulder. Computational Math, Multigrid Methods, Multiscale Simulation.

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, resigned as Assistant Professor, appointed Adjunct Assistant Professor in January 2005; PhD, Colorado State University. Applied Probability and Statistics.

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

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.

Oliver Roehrl, Postdoctoral Research Associate; PhD University of Colorado at Boulder. Numerical Analysis.

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.

Elizabeth Siewert, Professional Research Assistant, University of Colorado at Boulder.

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

Matthew Tearle, Lecturer, PhD, University of Colorado at Boulder, Hydrodynamic Stability Theory, Computational Fluid Dynamics.

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

Manuel 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.

Kamran Mohseni (Aerospace Engineering), Physical Applied Math, Computational Fluid Mechanics.

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.

Annick Pouquet (National Center Atmospheric Research), Physical Applied Math, Weather Prediction Models.

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), Numer. 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.

Henry Tufo (Computer Science) Computational science, parallel algorithms for high performance computers

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 mesoscale 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, 2004-2005

Antar, Nalan, Istanbul Technical University, June 1 – September 15, 2005.

Bahri, Abbas, Rutgers University, November 18-19, 2004.

Bakirtas, Ilkay, Istanbul Technical University, March 12 – September 16, 2004, June 1 – September 15, 2005.

Borisov, Alexey, Udmurt State University, Russia, March 22 – April 2, 2005.

Boutara, Aisha, Universite de Liege, June 8, 2005.

Carter, John, Seattle University, March 8 – 10, 2005.

Deconinck, Bernard, University of Washington, Seattle, March 7 – 11, 2005.

DeLillo, Silvana, Universita de Perugia, May 29 – June 11, 2005.

Docherty, Andrew, University of New South Wales, Sydney, Australia, June 2005.

Dragunov, T., Department of Mechanics and Mathematics Nizhny Novgorod State University, Russia, November 24 – December 8, 2004.

Dullin, Holger, Loughborough University, UK, May 27 – June 10, 2005.

Gangbo, Wilfrid, Georgia Institute of Technology, April 7 – 9, 2005.

Gonchenko, Sergey, University of Nizhny Novgorod, Russia, March 22 – April 2, 2005.

Herbst, Ben, University of Stellenbosch, South Africa, June 1 – December 31, 2005.

Hou, Thomas, California Institute of Technology, September 22-27, 2004.

Huang, Weizhang, University of Kansas at Lawrence, April 17 – 23, 2005.

Jegat, Cyrille, Ecole des Mines de Paris, June 20 – September 10, 2005.

Kim, Sang Dong, Kyungpook National University, South Korea, December 30 – March 1, 2005.

Knobloch, Edgar, University of Leeds, UK, March 18 – 24, 2005, June 19 – July 9, 2005.

Kruskal, Martin, Rutgers University, June, 2005.

Lerman, Lev, Department of Mechanics and Mathematics Nizhny Novgorod State University Russia, November 24 – December 8, 2004.

Lee, Jongwoo, Kwangwoon University, Seoul, South Korea, August 3 – 8, 2004.

Lomeli, Hector, Instituto Tecnológico Autónomo de México, March 17 – 22, 2005.

Maier, Robert, University of Arizona, January – August, 2005.

Mamaev, Ivan, Udmurt State University, Russia, March 22 – April 2, 2005.

Maruno, Kenichi, Kyushu University, Kasuga Japan, July 6 – 14, 2004 .

Mohlenkamp, Martin, Ohio University, Fall, 2004.

Morosov, Albert, Department of Mechanics and Mathematics, Nizhny Novgorod State University, Russia, November 24 – December 8, 2004.

Muslimani, Ziad, University of Central Florida, June and July, 2005.

Osher, Stan, UCLA, March 3 – 6, 2005.

Prinari, Barbara, Universite de Lecce, Italy, July 28 – October 1, 2004, January 10 – February 15, 2005, May 27 – August 1, 2005.

Proctor, Mike, University of Cambridge, February 24 – March 1, 2005.

Sasa, Narimasa, Center for Promotion of Computational Science and Engineering, Japan Atomic Energy Research Institute, March 11 – 19, 2005.

Spagnolie, Sevario, NYU, March 8 – 11, 2005.

Wu, Mingzhong, Colorado State University, April 12, 2005.

Yang, Paul, Princeton University, April 28 – May 1, 2005.

Zhang, Qi, University of California, Riverside, March 31 – April 3, 2005.

Kwangchul Kang, Choon-Oh Lee, Jungsub Lee, KiBaek Lee, KyungSub Lee - Korean undergraduate students who visited during the month of February, 2005.

D. Staff

Bruce Fast, Systems Administrator (until July, 2005).

Marcia Flynt, Office Manager (since January, 2005).

Karen Hawley, Student Coordinator.

Jan Kaufman, Office Coordinator.

Leslie Ordal, Outreach Coordinator (January through June, 2005).

Jennifer Qualteri, Accounting Technician/Faculty Coordinator (since August, 2004).

Sichia Bell, part-time student assistant.

4. WEEKLY COLLOQUIA and SEMINARS 2004-2005

A. Applied Mathematics Colloquium, 2004-2005

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.

Gregory Beylkin, Dept. of Applied Math, University of Colorado, Boulder, September 3, 2004, "Separated representations and fast adaptive algorithms in multiple dimensions".

James Meiss, Dept. of Applied Math, University of Colorado, Boulder, September 10, 2004, "Twistless Bifurcations in Hamiltonian Dynamics".

Horst Behncke, Joint Colloquium of Math and APPM, organized by Math, University of Osnabrück, Germany, September 15, 2004, "The splitting of control of multiclass epidemics".

Tom Hou, Charles Lee Powell Professor of Applied and Computational Mathematics, Dept. of Applied and Computational Math, California Institute of Technology, September 24, 2004, "Vortex stretching and dynamic generation of small scales in 3D incompressible flows".

Wenxiong Chen, Joint Colloquium of APPM and Math, organized by APPM, Yeshiva University, October 8, 2004, "Classification of Solutions for Integral Equations and Systems".

Shemin Ge, Dept. of Geological Sciences, University of Colorado, Boulder, October 15, 2004, "Seismically Induced Fluid Pressure Diffusion in the Earth's Crust".

Kaspar Willam, National Academy of Engineering, Department of Civil, Architectural and Environmental Engineering, University of Colorado, Boulder, October 22, 2004, "Challenges in Computational Failure Mechanics".

Rick Moeckel, Department of Mathematics, University of Minnesota, October 29, 2004, "Relative Equilibria, Newton Polytopes and Smale's 6th Problem".

Yongmin Chen, Department of Economics, University of Colorado, Boulder, November 5, 2004, "Price and Product Variety in the Spokes Model".

John Hansen, Electrical and Computer Engineering Department, University of Colorado, Boulder, November 12, 2004, "SpeechFind: Advances in Spoken Document Retrieval for a National Gallery of the Spoken Word".

Abbas Bahri, Department of Mathematics, Rutgers University, November 19, 2004, "Regular and Singular solutions in Conformal Geometry".

Lev Lerman, Department of Differential Equations and Math. Analysis, University of Nizhny Novgorod, Russia, December 3, 2004, "Integrable and Nonintegrable Behavior in Hamiltonian Dynamics".

Andrew Martin, Ecology & Evolutionary Biology, University of Colorado, Boulder, January 14, 2005, "Phylogenetic Inference of Molecular Evolution and Population History Shameless Request for Assistance: or Coming to a Crashing Halt".

Qinglan Xia, Department of Mathematics, University of Texas, Austin, January 21, 2005, "Ramified phenomena in optimal transportation".

Jon Wilkening, Courant Inst. of Mathematical Sciences, New York University, January 28, 2005, "A model of stress-driven grain boundary diffusion in microchips".

Sebastian Schreiber, Joint Colloquium of APPM and EEB, organized by EEB, January 28, 2005, Mitton Lab, "Coevolution of contrary choices in host-parasitoid systems".

Thomas Bengtsson, University of CA, Berkeley, February 4, 2005, "Forecasting and Updating Traffic Flow".

Karen Ball, Indiana University, February 11, 2005, "Stochastic models for multiscale chemical reaction kinetics".

Alejandro Murua, University of Washington, February 18, 2005, "On Potts Model Clustering, Kernel K-means, and Density Estimation".

Mike Proctor, University of Cambridge, Department of Mathematics, February 25, 2005, "Modulational instabilities of patterns induced by spatial resonances".

Stanley Osher, University of California, Los Angeles, Dept. of Mathematics, March 4, 2005, "Bregman iteration and the dual of BV in image analysis".

Harvey Segur, Applied Mathematics, C.U. Boulder, March 9, 2005, University of Colorado Distinguished Research Lecturer: "Waves in the Ocean".

Bernard Deconinck, University of Washington, Department of Applied Mathematics, March 11, 2005, "Computing spectra of linear operators".

Michael Sprague, Applied Mathematics, C.U. Boulder, March 18, 2005, "Numerical Simulation of a Reduced System for Rotationally Constrained Convection".

Qi S. Zhang, University of California, Riverside, Dept. of Mathematics, April 1, 2005, "On second order parabolic equations with singular lower order coefficients".

Wilfrid Gangbo, Georgia Institute of Technology, School of Mathematics, April 8, 2005, "The 2-- Wasserstein metric and its applications to PDEs".

Corrie Detweiler, MCDB, University of Colorado, Boulder, April 15, 2005.

Sharon Collinge, Ecology and Evolutionary Biology, University of Colorado at Boulder, April 22, 2005, "The Collinge Lab".

Paul Yang, Department of Mathematics, Princeton University, April 29, 2005, "Conformal invariants, Q-curvature and Ricci tensor".

B. Seminars in Applied Mathematics (Nonlinear Waves Seminar), 2004-2005

The Department maintained the Applied Mathematics Seminar, a weekly seminar series at 4:00 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:

Philip Treharne, DAMTP, Centre for Mathematical Sciences, Cambridge University, UK, August 24, 2004, "BVPs of evolution PDEs with Variable Coefficients."

Ilkay Bakirtas, Istanbul Technical University, Department of Mathematics, Turkey, August 31, 2004, "Wave collapse in nonlocal Nonlinear Schrödinger equations".

Barbara Prinari, Dipartimento di Fisica, Universita' di Lecce, Italy, September 7, 2004, "Inverse Scattering Transform – Tutorial".

Barbara Prinari, Dipartimento di Fisica, Universita' di Lecce, Italy, September 14, 2004, "Inverse Scattering Transform for the Nonlinear Schrödinger equation, Part II".

Barbara Prinari, Dipartimento di Fisica, Universita' di Lecce, Italy, September 21, 2004, "Inverse Scattering Transform for the Nonlinear Schrödinger equation, Part III".

Jamison Moeser, Department of Applied Math, CU Boulder, September 28, 2004, "Ground states for the NLS equation- a tutorial".

V.A.Vladimirov, Department of Mathematics, and Director of Hull Institute for Mathematical Sciences and Applications (HIMSA), University of Hull, UK, October 19, 2004, "On Vibrodynamics of Inverted Pendulum and Submerged Solid".

Lincoln Carr, CU-JILA, November 2, 2004, "Nonlinear band theory in Bose-Einstein condensates: the nonlinear Schrodinger equation with a Kronig-Penney potential".

Lincoln Carr, CU-JILA, November 9, 2004, "Quantum phase transitions in a novel Fermi-Bose Hubbard model".

Leo Razihovsky, CU-Physics, November 16, 2004, "Transverse-field tilting transitions in a planar vortex array pinned by a linear defect".

Jamison Moeser, CU Boulder, Applied Math Department, November 30, 2004, "Continuation of Ground states for the NLS equation- a tutorial".

Jamison Moeser, University of Colorado, Applied Math Department, January 18, 2005, "Ground states for the NLS equation - an informal tutorial".

Selim Esedoglu, Department of Mathematics, UCLA, January 25, 2005, "Total Variation Image Denoising: New Theory and Applications".

Stephen Watson, Northwestern University, February 1, 2005, "The Morphometry and Coarsening Dynamics of Faceted Crystal Surfaces".

Howard Bondell, Rutgers University, February 8, 2005, "Robust Logistic Regression via the Case-Control Formulation".

Manuel Lladser, CU, Boulder, February 15, 2005, "Multiple Pattern Matching: a Markov Chain Approach".

Victor Gurarie, Physics Department, CU, Boulder, February 22, 2005, "Hessian matrices of random functions at the points of their minima".

Dana Anderson, Physics Department, CU, Boulder, March 1, 2005, "Cocktail Party Dynamics".

Robert S. Maier, University of Arizona, March 8, 2005, "A New Approach to Hypergeometric and Other Special Function Identities".

Robert S. Maier, University of Arizona, March 15, 2005, "Lamé Polynomials, the Hermite-Krichever Ansatz, and Hyperelliptic Reduction".

Robert S. Maier, University of Arizona, March 29, 2005, "The Effects of Weak Noise on Finite-Dimensional Systems".

Robert S. Maier, University of Arizona, April 5, 2005, "The Effects of Weak Noise on Some PDEs".

Mingzhong Wu, Colorado State University, April 12, 2005, "Spin Wave Modulational Instability and Spin Wave Envelope Soliton Generation in Magnetic Films".

Oren Cohen, JILA, CU Boulder, April 19, 2005, "Partially coherent waves in nonlinear periodic systems".

Boaz Ilan, CU Boulder, April 26, 2005, "Dispersion Managed Solitons and the Revolution in Optical Clocks".

C. University of Colorado at Boulder/University of Colorado at Denver/Colorado School of Mines Joint Seminar in Computational Mathematics, 2004-2005

Because all of the organizers at CU-Denver and CSM were 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.

Ram Nair & Mike Levy, NCAR and CU, Boulder, January 25, 2005, "A Discontinuous Galerkin Atmospheric Model".

Sang Dong Kim, Kyungpook National University, Korea, February 1, 2005, "FOSLS approach for elliptic problem using pseudo-spectral methods".

Sang Dong Kim, Kyungpook National University, Korea, February 8, 2005, "A review on preconditioning on pseudo-spectral methods".

Jeff Heys, Arizona State University, February 22, 2005, "Things to do in the Desert or Problems in Search of a Good Mathematician".

Fernando Perez, CU, Boulder, Applied Math, March 1, 2005, "Adaptive application of operators using multiwavelets".

J. David Moulton, Los Alamos National Lab, March 15, 2005, "Multilevel Upscaling".

Radu Cascaval, UC Colorado Springs, April 12, 2005, "Computational Modeling of the Human Arterial System".

Ulrich Hetmaniuk, Sandia National Laboratory, April 25, 2005, "Solving a class of large-scale eigenvalue problems with multigrid".

D. Dynamical Systems Seminars, 2004-2005

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 in the fall and 4:00 in the spring. The following is a list of the speakers and the titles of their talks:

Meredith Betterton, CU Boulder, Department of Applied Mathematics, September 9, 2004, "Structure Formation in Melting Snow: Penitentes, Suncups, and Dirt Cones".

Randall Tagg, Department of Physics, CU Denver, September 16, 2004, "Tissue Dynamics".

Patrick Weidman, Mechanical Engineering, September 23, 2004, "Model Equations for the Eiffel Tower profile: Historical Perspective and New Results".

Dimitri Veras, CU Boulder, JILA & APS, October 7, 2004, "Libration Widths of Planets and Satellites in Gravitational Resonances".

Glen Stewart, CU Boulder, LASP, October 14, 2004, "Shock Wave Dynamics in Saturn's Rings".

Greg Duane, NCAR, October 21, 2004, "Synchronistic Approach to Data Assimilation".

Dhinakar Kompala, CU Chemical Engineering, October 28, 2004, "Dynamic Modeling in Biological Systems - Metabolic Engineering & Spontaneous Oscillations".

VIGRE Day Lectures, November 4, 2004.

Liz Bradley, CU Boulder, Computer Science, November 11, 2004, "Modeling and Control of the Dynamics of Denial-of-Service Attacks".

David Simpson, CU Boulder, Department of Applied Mathematics, November 18, 2004, "An Introduction to Auto: Software for Bifurcation Analysis".

Albert Morosov & Tim Dragunov, University of Nizhny Novgorod, Russia, December 2, 2004, "On Resonances in Near Hamiltonian Systems with Two Frequencies".

Bruce Sutherland, University of Alberta, December 7, 2004, "Intrusions, Waves and Solitary Waves".

Lev Lerman, Department of Differential Equations and Math. Analysis, University of Nizhny Novgorod, Russia, December 9, 2004, "Homoclinic Orbits to Invariant Tori in Nearly Integrable Hamiltonian Systems".

Sebastian Schreiber, William and Mary, January 27, 2005, "Persistence and Heteroclinic Cycles in Ecology".

Siva Mettupalayam, CU Boulder, Civil Engineering Department, February 3, 2005, "Modeling Approaches in Earthquake Engineering Simulation".

Paul Muldowney and Derin Wysham, CU Boulder, Applied Math Department, February 10, 2005, "New Results and New Questions, Part 1".

Geoffrey Vasil, PAOS, February 17, 2005, "Energy Troubles in Rotating Fluids, Weak Equations and Precessing Waves".

Mike Watson and Terry Haut, CU Boulder, Applied Math Department, February 24, 2005, "New Results and New Questions, Part 2".

Joanne Mason, HAO, March 3, 2005, "Long Dynamo Waves".

Hector Lomeli, Instituto Tecnológico Autónomo de México, March 17, 2005, "Evolutionary Game Theory and Voting".

Alexey Boriosv and Ivan Mamaev, Institute of Computer Science, Udmurt State University, March 31, 2005, "Nonholonomic Dynamical Systems and the Strange Attractors in the Rattleback".

Sergey V. Gonchenko, Institute of Applied Mathematics and Cybernetics, Nizhny Novgorod University, March 31, 2005, "Homoclinic Tangencies, Homoclinic Maps and Strange Attractors".

Patrick Weidman, CU Boulder, Mechanical Engineering, April 7, 2005, "The Terminal Motion of Sliding and Spinning Disks with Coulomb Friction".

James Meiss, CU Boulder, Applied Math Department, April 14, 2005, "New Results and New Questions, Part 3".

Keith Julien, CU Boulder, Applied Math Department, April 21, 2005, "New Results and New Questions, Part 4".

David Montgomery, Dept. of Physics & Astronomy, Dartmouth College, April 28, 2005, "Two-dimensional Turbulence with Material Wall Boundaries".

E. Probability and Statistics Seminars, 2004-2005

Several of our sessions this year were meetings of a Bayesian Statistics Reading Group, organized by Jem Corcoran. These sessions, along with special seminars were held on Wednesday afternoons at 3:30 pm. in the Applied Math Conference Room, ECOT 226.

Robert Maier, University of Arizona, April 27, 2005, "The Algebraic Theory of First Hitting Times in Markov Chains".

F. Mathematical Biology Reading Group, 2004-2005

The reading group is run by Professor Meredith Betterton and Josh Downer and met once a week. The goals of this reading group are to bring participants up to date so they may begin research in mathematical biology and to present results of their research. Participants take turns presenting a recent paper or their own work. This year's topics included Markov chains, DNA elasticity, motor proteins which move on nucleic acids (translocases), basics of protein biochemistry, models for sequence analysis based on stochastic processes, and modeling cellular signalling pathways. Participants in 2004-2005 included Meredith Betterton, Dave Clarke (CHEN), Josh Downer, Marcus Lanskey (CHEM), Jinyu Li, Stephanie Meyer (PHYS), Elizabeth Siewert, Laura Waterbury, Manuel Lladser, Terry Haut, and Maribeth Bleymaier.

G. Undergraduate and Graduate Seminars, 2004-2005

Undergraduate Seminars

August 26, 2004, Welcome Back Picnic - Get together with Undergraduate Applied Math majors/minors and SIAM members.

September 7, 2004, Graduate Student Panel – an opportunity to encourage undergraduate students to talk with graduate students about attending graduate school.

October 26, 2004, Advising Luncheon.

October 28, 2004, Student Talk – Moorea Brega, *How to Locate Membrane-Like Structures in 6 "Easy" Steps*.

November 18, 2004, Industry Talk - **Tyler Otto**, Western US Sales Manager for Digital Globe – *Satellite Imaging at Digital Globe* - Projects in the rapidly evolving field of satellite imaging and remote sensing.

November 30, 2004, Michael Sprague, CU Boulder, Applied Math, SIAM Talk - *Numerical Investigation of a Reduced Set of Equations for Rotationally Constrained Convection.*

February 3-7, Mathematical Contest in Modeling.

February 22, 2005, Doug Nychka, senior scientist at the National Center for Atmospheric Research (NCAR), Boulder, SIAM Talk – *Tutorial on Spatial Statistics.*

March 5, 2005, Front Range Applied Mathematics Student Conference (held jointly with student chapters at UC-Denver and UCCS), Keynote speaker, **Stanley Osher** of UCLA, *Level Set Methods.*

March 10th, 2005, John Carter, Seattle University, *Small Teaching School vs Large Research Institution.*

March 17, 2005, Undergraduate Advising Luncheon.

April 7, 2005, Fernando Perez, *High-level Scientific Computing: Python, Multiwavelets, and PDEs.*

April 12, 2005, Mathematical Contest in Modeling teams presented their solutions:

Rachel Danson, Kristopher Tucker, and Brandon Booth earned Honorable Mention.

Thomas Josephson, Edmund Lewis and Laura Waterbury earned an Honorable Mention.

Brian Camley, Bradley Klingenberg, and Pascal Getreuer earned Outstanding Performance.

Graduate Seminars

Throughout the course of the year several graduate seminars were held, with topics ranging from “How to Locate Membrane-like Structures in 6 Easy Steps, presented by Moorea Brega, and “Langrang Particle Transport/Mixing in Blinking-Roll Systems” presented by Paul Mullowney, (both held in the fall), to a spring seminar on transitioning from a research to a teaching institution by John Carter, from Seattle University. Mike Levy and Srinath Vadlamani, also made presentations to the grad students with Srinath’s topic being “Lie Symmetries of the Vaidya Equations”.

5. FACULTY SERVICE TO THE UNIVERSITY, DEPARTMENT AND SOCIETIES, CALENDAR YEAR 2004

Mark Ablowitz:

- Member of APPM graduate committee, Spring 2004.
- Member of APPM undergraduate committee, Fall 2004.
- Member of APPM Analysis Search Committee, Fall 2004.
- Member of APPM promotion committee, Fall 2004.
- Member of thesis committee in Physics (I. Coddington, E. Cornell’s student).
- Member of thesis committee in Math (C. Brown, Ramsay’s student).
- Member of Vice Chancellor’s Advisory Committee (VCAC).
- Coordinating Editor of Applied Math: Proceedings of American Math Society.
- Editor of Studies in Applied Mathematics.
- Editor of Dynamics of Partial Differential Equations.
- Editor of Cambridge University Press: Texts in Applied Math series.
- Member of Cambridge University Press Combined Editorial Board in Applied Mathematics (Monographs Series, Text Series, and Computational Math Series).
- Reviewer for: NSF Grants.

- Reviewer for: Hong Kong Grants.
- Reviewer for: Isreal Grants.
- Reviewer for journals: Studies in Applied Mathematics.
- Reviewer for journals: Optics Letters, Physical Review Letters.
- Reviewer for journals: Physical Review E. Proceedings of the American Mathematics Society.
- Reviewer of journals: Journal of Lightwave Communications.
- Reviewer for journals: Physica D.
- Reviewer for journals: Optics Communications.

Meredith Betterton:

- APPM Director of joint master's program in applied math/molecular biology.
- Biophysics Supergroup participant.
- Bioinformatics Supergroup participant.
- Perkins group meeting participant.
- Colorado Initiative in Molecular Biotechnology Task Force Member.
- Faculty hiring committee, Colorado Initiative in Molecular Biotechnology faculty search in bioinformatics.
- Reviewer for Physical Review Letters.
- Reviewer for Physical Review E.
- Reviewer for the Army Office of Scientific Research.
- Reviewer for Biophysical Journal.

Gregory Beylkin:

- Consultant for GeoEnergy, Inc.
- Consultant for Fast Mathematical Algorithms and Hardware, Corp.
- Member of graduate committee (Spring, 2004).
- 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 graduate committee.
- Member of faculty (probability/statistics) search committee.
- Reviewer of NSF grant proposal.
- Referee for the Journal of Applied Probability.
- Referee for the Journal of Statistical Computation and Simulation.

James Curry:

- Serve on the national American Mathematical Society's Committee on Academic Freedom, Tenure, and Employment Security (CAFTES).
- 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.
- Member of American Mathematical Society Committee on Exemplary Program or Achievement by a Mathematical Department Award Committee (2005 – 2007).
- Member of Ad Hoc Committee on Curriculum Reform for the Natural Sciences.
- Member of School of Education Tenure and Promotion Committee.
- Chair for the Department of Applied Mathematics, July 1, 2003 to the present.
- Member of Applied Math Department's search committees.
- Serve as an Associate Editor of the Mathematical Association of America (MAA) monthly journal.
- Serve as the J. R. Woodhull/Logicon Teaching Professor in Applied Mathematics.

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 probability and statistics faculty search committee (Fall, 2004).
- Organized Applied Math's participation in several Engineering College programs: Engineering Orientation, August 18-19, 2004; Engineering Open House, October 23, 2004; CU's Talented Scholars Day, November 20, 2004; Women in Engineering Career Days program, March 6, 2004.
- Wrote an article on the Department of Applied Mathematics for CU Engineering, 2004 magazine.
- Applied Math's representative to Engineering's Undergraduate Education Council, September 2001 to present.
- Judge for the first DLC (Discovery Learning Center) Research Symposium for engineering undergraduate students, April 23, 2004.
- Organized and delivered, together with several undergraduate and graduate students, APPM's presentation for the College of Engineering's High School Honors Institute, August 2-4, 2004.
- Actuarial Studies and quantitative Finance Program committee member.
- CU campus representative for Goldwater Scholarship.
- Coordinator, with Jim Curry, of the calculus portion of the CU-Dillard Educational Technology partnership.
- Online tutoring coordination for the Department of Applied Mathematics.
- Reviewer for IEEE Transactions on Pattern Analysis and Machine Intelligence.
- Outreach activity: Summer Institute in Applied Mathematics.
- Outreach activity: APPM/BVSD Partnership.

Bengt Fornberg:

- Member of the Undergraduate Committee. Advisor for sophomores (Spring, 2004) and juniors (Fall, 2004).
- Member of Primary Unit Evaluation Committee for two promotion cases.
- Collaborated on developing department policy document on faculty evaluation process; post-tenure review for five of the department's faculty members.
- Member of the statistics search committee.
- 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 20 articles during the year for various journals.

Keith Julien:

- Coordinator of Itanium Computing Environment.
- Member of Computer Committee.
- NASA Panel Member, Solar Heliospheric Program.
- Member of Arts & Sciences Budget Subcommittee.
- Reviewer for Journal of Fluid Dynamics.
- Grant Peer Review. NASA Living with a Star Program.
- Grant Peer Review. NASA Solar Heliospheric Program.
- Reviewer for NSF proposals.

Congming Li:

- Hiring Committee.
- Colloquium Committee.
- Editor of: Communication on Pure and Applied Analysis.
- Reviewed papers for many professional journals.
- Panel Member for NSF-DMS.

Manuel Lladser:

- Member of probability and statistics preliminary examination committee.
- Member of graduate committee.

Tom Manteuffel:

- Member of the Joint Policy board for Mathematics.
- Chair, SIAM Committee on Science Policy.
- Member of SIAM Publication Committee.
- DOE, Office of Science, Advanced Scientific Computing Advisory Committee.
- Consultant for Lawrence Livermore National Laboratory.
- Spring 2004, Department Numerical Analysis Prelim Committee.
- Hiring Committee, Analysis.
- Associate Chair for Graduate Studies.
- Fall 2004, 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.
- Reviewed papers for Journal of Mathematical Analysis & Applications.
- Reviewed papers for Numerical Methods for partial Differential Equations.
- Program Committee: 8th Copper Mountain Conference on Iterative Methods, Copper Mountain, CO, March 28 - April 2, 2004.
- Chair of the Review Panel of the Computational Sciences Program of the Helmholtz Association of National Research Centres, Germany.
- Member of Review Panel, DOE ASCO Alliance Center, C-SAFE, University of Utah, October 5-6, 2004.

Steve McCormick:

- IMACS Conference Committee on CFD.
- Member of 3-person SIAM/ACM Prize in Computational Science and Engineering Selection Committee.
- Consultant for Lawrence Livermore National Lab.
- Computing 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.

James Meiss:

- SIAM Dynamical Systems Activity Group Web Site moderator for the "Dynamics Thesaurus" Website, <http://www.dynamicalsystems.org>.
- Preliminary Examination Committee, January and August, 2004.

- Undergraduate Committee. Advisor for Freshmen and 5th Year Senior majors.
- Co-chair for Committee for 5th Year review of five Tenured Faculty in APPM.
- Member, PUEC for the Tenure and Promotion for two faculty in APPM.
- 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 Physica D.
- Reviewer for Nonlinearity.
- Reviewer for Physical Review Letters.
- Reviewer for Discrete and Continuous Dynamical Systems.
- NSF Grant Review Panel, Jan 29-31, 2004.
- NSF Grant Review Panel, Sept 23-25, 2004.
- Reviewer for Journal of Physics A.
- Reviewer for SIAM J. Dynamical Systems.
- Reviewer for the Journal Chaos (AIP).
- Reviewer for Journal of Marine Research.
- Letter of Reference for a Promotion to Full Professor at the Weizmann Institute.
- Letter of Reference for a Promotion to Associate Professor at the University of Texas.

Adam Norris:

- Coordinator for hiring exam graders.
- Coordinator for collection and distribution of special needs exams.

Harvey Segur:

- Co-organizer of "Workshop of Free Surface Water Waves", Fields Institute, Toronto, Ontario, Canada, June 14-18, 2004.
- Chairman of EMSW21-VIGRE proposal team.
- Member of EMSW21-MCTP proposal team.
- Member of VIGRE Committee.
- Member of Graduate Committee.
- Member of hiring committee in analysis.
- Member of Program Review Panel.
- Member of Planning Committee – Presidential Teaching Scholars Retreat
- Reviewer for J. Math Phys.
- Reviewer for Phys. Rev. Lett.
- Reviewer for J. Fluid Mechanics – four different articles.
- Reviewer for National Science Foundation.
- Reviewer for SIAM Review.
- Reviewer for Euro. J. of Mech., B-Fluids.

6. TEACHING ACTIVITIES

6A. Courses Taught by Department Faculty, Academic Year 2004-2005

(I) Undergraduate Courses

APPM 1350	<i>Carvalho, Lladser, Nelson, Nezzar, Norris</i> , Calculus I for Engineers
APPM 1360	<i>Ablowitz, Cooley, Corcoran, Mendez, Norris</i> , Calculus 2 for Engineers

APPM 2350	<i>Meiss, Norris, Tearle, Calculus 3 for Engineers</i>
APPM 2360	<i>Betterton, Ilan, Mullowney, Tearle, Introduction to Linear Algebra & Differential Equation</i>
APPM 2380	<i>Tearle, Felippa (Professor, Aerospace Engineering), Introduction to Ordinary Differential Equations</i>
APPM 2450	<i>Byrne, Claudepierre, Faulhaber, Haut, Jamroz, Kridler, Kurcz, Calculus 3: Computer Lab</i>
APPM 2460	<i>Adler, Byrne, Claudepierre, Faulhaber, Piret, Kridler, Simpson, Yannul, Differential Equations: Computer Lab</i>
APPM 2480	<i>Kurcz, Intro to O.D.E. Lab</i>
APPM 2750	<i>Bishop, Java 2</i>
APPM 3010	<i>Moeser, An Introduction to Nonlinear Systems: Chaos</i>
APPM 3050	<i>Mullowney, An Introduction to Symbolic and Numerical Computation</i>
APPM 3310	<i>Dougherty, Moeser, Matrix Methods and Applications</i>
APPM 3570	<i>Dougherty, Applied Probability</i>
APPM 4120	<i>Hallowell, Introduction to Operations Research</i>
APPM 4350	<i>Curry, Methods in Applied Mathematics: Fourier Series and Boundary Value Problems</i>
APPM 4360	<i>Meiss, Methods in Applied Mathematics: Complex Variables and Applications</i>
APPM 4380	<i>Fornberg, Modeling in Applied Mathematics</i>
APPM 4520	<i>Kuznetsov, Professor, Mathematics, Introduction to Mathematical Statistics</i>
APPM 4540	<i>Kuznetsov, Professor, Mathematics, Introduction to Time Series</i>
APPM 4560	<i>Corcoran, Introduction to Probability Models</i>
APPM 4570	<i>Lladser, Luftig, Norris, Statistical Methods</i>
APPM 4580	<i>Luftig (Senior Instructor, Leeds School of Business), Statistical Applications: Software and Methods</i>
APPM 4650	<i>Fox (Professor, Mathematics), Sprague, Intermediate Numerical Analysis I</i>
APPM 4660	<i>Sprague, Intermediate Numerical Analysis II</i>
APPM 4720	<i>Betterton, Mathematical Biology</i>
APPM 4950	<i>Betterton, Curry, Dougherty, Seminar in Applied Mathematics</i>
GEEN 1340/1345	<i>Nelson, Calculus I with Algebra</i>

(II) Graduate Courses

APPM 5120	<i>Hallowell, Operations Research</i>
APPM 5350	<i>Curry, Methods in Applied Mathematics: Fourier Series and Boundary Value Problems</i>

APPM 5360	<i>Meiss</i> , Methods in Applied Mathematics: Complex Variables
APPM 5380	<i>Fornberg</i> , Modeling in Applied Mathematics
APPM 5430	<i>Ablowitz</i> , Methods in Applied Mathematics, Complex Variables
APPM 5440	<i>Li</i> , Applied Analysis 1
APPM 5450	<i>Li</i> , Applied Analysis 2
APPM 5470	<i>Segur</i> , Methods in Applied Mathematics: Partial Differential and Integral Equations
APPM 5480	<i>Segur</i> , Approximation Methods
APPM 5520	<i>Kuznetsov, Professor, Mathematics</i> , Introduction to Mathematical Statistics
APPM 5540	<i>Kuznetsov, Professor, Mathematics</i> , Introduction to Time Series
APPM 5560	<i>Corcoran</i> , Introduction to Probability Models
APPM 5570	<i>Lladser, Luftig, Norris</i> , Statistical Methods
APPM 5580	<i>Luftig (Senior Instructor, Leeds School of Business)</i> , Statistical Applications: Software and Methods
APPM 5600	<i>Manteuffel</i> , Numerical Analysis 1
APPM 5610	<i>Fornberg</i> , Numerical Analysis 2
APPM 5720	<i>Betterton</i> , Mathematical Biology
APPM 7400	<i>Corcoran, Dougherty, Fornberg, Li, MacLachlan</i> , Seminar—special topics
APPM 8000	<i>Li, Moeser</i> , Colloquium
APPM 8100	<i>Ablowitz</i> Seminar - Nonlinear Equations
APPM 8100	<i>Meiss</i> , Seminar - Dynamical Systems
APPM 8600	<i>McCormick, Manteuffel</i> , Seminar in Computational Mathematics

B. Summer Courses, 2005

APPM 1350	<i>Brega</i> , Calculus I for Engineers
APPM 1360	<i>Carroll</i> , Calculus II for Engineers
APPM 2350	<i>Girard, Tearle</i> , Calculus III for Engineers
APPM 2360	<i>Sherman, Vadlamani</i> , Intro. Linear Algebra and Differential Equations
APPM 2450	<i>Barker</i> , Calculus III: Computer Lab
APPM 2460	<i>Vadlamani</i> , Differential Equations: Computer Lab
APPM 4650	<i>Norris</i> , Intermediate Numerical Analysis I
APPM 4720/5720	<i>Herbst</i> , Computational Vision Mathematics
APPM 5040	<i>Norris, Ruzzo</i> , Calculus Applications for High School Teachers
APPM 5070	<i>Biesterfeld, Luhring</i> , Applied Statistics for High School Teachers
APPM (non credit)	<i>Nelson, Funderburk</i> , Algebra for Teachers

7. RESEARCH ACTIVITIES FOR CALENDAR YEAR 2004

A. Research Publications for Calendar Year 2004

Mark Ablowitz

- Discrete and Continuous Nonlinear Schrodinger Systems, M. J. Ablowitz, B. Prinari and A. D. Trubatch, 258 pages, Cambridge University Press, Cambridge, UK, 2004.
- Dispersion management for randomly varying optical fibers, M.J. Ablowitz, and J.T. Moeser, Optics Letters, 29 (2004) 821-823.
- Carrier-envelope phase slip of ultra-short dispersion managed solitons, M.J. Ablowitz, B. Ilan and S. Cundiff, Optics Letters, 29 (2004) 1808-1820.
- On the initial value problem for the KP-II equation with data that does not decay along a line J Villarroel and M.J. Ablowitz, Nonlinearity, 17 (2004) 1843-1866.
- Reduction of collision-induced timing shifts in dispersion-managed quasi-linear systems with periodic group-delay dispersion compensation, M.J. Ablowitz, C. Ahrens, G. Biondini, S. Chakravarty and A. Docherty, Optics Letters, 29 (2004) 2354-2356.
- Soliton interactions in the vector NLS equation, M. J. Ablowitz B. Prinari and D. Trubatch, Inverse problems, 20 (2004) 1217-1237.
- Initial value problems and solutions of the Kadomstev-Petviashvili Equation, M.J. Ablowitz and J. Villarroel, New trends in integrability and partial solvability, Ed. A.B. Shabat, A. Gonzalez-Lopez, M. Manas, L. Martinez Alonzo and M. A. Rodriguez, NATO Science Series, II. Mathematics, Physics and Chemistry, Volume 32 (2004).
- Theory of carrier-envelope phase slip for ultra-short dispersion managed solitons, M.J. Ablowitz, B. Ilan and S. Cundiff, Technical Digest, Nonlinear Guided Waves and Their Applications, 2004.
- Reduction of collision-induced timing jitter via periodic-group-delay dispersion-compensating modules in quasi-linear return-to-zero systems, M.J. Ablowitz, C. Ahrens, G. Biondini, S. Chakravarty and A. Docherty, Technical Digest, OSA Conference Nonlinear Optics: Materials, Fundamentals and Applications, 2004.
- Ablowitz-Kaup-Newell-Segur (AKNS) System, M.J. Ablowitz, Encyclopedia of Nonlinear Science, Routledge Publishing Co., NY, (2004).
- Integrable Nonlinear Schrodinger Systems and their Soliton Dynamics, M.J. Ablowitz, B. Prinari and A.D. Trubatch, Dynamics of Partial Differential Equations, 1 (3) (2004) 239-299.

Gregory Beylkin

- Author: Yanai, T.; Fann, G.I.; Gan, Z.; Harrison, R.J.; Beylkin, G. Title: Multiresolution quantum chemistry: Hartree-Fock exchange Journal: J. Chem. Phys. Date: 2004 Volume: 121 Number: 14 Pages: 6680—6688.
- Author: Fann, G.I.; Beylkin, G.; Harrison, R.J.; Jordan, K. Title: Singular operators in multiwavelet bases Journal: IBM Journal of Research and Development Date: 2004 Volume: 48 Number: 2 Pages: 161—171.
- Author: Yanai, T.; Fann, G.I.; Gan, Z.; Harrison, R.J.; Beylkin, G. Title: Multiresolution quantum chemistry: analytic derivatives for Hartree-Fock and density functional theory Journal: J. Chem. Phys. Date: 2004 Volume: 121 Number: 7 Pages: 2866—2876.
- Author: Harrison, R.J.; Fann, G.I.; Yanai, T.; Gan, Z.; Beylkin, G. Title: Multiresolution quantum chemistry: basic theory and initial applications Journal: J. Chem. Phys. Date: 2004 Volume: 121 Number: 23 Pages: 11587—11598.
- Author: Yanai, T.; Fann, G.I.; Gan, Z.; Harrison, R.J.; Beylkin, G. Title: Multiresolution quantum chemistry: analytic derivatives for Hartree-Fock and density functional theory Institution: Journal of Chemical Physics, Volume 121, No. 7, (2004) 2866—2876.

- Author: Yanai, T.; Fann, G.I.; Gan, Z.; Harrison, R.J.; Beylkin, G. Title: Multiresolution quantum chemistry in multiwavelet bases: Hartree-Fock exchange: *Journal of Chemical Physics*, volume 121, number 14, (2004), 1-9.

Jem Corcoran

- J.N. Corcoran and U. Schneider, "Perfect Sampling for Bayesian Variable Selection in a Linear Regression Model," *Journal of Statistical Planning and Inference*, (2004), 126(1) 153-171.

James Curry

- Improving Non-negative matrix factorization through structured initialization, S Wild, J. Curry, and A.Dougherty. *Pattern Recognition* 37,(2004),2217-2232.

Anne Dougherty

- S. Wild, J. H. Curry, A. M. Dougherty (2004). Improving Non-Negative Matrix Factorizations through Structured Initialization. *Pattern Recognition*. Volume 37, Number 11, p 2217-2232.
- R. B. Corotis, A. M. Dougherty (2004). Reliable Design Loads for Natural Phenomena: Illustration with Wind Speeds. *ASCE Natural Hazards Review*, Volume 5, Number 1, 40-47.

Bengt Fornberg

- J. Lee and B. Fornberg, Some unconditionally stable time stepping methods for the 3-D Maxwell's equations, *Journal of Computational and Applied Mathematics* 166 (2004), 497-523.
- B. Fornberg and G. Wright, Stable computation of multiquadric interpolants for all values of the shape parameter, *Computers and Mathematics with Applications*, 48 (2004), 853-867.
- B. Fornberg, G. Wright and E. Larsson, Some observations regarding interpolants in the limit of flat radial basis functions, *Computers and Mathematics with Applications*, 47 (2004), 37-55.
- N. Flyer, B. Fornberg, S. Thomas and B.C. Low, Magnetic field confinement in the solar corona. I. Force-free magnetic fields, *The Astrophysics Journal* 606 (2004), 1210-1222.

Keith Julien

- Rotating Magnetoconvection with Magnetostrophic Balance. K. Julien, E. Knobloch and S. Tobias. *Dynamics and Bifurcation of Patterns in Dissipative Systems* G. Dangelmayr and I. Oprea (eds.) *World Scientific Series on Nonlinear Science*, Vol. 12 pp 78-102 World Scientific, Singapore, (2004) ISBN 981-238-946-6.

Tom Manteuffel

- Adaptive smoothed aggregation (aSA), *SIAM J. Sci. Comp.*, submitted (2002), to appear. (M. Brezina, R. Falgout, S. MacLachlan, T.A. Manteuffel, S.F. McCormick, and J. Ruge), *SIAM J. Sci. Comp.*, Vol. 25, No. 6, pp. 1896--1920, (2004).
- Least-Squares finite element methods for linear hyperbolic PDEs', (H. de Sterck, T. A. Manteuffel, S. F. McCormick, and L. Olson) *SIAM J. Sci. Comp.*, Vol. 26, No. 1, pp. 31--54, (2004).
- First-order system least squares and electrical impedance tomography: Part I, (H.R. MacMillan, T.A. Manteuffel and S.F. McCormick) *SIAM J. Numer. Anal.*, Vol. 42, No. 2, pp. 461--483, (2004).
- Modeling 3-d compliant blood flow with FOSLS (J. J. Heys, C. G. DeGroff, T. A. Manteuffel, S.F. McCormick, and H. Tufo) *Biomed Sci Instrum.* 40, pp. 193-199, (2004).
- A robust multilevel approach to minimizing $H(\text{div})$ dominated functionals in an H^1 -conforming finite element space, (T.M. Austin, T.A.Manteuffel and S.F. McCormick) *J. Numer. Lin. Alg. App.*, vol. 11, pp. 115-140, (2004).

Steve McCormick

- Asynchronous fast adaptive composite-grid methods for elliptic problems: Theoretical foundations, *SIAM J. Sci. Comp.* 42 (2004), pp. 130-152 (with B. Lee, T. Manteuffel, B. Philip, and D. Quinlan).
- First-order system least squares and electrical impedance tomography, *SIAM J. Numer. Anal.* 42 (2004), pp. 461-483 (with H. MacMillan and T. Manteuffel).
- Least-squares finite element methods and algebraic multigrid solvers for linear hyperbolic PDEs, *SIAM J. Sci. Comp.* 26 (2004), 31-54 (with H. de Sterck, T. Manteuffel, and L. Olson).
- Adaptive smoothed aggregation (aSA), *SIAM J. Sci. Comp.* 25 (2004), pp. 1896-1920 (with M. Brezina, R. Falgout, S. MacLachlan, T. Manteuffel, and J. Ruge).
- A robust approach to minimizing $H(\text{div})$ dominated functionals in an H^1 -conforming finite element space, *J. Numer. Lin. Alg. App.* 11 (2004), pp. 115-140 (with T. Austin and T. Manteuffel).
- First-order system least squares (FOSLS) for coupled fluid-elasticity problems, *J. Comp. Physics* 195 (2004), pp. 560-575 (with J. Heys, T. Manteuffel, and J. Ruge).
- Modeling 3-d compliant blood flow with FOSLS, *Biomed Sci Instrum.* 40 (2004), pp. 193-9 (with J. J. Heys, C. G. DeGroff, T. Manteuffel, and H. Tufo).

James Meiss

- Gomez and J.D. Meiss, "Reversors and Symmetries for Polynomial Automorphisms of the Complex Plane," *Nonlinearity* 17 975-1000 (2004).
- J.D. Meiss, "Hamiltonian Systems," in *Encyclopedia of Nonlinear Science*, ed. Alwyn Scott. (Routledge, New York and London, 2004).
- J.D. Meiss, "Symplectic Maps," in *Encyclopedia of Nonlinear Science*, ed. Alwyn Scott. (Routledge, New York and London, 2004).
- J.D. Meiss, "The Standard Map," in *Encyclopedia of Nonlinear Science*, ed. Alwyn Scott. (Routledge, New York and London, 2004).

B. Invited Lectures and Meetings Attended for Calendar Year 2004

Mark Ablowitz

- American Mathematics Society National Meeting, Phoenix, Az., Jan. 7-9, 2004, "Chazy-Darboux-Halphen Systems", Jan. 8, 2004.
- Department of Mathematics, University of Central Florida, April 10-13, 2004, "WWW: waves water and the web", April 12, 2004, "Chazy-Darboux-Halphen Systems", April 13, 2004.
- Conference "Symmetries and Perturbation Theory" Cala Ganone, Sardenia, Italy, June 1-7, 2004, "Chazy-Darboux-Halphen Systems", June 4, 2004.
- Department of Physics, University of Rome, Italy, June 12-17, 2004, "Nonlinear waves in high bit-rate communications", June 16, 2004.
- Department of Physics, University of Perugia, Italy, June 18-23, 2004, "Nonlinear waves in high bit-rate communications", June 22, 2004.
- Conference: Nonlinear Physics Theory and Experiment, Gallipolli, Italy June 24-July 3, 2004. "Chazy-Darboux-Halphen Systems", June 25, 2004.
- Conference: Mathematical Methods in Nonlinear Optics, July 19-24, 2004, Edinburgh, U.K. "Dispersion Managed Nonlinear Schrodinger Systems", July 19, 2004.
- AFOSR Workshop: Nonlinear Optics, University of Arizona, September 9-11, 2004. "Carrier Envelope Phase Slip for Ultra-Short Optical Pulses", September 10, 2004.
- Institute for Mathematics and Applications, University of Minnesota, October 25-29, 2004, "Wave Collapse in Nonlocal Nonlinear Schrodinger Systems", October 26, 2004.

Meredith Betterton

- Invited presentation, Workshop on Molecular Machines, Institute for Pure and Applied Mathematics, May 2004.
- Butcher Biotechnology Symposium, November 2004.
- Mathematical Modeling in Signaling Workshop, Vanderbilt University, June 2004.
- Rocky Mountain Regional Bioinformatics Conference, December 2004.
- Biophysics Seminar, Max Planck Institute for the Physics of Complex Systems, Dresden, Germany, January 2004.
- Seminar, Center for Computational Biology, University of Colorado at Denver, March 2004.
- Colloquium, Mathematics Department, University of Colorado at Colorado Springs, March 2004.
- Scientific Computing Seminar, Mathematics Department, Duke University, April 2004.
- Colloquium, Physics Department, University of Colorado at Boulder, September 2004.
- Applied Math Seminar, Mathematics Department, Colorado State University, September 2004.
- Cryosphere and Polar Processes Seminar, National Snow and Ice Data Center, October 2004.

Gregory Beylkin

- Separated Representations and Fast Adaptive Algorithms in Multiple Dimensions, Gregory Beylkin, Applied Mathematics Colloquium, September 3, 2004, CU.
- Separated Representations of periodic Green's functions, Gregory Beylkin, DOE Molecular Electronics Meeting, Vanderbilt University, May 27, 2004.
- Optimized Representation and Estimation of the Earth's Gravitational Field and other Measured Data, Gregory Beylkin, George Mason University, April 27, 2004.
- Separated Representations and Multiresolution Algorithms in Multiple Dimensions, Gregory Beylkin, University of Wyoming, January 30, 2004.
- Separated Representations and Fast Adaptive Algorithms in Multiple Dimensions, Gregory Beylkin, CSCAMM Program, FMM & Related Algorithms, University of Maryland, April 28, 2004.
- Operators and Fast Algorithms, Gregory Beylkin, IPAM, September 14, 2004.
- Unequally spaced FFT and fast Radon transform applied to seismic migration and imaging, Gregory Beylkin, IPAM, September 14, 2004.
- Algorithms for Numerical Analysis in High Dimensions. Part II: Operators in high dimensions, Gregory Beylkin, IPAM, October 19, 2004.
- Generalized Gaussian quadratures for exponentials, their properties and applications, Gregory Beylkin, IPAM, November 30, 2004.
- Separated Representations and Their Applications, Gregory Beylkin, SIAM 2004, Portland, Oregon, July 12, 2004.

Jem Corcoran

- "Perfect and Pseudo-Perfect Algorithms for ARCH Models", invited talk in the Applied Mathematics seminar hosted by the Mathematics Department at Colorado State University.

James Curry

- MVT-The Mathematical Visualization Toolkit SIAM conference in Applied Math in Portland in July 2004

Anne Dougherty

- "Demonstration of the Mathematical Visualization Toolkit (MVT)" presented on July 14, 2004 at the annual SIAM conference in Portland, Oregon and on August 11, 2004 at the Teaching With Technology Conference at CU Boulder.

Bengt Fornberg

- Seven colloquia, given in the following locations: in South Korea: Suanko (12th Applied Math. Forum), Kyungpook National University (Daegu), Korean Advanced Institute of Science and Technology (KAIST, Daejon); in South Africa: University of Stellenbosch; in Scotland: University of Strathclyde; in the US: US Air Force Academy, and UC Colorado Springs.

Keith Julien:

- Presented at the American Geophysical Union Ocean Sciences Meeting, Oregon, (2004).
- Invited Speaker Nonlinear Dynamics and Astrophysics Seminar. University of Cambridge, Department of Applied Mathematics and Theoretical Physics. An Investigation of the Reduced Set of Equations for Non-Hydrostatic Rotationally Constrained Flows.
- Mixing in the Kupperts-Lortz Mode. American Physical Society-Division of Fluid Dynamics Meeting (Nov 2004).
- Invited Speaker Mathematics Seminar. Colorado State University. Department of Mathematics. An Investigation of the Reduced Set of Equations for Non-Hydrostatic Rotationally Constrained Flows.
- Invited Speaker; University of Central Florida (Oct 2004) Department of Mathematics. Highly Supercritical Magnetoconvection.
- Invited Speaker Siam Conference on Nonlinear Waves and Coherent Structures. (Oct 2004). An Investigation of the Reduced Set of Equations for Non-Hydrostatic Rotationally Constrained Flows.
- Sprague, M., Julien, K., Knobloch, E., Millif, R., and Werne, J., Numerical Simulation of a Reduced Set of Equations for Rapidly Rotating Convection, American Physical Society Division of Fluid Dynamics Meeting, Seattle, (2004).

Congming Li

- Fluid Seminar, University of Texas at Austin, Austin, Texas
- PDEs Seminar, School of Mathematics, Georgia Institute of Technology, Atlanta, GA.
- Colloquium, CDSN, School of Mathematics, Georgia Institute of Technology, Atlanta, GA
- Workshop on new developments on variational methods and their applications, Pacific Institute for the Mathematical Sciences, Banff International Research Station, Canada.
- Fifth International Conference on Dynamical Systems and Differential Equations, California State Polytechnic University, Pomona, California.

Tom Manteuffel

- Invited Speaker, Workshop on Emerging methodologies and applications in numerical PDEs, School for Computational Science, Florida State University, March 11, 2004.
- Invited Speaker, CU-IBM Workshop on Biotechnology, CUHSC, February 3, 2004.
- Colloquium Speaker, CSU, October 14, 2004.
- Colloquium Speaker, University of Colorado at Colorado Springs, November 18, 2004.

James Meiss

- "Research in Pairs" at the Oberwolfach Mathematics Institute, Germany, with H. Dullin and A. Ivanov (funded by the Institute), May 23-June 5, 2004.
- "Transport in Blinking Rolls," Conference on Dynamics and Differential Equations, Pomona CA, June 17, 2004.
- "Drift in Symplectic Maps near the AntiIntegrable Limit," Conference on Dynamics and Differential Equations, Pomona CA, June 18, 2004.
- "Twistless Bifurcations in Symplectic Maps," Lecture at the DYNAMICAL SYSTEMS, CONTROL AND APPLICATIONS conference, Mexico City, Dec 4, 2004.
- "Three Dimensional Transport in Fluids," seminar at the Instituto Tecnológico Autónomo De México, Dec 2, 2004.
- "Twistless Bifurcations in Symplectic Maps," Colloquium for the Department of Applied Mathematics, Sept 10, 2004.

- Seminar for Grad Students in Applied Mathematics on Hamiltonian Chaos, Nov 22, 2004.

Mary Nelson

- Nelson, Mary. (2004, October). *Reforming Calculus Teaching: Oral Assessments before Tests*. Presented at North American Chapter of the International Group for the Psychology of Mathematics Education, Toronto, Canada. (published in conference proceedings).
- Ruth Streveler, Mary Nelson, Ronald Miller, and Barbara Olds. (2004, June). *Preliminary Results from the Development of a Concept Inventory in Thermal and Transport Science*. ASEE Annual Conference. Salt Lake City, Utah (paper published in conference proceedings).
- Eiteljorg, E., Pittman, M., Nelson, M., Frykholm, J., & Borko, H. (2004, April). Connecting teachers' views of their own learning of mathematics with that of their students: A program for teacher professional development. Paper presented in a symposium entitled *Supporting Middle School Teachers to Assist Students Make the Transition from Arithmetic to Algebraic Reasoning* at the Annual Meeting of the American Educational Research Association, San Diego.
- Ron Miller, Barbara Olds, Ruth Streveler, and Mary Nelson. (2004, April). *Assessing Students' Prior Knowledge About Engineering and Scientific Concepts*, Paper presented at Best Assessment Processes V Symposium, Terra Haute, Illinois.
- Ruth Streveler, Mary Nelson, Ronald Miller, Barbara Olds, Don Evans, John Mitchell and Jay Martin. (2004, April). *Investigating the Conceptual Understanding of Engineering Students*. Paper presented at American Educational Research Association, Chicago, Illinois.
- Invited Talk, (2004, January). *Front Range Community College Mathematics Department, Reform Mathematics in a College Calculus I Class*. Westminster, Colorado.

Harvey Segur

- "Stabilizing the Benjamin-Feir Instability", Workshop on Free Surface Waves, Fields Institute, Toronto, Ontario, Canada, June 17, 2004.
- "Stabilizing the Benjamin-Feir Instability", presented at SIAM Regional Meeting, October 3, 2004.

C. Research Grants Active In 2004

Mark Ablowitz

- NSF-DMS: "Collaborative Research: Mathematical and computational methods for high-data rate optical fiber communication", 2001--2005: P.I. M.J. Ablowitz; this is one part of a three-way focused research group grant. The other two P.I.s are from Northwestern University and University of Maryland.
- Air Force Office of Scientific Research, Mathematics Division, Award: "Nonlinear wave propagation"; 2003-2006.
- NSF DMS: "Nonlinear wave motion", 2003-2006: P.I. M.J. Ablowitz.

Meredith Betterton

- Butcher Foundation, "Single molecule studies of transcription factors", 2003-2004.
- NIH, General Medicine, "Computational modeling of proteomic data", 2003-2005.
- NSF, "Watching proteins bind and bend DNA with sub-nanometer resolution", Co-Principal Investigators: Meredith Betterton, James Goodrich, and Tom Perkins, 2004-2008.

Gregory Beylkin

- DOE: "Integrated Multiscale Modeling of Molecular Computing Devices", Award No.: DE-FG02-03ER25583, 9/15/2003-9/14/2006.
- DARPA/DOD Army ARO "Separated Representations for Computational Materials Science" Award No.: W911NF-04-1-0281; 7/1/2004-10/31/2005.
- DOD/NGA "Optimized Representation and Estimation of the Earth's Gravitational Field and other data", NMA401-02-1-2002, 6/13/2002-6/12/2004.

- NSF/ITR Collaborative Research: "Solving PDEs using low separation-rank representations and optimal quadratures for exponentials", DMS-0219326 8/15/2002-7/31/2004.

Jem Corcoran

- UCAR, "Properties of Perfect and MCMC Sampling for a Geophysical Space/Time Model, 2002-2004.

James Curry

- PI on NSF Scientific Computing Machinery in the Mathematical Sciences (SCREMS), 2002-present.
- CO-PI for NSF Science, Technology, Engineering Mathematics-Teacher Preparation (STEM-TP) June 2003-present.
- CO-PI on the NSF funded Noyce Fellowships. July 2004 through December 2008.

Anne Dougherty

- Award from the University of Colorado at Boulder Outreach Committee for the Summer Institute in Applied Mathematics, 2003-2004.
- Outreach Director for outreach supplement to Applied Math's NSF VIGRE grant. PI is James Meiss.

Bengt Fornberg

- NSF: "A Finite Difference Approach to Pseudospectral Methods", 2000-2004.
- NSF: "Pseudospectral Methods and Radial Basis Functions", 2003-2006.
- NASA: Numerical Algorithms for Astrophysical Computing, (support of Graduate Student Julia Zuev), 7/1/01-6/30/05.
- NSF "VIGRE - Vertical Integration of Research and Education in Applied Mathematics", 1999-2004.

Keith Julien

- NSF Ocean Sciences: Rotationally Constrained Conv.: Investigation of a New Class of Reduced Eq'ns, 2002-2005.
- Engineering Excellence Fund. Development of an Undergraduate Data Visualization Toolkit in APPM.
- Modeling Magneto-Inertial-Gravity waves in the Lower CONvection Zone. NASA Solar Heliospheric.
- Community Hounds and Hares Exercises in Local Helioseismology. NASA Living with a Star Program.

Congming Li

- Principle Investigator: "Qualitative properties of nonlinear differential and integral equations" NSF DMS-0401174, 2005-2007.

Tom Manteuffel

- 10/02-12/04 Sandia National Laboratories, Project title: Fast and Accurate Numerical Solution of Maxwell Equations, grant no. 1100.12.1512B. (PI: Tom Manteuffel, Co-PI: Steve McCormick)
- 9/15/03-9/14/06 DOE. Project Title: First-order system least-squares (FOSLS): fundamentals and applications. grant no. DE-FG02-03ER25574. (PI: Tom Manteuffel, Co-PI: Steve McCormick)
- 10/04 - 9/07, NSF, Project: hp-adaptive FOSLS methods for nonlinear problems with singularities. (CO PI: Steve McCormick)
- 7/01-6/05 DOE Co-Investigator. Project title: Terascale optimal PDE systems (TOPS), Grant no: DE-FC02-01ER25479. (PI: Steve McCormick, Co-PI: Tom Manteuffel, Xiao-Chuan Cai)

- 7/03-3/04 Lawrence Livermore National Laboratory, FAC, Adaptive AMG, and Compatible Relaxation for solving problems that arise in LLNL applications. (PI; Steve McCormick, Co-PI: Tom Manteuffel)
- 10/04-9/05 IBM Shared University Research (SUR) Proposal, Gift of Linux Cluster: Occam. (PI Henry Tufo, Co-PI: Tom Manteuffel)
- 11/04-2/04, NSF MRI Grant. (PI: Henry Tufo, Co-PI: Tom Manteuffel)

Steve McCormick

- 7/01-6/05 DOE Principal Investigator. Project title: Terascale optimal PDE systems (TOPS). (PI: Steve McCormick, Co-PI: Tom Manteuffel, Xiao-Chuan Cai)
- 3/30-4/4 Co-Organizer of the 8th Copper Mountain Conference on Iterative Methods, Copper Mountain, Colorado. Funded by DOE, NSF, and IBM.
- 7/04-3/05 LLNL Principal Investigator. Project Title: FAC, Adaptive AMG, and Compatible Relaxation for Solving Problems That Arise in LLNL Applications.
- 10/02-10/04 Sandia National Laboratories Co-Investigator. Project title: Fast and Accurate Numerical Solution of Maxwell Equations, grant no. 1100.12.1512B.
- 7/03-6/06 DOE Co-Investigator. Project title: First-order system least squares (FOSLS): fundamentals and applications (fast algorithms for transport models). (PI: Tom Manteuffel, Co-PI: Steve McCormick)
- 10/04-9/07 NSF Co-Investigator, Project title: hp-adaptive FOSLS methods for nonlinear PDE problems with singularities. (PI: Tom Manteuffel, Co-PI: Steve McCormick)

James Meiss

- Nearly Hamiltonian dynamics, CRDF grant # 13314, 2004-2006. With. V. Koslov, Moscow State Univ.
- "Geometry and Computation of Dynamics for Conservative Systems," J.D. Meiss, National Science Foundation, DMS-0202032, 2002-2007.
- "Vertical Integration in Research and Education for Applied Mathematics," J.D. Meiss, M. J. Ablowitz, B. Fornberg, and J.R. Curry, National Science Foundation, DMS-9810751, 1999-2004.
- The Niwot Ridge Long Term Ecological Research Program 1998-2004: Controls on the Structure, Function and Interactions of Alpine and Subalpine Ecosystems of the Colorado Front Range: UMB Supplement to NSF DEB-9810218. With J. Curry, M. Grant, D. McKnight, M. Williams.

Philippe Naveau

- NSF, 2003-2006

Mary Nelson

- NSF Grants:
 - STAAR (Studying the Transition from Arithmetic to Algebraic Reasoning)
 - STEMTP (Science, Technology, Engineering and Mathematics Teacher Preparation)
 - ASA (*Developing an Outcomes Assessment Instrument for Identifying Engineering Student Misconceptions in Thermal and Transport Sciences* (DUE - 0127806),

Harvey Segur

- NSF-FRG: "Collaborative Research: Fully nonlinear, three-dimensional waves in water of arbitrary depth", NSF-DMS-0139742, 2002-2005.
- NSF: "Vertical Integration in Research and Education for Applied Mathematics", DMS-9810751, 1999-2004.

D. Dissertations for Academic Year 2004 – 2005

Neil David Burrell

“Merger and Alignment of Three-Dimensional Quasi-Geographic Vortices,” Advisor: Keith Julien and Jeffrey Weiss – Ph.D. August, 2004.

Marcio Carvalho

“Applying Perfect Simulation to Solve Stochastic Difference Equations that Arise from Certain Time Series Models,” Advisor: Jem Corcoran – Ph.D. May, 2005

Feng-Nan Hawng

“Some Parallel Linear and Nonlinear Schwarz Methods with Applications in Computational Fluid Dynamics,” Advisor Steve McCormick and Xiao-Chuan Cai – Ph.D., December 2004.

Scott Patrick MacLachlan

“Improving Robustness of Multiscale Methods,” Advisor: Steve McCormick – Ph.D. August, 2004.

Paul Joseph Mallowney

“Lagrangian Particle Transport/Mixing in Roll Switching Systems,” Advisor: Keith Julien and James Meiss – Ph.D. December, 2004

Mark Roger Petersen

“A Study of Geophysical and Astrophysical Turbulence Using Reduced Equations,” Advisor: Keith Julien and Jeffrey Weiss – Ph.D. December, 2004

Oliver Roehrl

“Multilevel First-Order System Least Square for Quasilinear Elliptic Partial Differential Equations,” Advisor: Steve McCormick – Ph.D. August, 2004.

Matthew Oliver Tearle

“Optimal Perturbation Analysis of Stratified Shear Flow,” Advisor: Keith Julien and Joesph Werne – Ph.D. August, 2004.

Eric Ronald Thaler

“An Evaluation of the Operational Use of Numerical Solutions to the Quasieostrophic Diagnostic Equations by Weather Forecasters,” Advisor: Keith Julien and Thomas Warner – Ph.D. August, 2004.

Srinath Vadlamani

“An Algorithmic Unification of Particle-in-Cell and Continuum Methods and a Wave-Particle Description for the Electron Temperature Gradient (ETC) Instability Saturation,” Advisor: James Meiss – Ph.D. May, 2005

Chad Russell Westphal

“First-Order System Least Square for Geometrically-Nonlinear Elasticity in Nonsmooth Domains,” Advisor: Tom Manteuffel – Ph.D. August, 2004.

Master's Theses for Academic Year 2004-2005

Santhosh L. Heddesse

"Existence of a Solution to the Discrete Nonlinear Schrödinger Equation," Advisor: Congming Li – M.S. August, 2004.

Moorea Brega

"Orientation Fields and their Applications to Image Processing," Advisor: Kristian Sandberg – M.S. May, 2005.

8. PREPRINTS OF THE DEPARTMENT: Academic Year 2004-2005

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).

524. *On approximation of functions by exponential sums*, Beylkin, G.; Monzón, L., Univ. of Colorado, 2004.
525. *The Need for Control Experiments in Local Helioseismology*, Werne, J., Birch, A. and Julien, K. A., August 31, 2004. [To Be Pub. in Proceedings of SOHO 14/GONG. Helio and Asteroseismology: Towards a Golden Future].
- 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. Mullaney, K. Julien, J.D. Meiss, April 12, 2004, in press 2004.
530. *Symbolic Codes for Rotational Orbits*, Dullin, H. R., Meiss, J. D. and Sterling, D. G., August 6, 2004.
531. *The Fast Gauss Transform with Complex Parameters*, Andersson, F. and Beylkin, G., 20 August 2004. [submitted to Journal of Computational Physics]
532. *Multiresolution quantum chemistry in multiwavelet bases: Analytic derivatives for Hartree-Fock and density functional theory*, Yanai, T., Fann, G. I., Gan, Z., Harrison, R. J. and Beylkin, G., 2004. [Journal of Chemical Physics].
533. *Multiresolution quantum chemistry in multiwavelet bases: Hartree-Fock exchange*, Yanai, T., Fann, G. I., Gan, Z., Harrison, R. J. and Beylkin, G., 8 October 2004. [Journal of Chemical Physics].
534. *Saturation of the Magnetorotational Instability*, Knobloch, E. and Julien, K. A., December 1, 2004. [Physics of Fluids].
535. *Scattered Node Compact Finite Difference-Type Formulas Generated From Radial Basis Functions*, Wright, G. and Fornberg, B., December 13, 2004.

536. *A Pseudospectral Fictitious Point Method for High Order Initial-Boundary Value Problems*, Fornberg, B., 14 January 2005. [submitted to SIAM J. Sci. Computing].
537. *Extrapolation Methods for Solving Wave Equations*, Fornberg, B., Zuev, J. and Lee, J., 26 January 2005. [submitted to J. Comp. and Appl. Mathematics].
538. *Numerical simulation of an asymptotically reduced system for rotationally constrained convection*, Sprague, M., Julien, K., Knobloch, E. and Werne, J., 30 March 2005. [submitted to J. Fluid Mech.]
539. *Vortex cores, circulation cells, and filaments in quasi-geostrophic turbulence*, Petersen, M. R., Julien, K. and Weiss, J. B., 11 May 2005. [Physics of Fluids]
540. *Striving towards equity; Underrepresented minorities and mathematics Part I*, Petersen, M. R., Kraus, B. and Windham, T., Mar 2005. [SIAM News, v.38 n.2]
541. *Striving towards equity; Underrepresented minorities and mathematics Part II*, Petersen, M. R., Kraus, B. and Windham, T., Mar 2005, v.38 n.3. [SIAM News]
542. *Musical analysis and synthesis using Matlab*, Petersen, M. R., 5 Nov 2004. [College Mathematics Journal, v.35]
543. *Theory of Magnetodynamics Induced by Spin Torque in Perpendicularly Magnetized Thin Films*, M.A. Hofer, M.J. Ablowitz, B. Ilan, M.R. Pufall, T.J. Silva, June 30, 2005.