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Free Probability Theory
Dan-Virgil Voiculescu, University of California, Berkeley Editor
Free probability theory is a highly noncommutative probability theory, with independence based on free products instead of tensor products. The theory models random matrices in the large N limit and operator algebra free products. It has led to a surge of new results on the von Neumann algebras of free groups.

This is a volume of papers from a workshop on Random Matrices and Operator Algebra Free Products, held at The Fields Institute for Research in the Mathematical Sciences in March 1995. Over the last few years, there has been much progress on the operator algebra and noncommutative probability sides of the subject. New links with the physics of master fields and the combinatorics of noncrossing partitions have emerged. Moreover there is a growing free entropy theory. The idea of this workshop was to bring together people working in all these directions and from an even broader free products area where future developments might lead.

Fields Institute Communications, Volume 12; 1997; 312 pages; Hardcover; ISBN 0-8218-0522-3; List $75; Individual member $45; order code FIC/12NA

Operator Algebras and Their Applications
Peter A. Fillmore, Dalhousie University, Halifax, NS, Canada, and James A. Mingo, Queen’s University, Kingston, ON, Canada, Editors
The study of operator algebras, which grew out of von Neumann’s work in the 1920s and the 1930s on modelling quantum mechanics, has in recent years experienced tremendous growth and vitality. This growth has resulted in significant applications in other areas—both within and outside mathematics. The field was a natural candidate for a 1994–1995 program year in Operator Algebras and Applications held at The Fields Institute for Research in the Mathematical Sciences.

This volume contains a selection of papers that arose from the seminars and workshops of the program. Topics covered include the classification of amenable $C^*$-algebras, the Baum-Connes conjecture, $E_k$ semigroups, subfactors, $E_k$-theory, quasitreeds, and the solution to a long-standing problem in operator theory: Can almost commuting self-adjoint matrices be approximated by commuting self-adjoint matrices?

Fields Institute Communications, Volume 15; 1997; 323 pages; Hardcover; ISBN 0-8218-0522-3; List $75; Individual member $47; order code FIC/13NA

Recent Developments in Optimization Theory and Nonlinear Analysis
Yair Censor, University of Haifa, and Simeon Reich, The Technion—Israel Institute of Technology, Haifa, Editors
This volume contains the refereed proceedings of the special session on Optimization and Nonlinear Analysis held at the Joint American Mathematical Society-Israel Mathematical Union Meeting which took place at the Hebrew University of Jerusalem in May 1995. Most of the papers in this book originated from the lectures delivered at this special session. In addition, some participants who didn’t present lectures and invited speakers who were unable to attend contributed their work.

The fields of optimization theory and nonlinear analysis continue to be very active. This book presents not only the wide spectrum and diversity of the results, but also their manifold connections to other areas, such as differential equations, functional analysis, operator theory, calculus of variations, numerical analysis, and mathematical programming.

In reading this book, one encounters papers that deal, for example, with convex, quasiconvex and generalized convex functions, fixed and periodic points, fractional-linear transformations, moduli of convexity, monotone operators, Morse lemmas, Navier-Stokes equations, nonexpansive maps, non-smooth analysis, numerical stability, products of projections, steepest descent, the Leray-Schauder degree, the turnpike property, and variational inequalities.

Contemporary Mathematics, Volume 204; 1997; approximately 300 pages; Softcover; ISBN 0-8218-0515-0; List $45; Individual member $29; Order code CONM/204NA

Solitons, Geometry, and Topology: On the Crossroad
V. M. Buchstaber, Moscow State University, Russia, and S. P. Novikov, University of Maryland, College Park, Editors
This collection contains articles reflecting the most recent activity in topology and mathematical physics presented at the 5th Novikov Seminar held in Moscow. Papers in the volume are devoted to problems in geometry, topology, and mathematical physics, including applications of topology to physical problems. Such a combination is a long-standing tradition of the seminar, which originated in 1965.

American Mathematical Society Translations—Series 2, Volume 179; 1997; 180 pages; Hardcover; ISBN 0-8218-0666-1; List $89; Individual member $53; order code TRANS/179NA

Special Functions, $q$-Series and Related Topics
Mourad E. H. Ismail, University of South Florida, Tampa, David R. Masson, University of Toronto, ON, Canada, and Mizan Rahman, Carleton University, Ottawa, ON, Canada, Editors
This book contains contributions from the proceedings at The Fields Institute workshop on Special Functions, $q$-Series and Related Topics that was held in June 1995. The articles cover areas from quantum groups and their representations, multivariate special functions, $q$-series, and symbolic algebra techniques as well as the traditional areas of single-variable special functions. The book contains both pure and applied topics and reflects recent trends of research in the various areas of special functions.

Fields Institute Communications, Volume 14; 1997; 277 pages; Hardcover; ISBN 0-8218-0524-X; List $90; Individual member $54; order code FIC/14NA

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**New in MATHEMATICS**

**Numerical Analysis**

An Introduction

W. Gautschi, Purdue University, West Lafayette, IN

The term "Numerical Analysis" in this text means the branch of mathematics that develops and analyzes computational methods dealing with problems arising in classical analysis, approximation theory, the theory of equations, and ordinary differential equations. The topics included are presented with a view towards stressing basic principles and maintaining simplicity and teachability as far as possible. In this sense, the text is an "Introduction".

**Contents**: Machine Arithmetic and Related Matters • Approximation and Interpolation • Numerical Differentiation and Integration • Nonlinear Equations • Initial Value Problems for ODEs – One-Step Methods • Initial Value Problems for ODEs – Multistep Methods • Boundary and Eigenvalue Problems for ODEs


**A Practical Guide to Heavytails**

R. Adler, University of North Carolina at Chapel Hill; R. Feldman, University of California, Santa Barbara; & M.S. Taqqu, Boston University, MA (Eds.)

This volume of invited papers collects, for the first time, techniques and approaches for the statistical analysis of heavy tailed distributions and processes.

The papers cover a number of applications of heavy tailed modeling, running the gamut from insurance and finance, through telecommunication and the World Wide Web, to classical signal/noise detection problems. Along with the specific applications are a number of papers covering areas such as time series analysis in the heavy tailed setting, regression, and the general structure of stable processes as viewed from a modeling viewpoint.

There is considerable emphasis on recent developments in handling the numerical problems associated with stable distributions, which have been one of the main technical difficulties in working in the heavy tailed setting.


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**A Brief Introduction to Numerical Analysis**

E.E. Tyrtyshnikov, Institute of Numerical Mathematics, Russian Academy of Sciences

This advanced textbook is based on lectures delivered by the well-known specialist at the Moscow Physico-Technical Institute. The manner of presentation helps the reader receive insight into the most important ideas and approaches of numerical analysis in a short time.

Emphasis is placed upon numerical methods and algorithms of matrix analysis. Also considered are function approximations, methods of solving nonlinear equations, and minimization methods. Alongside classical methods, new results and approaches developed over the last few years are discussed.

**Contents**: Preface • Metric space • Scalar product • Perturbation theory • Diagonal dominance • Spectral distances • Floating-point numbers • Direct methods for the linear systems • The QR decomposition of a square matrix • The eigenvalue problem • The QR algorithm • The QR algorithm with shifts • Function approximation • Convergence of the interpolation process • Splines • Norm minimization • Numerical integration • Nonlinear equations • Minimization methods • Quadratic functionals and linear systems • Convergence rate of the conjugate gradient method • General and proper clusters • Integral equations and discretization strategies • References


Recently Released!

**Distributions in the Physical and Engineering Sciences**

Volume 1: Distributional and Fractal Calculus, Integral Transforms and Wavelets

A.I. Saichev, University of Nizhni Novgorod, Russia & W.A. Woyczynski, Case Western Reserve University

This book, designed as a textbook, is written from the unifying viewpoint of distribution theory and enriched by such modern topics as wavelets, nonlinear phenomena, and the white noise theory, which became very important in physical and engineering practice, and which naturally fit into the flow of the material. The book provides the graduate physical and engineering sciences students, as well as non-specialists, with a useable major modern analytic tool in their research.


**Singularity Theory and Gravitational Lensing**

H. Levine, Brandeis University, Waltham, MA; A.O. Petters, Princeton University, NJ; & J. Wambsganss, Astrophysics Institute Potsdam, Germany

This monograph addresses several fundamental mathematical and physical issues in gravitational lensing. Mathematical topics include a study of the stable features of maps arising in lensing, the local and global geometry of caustics due to gravitational lenses, the magnification and multiple imaging of lensed light sources, and multi-plane lensing by singular and nonsingular deflectors. Some (astro-) physical topics include Einstein rings and Giant Luminous Arches, time delay and Hubble's constant, microlensing of stars and quasars, and the detection of dark matter and planets with lensing.


**Topics in the Mathematical Modelling of Composite Materials**

A. Cherkaev, University of Utah & R.V. Kohn, Courant Institute, NYU (Eds.)

The past 20 years have witnessed a renaissance of theoretical work on the macroscopic behavior of microscopically heterogeneous materials. But for various reasons certain fundamental papers by the French and Russian schools were never properly published, circulating instead mimeographed notes and preprints, the result of which is a gap in the literature, making the subject unnecessarily difficult for newcomers to penetrate. This new book is designed to fill this gap by assembling some of this "hidden literature" for the first time in a single, readily accessible place.


**Gabor Analysis and Algorithms**

Theory and Applications

H.G. Feichtinger & T. Strohmer, both at University of Vienna (Eds.)

For the first time, the field's leading international experts have come together to present a detailed overview of the theory of Gabor analysis and its applications in signal and image processing.

The first part of the book is devoted to the mathematical foundations of Gabor theory; the second part covers important concepts such as the uncertainty principle, the Zak transform and density conditions for Weyl-Heisenberg frames; and the third part covers applications in signal and image processing.

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Evaluating Student Evaluations

A recent study by Harvard psychologists claimed that student reactions to randomly selected 30-second clips of soundless videotapes of actual class instruction were extremely accurate predictors of end-of-course student evaluations, even though the sound had been turned off. Moreover, the correlation decreased only slightly when the length of the film clips was reduced to 10 or 5 seconds. Because my source of information for this apparent indictment of student evaluations was the Boston Globe Sunday magazine, I tracked down the original article in the Journal of Personality and Social Psychology.

The actual purpose of the study was not to assess the validity of student evaluations, but to examine the accuracy of first impressions. End-of-course ratings were chosen as the comparison measure because "student evaluations seem to be a valid means of evaluating teacher effectiveness." The methodology of the study, which used samples of only thirteen instructors and a quite different set of questions from those on the evaluation forms, left me skeptical about drawing any conclusions from it. Nevertheless, the findings raise serious concerns that merit further study.

Meanwhile, a variety of sources, including many of the legislators responsible for funding state-supported universities, are calling for increased use of student evaluations. Administrators, faced with a glut of data, often find creative ways to reduce it to meaningless numbers. I encountered one who insisted that it sufficed to consider only the question on overall effectiveness, because he had once seen a report that, on average, the average on this question equaled the average of all other questions. He persisted in this policy even in cases for which it was patently false.

Advocates often cite a few superficial studies in support of the reliability of student evaluations. However, other studies give a more complex picture. Moreover, survey results can be extremely sensitive to the wording of questions and the circumstances under which the survey is given. An evaluation which asks both "Did the homework assignments increase your understanding and facility with the subject?" and "Were the homework assignments reasonable in length and difficulty?" is more likely to provide meaningful information than "Was the homework appropriate to the course." And where did the question about instructor's "sensitivity to student difficulty with course material" come from? Questions about an instructor's willingness to answer questions and/or the clarity of an instructor's answers may seem straightforward until one sees low ratings followed by comments such as "often answers indirectly by working a similar problem or asking us questions."

But simply bashing student evaluations serves little purpose. Some types of student feedback are useful, and many advocates of student evaluations are motivated by a genuine concern about the quality of education. However, many experienced faculty question the reliability of student evaluations as a measure of teaching effectiveness and worry that they may have counter-productive effects, such as contributing to grade inflation, discouraging innovation, and deterring instructors from challenging students.

Student evaluations need to be much more carefully investigated. Their deficiencies, their limitations, and the circumstances under which they can be useful all need to be thoroughly documented. Other mechanisms for evaluating and improving teaching effectiveness need to be explored and given greater emphasis.

While these issues concern faculty in all disciplines, mathematical scientists, because of their close link to statistics, bear a special role and responsibility. At the very least, mathematics faculty should insist that any numerical component to the evaluation process used at their institution meet minimum standards of statistical validity. In addition, the AMS and other organizations representing mathematicians should promote and publicize high-caliber studies which address these issues. Our commitment to excellence in mathematics instruction must extend beyond our own classrooms.

—Mary Beth Ruskai
Letters to the Editor

Three Lessons I Wish I Had Never Been Taught by Gian-Carlo Rota

I have the greatest admiration for Gian-Carlo Rota's mathematics, energy, talent, wit, personality, charisma, enthusiasm, and the list could (and perhaps should) be continued. However, the purpose of this letter is to point out that by publishing his "Ten Lessons I Wish I Had Been Taught" in the January 1997 issue of the AMS Notices (cf. p. 22-25) without any appropriate footnote indicating that some of the "lessons" are meant to be just read and enjoyed and must not be taken seriously without parental supervision, you (and, indirectly, Gian-Carlo Rota) may have caused irreparable damage to a large segment of our young (and not so young) mathematicians who are naive beyond belief and who will accept any advice no matter how absurd and nonsensical it is from such an international authority and supernova as Gian-Carlo Rota.

More specifically, Gian-Carlo Rota advises to "Publish the Same Result Several Times" and then uses the example of F. Riesz to illustrate his point. Poor F. Riesz and poor advice. First, F. Riesz was a perfectionist beyond help (just like yours truly). Second, his mother tongue was Hungarian, whereas his working languages were Hungarian, German, and to some extent English; and he lived in an era when the international language of mathematics was transforming towards (broken) English. Especially the latter played a major role in why some of his results appeared more than once in print. Gian-Carlo Rota writes, "Riesz's example is well worth following today." If he means that it's worth following (F. or M.) Riesz's taste, talent, and depth, then I couldn't agree more. Let me put it this way: if you are a mathematician of (F. or M.) Riesz's caliber, please do whatever you want. Otherwise, please do not contribute indiscriminately to the information junkyard, and please publish only "final" definitive forms of your results, and spare us from being bombarded by ε-improvements and generalizations.

By the way, Gian-Carlo Rota writes, "I bought a copy of Frederick Riesz's Collected Papers as soon as the big, thick, heavy, oversize volume was published." I wonder if he realizes that he was grossly cheated, because it's really two big, thick, heavy, oversize volumes.

Then Gian-Carlo Rota advises "Do Not Worry about Your Mistakes" and brings up Hilbert and himself to make his point. Well, who the heck should worry about them if not the one who is responsible for them? This is nightmarish advice for readers and editors alike. In addition, it adds to the instability of our mathematical structure: just imagine theorem after theorem proved using erroneous results (sound familiar?). My advice is: forget it, and please do keep worrying about all your past, present, and future mistakes.

About the Cover

It is possible to deform a plane in three-space into a ruled surface containing one triple point and two pinch points using equations $(x, y^3 - cy, xy + y^2 - cy^2)$, as described in the work of David Mond and Washington Marar. This rendering was produced at the Geometry Center by Thomas Banchoff of Brown University and Davide Cerbone of Union College. It was included in the show "Surfaces beyond the Third Dimension" at the Providence Art Club in March 1996. For more information about this image, see http://www.geom.umn.edu/locate/tfb/art/.
Then Gian-Carlo Rota tells the reader to “Give Lavish Acknowledgments”. Funny but phony, and it may ruin one’s credibility. My advice is: give fair acknowledgments, no more and no less. Never say “I would like to thank Professor X...” If you would like, then please do so and say “I thank...” (if I recall correctly, this comes from Paul Halmos). Don’t use the word “Professor”; it’s superfluous.

Acknowledgment. I would like to sincerely thank Professor Gian-Carlo Rota for the remaining “Seven Lessons I Wish I Had Been Taught”. I wish I had the words to describe how much his advice means to me. I also would like to thank the readers of my letter for their wisdom and infinite patience. If I may, I would also like to ask the readers to send me a complete set of their reprints so that I could lavishly refer to their invaluables mathematical contributions for years to come, whether or not they contradict my own results.

Paul Nevai
The Ohio State University
Received December 12, 1996

P.S. When “Ten Lessons I Wish I Had Been Taught” was originally published in Concerns of Young Mathematicians, Vol. 4, Issue 25, August 21, 1996, it was preceded by “The views expressed here do not necessarily represent those of the administrative board or membership of the Young Mathematicians’ Network” (cf. http://www.math.usouthal.edu/brick/ymn/V4/vol14.25.html).

P.P.S. Gian-Carlo Rota’s recently published Indiscrete Thoughts (Birkhäuser, 1997) contains several chapters in the same spirit as the subject of this letter. Although I have not had a chance to read the entire book yet and therefore am in no position to praise or criticize it, I am sure that once I finish reading the book, I will heartily recommend it to all mathematicians, dead or alive.

Withdraw Endorsement of NCTM Standards

I would like to thank Professor Wu for his insightful article on the mathematics reform movement published in the December 1996 “Forum”. Professor Wu has asked if the rank-and-file members of the AMS agree with the endorsement of the NCTM Standards by the AMS leadership. I do not. I respectfully urge the AMS leadership to withdraw its endorsement of the NCTM Standards.

The NCTM Standards lack balance and downgrade the importance of basic skills. They have spawned the disastrous California Mathematics Framework, which, for example, advocates access to calculators for all kindergarten and elementary school students. The NCTM Standards have paved the way for elementary school pedagogies such as MathLand, which fails to explicitly develop the standard multiplication algorithm for elementary school students, and high school pedagogies such as Interactive Mathematics Program (IMP), which delays presenting the quadratic formula until the twelfth grade. These are not even the worst of the so-called reform pedagogies.

When research mathematicians lend credibility to these tendencies, it has a bullying effect on teachers and parents who object to extremist pedagogies in the reform movement. School administrators can point out, and some already have pointed out, that the AMS, the leading organization for U.S. mathematicians, supports the NCTM Standards on which the reform pedagogies are based.

When research mathematicians further endorse reform versions of calculus, like the “Harvard Calculus”, which radically deemphasize the use of high school algebra, this lends support for high schools to teach less algebra. And many are doing just that.

In my opinion, the AMS leadership has created barriers to criticism of the mathematics reform movement through its editorial decisions and its appointments to committees which can influence mathematics pedagogy. I urge greater openness on the part of the AMS leadership toward criticisms of the mathematics reform movement.

David Klein
California State University, Northridge
Received December 16, 1996

Mathematics Teaching at Illinois

In the editorial of the Notices of the AMS, Vol. 44, Number 1, signed by Steven G. Krantz, it is stated: “At the University of Illinois in Urbana the engineers have started teaching their own math courses...” I wish to point out that this statement has no basis in fact. It is either an error or a product of the imagination.

Philippe Tondeur
University of Illinois at Urbana-Champaign
Received December 19, 1996

Mathematics Reform at Second-Tier Institutions

Professors Wu (“Forum”, December 1996] and Mac Lane (“Letters to the Editor”, December 1996] express criticisms of the current wave of “reforms” in the teaching of mathematics. We feel that such criticisms are long overdue and wish to congratulate both authors for expressing their opinions.

Wu and Mac Lane may not have first-hand experience of the status of the “calculus reform” at second- (and third-) tier four-year institutions (as we do). At these institutions the “reforms” hold greater sway than at institutions where scholarship is more highly valued. At such institutions, in our experience, political activists from the administration, from the school of education, from those with a financial stake in the “reform movement”, and from governmental “politically correct” funding organizations promote such reforms (and are sometimes joined by a contingent of resident activist mathematicians). In the process, all distinctions between “proof”, “explanation”, and “observation” are often lost. In such schools, mathematics programs are often extremely starved for resources, even when compared to other programs at the same schools. In such a situation, a little seed money from cynical or ignorant book publishers, calculator salesmen, and Washington bureaucrats can have an immense impact. Official-looking flyers from commercial interests too often im-
press administrators (who are frequently more versed in "cooperative learning" than mathematicians). Occasional letters critical of the "reforms" from famous mathematicians (famous, that is, to other mathematicians) are printed in journals outside the reading circle of ordinary administrators.

In many such mathematics departments, Ph.D. mathematicians are outnumbered by those with degrees from the school of education or those who lack advanced degrees. One can easily guess the effect this situation has on the current employment opportunities for new Ph.D.s in our field. It is not uncommon to observe students in class circled in groups of four or five with their graphing calculators and four-colored, expensive, and faddish calculus books attempting, in a few hours, to empirically rediscover the great insights of Newton, Leibniz, and Gauss. Their "discoveries", expressed on poster boards or on group tests, are recorded frequently in "collective grades". These "educational" procedures differ in essential ways from the more successful methods used to teach mathematics in the past. Instead of developing deep insights and a love for the beauty of mathematics, our students make observations with their calculators and look for patterns (much as our colleagues in experimental psychology do). Theory makes such students positively uncomfortable.

The "reform" movement, in its religious fever and intolerance, declares that the teaching of mathematics must change to reflect modern technology, the demands of the employment market, and the increasingly fickle taste of our students (with their abysmal algebraic skills). Ironically, these untested "reforms" forced on second-tier colleges and public schools have coincided with students less enthusiastic about mathematics, less able to apply what they have learned (even to easy, artificial problems, much less to "real-world" problems), and, in general, less familiar and knowledgeable about mathematics. Lost in all the sloganeering is the fact that real mathematics, as taught by real mathematicians, is becoming a rarer and rarer experience at American second- and third-tier universities and colleges. Mathematics without precision, rigor, and proof, while not totally lacking in value, is simply not mathematics!

In endorsing the NCTM Standards, the AMS implied it was speaking for its members. This is not so for the undersigned (both members of the AMS). Our deep appreciation to Doctors Wu and Mac Lane for sounding the alarm on this threat to our profession and to our students.

Boris A. Kushner
Marc H. Melman
University of Pittsburgh at Johnstown
(Received December 16, 1996)

A Cyclic Pattern in Ph.D. Awards

Does anyone have an explanation for the strong biennial cycle in mathematics Ph.D.s, shown in Table 5 (and the first figure accompanying that table) on p. 1499 of the December 1996 Notices? Starting in 1989 (for simplicity I will write "1989" for "88-89", i.e., "Fall '88 and Spring '89 degrees", and likewise for other years), every odd-numbered year has shown more U.S. citizen doctoral recipients than the preceding year, while every even-numbered year has shown fewer than the preceding year. Looking at even- and odd-numbered years separately, we see two rather smooth growth curves, one above the other.

Is there some two-year cycle of funding? Could the way the information is gathered be changing in a two-year cycle? Do related disciplines show the same cycle?

Subtracting U.S. citizen recipients from total recipients, it appears that noncitizen recipients were affected by the same cycle from 1991 through 1995. (Perhaps the cycle was present over the whole period but masked by a stronger and less regular overall rise than for U.S. recipients.) Among U.S. recipients, male and female recipients both show the same alternation of increases and decreases for the full period mentioned. I have also checked my own department's Ph.D. lists, and they have shown the same cycle even longer—since 1985—except for irregular peaks in the even-numbered years 1988 and 1994.

The unemployment information in the same article does not show a two-year cycle. However, it has been suggested to me that the cycle in Ph.D.s may be driven by "hidden unemployment", which could be looked for in the future by adding to the questionnaire to new Ph.D.s an item asking whether the respondent attempted a job search the preceding year and delayed graduation partly due to an unsatisfactory outcome. If true, this would just be a start to explaining the mystery.

George Bergman
University of California, Berkeley
Received December 18, 1996

Preparation of Future Teachers

Both H. Wu in "The Mathematician and the Mathematics Education Reform" (Notices, December 1996) and Hyman Bass in "Mathematicians as Educators" (Notices, January 1997) suggest that mathematicians should pay much more attention to pedagogy at all levels. I agree. I would like to recount some of the efforts in this direction of the mathematics department at UC Davis, whose experiences may be instructive.

Over twenty years ago we introduced an MAT (Master of Arts in Teaching) degree, designed to prepare mathematically strong teachers at the elementary and secondary levels. This is a two-year program during which the student takes special mathematics courses, such as the history of calculus, and has extensive practice teaching, closely monitored by peers, professors, and resident teachers. Unfortunately, we were too successful. I estimate that over 80 percent of our graduates went into teaching at community colleges either directly or after a brief stint at the secondary level. (Three reasons: better pay, shorter hours, no discipline problem.)

We also introduced a two-quarter undergraduate course to provide prospective elementary teachers with a strong mathematics background. On the first day students are asked to
write a mathematical autobiography. Almost all mention that they dislike or fear mathematics and trace that attitude back to an episode in an elementary mathematics class. No wonder they tend to avoid science and mathematics courses and put off our course till their senior year.

The main objective of the instructor in that course is to change students' attitudes toward mathematics. Very few instructors can cope with such a challenge. Years spent in graduate school mastering analysis, algebra, and topology unfit most of us for empathizing with students who dislike mathematics.

Many mathematicians become interested in the way mathematics is taught when their own children enter school. But that interest does not qualify them to teach such a class. Someone who is going to teach prospective teachers should visit many classrooms and see the different ways of organizing a class (lecture, small-group, etc.), even try to teach a class over a period of weeks.

However, someone who wants to do a good job in mathematics education will not have the time or energy to continue mathematics research. If the campus or department does not appreciate the effort, that instructor may become a second-class citizen. On the other hand, if a department views mathematics education as an application of mathematics (as it views fluid flow, for instance), then the instructor may expect appreciation and promotion.

Mathematicians are probably far more involved in precollege education than they realize. They may be surprised to learn how many of their students who earn a bachelor's degree in mathematics become teachers. When they do learn, they may ask, "Is the present curriculum, which is designed for other purposes, the best preparation for future teachers?" The answer will likely be no, for the same reason that a curriculum chosen to prepare future teachers may not be ideal for preparing students for research or industry.

Anyone interested in mathematics education should become familiar with two books published by NCTM, *Curriculum and Evaluation Standards for School Mathematics* (1989, 258 pp.) and *Professional Standards for Teaching Mathematics* (1991, 196 pp.), which describe quite specifically how mathematics should be taught. These volumes, both endorsed by the AMS and the MAA, also strongly influence what textbooks will be published. The slogan of *The Mathematics Teacher*, the main journal of the NCTM, shows the importance of the *Standards*. It says that "The mission of NCTM is...that every student is ensured an equitable Standards-based mathematics education. ..." This is quite a contrast with its ecumenical slogan up to 1995: "The Mathematics Teacher is devoted to improving mathematics instruction."

Pages 132–143 of the second volume are of particular interest to mathematicians, for they describe the mathematics a teacher should know in order to teach the *Standards* way. This critical section begins:

Knowledge of both the content and discourse of mathematics is an essential component of teachers' preparation for the profession. Teachers' comfort with, and confidence in, their own knowledge of mathematics affects both what they teach and how they teach it. Their conceptions of mathematics shape their choice of worthwhile mathematical tasks, the kinds of learning environments they create, and the discourse in their classrooms.

All of us would agree with that. The first stage in the reform movement should have been to improve the mathematical knowledge of present and prospective elementary teachers. Unfortunately, the cart of curriculum reform has been put before the horse of well-prepared teachers. In fact, not a single article on the subject of the mathematical preparation of teachers has appeared in *The Mathematics Teacher* since the second *Standards* volume was published.

Because the AMS and MAA presumably agree with those twelve most crucial pages, these organizations should persuade mathematics departments to implement the recommendations made there. If all teachers were mathematically well prepared, I for one would stop worrying about the age-old battle still raging between "back to basics" and "understanding".

On the other hand, if mathematics departments do nothing to improve school mathematics, they should stop complaining that incoming freshmen lack mathematical skills.

Sherman Stein
University of California, Davis

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Interview with Bartel Leendert van der Waerden

Yvonne Dold-Samplonius

Dold: Professor van der Waerden, how did your interest in mathematics begin? What are your first memories hereof?

van der Waerden: My father was a teacher of mathematics; thus, in our house there were books in this discipline. He absolutely did not want me to study these; he maintained that I should play outside rather than dedicate myself to mathematics books. So he locked up the books, and I could not have access to them. That stimulated me at times. For example, I rediscovered all of trigonometry, starting from the law of cosines. I knew, somehow, what the cosine means. I also knew the law of cosines. From my investigations emerged an expression which I called “the square root of one minus the cosine squared”. Then my father helped me, telling me this was called the “sine”.

At that time I was a student at the Hogere Burger School (HBS) of Amsterdam, the city where I was born February 2, 1903—a school following elementary school, which lasted five years. Geometry was the object of study, but not trigonometry; that would be taught in the later classes.

Dold: Could you tell us some other “mathematical” experiences of that period?

van der Waerden: I had a game called “Pythagoras”. It consisted of pieces which could be moved around freely and with which it was possible to construct a square or a rectangle or a triangle by combining them in a variety of ways. I received it as a present, and I played with it most happily. Almost always I played alone or with my father. My two brothers were not at all interested in this type of game.

Dold: Was your mother interested in mathematics?

van der Waerden: No, I think not. I loved my mother very much. Often we went by boat to Zaandam, where she had relatives. I always liked very much to go to Zaandam. These relatives also had a sailboat, and we often went sailing there.

Dold: What happened after HBS?

van der Waerden: After HBS I continued to study. Naturally, according to the experts, I should become a mathematician. However, I do not remember any particular mathematics teacher. But at school I did have an ex-
Camilla and Bartel van der Waerden, Seattle 1949.

Dold: You have also worked in topology.
van der Waerden: Yes, I learned a little topology from Mannoury. He wrote a beautiful paper, "Surfaces Images". He was an original person.

Dold: Then how did your studies proceed?
Camilla van der Waerden: He did his military service in the middle of them.

Dold: Were you required to do your military service before finishing your studies?
van der Waerden: No. I had terminated them, but I hadn't yet graduated. I had already finished all the necessary exams. Military service was put off until after the final exam.

Dold: Did you take the final exam with Brouwer, Mannoury, and Weitzenböck?
van der Waerden: No, with de Vries; de Vries also was a very original person. He gave a course on "de meetkunde van het aantal" [geometry of the number], the numerative geometry of Schubert, which he admired very much. But the foundations of this geometry were bad. So, for example, the principle of the conservation of number states that the number of solutions of a geometric problem does not change when the associated parameters change. This was his principal thesis. But let us suppose that one passes from the general case to a special case, so that the parameters also change. It can happen that there are several solutions for the general case but one solution only in the special case. But in the special case, the solutions must be counted with their multiplicity. For example, two conics always have four points of intersection: where they are tangent such points must be counted with their multiplicity. For example, two conics always have four points of intersection: where they are tangent such points must be counted with their multiplicity. For example, two conics always have four points of intersection: where they are tangent such points must be counted with their multiplicity. For example, two conics always have four points of intersection: where they are tangent such points must be counted with their multiplicity. For example, two conics always have four points of intersection: where they are tangent such points must be counted with their multiplicity.

1 Already in 1900, Hilbert, in his 15th problem, had asked for a rigorous demonstration of the Schubert calculus. But one had to wait until 1912, for the work of F. Severi, and 1930, when van der Waerden proved this by using topological methods.
asked my father whether he would allow me yet another semester at Göttingen, whether he could pay for it, and he said yes.

Dold: In what year did this occur?

van der Waerden: Well, I stayed at HBS until 1919, for the duration of the World War. Then I went to Göttingen in 1923, and at Göttingen I proved the principle of the conservation of number. I gave a definition of the concept of multiplicity and a method to calculate it. I wrote in the introduction: "The branch of algebraic geometry which came to be called 'numerative geometry' rested until today on a not very secure foundation. Schubert's principle of the conservation of number, on which a great part of this geometry is based, is neither rigorous in the formulation of Schubert, nor in subsequent definitions, where they are either defective or insufficient." Then I gave a precise basis for numerative geometry. I wanted to make it my thesis, but it was too long. Besides, there was a rule that a thesis could be written only in one of two languages, Dutch or Latin. Thus I could not present it in German. So I published my foundations of numerative geometry in several articles in Math. Annalen, and I presented as my thesis a statement of these themes without proofs. This solution was accepted, and my thesis advisor was Hendrik de Vries, who has already been mentioned. The thesis—well, what was the date? In 1926 on the 24th of March, I defended my thesis in the grand hall of the University of Amsterdam.

Dold: Thus you worked on your thesis in Göttingen, and immediately afterwards you had to do military service. Were you able to work on your thesis during this time?

van der Waerden: I wrote the thesis during my service as a marine at den Helder. Naturally, I was not free to go to Amsterdam to discuss my thesis, and I did my thesis practically by myself. At Göttingen I had above all made the acquaintance of Emmy Noether. She had completely redone algebra, much more general than any study made until then, and she was in fact my teacher at Göttingen. Thus I proved my theorems with the methods she had developed.

Camilla van der Waerden: You also had a Rockefeller grant to stay in Göttingen.

van der Waerden: Yes, after one semester at Göttingen, Courant started to take notice of me. He procured for me, on the recommendation of Emmy Noether, a Rockefeller grant for one year. With this I studied another semester at Göttingen and one semester at Hamburg with Artin.

Dold: Who was at Göttingen then?

van der Waerden: Naturally there was Hilbert, who was very affable. Often he even invited me to his house, but I cannot say how interesting my research was to him.

Dold: Who else was there?

van der Waerden: Felix Bernstein was also at Göttingen. And then there was as "Privatdozent" Hellmuth Kneser, the second of the three Knesers (son of Adolph Kneser, father of Martin Kneser). Others of my age were, in the first place, Hans Lewy and Kurt Friedrichs, who worked on PDEs; together they had proven the existence and uniqueness of solutions. However, I had the most contact with Hellmuth Kneser, to whom Brouwer had written a letter of introduction for me. Thus from the beginning I was in contact with him, and from him I really learned topology. Kneser and I used to have lunch together; after having eaten he went home, but on occasion we first took a brief walk. We strolled through the woods of Göttingen, and he taught me many things. It always went like this: he made some observations which I did not completely understand, so I then went into the library to find out what he was really saying. The next day I asked him if the interpretation was correct. Thus I learned, for example, topology.

Dold: One often hears about the celebrated reading room of Göttingen.

van der Waerden: Yes, it was splendid; you could take the books from the shelves yourself. This was really not possible anywhere else. At Amsterdam, when you went into the university library, first you had to look in the catalogue, fill out a form, and put it in a box. And then, after half an hour, you obtained the book requested. At Göttingen, instead, where you could get the books from the shelves by yourself, it often happened that right near the book you were looking for there was another interesting one.

Dold: Was the Göttingen atmosphere as free as they say?

van der Waerden: I think so.

Dold: Did you meet your wife at that time, while at Göttingen?

van der Waerden: No, that happened later. I obtained a chair at Groningen.

Camilla van der Waerden: However, you received the offer to Groningen from Göttingen.

van der Waerden: It went like this: In the reading hall of the public library at Amsterdam I had studied a treatise in analytic geometry by Barrau, which contained in Part II many theorems insufficiently proven, even insufficiently formulated. I wrote to the author, to Barrau. I wasn't yet a student of the university; I was still at HBS. Barrau, then a professor at Groningen, said that should he leave, they would have to nominate van der Waerden as his successor. And things happened like that. He went to...
Utrecht, and they offered me the chair at Groningen.

Dold: When did you go to Groningen?

Camilla van der Waerden: In 1927 or '28. And then in 1929 we met.

van der Waerden: It was in 1927.

Camilla van der Waerden: At the same time they made you an offer to Rostock.

van der Waerden: Yes.

Dold: How was the situation at Groningen? How many students were there? Did you have interesting colleagues?

van der Waerden: At Groningen there was van der Corput, from whom I learned many things, above all his asymptotic expansions. He wrote a book on asymptotic expansions which I read.

Dold: Did you begin to write your book on algebra while you were at Groningen?

van der Waerden: Yes. Then, in 1929, I took the position of visiting professor at Göttingen, and there I met my wife.

Camilla van der Waerden: When I came to Göttingen, you weren't there, but my brother (Franz Rellich) was there. I came to stay with my brother and worked in a pharmacy. Later, in the summer, you came as a visiting professor, and that's how we met. Then we were married, and everything went well and was beautiful, even very beautiful. We met in July and were married in September. Then we went to Groningen. After a while, Emmy Noether called, I surely remember, and said, "Time to end the honeymoon; back to work again!" Then he put himself back to work and finished the book in one stretch. I surely remember.

Dold: This book on the foundations of algebra (Moderne Algebra I, Berlin, 1930) was a great success. Did you have many readers right from the beginning?

van der Waerden: Yes, from the beginning. With my book, the Algebra, it went like this: Artin was supposed to write a book and wanted to write it with me. Having finished the first chapter, I showed it to Artin. Then I sent him the second and asked him about the progress of his part of the book. He hadn't yet done anything. Then he gave up the idea of writing the book with me. Nevertheless, the book is based on lectures of Artin and Noether.

Dold: How long did you stay at Groningen?

van der Waerden: At Groningen, two years; then we went to Leipzig.

Camilla van der Waerden: This happened in 1931. In 1933 we probably would not have gone anymore.

Dold: Which mathematicians were then at Leipzig?

van der Waerden: There was Köbe.

Camilla van der Waerden: The mathematicians did not attract you, but the physicists Heisenberg and Hund—not the mathematicians.

van der Waerden: Heisenberg and Hund held a seminar together, and I attended. It was on this occasion that I learned physics. At Amsterdam the physics instruction was not good; there I had followed the lessons of van der Waals, the son of the Nobel laureate Johannes Diderik van der Waals.

Dold: How did these contacts influence your work?

van der Waerden: I wrote a book on group theory and quantum mechanics. There are applications of group theory to quantum mechanics, made at that time by John von Neumann and Wigner. Hermann Weyl had written a book on the subject entitled—I think—Group Theory and Quantum Mechanics. However, his book was so difficult that no one understood it. Hermann Weyl wanted to write mathematics for beauty's sake, but I did not find it very beautiful. Thus I wrote a new book on the method of group theory in quantum mechanics. The book was well received by physicists and was rapidly sold out. Later I rewrote it in English; it is still available.

Dold: Did Heisenberg and Hund remain at Leipzig?

van der Waerden: Heisenberg went to Berlin.

Camilla van der Waerden: Much later, in the last year of the war, he went to Berlin to the Kaiser Wilhelm Institute (now the Max-Planck Institute).

Dold: During the war, did things continue normally? Were there students, or were they all drafted?

van der Waerden: Most of the students were drafted, but I had one who later became famous. He was the Chinese Wei-Lang Chow (1911–1995). Together we wrote a paper on the method of representing an algebraic variety by means of parameters. To every algebraic variety is associated a form which I invented. Chow gave the proof. We published a paper together on this.

Dold: Does the famous dissertation of Chow come from this common work?

van der Waerden: Yes. We found the way to represent an algebraic variety by an equation. That is to say, when an \( r \)-dimensional variety is intersected by \( r \) hyperplanes, we consider the points of intersection. The dimension decreases by one with each hyperplane, and thus the intersection with \( r \) hyperplanes is a finite set of points. Each point can be determined by its coordinates. Now if one intersects with \( r + 1 \) hyperplanes, there will be a condition for these \( r + 1 \) hyperplanes to have a point in common with the variety. This brings us to an equation,
whose coefficients are the Chow coordinates. I had the idea, and Chow, as I said, found the proof. Now W.L. Chow is in America and is a famous mathematician.

Dold: Chow is your most celebrated student. But you have had other students who became famous. Wasn’t Herbert Seifert your student at Leipzig?

van der Waerden: Yes, Seifert was my assistant at Leipzig. However, he wasn’t my student. When I went to Leipzig, he was already a mature mathematician. He wrote a beautiful book on topology. Later at Zürich I had many students who worked on quadratic forms. Their dissertations were published by me, together with one of my works, with the title *Studies on the Theory of Quadratic Forms*, edited by me and Herbert Gross. Other than Gross I can recall Aeberli, Germann, Benz, and Demuth.

Dold: At Leipzig you also knew the philosopher Gadamer?3

Camilla van der Waerden: We were very close friends. It was really very nice.

Dold: Was it Gadamer who aroused your interest in Greek mathematics?

van der Waerden: Yes, Gadamer had worked a lot on Plato. I even took his courses.

Dold: When did this happen?

Camilla van der Waerden: At the end of the war. He gave a beautiful course.

Dold: And this increased your interest in Greek mathematics?

Camilla van der Waerden: One can’t say for sure. During the war we did not talk about science with them. With Litt and Gadamer, who were both philosophers, we spoke of Nazism and how it would continue. Neither of the two were Nazis. We then did not talk about science, only, in fact, of how it would continue. We were so trapped during the whole time of Nazism. Instead, with Heisenberg and with Hund we talked about science and not about politics. It was a strange thing.

van der Waerden: Gadamer gave a course on Plato’s Republic, which I attended. This happened during Nazism. He explained, as Plato shows in the Republic, that a dictator is necessarily antagonistic to a reasonable person and finally that a dictator necessarily destroys himself. At first he ruins his enemies, then his friends, and finally himself. There were certainly also Nazi students in the class, but they did not understand him.

Camilla van der Waerden: They never understood anything.

Dold: This happened during the war. And then you had to leave Leipzig?

van der Waerden: On the 4th of December, 1943, we were bombed out, and my wife and I, with the children, left for Dresden.

Camilla van der Waerden: My brother was in Dresden. However, we remained there only one night.

van der Waerden: The brother was Franz Rellich. During the trip from Leipzig to Dresden we met one of my students. She was on the same train and said, “Come to us at Bischofswerda, where you will be safe.” Bischofswerda is a small town in the vicinity of Dresden.

Camilla van der Waerden: There we remained a year, or perhaps a little longer. We returned to Leipzig at the end of 1944. The city was under heavy air attack.

Dold: Were you able to take anything with you?

Camilla van der Waerden: My husband said, “You must take nothing.” But I secretly put in the knapsack some silver for each one of us—we were five—a knife, fork, and spoon. Later this proved to be so useful.

Dold: Then came the fall of the Third Reich.

Camilla van der Waerden: We survived in the country in Austria. In 1945 we could no longer take the incessant bombardments. So we went to my mother, who lived in the country at Tauplitz, near Graz.

Dold: Were you able to dedicate yourself to mathematics there?

van der Waerden: No, for a certain time, I did nothing.

Camilla van der Waerden: There we discovered how difficult it is to procure food. From there we went to Holland.

Dold: When did you return to Holland?

van der Waerden: In July 1945. At Tauplitz we were “displaced persons”. The Americans were there, and they took us away in buses.

Camilla van der Waerden: The Americans said, “Now, everyone returns to their country of origin.” Thus we Dutch should return to Holland. Johannes Heesters, from whom my husband sought advice, remained in Austria; he did not return to Holland.

Dold: Did you have a job in Holland?

\[3\] Recently Gadamer recalled, in a letter to Yvonne Dold, the following episode: “The time at Leipzig, those awful years, created above all precious links of friendship. I had the joy of stimulating van der Waerden’s interest in the birth of science. Since I was an old friend of Franz Rellich, our interactions were wonderful from the beginning. When the war began, I had the opportunity to perform a little act of heroism. When van der Waerden was arrested for being a Dutchman, an expedient came to my mind. Once I had helped the wife of the then chief of police on her philosophical travels and thus I also had the opportunity to make the acquaintance of her husband. I wrote to him, and van der Waerden was released, and the chief of police thanked me, for, after a few days, the liberation of all the Dutch citizens was ordered.”
Camilla van der Waerden: It is impossible to describe the situation in which we found ourselves at that time. No one can imagine this.

van der Waerden: I had an offer from Utrecht. During the war they had written asking if I wished to come to Utrecht. I answered, "Not now, but after the war I shall come." If I had gone to Holland during Nazism, I would have received the title from the Nazi minister of public instruction. And I did not want this to happen. Then we arrived indeed in buses. In the meantime my parents had died, and we went to live in the house which my father had constructed at Laren.

Camilla van der Waerden: We arrived without money, without anything, and found no work, not in instruction nor anywhere else.

van der Waerden: Then there was this offer from Utrecht, where my good friend Freudenthal was. The papers went to the minister, but the queen refused to sign them, because during all the Nazi time I had been in Germany.

Camilla van der Waerden: One can really understand it. Afterwards I understood it all.

Dold: Thus you were without a position. You had a house, but nothing else. How did you get along?

Camilla van der Waerden: One day he came home and said, "We still have enough to live for one more month, and then we shall have nothing left."

van der Waerden: Finally, one day Freudenthal called me and wanted me to come to Amsterdam to talk. I went to Amsterdam, and Freudenthal told me that he was able to find a position for me at Shell. "Would you accept it?" Yes, of course; I accepted it most willingly.

Camilla van der Waerden: So we were saved. I have always said that they can take everything away from us but our intellect. And so it was.

Dold: What did you do at Shell?

van der Waerden: At Shell I solved some problems which the engineers found too difficult. It was entertaining. They had quite different problems: for example, what is the best circuit for regulation devices? Problems of optimization, in a word. At Shell there was another mathematician with whom I worked on questions of optimization, and together we found beautiful solutions.

Camilla van der Waerden: It was a good time for us, something quite different for a while.

Dold: How long did you remain at Shell? What happened afterwards?

van der Waerden: In 1947 I spent a year at Baltimore. They wanted me to stay, but I refused and preferred Amsterdam. Amsterdam is a city university, and there the queen was unable to interfere. It was van der Corput who intervened and had them make me an offer to Amsterdam.

Dold: Nevertheless, you did not remain at Amsterdam very long.

Camilla van der Waerden: That gave a lot of trouble there. They had made such efforts for him. He left because he got an offer from Zürich.

van der Waerden: We were two years at Amsterdam.

Camilla van der Waerden: And in 1951 we came to Zürich.

Dold: Did you spend the rest of your life here at Zürich?

Camilla van der Waerden: Two years later he had an offer from München; in 1953 we could have gone. But we did not accept it, because of our children, who had become uneasy with all the changes.

Dold: Who were your colleagues at Zürich at that time?

Camilla van der Waerden: Finsler and Nevanlinna.

van der Waerden: Yes, Finsler and Nevanlinna. We were just three professors then; today there are seven chairs in mathematics. The special thing about Zürich is that there is also ETH. Heinz Hopf was here and Beno Eckmann. Together with Eckmann I published the "yellow series", the series started by Courant. These are books with yellow covers; my algebra was published there. Eckmann and I edited the series for quite a while, until I left it completely to him.

Dold: Did you have good rapport with the colleagues at ETH?

Camilla van der Waerden: Very good, excellent. There was a seminar which he always attended. My husband made no distinction between ETH and the university. Sometimes he said to students, "It is better to take these classes at ETH, where they are at the highest level."

Dold: When did you get interested in the history of mathematics?

van der Waerden: When I was a student, when Hendrik de Vries gave a course on the history of mathematics. After that I read Euclid and some of Archimedes. Thus, my interest began very early. At Göttingen—the first time I was
there—I attended the lectures of Neugebauer, who gave a course on Greek mathematics.

**Dold:** Neugebauer worked mainly on the Babylonians. Did he also give seminars on Greek mathematics?

**van der Waerden:** He lectured also on Greek mathematics. At that time, at Göttingen, Neugebauer worked above all on Egyptian mathematics and gave classes on it. His thesis was precisely on Egyptian mathematics. This was very stimulating. Later I visited him once at Copenhagen, and then he spoke to me of Babylonian astronomy. This was most interesting to me.

**Dold:** When did you begin your work on the history of mathematics? Your book Science Awakening appeared, it seems to me, at the beginning of the 50s. Did you write the book while in Holland?

**van der Waerden:** Yes. Here in the introduction (of the German translation) is written “Several well-disposed reviewers of my book, Ontwa­kende Wetenschap, first published in Dutch in 1950, recommended that the book be translated into German.” Helga Habicht-van der Waerden, my oldest daughter, has now made a faithful and readable translation of it (Erwachende Wis­senschaft, Basel/Stuttgart, 1956). The second, enlarged edition appeared in 1966.

**Dold:** What were the reactions to the book? To Erwachende Wissenschaft?

**van der Waerden:** Oh, it was widely read. It has sold well and is often cited. It has been translated into many languages: Japanese, English, and Russian.

**Dold:** Was this your first publication on the history of mathematics?

**van der Waerden:** I think so.

**Camilla van der Waerden:** Yes, it was the first.

**van der Waerden:** From then on I remained interested in the history of mathematics, also in the history of astronomy, which more recently has interested me even more.

**Dold:** Have you also been interested in the history of quantum mechanics?

**van der Waerden:** No, not in the history of quantum mechanics. My Sources of Quantum Mechanics is a source book.

**Dold:** When you came to Zürich in the 50s, did you give a course on the history of mathematics?

**van der Waerden:** No, I think not; I gave courses in mathematics, but I also worked on the history of astronomy and mathematics.

**Dold:** If I am not mistaken, you were also engaged in Indian mathematics.

**van der Waerden:** Indian mathematics, no—Indian astronomy. I worked on Indian astronomy, on Aryabhata.

**Dold:** What mathematics did you work on since you came to Zürich?


**Camilla van der Waerden:** These papers on algebraic geometry date from before the 50s, not from when we were at Zürich. There you did no more, no?

**van der Waerden:** This is not true. The last paper, ZAG XX, is rather recent, from 1971.

**Dold:** So, you worked in the theory of groups, in algebra, and, together with Heisenberg and Hund in mechanics, in number theory, which one can consider part of algebra, and in the history of mathematics. These are quite different areas. Which of these fields gave you the most pleasure?

**van der Waerden:** Actually, algebraic geometry.

**Camilla van der Waerden:** But now, as far as I know, it is the history of mathematics.

**van der Waerden:** Yes, and the history of astronomy.

**Camilla van der Waerden:** This pleased him the most, to tell the truth, for many years.

**Dold:** Has your wife always been interested in the history of mathematics? This is really easier to understand than mathematics.

**Camilla van der Waerden:** I have always preferred that he were more involved in mathematics. He didn't do it. I have always said he spends too much time on history and truly too little on mathematics.

**Dold:** Were your children interested in mathematics? Your daughter Helga translated the book (Science Awakening) into German, so she had some interest. And the other two?

**van der Waerden:** Absolutely no. None of the three had any interest in mathematics. Perhaps the youngest of my grandchildren has some, but it is still too early to tell; he is only ten years old.

**Dold:** Under your direction the institute at Zürich grew. You succeeded in obtaining more positions. When you arrived, there were only three chairs. How many were there in 1973, at the time of your retirement?

**van der Waerden:** Not more, I think. But yes, Gross came to the university before my retirement. He was temporarily at ETH.

**Dold:** When you went into retirement, the secretary of education (of the Canton Zürich) Künzi created for you, on the occasion of your seventieth birthday, an Institute for the History of Mathematics, with a library.
Receiving the honorary doctor degree at Leipzig, June 12, 1985. At right, Professor Rathmann, president of the University (with kind permission of the University Archives Leipzig).

van der Waerden: Yes, however, a part of the library was my personal library, which I donated to the Institute.
Dold: You continued to work in this institute for many years.
van der Waerden: Yes, Neuenschwander wrote his thesis with me.
Camilla van der Waerden: First he wrote his thesis with you, and then the Institute was founded. But your successor didn't want to know anything about the Institute, nor any of the others.
van der Waerden: The Institute was abolished by my successor.
Dold: In Switzerland interest in the history of mathematics is very rare. Do you have an explanation for this? It really is a rich nation, which could afford something.
van der Waerden: Yes.
Camilla van der Waerden: The only one now interested is Costantinescu, who works at ETH and always tries to organize something, at least a course given by a "Privatdozent". He notices again and again that the students are much interested. Whenever he takes an initiative, there is always a lot of attention. But also he cannot prevail.
Dold: Perhaps the right people are not here.
Camilla van der Waerden: This is certainly a reason. What people want is a historian of mathematics who is also a mathematician. This is a handicap for many. In this sense my husband did not have any difficulty.

Dold: Was Burckhardt already in Zürich when you arrived?
van der Waerden: I became acquainted with him much earlier, in the days of Göttingen. This is our only joint paper.
Camilla van der Waerden: Burckhardt was of great help to my husband when we came here, without knowing the Swiss situation. If he had not been here! He helped and advised my husband in everything. In 1951 the situation in Switzerland was quite different.
Dold: Are you continuing your work on astronomical systems?
van der Waerden: No, this subject is now over. Since then I have published no more. But the subject still interests me.
Dold: Did you have friendly relations with other historians of mathematics? With Freudenthal, for example?
van der Waerden: Yes, Freudenthal was Brouwer's assistant before becoming professor.
Camilla van der Waerden: He became professor when we were still in Holland. Was Freudenthal younger or older than you?
van der Waerden: He was much younger.
Camilla van der Waerden: He died quite a while ago; he was much younger. He survived the war in Holland, even though he was Jewish.
Dold: What were your relations with the German historians of mathematics?
Camilla van der Waerden: I should mention another, Weidner, who was at Graz. Each year in the summer we visited my mother, and each time my husband spent some time with Weidner. It was most pleasant to be with him. And other historians? I can't remember whether or not there was somebody at Leipzig. Was there anyone at Leipzig who was interested in the history of mathematics?
van der Waerden: No.
Camilla van der Waerden: He was always a great solitary figure.
Dold: It is marvelous all that you have told me. Thank you so much!
B. L. van der Waerden's early studies in the Netherlands of algebraic geometry led him to think about useful definitions of intersection multiplicity for curves and surfaces. He heard that Emmy Noether at the University of Göttingen used newer ideas about ideals to provide precise definitions of such multiplicities. So he went to Göttingen to listen to her inspired but sometimes confusing lectures on ideal theory and presently gave a very clear course of lectures on ideal theory. He then visited the University of Hamburg, where Professor Emil Artin (in 1921) was giving his impassionately insightful lectures on modern algebra. For a brief period there developed a plan that Artin and van der Waerden would collaborate to prepare an algebra text, but Artin did not get around to writing up his planned chapters. Then van der Waerden proceeded alone to write and publish (with Springer) his two-volume 1931 text Modern Algebra, with the caption "using lectures by E. Artin and E. Noether".

This beautiful and eloquent text served to transform the graduate teaching of algebra, not only in Germany, but elsewhere in Europe and the United States. It formulated clearly and succinctly the conceptual and structural insights which Noether had expressed so forcefully. This was combined with the elegance and understanding with which Artin had lectured. The first volume included his neat and clean presentation of the Galois theory, a presentation which rapidly replaced the earlier, often obscure treatments. The volume also covered formally real fields and valuation theory. The second volume covered ideal theory, algebraic integers, linear algebra, and representation theory. The whole was inspired by a facility for conceptual clarity and was written in simple, understandable German. Upon its publication it was soon clear that this was the way in which algebra must now be presented. Its simple but austere style set the pattern for mathematical texts in other subjects, from Banach spaces to topological group theory. When I first taught modern algebra as a beginning instructor at Harvard University in 1934, I of course used van der Waerden as my text.

The presentation then of newer ideas from Dedekind, Noether, and Artin should not blind us to the decisive contribution made by van der Waerden. For comparison, recall a two-volume text in algebra by Otto Haupt, then a professor at Erlangen. Haupt was well acquainted with Emmy Noether's new ideas, and he presented them very carefully in his two volumes (published in 1928). I chanced to have studied the volumes then and found them helpful but heavy-handed—indeed, pedantic. It was van der Waerden who understood the real thrust of abstract algebra and who presented it abstractly but without pedantry. His two volumes remained
the text of choice—in German, or in the second edition published during the war by the alien property custodian, or in English translation, or in a later German edition in which the title dropped the claim to "modernity".

Van der Waerden himself wrote a number of other books and carried on an active research program in algebraic geometry, publishing in the 1930s and 40s many papers "Zur Algebraische Geometrie" (#1 to #20) in the Mathematische Annalen, as well as a text (1939) Introduction to Algebraic Geometry. This text provided, inter alia, a much needed systematic and precise formulation of the notion of intersection multiplicity. At the time, I bought a copy, but soon realized that this was only the start of the needed re-form of algebraic geometry.

The Italian school of algebraic geometry had made effective and imaginative use of intersection multiplicity, but it was clear that many proofs were not rigorous and that indeed the concepts needed a careful analysis and redevelopment. This need must have been clear to many mathematicians; for example, it became clear to me when in 1937 I learned how R. J. Walker had developed in his thesis a careful treatment of the "infinitely near points" used for the intersection multiplicity of algebraic curves. In 1939 and 1942 Oscar Zariski had published in the Annals of Mathematics his careful resolution of the singularities of an algebraic surface. In 1946 Andre Weil's Foundations of Algebraic Geometry (AMS Colloquium Publications, vol. 29) had given an extensive analysis of intersection multiplicity (and this volume had aspects which suggested to me the possible uses of category theory, as was done in the later work of Grothendieck).

But Italian-style algebraic geometry still flourished in Belgium, where a young Belgian, L. Derwidue, studied the singularities of algebraic varieties of higher dimension. At that time, van der Waerden had a summer home in the Netherlands. Derwidue visited him and explained his method of resolving singularities in all dimensions. Soon van der Waerden accepted and published in the Mathematische Annalen a paper by Derwidue, "La problemé de la réduction des singularités d'une variété algébrique" (vol. 123, 302-330, 1951). At the time of publication, I happened to read the title in the volume in the Widener Library at Harvard; I at once searched out and found Oscar Zariski. "Oscar, they have solved your problem of the resolution in all dimensions." Professor Zariski at once wrote the editor of the Mathematical Reviews, asking to review this paper. His resulting review (MR, vol. 13, p. 67 ff) demolishes the purported resolution with analysis and striking counterexamples.

It required Zariski's expert understanding of the resolution problem to correct van der Waerden's mistake in accepting the Derwidue paper for publication. This is just one dramatic moment in the long and elaborate process in which algebraic geometry was gradually and totally transformed by the successful efforts of van der Waerden, Lefschetz, Walker, Zariski, Weil, Chevalley, Serre, Hironaka, Grothendieck, and many other mathematicians. One might hope that soon experts will examine and explore the many stages involved in this complex process, including the role of van der Waerden.

The historical situation of abstract algebra is a simpler one. I again emphasize the decisive contribution made by his two volumes on modern algebra. They dramatically changed the way algebra is now taught by providing a decisive example of a clear and perspicuous presentation. It is, in my view, the most influential text in algebra of the twentieth century.

Such assessments are uncertain and are perhaps to be avoided, as in van der Waerden's own judicious work in the history of mathematics. For example, his 1985 book A History of Algebra from Al Kharisme to Emmy Noether indeed gives a brief and objective description of Noether and her lectures on crossed products, on hypercomplex numbers, on division algebras, and on general representation theory (of groups and algebras). There is mention of Noether's use of van der Waerden's notes on some of her lectures. His 1985 book notes her profound influences on the development of modern algebra (p. 241) and quotes Herman Weyl's memorial address on page 217: "She could just utter a far-seeing remark like this, 'Norm residue symbol is nothing else than cyclic algebra' in her prophetic lapidary manner, out of her mighty imagination." We are fortunate that her imagination has been made accessible by van der Waerden.

It was van der Waerden who understood the real thrust of abstract algebra and who presented it abstractly but without pedantry.
From Matrix Mechanics and Wave Mechanics to Unified Quantum Mechanics

B. L. van der Waerden

Editor's note: Like many mathematicians of his generation, van der Waerden was extremely broad. In 1932 he published one of the first books on group theory and quantum mechanics. In the following remarkable paper, delivered in Trieste in September 1972 at a symposium celebrating Dirac's seventieth birthday, he clarifies the connection between the Heisenberg and Schrödinger formulations of quantum mechanics and earlier work by Cornelius Lanczos.

The story I want to tell you begins in March 1926 and ends in April 1926. Early in March two separate theories existed: matrix mechanics and wave mechanics. At the end of April these two had merged into one theory, more powerful than the two parents taken separately.

Wave mechanics was based upon three fundamental hypotheses:
A. Stationary states are determined by complex-valued wave functions \( \psi(q) \), which remain finite everywhere in \( q \)-space.
B. The functions \( \psi \) satisfy a differential equation
\[
H \psi = E \psi
\]
C. The eigenvalues \( E \) are the energy values.

To these three hypotheses, Schrödinger added Bohr's postulate:
D. \( E_m - E_n = h \nu_{mn} \).

This theory was presented in Schrödinger's first and second communications on "Quantisierung als Eigenwertproblem" in Annalen der Physik 79. The first communication was received on 27 January, and the second on 23 February 1926.

On the other hand, matrix mechanics was invented by Heisenberg in June 1925, and presented in a fully developed form in Dirac's first paper on quantum mechanics (received 7 November 1925) and also in the famous "three-men's paper" of Born, Heisenberg and Jordan (received 16 November 1925). This theory was based upon four mechanical hypotheses and two radiation hypotheses. The mechanical hypotheses are:
1. The behaviour of a mechanical system is determined by the matrices \( p \) and \( q \) (one matrix \( q \) for every coordinate \( q \), and one \( p \) for every momentum \( p \)).
2. \( pq - qp = \left( \frac{\hbar}{i} \right) \mathbf{1} \) if \( p \) belongs to the same coordinate \( q \), otherwise equal to 0.
3. \( H(p, q) = W = \text{diagonal matrix, having diagonal elements} \ E_n, \text{the energy values.} \)
4. Equations of motion:
\[
\dot{p} = -\frac{\partial H}{\partial q}, \dot{q} = \frac{\partial H}{\partial p}
\]
in which the operator \( H \) is obtained from the classical Hamiltonian \( H(p, q) \) by replacing every momentum \( p \) by
\[
\frac{K \partial}{i \partial q}, K = \frac{\hbar}{2 \pi}.
\]
These hypotheses imply
\[ p_{mn} = a_{mn} e^{2\pi i (v_m - v_n) t} \]
\[ E_n = h v_n. \]

The radiation hypotheses determine the frequency and intensity of the radiation emitted or absorbed:
5. \( E_m - E_n = h v_{mn} \).
6. The transition probabilities are proportional to the square of \( |a_{mn}|^2 \).

In his second communication, Schrödinger confesses that he did not succeed in finding a link between his own approach and Heisenberg's. This was written in February 1926, but in March he found the link. In his paper "Über das Verhältnis der Heisenberg-Born-Jordanschen Quantenmechanik zu der meinigen", received 18 March 1926, Schrödinger writes: "In what follows...the inner connection between Heisenberg's Quantum Mechanics and my own will be made clear. From the formal mathematical standpoint one may even say that the two theories are identical."

Now is this true? Are the two theories really equivalent in the formal mathematical sense? Equivalence (or identity, as Schrödinger says) would mean
\[ A, B, C, D \iff 1, 2, 3, 4, 5, 6. \]

Now what Schrödinger actually proves is
\[ A, B, C \iff 1, 2, 3, \]
and of course
\[ D \iff 5. \]

Moreover, if time-dependent functions \( \psi \) are allowed, satisfying Schrödinger's time-dependent differential equation, one can prove 4. However, hypothesis 6 can in no way be derived from Schrödinger's set of hypotheses.

The converse \( \iff \) Schrödinger does not even attempt to prove. Yet he refers to his proof as "Äquivalenz-Beweis", and he asserts confidently: "Die Äquivalenz besteht wirklich, sie besteht auch in umgekehrter Richtung."

From the formal logical point of view, one may even say that it is impossible to derive \( A, B, C \) from 1, 2, 3, 4, 5, 6, because in hypothesis 4 the notion "stationary state" occurs, which does not occur in 1, 2, 3, 4, 5, 6.

After the publication of this paper, everybody accepted Schrödinger's conclusion that the two theories are "equivalent". Everybody except Pauli. He knew better.

On April 12, just after the publication of Schrödinger's first communication, but before his "equivalence" paper came out, Pauli wrote a very remarkable letter to Jordan, in which he established the connection between wave and matrix mechanics, in a logically irrefutable way, independent of Schrödinger. He never published the contents of this letter, but he signed the carbon copy (which is quite unusual), and he kept the letter in a plastic cover until his death. I am indebted to his widow, Franca Pauli, for giving me her consent to publish this letter.

**Pauli's Letter**

*This letter was probably written and typed at Copenhagen*

12th April 1926

Dear Jordan,

Many thanks for your last letter and for your looking through the proof sheets. Today I want to write neither about my Handbüch-Article nor about multiple quanta; I will rather tell you the results of some considerations of mine connected with Schrödinger's paper "Quantisierung als Eigenwertproblem" which just appeared in the *Annalen der Physik*. I feel that this paper is to be counted among the most important recent publications. Please read it carefully and with devotion.

Of course I have at once asked myself how his results are connected with those of the Göttingen Mechanics. I think I have now completely clarified this connection. I have found that the energy values resulting from Schrödinger's approach are always the same as those of the Göttingen Mechanics, and that from Schrödinger's functions \( \psi \), which describe the eigenvibrations, one can in a quite simple and general way construct matrices satisfying the equations of the Göttingen Mechanics. Thus at the same time a rather deep connection between the Göttingen Mechanics and the Einstein-de Broglie Radiation Field is established.

To make this connection as clear as possible, I shall first expose Schrödinger’s approach, styled a little differently. According to Einstein and de Broglie one can assign to any moving particle with energy \( E \) and momentum \( G \), taking care of the relativity terms,
\[ G = \frac{m_0 v}{\sqrt{1 - \frac{v^2}{c^2}}}, E = \frac{m_0 c^2}{\sqrt{1 - \frac{v^2}{c^2}}} \]
normed in such a way that the energy at rest is \( m_0 c^2 \), hence \( E^2 - c^2 G^2 = m_0^2 c^4 \) an oscillation with frequency \( v = E/h \) and wave length \( \lambda = h/|G| \). (This assignment is invariant with respect to Lorentz transformations.) The phase velocity \( V \) is
\[ V = \lambda v = \frac{E}{|G|}, \]
hence the wave equation of de Broglie's radiation field
\[ \Delta \psi - \frac{1}{V^2} \frac{\partial^2 \psi}{\partial t^2} = 0 \]
assumes the form

\( \Delta \psi - \frac{G^2 \partial^2 \psi}{E^2 \partial t^2} = 0. \)

Taking care of the relation

\[ E^2 - c^2 G^2 = m_0^2 c^4 \]

between energy and momentum, one obtains

\[ \Delta \psi - \frac{E^2 - m_0^2 c^4 \partial^2 \psi}{c^2 E^2 \partial t^2} = 0. \]

Now if we have a mass point moving in a field of force and if \( E_{\text{pot}} \) is its potential energy, the relation between energy and momentum becomes (taking care of the variability of the mass)

\[ (E - E_{\text{pot}})^2 - c^2 G^2 = m_0^2 c^4 \]

provided \( E \) is again normalized so that for the mass point at rest \( E = E_{\text{pot}} = m_0 c^2 \). (For the hydrogen atom with relativistic correction one obviously has to put \( E_{\text{pot}} = -Ze^2/r \). Substituting this into (1) one obtains instead of (2)

\[ \Delta \psi = \frac{[E - E_{\text{pot}}(x, y, z)]^2 - m_0^2 c^4 \partial^2 \psi}{c^2 E^2 \partial t^2} = 0. \]

The phase velocity now depends on position.

Schrodinger’s approach is now as follows: A quantum state of the system with energy \( E \) is only possible if a standing de Broglie-Wave without spatial singularities, depending on \( t \) like a sine function with frequency \( \nu = E/h \), can exist in accordance with (3).

So one has to replace \( \psi \) in (3) by a product of a new function \( \psi(x, y, z) \) depending only on position with the factor

\[ e^{2\pi i /h t} = e^{2\pi (E/h)t} \]

thus obtaining

\[ \psi = \tilde{\psi} e^{2\pi (E/h)t} \]

then

\[ \frac{\partial^2 \psi}{\partial t^2} = -\frac{4\pi^2}{h^2} E^2 \psi \]

and one obtains

\[ \Delta \psi + \frac{[E - E_{\text{pot}}(x, y, z)]^2 - m_0^2 c^4 \psi}{c^2 E^2 \partial t^2} = 0, \]

putting, as Schrödinger does, \( K = h/2\pi \).

This is an eigenvalue problem for the possible values of \( E = h\nu \). These \( \nu \) are enormously large, because in \( E \) the energy of the electron at rest is included. The Frequency Condition now says that the light waves can formally be considered as difference-oscillations of the de Broglie-radiation. Planck’s constant enters the theory only at that point where one passes from the energy of the states to the frequency of the radiation of de Broglie.

Neglecting relativistic corrections one obtains from (4) by putting \( E = m_0 c^2 + \tilde{E} \) and expanding according to powers of \( 1/c^2 \): \n
\[ \Delta \psi + \frac{2m_0}{K^2} (E - E_{\text{pot}}) \tilde{\psi} = 0. \]

This equation is given in Schrödinger’s paper, and he also shows how it can be derived from a Variation Principle.

Here is another remark for which I am indebted to Mr. Klein. The difference between the general Quantum Theory of periodic systems and Schrödinger’s Quantum Mechanics based upon Equation (5) is, from the point of view of the de Broglie-Radiation, the same as the difference between Geometrical Optics and Wave Optics. Namely if the wavelength of the de Broglie-Radiation is small, one can put in (5), as is well-known

\[ \psi = e^{i(1/K)S}. \]

If \( S/K \) is large, one now obtains from (5), according to Debye, the Hamilton-Jacobi differential equation for \( S \). In this case \( \psi \) becomes a univalued point function only if the moduli of periodicity of \( S/K \) are integer multiples of \( 2\pi \). This leads to the usual condition \( \int pdq = nh \), which has been interpreted already by de Broglie from the point of view of the geometrical optics of his Radiation Field.

In reality, however, \( S/K \) is not large generally, so one has to stick to (5) and to use the mathematics of Wave Theory to integrate this equation.

Next comes my own contribution, namely the connection with the Göttingen Mechanics. For the sake of simplicity I shall consider a one-dimensional problem and use Cartesian coordinates in the three-dimensional case and with arbitrary coordinates everything goes just so, also if gyroscopic terms are added. So let the wave-equation be given as

\[ \frac{d^2 \psi}{dx^2} + \frac{2m}{K^2} (E - E_{\text{pot}}(x)) \psi = 0 \]

(compare (5), the bars are omitted).

Now let \( E_1, E_2, \ldots, E_n, \ldots \) be the eigenvalues, \( \psi_1, \psi_2, \ldots, \psi_n, \ldots \) a complete set of eigenfunctions. For these we have

\[ \int_{-\infty}^{\infty} \psi_n \psi_m dx = \begin{cases} 0 & \text{for } n \neq m \\ 1 & \text{for } n = m \end{cases} \]

The first equation (orthogonality) follows from Green’s formula, the second means a normalization of the multiplicative constants in the \( \psi_n \). Any arbitrary function of \( x \) can be expanded in a series with

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respect to the $\psi_n$. Now one considers in particular the expansion of $x\psi_n$
\[ x\psi_n = \sum_{m} x_{nm}\psi_m(x); \]
(I)
\[ x_{nm} = \int_{-\infty}^{+\infty} x\psi_n\psi_m dx \]

One also puts
\[ (p_x)_{nm} = iK \int_{-\infty}^{+\infty} \frac{\partial\psi_n}{\partial x}\psi_m dx; \]
(II)
\[ iK \frac{\partial\psi_n}{\partial x} = \sum_{m} (p_x)_{nm}\psi_m(x) \]

($i =$ imaginary unit, $K = h/2\pi$). Now $x_{nm} = x_{mn}$ is real, $(p_x)_{nm} = -(p_x)_{mn}$ purely imaginary. It can be shown without difficulty, that the matrices for $x$ and $p_x$ thus defined satisfy the equations of the Göttingen Mechanics. Namely
\[ p_x x - p_x x = -iK, \]
\[ \frac{1}{2m} p_x^2 + E_{pot}(x) = E \quad \text{(Diagonal matrix)} \]

From the rule of multiplication it follows that the matrix belonging to any function $F(x)$ of $x$ is just given by
\[ F_{nm} = \int_{-\infty}^{+\infty} F(x)\psi_n\psi_m dx. \]

I shall not write out the calculations in detail; you will be able to verify the assertion easily.

I have calculated the oscillator and rotator according to Schrödinger. Further the Hönli-Kronig-formulae for the intensity of the Zeeman components are easy consequences of the properties of the spherical harmonics. Perturbation theory can be carried over completely into the new theory, and the same thing holds for the transformation to principal axes, which in general is necessary if degeneracies (multiple eigenvalues) are cancelled by external fields of force. At the moment I am occupying myself with the calculation of transition probabilities in hydrogen from the eigenfunctions calculated by Schrödinger. For the Balmer lines finite rational expressions seem to come out. For the continuous spectrum the situation is more complicated: the exact mathematical formulation is not yet quite clear to me.

As regards Lanczos, my considerations have only very few points of contact with his ideas. He considers a problem for which the eigenvalues are the reciprocal energy values, whereas here the eigenvalues are just the energy values. In his exposition certain functions depending, like Green's function, on two points, play an essential role; such functions are not used here. On the whole I feel that Lanczos' approach has not much value.

About the physical significance of the expressions (I) and (II) I do not know much. In any case they seem to be connected with the idea that the ordinary light waves are different oscillations (beats) of de Broglie's radiation. The fact that in (I) and (II) no indefinite phases occur is due to the trivial reason that in passing from (3) to (4) the periodic factor depending on time has been suppressed. If this factor is taken into account, one obtains in $x_{nm}$ and $(p_x)_{nm}$ besides $\exp((2\pi i/h)(E_n - E_m)t)$ a phase factor $\exp[2\pi i(h\delta_n - \delta_m)]$ in which $\delta_n$ are the phases of eigenvibrations belonging to $E_n$ and $E_m$. In principle, in the Göttingen theory as well as in de Broglie's statement of the quantum problem, no description of the motion of the electron in the atom in space and time is given. In the latter theory this is clear from the fact that outside the domain of validity of Geometrical Optics it is impossible to construct "rays" in de Broglie's Wave System that can be considered as orbits of particles. The problem of the asymptotic linkage with the usual pictures in space and time for the limiting case of large quantum numbers remains unsolved. Yet it is a definite progress to be able to see the problems from two different sides. It seems one also sees now, how from the point of view of Quantum Mechanics the contradistinction between "point" and "set of waves" fades away in favour of something more general.

Cordial greetings for you and the other people at Göttingen (especially Born, in case he is back from America; please show him this letter).

Yours, (carbon copy signed) W. Pauli

**COMMENTS ON PAULI'S LETTER**

Pauli's wave equation (1) is called in the letter "the wave equation of de Broglie's radiation field." It is not given in de Broglie's thesis, but it is very easy to derive it from the given expressions for $\nu$ and $\lambda$. It is valid for plane waves, i.e. for a free election.

Equation (3) is essentially the Klein-Gordon equation. It is true that the magnetic terms are missing, but Pauli expressly says in the course of his letter that "everything goes just so if gyroscopic terms are added," which shows that Pauli, who was at that time thinking very hard about the anomalous Zeeman effect, knew perfectly well how to handle magnetic fields. He omitted the magnetic terms only "for the sake of simplicity."

We know from Schrödinger's letters that he also tried the Klein-Gordon equation, but he gave it up because it did not yield the right fine-structure of the hydrogen atom.

The Klein-Gordon equation was discovered independently by Schrödinger, by Pauli, by Klein and Gordon, and by at least two other people.\(^1\)

To Pauli's orthogonality relations
we may remark that in the one-dimensional case the eigenfunctions are single and real, so that complex conjugate factors \( \psi^* \) are not needed.

The paper of Lanczos, to which Pauli refers at the end of his letter, was published in *Zeitschrift für Physik* 35 (received 22 December 1925). I feel it has more value than the contemporaries suspected. Let us use our hindsight and start with Schrödinger's equation, which I shall write as

\[
-\Delta \psi + V \psi = E \psi
\]

leaving out all numerical factors. Lanczos considers a finite domain in \( \sigma \)-space, so let us enclose our atom in a large sphere of radius \( R \). As a boundary condition we may assume \( \psi = 0 \) on the boundary. Since the zero-point on the energy scale is quite arbitrary, we may suppose that it lies below the lowest energy value. It follows that zero is not an eigenvalue.

Under these assumptions, the boundary value problem

\[
-\Delta \psi + V \psi = u,
\]

\( \psi = 0 \) on the boundary

can be solved by means of Green's function \( K(P, Q) \) as follows;

\[
\psi(P) = \int K(P, Q)u(Q)dQ.
\]

Replacing \( u(Q) \) by \( E\psi(Q) \), and dividing by \( E \), one obtains

\[
\int K(P, Q)\psi(Q)dQ = \frac{1}{E} \psi(P).
\]

This integral equation is equivalent to Schrödinger's equation (6). Its eigenvalues are just \( 1/E \), the reciprocal energy values.

Now this is just the kind of integral equation Lanczos considers. He does not specify what kind of function \( K(P, Q) \) is, but he does say that the eigenvalues of his integral equation are the reciprocal energy values.

Now let us hear what Schrödinger says about the paper of Lanczos. In a footnote on p. 754 of his "equivalence" paper he writes:

> Similar ideas are exposed in an interesting paper of Lanczos, which already contains the valuable insight that Heisenberg's atomic dynamics is capable of a continuous interpretation. For the rest, the paper of Lanczos has less points of contact with mine than one might think at first sight.

The determination of the system of formulae, which Lanczos leaves quite undetermined, cannot be found in the direction of identifying the symmetrical kernel \( K(s, \sigma) \) with Green's function of our wave equation... For this function of Green, if it exists, has as its eigenvalues the quantum levels themselves.

This is an error of Schrödinger, for which I have no explanation. We have just seen that the eigenvalues of Green's kernel \( K(P, Q) \) are \( 1/E \) and not \( E \). Schrödinger continues: "On the contrary, the kernel of Lanczos is required to have as its eigenvalues the reciprocal quantum levels."

Schrödinger just missed the point.

If Lanczos' kernel \( K(P, Q) \) is identified with the Green's function of Schrödinger's differential equation, its eigenfunctions \( \phi_1, \phi_2, \ldots \) are Schrödinger's eigenfunctions.

Besides the integral operator \( K \) defined by the kernel \( K(s, \sigma) \):

\[
K\psi(s) = \int K(s, \sigma)\psi(\sigma)d\sigma,
\]

Lanczos introduces two more integral operators \( p \) and \( q \):

\[
p\psi(s) = \int p(s, \sigma)\psi(\sigma)d\sigma,
\]

\[
q\psi(s) = \int q(s, \sigma)\psi(\sigma)d\sigma
\]

in such a way that

\[
pq - qp = \frac{1}{2\pi i} 1.
\]

Since \( p \) and \( q \) are supposed to be integral operators, the unit operator \( 1 \) must also be an integral operator

\[
1\psi(s) = \int E(s, \sigma)\psi(\sigma)d\sigma.
\]

This implies, as Lanczos says, that \( E(s, \sigma) \) is zero for \( \sigma \neq s \), and that

\[
\int_{-\infty}^{\infty} E(s, \sigma)d\sigma
\]

is equal to \( 1 \). Hence, Lanczos' function \( E(s, \sigma) \) is just Dirac's function \( \delta(s - \sigma) \).

Lanczos concludes that the functions \( p(s, \sigma) \) and \( q(s, \sigma) \) cannot be everywhere finite. In fact, if one wants to reach complete agreement between Lanczos, Schrödinger, and Pauli, one has to assume
\[ q(s, \sigma) = s \cdot \delta(s - \sigma), \]
\[ p(s, \sigma) = -\frac{\hbar}{2\pi i} \delta'(s - \sigma). \]

Next, Lanczos defines the matrices corresponding to the operators \( p \) and \( q \):

\[ p_{ik} = \int p(s, \sigma) \phi_i(s) \phi_k(\sigma) ds d\sigma \]
\[ q_{ik} = \int q(s, \sigma) \phi_i(s) \phi_k(\sigma) ds d\sigma \]

and proves that the matrices \( p \) and \( q \) satisfy the Born-Jordan condition

\[ pq - qp = \frac{\hbar}{2\pi i} 1. \]

From this analysis we see that Lanczos’ approach had more points of contact with the ideas of Schrödinger and Pauli than these two suspected. His weakness was that he was not able to specify his functions \( K(s, \sigma), p(s, \sigma) \) and \( q(s, \sigma) \).

Let us now return to Pauli’s letter. Pauli says at the end: “The problem of the asymptotic linkage with the usual pictures in space and time for the limiting case of large quantum numbers remains unsolved.”

More light on this problem was shed by the study of the behaviour of wave packets. A most interesting contribution was a little-known paper of Ehrenfest, in which he proved that the centre of gravity of a wave packet moves according to the classical law: force = acceleration \( \times \) mass, provided the force exerted upon the electron by the electromagnetic field is calculated by integrating the Lorentz force over the charge density \(-\vec{\psi}^* \vec{\psi} \). Another important contribution was, of course, Heisenberg’s Uncertainty Principle, which was also derived from the study of the behaviour of wave packets in \( q \)-space and \( p \)-space.

A quite new point of view was Born’s interpretation of \( \psi^* \psi \) as a probability density, proposed in connection with his study of collisions. Dirac extended Born’s probability interpretation to much more general measurements. However, in this lecture I wanted to restrict myself to what happened in March and April of 1926, so I shall stop here.

Editor’s notes: 1. Unknown to van der Waerden, Cornelius Lanczos, whom he had never met, was in the audience. When the moderator introduced them, van der Waerden was visibly pleased and exclaimed, “Oh, This is marvelous. I didn’t know that you were here at this symposium or that you would come to this lecture.”

Later in the discussion period, Lanczos made a remark about Einstein’s approach to quantization. van der Waerden then took the opportunity to initiate the following exchange:

van der Waerden (to Lanczos): Did you know all this to which I have referred in my paper? Were you aware of these connections?

Lanczos: You are absolutely right. You rehabilitated my work. Pauli was a vicious man, as everybody knows. Anything which didn’t agree with his ideas was wrong, and anything was right only if he made it, if he discovered it, which is all right for such a great man. He could allow himself such viciousness, but I am very grateful to you for pointing out what you have.

I certainly was aware of these connections, but as you pointed out, the weakness was that I didn’t specify the kernel function and the special functions. At that time, you know, after the matrix mechanics it looked as if you couldn’t do anything with the continuum, and one would have to operate with the discontinuum. Everything is discontinuous in the matrices. Now I was very much interested at that time in integral equations, and actually the integral equation which I used was not the Schrödinger equation, but the inverse equation, because only a differential equation can be changed to an integral equation, as you pointed out. And that is the reason why the energies actually come in with a reciprocal, so that the Green’s function which I had is basically the Schrödinger equation with the source of a delta function. If you have a source, and that source happens to be a delta function, then this function does have a physical significance, whereas it looks after Pauli’s criticism that it has no physical significance. But it does have a physical significance.

van der Waerden: Yes, but after you read Schrödinger’s paper, did you realize that this was the case?

Lanczos: Afterwards, it was too trivial. I mean, it was no longer of interest, because Schrödinger came along and he did it. As it often happens, it is the second man who hits the nail on the head and not the first one.

2. Cornelius Lanczos emigrated from Hungary to the U.S. in 1931 to take a position at Purdue University, and joined the AMS in 1934. In 1952 (while Schrödinger was acting director) Lanczos moved to the Dublin Institute for Advanced Study where he remained (including serving as director for a time) until his death in 1974 at the age of 81.

W. Moore’s biography Schrödinger’s Life and Thought (Cambridge University Press, 1989) indicates that Schrödinger and Lanczos had considerable social as well as scientific contact during the years they were both in Dublin. He also writes (p. 430) “Erwin was quite fond of him (Lanczos) but this feeling was not reciprocated.”

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The American Mathematical Society's first electronic-only journal, Electronic Research Announcements of the AMS (ERA-AMS), is available on the World Wide Web at the URL: http://www.ams.org/era/

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Since its founding in 1940, Mathematical Reviews has been an important part of the AMS and the mathematical sciences community. Sweeping in scope, solemn in tone, and deadly accurate, MR has led multitudes to what they were searching for in the literature of mathematics and allied areas. Mathematicians have come to rely on this stalwart guide for information on work in a particular area or by a particular author, as well as for bibliographic references. Over the years the AMS has devoted attention and resources to making MR as useful as possible. While you cannot please everybody all the time, MR has consistently provided high-quality information through a variety of media. The latest addition to the MR menu of services is MathSciNet, which provides access to the MR database through the World Wide Web. The reaction to MathSciNet has been enthusiastic.

In 1990 Science Citation Index did a study of the aging of references and concluded that citations of work in molecular biology had a "half-life" of months, while work in mathematics had a half-life of at least decades. There are many examples of old mathematical results spurring developments at the frontier of research. Reference works like MR therefore become crucial to progress in the field. At the other end of the spectrum, as technology makes publishing easier for groups and individuals, it becomes ever more important to have a way of organizing and preserving the literature. The AMS in the coming years will continue to invest in Mathematical Reviews to ensure that it remains a high-quality guide to the literature, both past and present.

This article describes Mathematical Reviews—its functions, its foibles, its folklore, its future—so that mathematicians who use MR will have a better understanding of this journal that has become such an important part of mathematical life.

The Early Days

The two main mathematical reviewing journals today—MR and Zentralblatt für Mathematik und ihre Grenzgebiete—were both founded by Otto Neugebauer. He started Zentralblatt in the early 1930s and also launched the book series Ergebnisse der Mathematik und ihrer Grenzgebiete and, with W. Flugge, Zentralblatt für Mechanik. These ventures, valuable as they were, were by no means Neugebauer's main accomplishments. His first love was the history of ancient and medieval mathematics and astronomy, and at Brown University he built a leading center for the history of the exact sciences. A scholar versed in the interpretation of cuneiform texts, he was responsible for much of present-day knowledge of ancient mathematical astronomy. His last scholarly work, a chronography of Ethiopic sources, was published in 1989, a year before his death at age ninety-one.

Neugebauer was a professor at the University of Göttingen when, in 1934, he refused to sign an oath of loyalty to the Nazi regime. He was forced to emigrate to Denmark, though he continued as editor of Zentralblatt für Mathematik. Four years later the publisher, Springer-Verlag, asked for written assurances that no Jews would act as reviewers. Neugebauer resigned, along
with most of the editorial board, and he destroyed his files. Soon thereafter Neugebauer moved to Brown. By that time there was talk of the need for a reliable reviewing journal for mathematics and the possibility of establishing one in the United States. Neugebauer was clearly perfect for the job, so in 1940 he started *Mathematical Reviews*, with the assistance of J. D. Tamarkin and W. Feller. The AMS received financial support for MR from the Carnegie Corporation of New York, the Rockefeller Foundation, and the American Philosophical Society.

“The character of MR was established by Neugebauer,” stated Ralph Boas in an obituary for Neugebauer [1]. Boas served as editor of MR from 1945 to 1950. In Neugebauer’s view any mathematics paper should be reviewed whether or not it was significant. This vision of *Mathematical Reviews* has remained largely unchanged to this day. “Neugebauer always insisted that the length of the review was not intended to be directly proportional to the importance of the paper,” wrote Boas. “Indeed, a bad paper needed to have a review sufficiently detailed so that nobody needed to look at the paper itself, whereas a really important paper needed only to be called to the world’s attention.”

In the early days of MR, the editor did everything. John V. Wehausen, who served as editor from 1950 to 1956, described his job this way: “[A]ssign papers to reviewers; translate titles not in English, French, German, or Italian (the allowable languages for reviews; in those days it was assumed that every educated mathematician could read at least these); edit the reviews, including checking cited references; prepare them for the printer; assign a field to each review; gather all the reviews together once a month, put them in some sort of order, and send them to the printer; read galleys; check page proof to verify that all corrections had been made and perhaps to make new ones; and then rejoice when the printed issue is received, while feeling like an ass because of missed errors.” [2] He could never leave Providence for more than two weeks at a time, and even then he would be sent proofs to read at odd times so as not to be buried under the workload when he returned.

Wehausen had a staff of three secretaries and a half-time graduate student. Today, MR executive editor R. Keith Dennis oversees about seventy copyeditors, filers, keyboarders, librarians, associate editors, and computer personnel. The increase in the size of the MR operation is not due to changes in the basic process—receive papers, send them out to reviewers, publish the reviews—for it has not changed since Neugebauer’s time. What has changed is the volume of the mathematical literature. In its first year MR ran 400 pages and contained 2,115 reviews. Today a typical year comprises about 7,000 pages (11,000 if you count indexes) and about 50,000 reviews. An enormous effort is required simply to keep up with the mass of incoming material.

A backlog could be fatal, but MR has always pulled through. Some years before he became MR executive editor, William J. LeVeque served as an associate editor in 1961. “MR was then near death,” he wrote in a reminiscence [3]. “[Walter Hayman and I] were put to work assigning journal articles to the various reviewers, from what seemed to be an enormous backlog. As we finished assigning the articles in each issue, we put the latter on a pile in the corner of the room—until the top of that pile rose to eight feet and we had to start a new one.” Despite their efforts the situation remained grim. A few months later the AMS hired A. J. Lohwater as executive editor. According to LeVeque, Lohwater could work 18–20 hours a day, so “within about three years he had the journal back on schedule.”

Mathematical Literature: A Relentless River

Right now MR operates with a cap of 50,000 reviews. If this yearly output seems like a fast-flowing river, consider that it is merely a tributary of the main gusher, the material arriving at MR. Each day the mail brings 230–240 potentially reviewable books and papers as well as many others that are outside of mathematics. And MR is always on the lookout for more: one of the functions of the Acquisitions Department is to make sure MR is not missing anything. MR does not take out subscriptions; it relies primarily on
MR Folklore: Unflattering Reviews

Snide reviews form part of the folklore of Mathematical Reviews. The most famous one is as sublimely succinct as it is damning:

"This paper fills a much needed gap in the literature."

Though well known, this sentence never actually appeared in a review. Its origins were explained in a letter from Lee Neuwirth to Gerald Janusz, who looked into the matter when he served as executive editor from 1990 to 1992. Around 1960, when he was an instructor at Princeton, Neuwirth began a review of an article by Hale Trotter with the infamous sentence. Unaware of what he had done, Neuwirth showed the review to his colleague Ralph Fox, who "roared with laughter." Fox rewrote the review, and it eventually appeared, without the sentence, under Fox's name (MR 24 (1962), 683, number A3645). It appears that Fox told the story about the review to others, but in the telling he left out the names of Neuwirth and Trotter.

The mild wording and matter-of-fact tone of that sentence perfectly capture the kind of humor one finds in MR, where vituperation is usually excised. What follows is a collection of tidbits culled from some of the less flattering reviews.

"This paper is incorrect and most of its conclusions are false."

"The author has published in various journals the contents of this paper." [This statement is followed by a list of seven references for the paper in different journals.]

"The results are presented by means of a terminology and in a style of which it is impossible here to give the slightest idea; the notions introduced by the author (radiors, coradiors, expansors) appear to be totally superfluous (unless it is to rescue his work from complete indiscretion) and can be cast in relatively civilized language. Nevertheless it would be premature and imprudent to attach to these comments any absolute value because of the uncertainty which weighs on the intentions of the author." [translated from the French]

"The author tries to put Fermat's last theorem into a physical and general dimensional analysis situation... No proofs are given."

"As a result of correspondence with the author, the reviewer realises that his attempt to understand the paper was unsuccessful; the criticism based on that attempt should be withdrawn. The reviewer does not understand the paper at all now."

"[The author] leads the reader over a rough road to [a certain] inequality.... However, at one rough spot on the road the author introduces the series \( 0! + 1!/x + 2!/x^2 + \ldots \). This series is convergent only at \( x = \infty \). The proof needs fixing."

"...The reviewer is unable to follow these proofs which hinge on unexplained dependencies among the ten variables."

Reviewer's remark: The author offered to explain the 'proof' of the Fermat conjecture to the reviewer. The reviewer declined, considering such a meeting pointless, because—as transpires from the book—the author has difficulties with the language of mathematics.

...
might hold for a few months or a couple of years. On occasion the post served well some mathematicians who had few recourses. Chandler Davis, who was not able to get a permanent job at a U.S. institution after he refused to answer questions before the House Un-American Activities Committee, worked at MR from 1958 to 1962. "When I served my prison term in spring 1960," he says, "MR gave me unpaid leave, so when my time was up, I just went back to work." Nowadays associate editors tend to spend more years at MR; three-quarters of the present group have been there a dozen years or more. Armando Armendáriz holds the record, having been at Mathematical Reviews since 1965. This accumulated experience, together with help from the computer, has made the associate editor staff faster, with each editor handling more material in less time.

The staff of associate editors has seen its share of colorful characters. One of these is Jeffrey Joel, who after working at MR from 1973 to 1991, went to live in a yurt in Jackson Hole. A licensed rolfer and one-time member of a rock band, Joel has been known to transpose Mozart pieces to the piano while sight-reading. It is alleged that when Joel was asked by MR to fill in a form listing the languages he knew, he wrote "All"—which, according to associate editor Patrick D. F. Ion, was in some sense the best approximation. Indeed, the linguistic capability of the MR staff is impressive. Ion reports that he once overheard one of his colleagues exclaiming, "Fortunately, there is a Bulgarian summary!" The paper itself was in Tajiki.

The associate editors spend their days in a sea of mathematics. There is a continual flow of new material that needs to be examined, and examined in just the right way: carefully enough to select an appropriate reviewer, but without spending so much time as to create a bottleneck. It can be tough to strike a balance, especially when an editor comes across something he or she is very interested in reading. Selecting the right reviewer requires finesse, notes Robert Bartle, who served two terms as executive editor, 1976-78 and 1986-90. "You don't want a hatchet job or a review praising the paper to the sky because it was written by a friend of the reviewer," he says.

In times past the list of reviewers was kept on a hanging-card file, with colored paperclips indicating various bits of information, such as how many papers were with a reviewer. Armendáriz says he used to be able to keep in his head the names of all the reviewers in his own area of function theory, but today there are far too many. Fortunately the MR reviewer database has taken over where brain cells give out. Using this database, the editors easily look through reviewers' MR classification numbers and brief descriptions of what they say they would like to review. In addition, the database gives information to help the editors avoid deadbeat reviewers and prevent reliable ones from being overloaded. The associate editors also have to deal with problematic reviews. In his reminiscences about MR, Boas mentions a review that read, "This paper contains two results. The first is due to the reviewer and the second is false." The rule of thumb, though, is that such remarks should not make it into print unless they can be substantiated. As much as is possible, the associate editors watch for claims that a paper was plagiarized and for unjustified criticisms, personal attacks, or im­ temperate language. In such cases the editors use their judgment to decide what to do: check back with the author for clarification, tone down harsh wording, etc. Sometimes authors send instructions that certain individuals should not be asked to review their papers, and the editors try as best they can to honor such requests. Wehausen found that his association with MR made his colleagues think that he was an expert on mathematical ethics. "Every few months I would receive a telephone call complaining that someone had stolen the caller's result," he remarked. He counseled them as best he could.

A common complaint about Mathematical Reviews is that it reports on too many uninteresting or trivial papers. The MR editors can decide not to review papers that are not about mathematics or are incomprehensible. But many cases are not so clear-cut; for example, a search of "Fermat" in MathSciNet turns up quite a few reviews of bogus proofs of Fermat's Last Theorem. If there were a way of deciding what was junk and what was not, then one could give the junk an automatic treatment that does not absorb much time or money and send the rest out for review. But "I don't have any idea how you do that," says John Selfridge, who served as executive
John V. Wehausen

editor from 1978 to 1986. "No matter how you look at it, it's going to take a tremendous amount of resources to make all these judgments, unless you are sloppy. And so the best thing would be to have some way where the judgments are semiautomatic and done by professional people like the associate editors."

Nevertheless, Mathematical Reviews inevitably devotes more space to unimportant papers than to important ones. Several years ago MR introduced "Featured Reviews", which highlight influential papers. The "Featured Reviews" represent something of a departure from Neugebauer's original vision in which bad papers might have longer reviews than good ones. On the other hand, Neugebauer could not have predicted the immense increase in the mathematical literature that prompted this new kind of review, for in his day some mathematicians read MR cover to cover to find out what was going on. Today the issues are too big even for full browsing.

Checking and More Checking

In 1972 AMS President Nathan Jacobson appointed the Mathematical Reviews Crisis Committee to deal with a $90,000 deficit the journal was facing. One of the main causes of the crisis was the large increase in the number of reviews. The committee conducted a survey, receiving 1,000 replies, to get an understanding of the needs of the users and subscribers of Mathematical Reviews. Although almost every aspect of MR was unsatisfactory to someone, they received no complaints on one point: its level of accuracy. "Mathematical Reviews almost never sends the reader to the wrong source, either of a paper reviewed or of one quoted in a review," the committee noted. To this day the MR staff prides itself on meticulous precision. As the committee pointed out, this meticulousness is expensive. In the end MR survived the crisis and has maintained its legendary accuracy. (But the committee was unable to enact a

recommendation they say they received from half a dozen survey respondents: "Write fewer papers!")

"Everything that gets done here—especially bibliographic entries—gets double-, triple-, quadruple-checked by lots of people," says Bert TePaske-King, manager of Bibliographic Services. "We want to be sure that if we say a paper has been published somewhere, it has." The same mania for precision extends to "author authority". This task consists of trying to distinguish authors with the same name. The information used to be on the "salmon cards"—so named for their pale pink color—but the cards are diminishing in number as the information migrates to the computer. About 80 percent of the time the computer finds a unique individual match for any author name, and for the remaining 20 percent the staff uses other means to verify who the author is, even writing to an individual to ask if he or she has written the paper at hand. The level of detail of this work goes beyond that for comparable journals in other areas and has made possible the refinement found in the Author Identification tool on MathSciNet.

As a review wends its way through the production process, it passes through many hands. Upon receipt, reviews are copyedited, all references are verified, and MR numbers are inserted. The associate editor who solicited the review reads it with an eye toward catching any problems in the content. The review is then either keyboarded from scratch, or, if it has arrived electronically, the corrections are made in the file. After proofreading, the review is read by two associate editors. Once a month all reviews that are ready are pooled into an issue. Galleys are produced and given a final scan by copyeditors and the executive editor. In all, each MR review is read at least three times, by different people, and scanned a number of times. All aspects of the production of MR are carried out in Ann Arbor, while everything else—pricing, marketing, subscriptions—is centered at AMS headquarters in Providence.

Just how the MR staff maintain such minute attention to detail day after day is anybody's guess. When Bartle was executive editor, a psychologist came to interview the MR staff. She classified them according to a system of personality types and found that a high percentage (80 percent, if Bartle's memory serves him well) were found to be in the "introspective perfectionist" category. The psychologist said she had never seen in one workplace so many people in that category. "It seems that the people who stay on at MR have that kind of personality," Bartle observes.

According to Lila Dann, the Reviewer Services Department receives 250-300 reviews on
Mondays and 100-150 on each of the other days of the week. The department uses a computerized tracking system to deal with the weekly onslaught, so that they know which reviews have been received and when to send reminder letters to laggard reviewers. Currently MR has about 13,000 reviewers and is looking for more all the time, sending out each week about one hundred invitations to review. The reviewer database makes all of these tasks much easier to manage than in the past. But because the old records can be information gold mines, one finds in Dann's office a filing cabinet containing several thousand 3-by-5 cards with data on reviewers. FBI agents confiscated the card of Theodore J. Kaczynski during their investigation of the Unabomber case—he reviewed only one paper for MR—but if you ask Dann, she will show you a copy of the card that she keeps in her desk.

Brewing a High Tech Database

Mathematical Reviews has had many homes over the years. It was located in various buildings on the Brown University campus until 1965, when the AMS trustees decided to move MR to Ann Arbor, where it has always maintained close ties to the University of Michigan. MR's present home at 416 Fourth Street is a 1904 brick building that was home to Ann Arbor's most successful brewery. Brewing up "Ann Arbor Old Tyme", "Creme Top", and "Town Club", it survived Prohibition only to close down in 1949. To the uninitiated (meaning those who have worked at MR for less than a decade) the building is a maze of ramps and hallways and staircases; to get to certain parts of the building from others, one must ascend one set of stairs and descend another.

The MR offices are modest, sporting some 1970s-vintage furnishings which, twenty years later, have earned the term quaint. These surroundings are in stark contrast to the very modern production methods. Production manager Sandra Barth started at MR thirty-one years ago doing a wide variety of tasks without a computer in sight; today her job is much narrower and entirely computerized. The centerpiece of Barth's department is the MR database, which contains all of the bibliographic information for every item reviewed in MR going back to 1940 as well as all reviews going back to 1980. The department continually feeds new material into the database, spinning off whatever is needed for production: lists of various sorts, proof copy, and camera copy for the printed MR. The data are also transformed into various formats used by commercial distributors of the MR database and re-arranged in different formats to create specialized indexes.

Early efforts at computerizing MR operations began in the early 1970s, when Jacob Burlak was executive editor, and came to fruition during the tenure of John Selfridge, who came to MR in 1978. At that time bibliographic information was typed onto dittoes, and these would be used to reproduce as many copies as needed for record keeping and other purposes. "In 1940 this was a marvelous system," Selfridge remarks, "but by 1978, it was just hopelessly out of date." MR was then typeset in hot lead by a compositor. Afterward, the lead was melted and all that remained was the printed publication and the paper records in Ann Arbor. This

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**MR Folklore: Reviews That Didn't Make It**

Because of the diligence of the associate editors in ensuring that reviews stick to the facts—not to mention to conventions of grammar and spelling—what does not make it into MR is sometimes funnier than what does. Below are excerpts from unedited reviews arriving at the MR office. (Thanks to MR associate editors W. Bouwsma and P. D. F. Ion for supplying plenty of examples.)

**Gastronomy**

"...plays important roles in many different branches of mathematics..." [branches]

"...seem to be dependent on the mush parameter in my opinion." [mesh]

"Authentication codes (A-codes) have been developed to provide protection against these treats." [threats]

"...the so-called Einstein effect where ordinary tea leaves floating at the bottom of a cap filled with tea," [cup]

"...by means of the method of supper and lower solutions..." [upper]

**Hoist with Own Petard**

"The paper is written very bad. The language used in the paper is only a little similar to English but it is not English."

**Barnyard Animals in Mathematics**

"...torsion-free submodule of the free mule F..." [module]

**It Don't Mean a Thing If It Ain't Got That Swing**

"...to the current local-differential approximations of gravitational collapse, black holes, big band and all that." [big bang]

**The Places They Go!**

"With the migration of Soviet mathematicians along the unstable manifold of economic and societal situations some classical results have now been translated into English."

**Threatening Integrals and Mathematical Combat**

"...using the theme of oscillatory integrals as a common threat." [thread]

"...which make it possible to study a really mean p-valent functions..." [areally]

"...they are able to make sophisticated use of combatibility..." [compatibility]

"...that is, the execution of a newly arriving customer has to wait only for the termination of execution of some customers which have already arrived,..." [would not want to be a customer here!]

**Greetings from a Faraway Land**

"Best wishes for a Happy New Year for You and all Your Stuff." [Staff]
meant that other products, such as author indexes and reviews volumes, all required laborious retyping. By 1980 MR had set up a bibliographic database (pre-1980 material was added gradually over the succeeding ten years). About that same time MR switched from hot lead typesetting to a proprietary computerized typesetting system; later on, it switched over to \LaTeX.

Information from the MR database has been available electronically for a number of years through commercial database vendors as well as on magnetic tape and CD-ROM. Today the database seems to have found its most comfortable home in the form of MathSciNet, the service offering access to the MR database through the World Wide Web. MathSciNet offers complete bibliographic information for MR and the text of reviews from 1980 to the present, as well as extensive links between reviews, a sophisticated author identification tool, and journal issue information.

Getting MathSciNet up and running was a collaborative effort involving a couple dozen staff members in the AMS headquarters office in Providence and the MR office in Ann Arbor. Donald C. Babbitt, who was executive editor at the time (and who is now in the Providence office as AMS publisher), got the project off the ground. MR systems developer Drew Burton and associate executive editor Jane Kister worked on the first design plan for MathSciNet in 1994, and their design is very close to what one finds on MathSciNet now. In addition to the powerful search capabilities, Burton notes, MathSciNet also "allows people to browse almost like they would in a library." He credits the attention and care put into the MR database with making MathSciNet so flexible and powerful. In addition, the rapid spread of the World Wide Web meant that, by the time MathSciNet was introduced in January 1996, enough people were familiar with using Web browsers that MathSciNet caught on very quickly. According to Burton, the reaction to MathSciNet has been "overwhelmingly favorable."

Another long-time MR employee, Burton was originally trained as a biblical scholar. He was on the research team for the Genesis Project, which in 1977 set out to produce one film each year for thirty years covering all of the books of the Bible. The hope was that churches around the world would put in subscriptions for the films, but the project folded after the first film for lack of subscriptions. So the following year Burton took a job as a copyeditor at MR and gradually got involved in the computerization effort, learning what he needed about programming as he went along. Working on MathSciNet is closer to Burton’s scholarly training than one might think at first: he points out that the New Testament, with its linked parallel descriptions of the life of Jesus, was the world’s first hypertext document.

**The Future of Mathematical Reviews**

Now more than half a century old, Mathematical Reviews has weathered a number of crises that threatened its very existence. It survived because mathematicians saw great value in preserving this guide to the mathematical literature. Today MR is an institution, and its disappearance is difficult to imagine. However, the simple fact that information is valuable does not ensure its survival. Keith Dennis knows this only too well. When he came to MR as executive editor in 1995, he heard about a card catalog of mathematics books and papers written from the time of the invention of the printing press to about 1920 said to be in a library in Berlin. A Berlin librarian, Georg Valentin, worked on this catalog for forty years, starting in 1880. The idea of making the catalog more widely available was discussed at International Congresses of Mathematicians, but the catalog was never published. Realizing that this information would vastly increase the scope of MR, Dennis began writing to numerous mathematicians and librarians in Germany. It took two months, but he finally discovered the fate of Valentin’s catalog: it was destroyed by a bomb in February 1944.

Don’t computers make such losses less likely today? Dennis is not sure. "I think things are disappearing at a more rapid rate now than they ever have before," Dennis notes. "They’re up on the Web, and then they’re gone." What is needed is an organization to collect and preserve information of value so that present and future mathematicians have access to it. "I think that’s the role of the AMS and MR," Dennis says. For example, MR is working with Zentralblatt on a project to convert the first mathematical reviewing journal, *Jahrbuch über die Fortschritte der Mathematik*, into electronic form. *Jahrbuch*, the precursor of both MR and Zbl, ran from 1868 to 1942 and would expand considerably the scope of MR.

Other enhancements to MR are under way. Right now one of the top priorities is to enter into the database the reviews from 1940 to 1979, which currently are available only on paper. It is expected that these reviews will be available on MathSciNet in about two years. Another improvement to MathSciNet is already here: direct links from reviews to articles appearing in AMS electronic journals. The vision is eventually to provide links from MathSciNet to any electronic journal. This is not as simple as it sounds, because there are no standards for the way information is organized in electronic journals. "If there is a different scheme for every journal, then that’s going to make it very difficult," Dennis
says. "The more standardized things are, the more quickly—and, needless to say, more cheaply—we can do it."

In fact, many ideas that one could envision for increasing the power and reach of MR turn out to be more expensive than they seem at first glance. MR is not cheap, and, given libraries' ever-shrinking budgets, it would be perilous to pursue expensive projects to improve MR without knowing whether the improvements would pay for themselves. MR is therefore considering a number of ways to inexpensively increase its scope, such as through cooperative agreements with other organizations. For example, MR is looking into an agreement with a commercial firm that would allow MR users to connect to an existing database of Ph.D. theses. Because MR does not review Ph.D. theses, such an agreement would widen its scope. In addition, MR is discussing ways to connect to indexes of literature published by other professional societies in the mathematical sciences. This information is already accessible through some electronic products the AMS offers, so the aim now is to make it available on the World Wide Web through MathSciNet.

Another effort centers on making Mathematical Reviews more widely available. The main cost of MR is the preparation of the database, and this cost is the same whether three people use it or thirty thousand. "What we're looking for is an economic model which will pay the bills and make the results available to as many people as possible," Dennis explains. There are two components to the charge for MR: the Data Access Fee (DAF), which covers the cost of creating the database, and a set of subscription charges for the various delivery mechanisms (paper, tape, CD-ROM, or World Wide Web). For many institutions in poor countries, the DAF is prohibitive, and MR has a program whereby such institutions can receive discounts on the DAF and MR products. A new program now under development will make MR more affordable to about two dozen of the poorest countries, such as Ghana, Sri Lanka, and the Dominican Republic. Under this program, a country would pay a reduced-price "National DAF," and then any institution in that country would pay only the subscription fees for the MR products it needs. Croatia was the first country to sign up for a National DAF. A second new program, for consortium pricing of MR, is also under development. This program will benefit groups of institutions which include some that subscribe to MR and some that do not. The amount consortium members pay will be such that the sum is not less than the sum of the fees for the current subscribers and such that all members of the consortium pay less than the regular subscription price for a single institution.

Guiding Progress in Mathematics
In addition to the efforts described above, MR is looking into other projects, such as improving document delivery. This service could increase in importance if libraries move to a different mode of operation in which they obtain a copy of a paper when it is requested rather than keeping journal issues sitting on a bookshelf. Most colleges and universities do not have great mathematics libraries, and those that do find their libraries' budgets shrinking. "So if you have no access to reviews, then you're dead; you cannot do much mathematics," Bartle observes. In this environment, wide access to MR can become crucial to progress in the field.

In addition, the transformation that computers are wreaking on the publishing world makes the future very difficult to predict. "There's really a boundary line between how things were done in the past and the way they're going to be done in the future," Dennis notes. "I would like to see MR become a place where you can do 'one stop shopping'. If you're interested in finding out about publications in mathematics—whatever 'publications' might turn out to mean in the future—I hope that we can set it up so that when you go to MR, you can find out what it is you want to know, and then once you've found out about it, be able to get to the original sources." The major challenge facing Mathematical Reviews today is to extend its reach into the past while looking forward to the future. The AMS is working hard to meet this goal.

References

—Allyn Jackson
Are Women Getting All the Jobs?

Marie A. Vitulli and Mary E. Flahive

Over the past few years some members of the mathematics community have voiced considerable concern that women are getting more than their share of the jobs available for Ph.D. mathematicians. In response to this we analyzed AMS data requested by the Joint Committee on Women in the Mathematical Sciences. We thank John Fulton, Jim Maxwell, and Kinda Remick of the AMS for supplying the data.

The data were collected from the 1991-1995 AMS-IMS-MAA Annual Surveys on initial employment of Ph.D.s in mathematics. The tables of data we received were refinements of those which regularly appear in the Notices (cf. August 1996, p. 850, Table 2B), further tabulated according to gender and citizenship. These survey data were obtained from questionnaires distributed to mathematics departments with follow-ups to the degree recipients. In our study we focused entirely on new Ph.D.s from Group I-III departments, that is, from departments of mathematics. The high response rate (95%) from Group I-III departments allowed us to regard it as a census. The primary result of this analysis is that women seem to be getting their share of first jobs, no more and no less. This note is a report on our findings.

The first question we asked is: Do men and women have the same employment rates? To answer this we calculated jobless rates; that is, among the new Ph.D.s who reported their initial employment status, we calculated the percentage of individuals who were either still seeking or not seeking employment. The jobless rate for females was 10.2% and for males 12.0%. Since the jobless rates are not substantially different, we next focused on the Ph.D.s who obtained jobs and looked at what types of jobs men and women were getting. Table 1 summarizes the frequencies and percentages of first jobs in various categories.

From the information in Table 1 we see that there are gender differences in the pattern of first jobs. The greatest differences appear in the rates of employment at Bachelor's departments and the rates in Government & Industry. These differences are substantial, and we wonder why they occurred. Possibly women are more frequently offered or seek employment at Bachelor's departments in preference to Government and Industry. The opposite appears true for men. Is this due to bias on the part of employers or preference on the part of the new Ph.D.s? A definitive answer cannot come from these data.

The final question we asked is: Have women been equally successful in obtaining academic positions at a department of at least comparable ranking to that of the degree-granting department? We informally call this a comparable employment rate. After earning the Ph.D., many non-U.S. citizens left the U.S., and we do not know what type of foreign employment they found. Consequently, for this question we fo-
Table 1. Observed frequencies of first jobs (percentages of column totals) for new Ph.D.s 1990-1995.

<table>
<thead>
<tr>
<th>Type of Employer</th>
<th>Female</th>
<th>Male</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Ia*</td>
<td>106 (15.4%)</td>
<td>491 (19.6%)</td>
<td>597</td>
</tr>
<tr>
<td>Group II</td>
<td>34 (4.9%)</td>
<td>149 (5.9%)</td>
<td>183</td>
</tr>
<tr>
<td>Group III</td>
<td>65 (9.4%)</td>
<td>183 (7.3%)</td>
<td>248</td>
</tr>
<tr>
<td>Master's</td>
<td>82 (11.9%)</td>
<td>235 (9.4%)</td>
<td>317</td>
</tr>
<tr>
<td>Bachelor's</td>
<td>185 (26.9%)</td>
<td>422 (16.8%)</td>
<td>607</td>
</tr>
<tr>
<td>Other Academic (incl. Foreign)</td>
<td>155 (22.5%)</td>
<td>652 (26.0%)</td>
<td>807</td>
</tr>
<tr>
<td>Government &amp; Industry</td>
<td>62 (9.0%)</td>
<td>379 (15.1%)</td>
<td>441</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>689</strong></td>
<td><strong>2,511</strong></td>
<td><strong>3,200</strong></td>
</tr>
</tbody>
</table>

*Group Ia = Group I + Research Institutes


<table>
<thead>
<tr>
<th>Type of Ph.D.-Granting Department</th>
<th>Group I</th>
<th>Group II</th>
<th>Group III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employer Type</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>--------</td>
<td>-------</td>
<td>--------</td>
</tr>
<tr>
<td>Group Ia</td>
<td>25.9%</td>
<td>26.7%</td>
<td>na</td>
</tr>
<tr>
<td>Group Ia-II</td>
<td>na</td>
<td>na</td>
<td>9.3%</td>
</tr>
<tr>
<td>Group Ia-V</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
</tbody>
</table>

na means that this data entry is not applicable

Our analysis suggests several avenues for future AMS-IMS-MAA data collection. As we said above, the causes for the observed differences in employment patterns could be investigated. Also, it is not known if the first job patterns result in salary disparity for females and males, but we suspect starting salaries in Government and Industry are higher than those at Bachelor's departments. Finally, a five- or ten-year longitudinal study would give information on what happens to mathematics Ph.D.s after the first year of employment. A careful survey and analysis would benefit all Ph.D.s in mathematics.

From the data we received and analyzed it appears that women are doing about as well as men in the search for jobs: about as well at finding first jobs and about as well at finding comparable employment. Although there are gender differences in patterns of initial employment, there seems to be little reason for concern that women are getting preferential treatment in the new Ph.D. job market. To summarize: Are women getting all the jobs? We think not.
H. S. M. Coxeter Celebrates 90th Birthday

George F. D. Duff

Born in London, England, on February 9, 1907, Harold Scott MacDonald Coxeter took his Ph.D. at Cambridge University in 1931. He then became a Research Fellow of Trinity College, Cambridge, until 1936, with two intervals in Princeton as a Rockefeller Foundation Fellow in 1932-33 and a Procter Fellow in 1934-35. In 1936 he joined the Department of Mathematics at the University of Toronto, where he has remained since, with numerous visiting appointments at intervals. He has been professor emeritus since 1980, but continues to work, write, and publish actively.

Coxeter was recognized early as an outstanding geometer, his main interests centering on polyhedra, polytopes, finite groups, symmetry, and related topics. He is the author or coauthor of ten full-length books and several shorter well-known works, including his Fifty-nine Icosahedra, and 170 research papers. His Non-Euclidean Geometry (1942) will appear shortly in a fourth edition, with a new section on loxodromic sequences of circles and spheres. His monograph Regular Polytopes (1948) remains a definitive work that established his reputation as a leading expert in the subject. His textbook The Real Projective Plane (1949) has been used widely for many years. With W. O. J. Moser he wrote Generators and Relations for Discrete Groups (1957), and with S. L. Greitzer as coauthor, Geometry Revisited (1967). His Introduction to Geometry (1961) is a wide-ranging and far-reaching study of geometry that was translated into many other languages, has gone through several editions, and has been a Book-of-the-Month-Club selection.

Coxeter himself regards his Regular Complex Polytopes (1974) as his favorite work, and a second edition appeared in 1991. Two volumes of collected papers have also been published—his Twelve Geometric Essays in 1968 and Kaleidoscopes in 1995. As well, Coxeter has revised and rewritten so many editions of Mathematical Recreations and Essays, originally published by W. W. Rouse Ball in 1887, that he is now regarded as the author of the thirteenth edition (1987). All of these books have been widely read and are still frequently consulted.

As a teacher Coxeter has become known to three generations of students of geometry at every level, from school to research institute, both throughout North America and abroad. His influence has been important in the career choices of many mathematicians, and he has been a remarkable reviving force in maintaining the popularity of several branches of geometry. The continuing influence of his work is itself a striking testimony to his fine aesthetic and artistic sense.

Coxeter is an acknowledged expert on the works of the artist Maurits Escher, who presented Coxeter with originals of certain of his most geometrical drawings. He was also well acquainted with the late Buckminster Fuller, after whom buckyballs, buckytubes, and other fullerene compounds of carbon have recently been named. Coxeter has served as president of the Canadian Mathematical Society (1962-63), as vice-president of the American Mathematical Society (1968), and as president of the Interna-

George F. D. Duff is professor emeritus, Department of Mathematics at the University of Toronto.
tional Congress of Mathematicians in Vancouver in 1974. He has received numerous academy memberships, as well as awards and prizes and honorary degrees.

To celebrate Coxeter's ninetieth birthday, a special occasion took place at The Fields Institute for Mathematical Sciences and the Department of Mathematics at the University of Toronto. A sculpture of a loxodromic sequence of eight spheres by the English sculptor J. Robinson was officially unveiled by Coxeter on February 9, 1997. This sculpture will stand in front of the building that houses The Fields Institute on the University of Toronto campus. The Department of Mathematics has also established a special Coxeter Scholarship Fund in Mathematics, for which an appeal is currently under way. A first list of contributors to date, inscribed in a presentation volume, was ceremonially presented to Coxeter on this occasion, in honor of his more than sixty years presence in the department. An ongoing Coxeter Society, with future membership based on the recipients of the Coxeter Scholarships, is being established to carry forward the influence of this much respected and admired mathematician. Further detailed information of this celebration is available at The Fields Institute and at the Department of Mathematics, University of Toronto.

On November 19, 1996, AMS President Cathleen S. Morawetz received the honorary degree of Doctor of Science from her alma mater, the University of Toronto. She was escorted to the convocation by her old family friend Professor H. S. M. Coxeter.

American Mathematical Society

ALGEBRA AND ALGEBRAIC GEOMETRY

Cogroups and Co-rings in Categories of Associative Rings

George M. Bergman, University of California, Berkeley, and Adam O. Hausknecht, University of Massachusetts at Amherst

This book studies representable functors among well-known varieties of algebras. All such functors from associative rings over a fixed ring R to each of the categories of abelian groups, associative rings, Lie rings, and to several others are determined. The book includes a “Symbol index,” which serves as a glossary of symbols used and a list of the pages where the topics so symbolized are treated, and a “Word and phrase index.” The authors have strived—and succeeded—in creating a volume that is very user-friendly.


Enveloping Algebras

Jacques Dixmier, Paris, France

For the graduate student, this is a masterpiece of pedagogical writing, being succinct, wonderfully self-contained and of exceptional precision.

—Mathematical Reviews

The above citation is taken from the review of the first English edition of Dixmier’s book. The book, which is the first systematic exposition of the algebraic approach to representations of Lie groups via representations of (or modules over) the corresponding universal enveloping algebras, turned out to be so well written that even today it remains one of the main textbooks and reference books on the subject. In 1992, Jacques Dixmier was awarded the Leroy P. Steele Prize for expository writing in mathematics. The Committee’s citation mentioned Enveloping Algebras as one of Dixmier’s “extraordinary books”. For the 1996 printing the author updated the status of open problems and added some relevant references.

Graduate Studies in Mathematics, Volume 11, 1996; 379 pp.; Hardcover; ISBN 0-8218-0560-6; List $59; All AMS members $47; Order code GSM/11NA

Tight Closure and Its Applications

Craig Huneke, Purdue University, West Lafayette, IN

This monograph deals with the theory of tight closure and its applications. The contents are based on ten talks given at a CBMS conference held at North Dakota State University in June 1995.

Tight closure is a method to study rings of equicharacteristic by using reduction to positive characteristic. In this book, the basic properties of tight closure are covered, including various types of singularities, e.g. F-regular and F-rational singularities. Several applications of the theory are given. These include the existence of big Cohen-Macaulay algebras and various uniform Artin-Rees theorems.

CBMS Regional Conference Series in Mathematics, Number 88, 1996; 137 pp.; Softcover; ISBN 0-8218-0412-X; List $29; All individuals $22; Order code CBMS/88NA

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Three Leroy P. Steele Prizes were awarded at the 103rd Annual Meeting of the AMS in January in San Diego. These prizes were established in 1970 in honor of George David Birkhoff, William Fogg Osgood, and William Caspar Graustein and are endowed under the terms of a bequest from Leroy P. Steele.

The Steele Prizes are awarded in three categories: for expository writing, for a research paper of fundamental and lasting importance, and for cumulative influence extending over a career, including the education of doctoral students. The current award is $4,000 in each category.

The recipients of the 1997 Steele Prizes are ANTHONY W. KNAPP for Mathematical Exposition, MIKHAEL GROMOV for a Seminal Contribution to Research, and RALPH S. PHILLIPS for Lifetime Achievement.

The Steele Prizes are awarded by the AMS Council acting through a selection committee whose members at the time of these selections were Richard Askey, Ingrid Daubechies, Eugene Dynkin, Ciprian Foias, H. Blaine Lawson, Andrew J. Majda, Louis Nirenberg, Gary M. Seitz, and John T. Tate.

The text that follows contains, for each award, the committee's citation, a brief biographical sketch of the recipient, and the recipient's response upon receiving the award.

**Steele Prize for Mathematical Exposition: Anthony W. Knapp**

**Citation**

For his book *Representation Theory of Semisimple Groups (An overview based on examples)*, Princeton University Press, 1986, a beautifully written book which starts from scratch but takes the reader far into a highly developed subject. The motivation, which is consistently and artfully provided as the general theory unfolds, is a model of exposition. In addition, Anthony Knapp has written other major texts in more recent years, all outstanding expositions of important and difficult material.

**Biographical Sketch**

Anthony W. Knapp is the author of seven books. His first book, *Denumerable Markov Chains*, was written jointly with John Kemeny and Laurie Snell and appeared in 1966. He has written one book about elliptic curves, and the others are on Lie groups and representation theory, the most recent one being *Lie Groups beyond an Introduction*, published in 1996. His book with David Vogan entitled *Cohomological Induction and Unitary Representations* was designated the best mathematics book in 1995 by the Professional and Scholarly Publishing Division of the Association of American Publishers.

Knapp was born in 1941, was an undergraduate at Dartmouth, and received his Ph.D. from Princeton in 1965, with Salomon Bochner as thesis advisor. He was a C. L. E. Moore Instructor at...
MIT for two years and joined the faculty of Cornell University in 1967. Since 1986 he has been professor of mathematics at SUNY at Stony Brook.

He has been a member of the Institute for Advanced Study in Princeton for three one-year terms and has had visiting positions for one year at MIT; for one semester each at Princeton University, Rice University, and Université Paris VII; and for shorter intervals at places in the United States, Canada, France, Italy, Sweden, India, China, and Australia. He was an invited speaker at the International Congress of Mathematicians in Vancouver in 1974 and was a Guggenheim Fellow in 1982-83.

**Response**

It is a great honor to be awarded the Steele Prize for exposition and to have my book associated with the extraordinary books that have been the subjects of this award in past years. I thank the Committee for its choice, and I thank the AMS for long recognizing that high-quality exposition has an important role to play in the advance of mathematics. Writing a book of this level and length takes large blocks of time and requires active support from one’s immediate family; I thank my wife and two children for providing that support. As late as 1981, the field of representation theory, particularly the representation theory of semisimple groups, was notoriously difficult to enter. Tackling two thousand pages of Harish-Chandra was not for the faint-hearted. One needed to learn from mentors in order to see what was beautiful about the subject, to get through the background, and to find out where the subject might be headed. About that time, after having given several short series of lectures on aspects of representation theory to nonexperts, I began to look for a way for more mathematicians to gain some appreciation for the field without help from a specialist. That way was in fact already what I was doing in my lecture series—explaining things often in the context of examples—and what I was sometimes witnessing in the lectures of others. Many times with theorems about semisimple groups, there is one example where one can see all the important ideas without being distracted by technical details. I remember lectures by G. D. Mostow, for example, where he would cut through technicalities right away by defining a semisimple Lie group to be a connected closed subgroup of real or complex matrices stable under conjugate transpose and having finite center. Mostow’s definition does not cover all cases, but it does cover enough cases to make a start at appreciating the subject. It was a question of weaving such descriptions into a coherent book. Despite the use of examples in this way, I felt that it was important to state precise theorems and to provide a guide to further reading so that a person could selectively go more deeply into an aspect of the subject at will.

Several things made the writing of such a book possible. One was the readability of Harish-Chandra’s papers and the presence of several entry points to their study. Another was the encouragement of editor Robert Langlands. A third was that the literature in the subject was in good order, any mistakes not having spread into paper after paper. The opportunity to do a serious experiment with this writing style came with a semester-length course at Université Paris VII in 1982. The handouts of notes for that course became a preliminary edition of the book, and the writing of the full text was complete two years later.

**Steele Prize for a Seminal Contribution to Research: Mikhael Gromov**

**Citation**

For his paper “Pseudo-holomorphic curves in symplectic manifolds”, *Inventiones Math.* 82 (1985), 307-347, which revolutionized the subject of symplectic geometry and topology and is central to much current research activity, including quantum cohomology and mirror symmetry.

**Biographical Sketch**

Gromov was born in 1943 in Boksitogorsk, Russia. He received his Ph.D. in 1969 and his D.Sc. in 1973 from the University of Leningrad. After holding positions at the University of Leningrad, the State University of New York at Stony Brook, and the Université de Paris, he moved to Institut des Hautes Études Scientifiques, where he is a permanent fellow (1982-). For five years he also held the position of professor of mathematics at the University of Maryland, College Park. He is now a professor at the Courant Institute of Mathematical Sciences. Gromov received the Moscow Mathematical Society Prize (1971), the AMS Oswald Veblen Prize in Geometry (1971), the Elie Cartan Prize of the French Academy of Sciences (1984), the Prix UAP (1989), and the Wolf Prize in Mathematics (1993). He also holds an honorary doctorate from the University of Geneva. He is a foreign member of the U.S. National Academy of Sciences, the French Academy.
Eliashberg came across them unable to publish (staying in the independently in the contact framework but was morsified them by breaking the symmetry, and morphic curves immediately after birth: Eliashberg thought this was in the air. So I tried to replay Yang-Mills on a single line of this style of analysis). I was ready for the miracle; Donaldson’s ideas made me feel claustrophobic. And my mind was ready for the miracle; Donaldson’s ideas were in the air. So I tried to replay Yang-Mills on my holomorphic curves (strings?) and reluctantly abandoned the idea, being convinced by Pierre Deligne that the area of curves cannot be controlled without a symplectic structure. Everything went smoothly with the symplectic structure, and I even came to understand the definition of quasianalytic functions and of the nonlinear Riemann-mapping theorem of Schapiro-Lavrentiev (albeit I am still unable to read a single line of this style of analysis).

I was happy to see my friends using holomorphic curves immediately after birth: Eliashberg, Floer, McDuff. Eliashberg came across them independently in the contact framework but was unable to publish (staying in the USSR). Floer has morsified them by breaking the symmetry, and I still cannot forgive him for this. (Alas, prejudice does not pay in science.) McDuff started the systematic hunt for them which goes on till present day. And what goes on today goes beyond these lines and the pen behind them.

**Steele Prize for Lifetime Achievement: Ralph S. Phillips**

**Citation**

Ralph Phillips is one of the outstanding analysts of our time. His early work was in functional analysis: his beautiful theorem on the relation between the spectrum of a semigroup and its infinitesimal generator is striking as well as very useful in the study of PDEs. His extension theory for dissipative linear operators predated the interpolation approach to operator theory and robust control. He made major contributions to acoustical scattering theory in his joint work with Peter Lax, proving remarkable results on local energy decay and the connections between poles of the scattering matrix and the analytic properties of the resolvent. He later extended this work to a spectral theory for the automorphic Laplace operator, relying on the Radon transform on horospheres to avoid Eisenstein series. In the last fifteen years, Ralph Phillips has done brilliant work, in collaboration with others, on spectral theory for the Laplacian on symmetric spaces, on the existence and stability of cusp forms for general noncompact quotients of the hyperbolic plane, on the explicit construction of sparse optimal expander graphs, and on the structure of families of isospectral sets in two dimensions (the collection of drums that sound the same).

**Biographical Sketch**

Ralph S. Phillips was born on June 23, 1913, in Oakland, California. He received his A.B. degree from the University of California, Los Angeles, in 1935 and his Ph.D. from the University of Michigan in 1939. He was an instructor at the University of Washington (1940–41) and Harvard University (1941–42) before becoming the leader of a research group at the Radiation Laboratory at the Massachusetts Institute of Technology. In 1946 he became an assistant professor at New York University, and the following year he moved to the University of Southern California. He took a position as professor at UCLA in 1958 and in 1960 moved to Stanford University, where he is currently a professor.

Professor Phillips was a Rackham Fellow at the University of Michigan while he was a doctoral student there. He was a member of the Institute for Advanced Study (1939–40 and 1951–52) and was a Guggenheim Fellow (1954 and 1974). He was elected to the American Academy of Arts and Sciences in 1971. In 1977 he was the Robert Grimmett Professor of Mathematics at Stanford.
Response
I am both elated and surprised to have been chosen as a recipient of this prize, and I am very grateful to all those who made it happen. Since this prize is for lifetime achievement, let me briefly sketch my mathematical history. I started out in functional analysis, and traces of this field can be found in all of my work. My pursuit of mathematics was interrupted for five years during World War II while I was at the MIT Radiation Lab. After this I worked my way back into mathematics by mastering Einar Hille’s book on wave equation for automorphic functions in hyperbolic spaces. This automorphic function research led to a very productive ten-year collaboration with Peter Lax on scattering theory, first on the acoustic equation in Euclidean spaces and later on the wave equation for automorphic functions in hyperbolic spaces. This automorphic function research led to a very productive ten-year collaboration with Peter Lax on problems related to number theory and geometry. Finally I would like to take advantage of this opportunity to present a list of what I consider to be the ten most insightful of my papers; they are not necessarily the most influential.

References
1997 Cole Prize

Andrew Wiles

The Frank Nelson Cole Prize in Algebra is awarded every five years for a notable research memoir in algebra which has appeared during the previous five years. This prize, as well as the Frank Nelson Cole Prize in Number Theory, was founded in honor of Professor Frank Nelson Cole on the occasion of his retirement as secretary of the American Mathematical Society after twenty-five years and as editor-in-chief of the Bulletin for twenty-one years. The original fund was donated by Professor Cole from moneys presented to him on his retirement. It has been augmented by contributions from members of the Society, including a gift made in 1929 by Charles A. Cole, Professor Cole's son, which more than doubled the size of the fund. In recent years, the Cole Prizes have been augmented by awards from the Leroy P. Steele Fund and currently amount to $4,000.

The twenty-fifth Cole Prize has been awarded to ANDREW WILES. The prize was presented at the Society's 103rd Annual Meeting in San Diego in January 1997. The Cole Prize was awarded by the Council of the American Mathematical Society, acting through a selection committee consisting of Hyman Bass, Karl Rubin (chair), and Wolfgang Schmidt.

The text below includes the committee's citation, a brief biographical sketch, and a response from Andrew Wiles upon receiving the award.

Citation

The 1997 Frank Nelson Cole Prize in Number Theory is awarded to Andrew Wiles for his work on the Shimura-Taniyama conjecture and Fermat's Last Theorem, published in "Modular elliptic curves and Fermat's Last Theorem", Ann. of Math. 141 (1995), 443-551. Fermat proved his "Last Theorem" for exponent 4 by developing the theory of elliptic curves. But there was no apparent connection between elliptic curves and higher exponent Fermat equations, so elliptic curves played no further role in work on Fermat's Last Theorem for almost 350 years, by which time it had become the most famous unsolved problem in mathematics.

The first person in modern times to connect elliptic curves with Fermat's Last Theorem was Y. Hellegouarch in the 1970s. Then about ten years ago, G. Frey suggested and K. Ribet proved (building on ideas of B. Mazur and J.-P. Serre) that Fermat's Last Theorem follows from the Shimura-Taniyama conjecture that every elliptic curve defined over the rational numbers is modular. Precisely, if

\[ a^n + b^n = c^n \]

is a counterexample to Fermat's Last Theorem, then the elliptic curve
$$y^2 = x(x - a^n)(x + b^n)$$
cannot be modular, thus violating the Shimura-Taniyama conjecture. This result set the stage for Wiles’ work. Using Mazur’s deformation theory of Galois representations, recent results on Serre’s conjectures on the modularity of Galois representations, and deep arithmetic properties of Hecke algebras, Wiles (with one key step due jointly to Wiles and R. Taylor) succeeded in proving that all semistable elliptic curves defined over the rational numbers are modular. Although less than the full Shimura-Taniyama conjecture, this result does imply that the elliptic curve given above is modular, thereby proving Fermat’s Last Theorem.

Wiles’ work is highly original, a technical tour de force, and a monument to individual perseverance. In addition, it serves as encouraging evidence that the abstract machinery of modern arithmetic algebraic geometry has the power to solve long-standing classical problems.

For further reading see the introduction of Wiles’ cited paper for a very readable account of the history of his attack on Fermat’s Last Theorem. Among several other accounts of this work and the excitement surrounding it are four pieces in the Notices of the AMS (July/August 1993, 575-576; March 1994, 185-186; January 1995, 48; July 1995, 743-746) and two in the Bulletin of the AMS (July 1994, 15-38; October 1995, 375-402).

Biographical Sketch
Andrew J. Wiles was born in Cambridge, England, on April 11, 1953. He attended Merton College, Oxford University, starting in 1971, and he received his B.A. there in 1974. That same year he went to Clare College, Cambridge University, earning his Ph.D. there in 1980. From 1977 until 1980, Wiles was a Junior Research Fellow at Clare College and a Benjamin Peirce Assistant Professor at Harvard University. In 1981 he was a visiting professor at the Sonderforschungsbereich Theoretische Mathematik in Bonn, and later that year he was a member of the Institute for Advanced Study in Princeton. In 1982 he became a professor at Princeton University and in the spring of that year was a visiting professor at the Université de Paris, Orsay.

On a Guggenheim Fellowship he was a visiting professor at the Institut des Hautes Études Scientifiques and at the Ecole Normale Supérieure (1985-86). From 1988 to 1990 he was a Royal Society Research Professor at Oxford University. In 1994 he assumed his present position as the Eugene Higgins Professor of Mathematics at Princeton.

Wiles was elected a Fellow of the Royal Society, London, in 1989. In 1995 he received the Schock Prize in Mathematics from the Royal Swedish Academy of Sciences. That same year he was awarded the Prix Fermat, presented by the Université Paul Sabatier and Matra Marconi Space. In 1996 Wiles received the Wolf Prize in Mathematics. Wiles was elected a foreign member to the U.S. National Academy of Sciences (NAS) in 1996 and also received the 1996 NAS Prize in Mathematics.

Response from Andrew Wiles
It is a pleasure to thank the American Mathematical Society and the Selection Committee for the award of the Cole Prize in Number Theory. Needless to say on the path to Fermat I benefited enormously from the work of many people, not only of Frey and Ribet, who directly inspired it, but also the many others who knowingly influenced my thinking along the way. I thank them all. Finally, I would like to acknowledge my debt to both Pierre and Samuel Fermat.
The Ruth Lyttle Satter Prize in Mathematics was established in 1990 using funds donated to the AMS by Joan S. Birman of Columbia University in memory of her sister, Ruth Lyttle Satter. Professor Satter earned a bachelor's degree in mathematics and then joined the research staff at AT&T Bell Laboratories during World War II. After raising a family, she received a Ph.D. in botany at the age of forty-three from the University of Connecticut at Storrs, where she later became a faculty member. Her research on the biological clocks in plants earned her recognition in the U.S. and abroad. Professor Birman requested that the prize be established to honor her sister's commitment to research and to encouraging women in science. The prize is awarded every two years to recognize an outstanding contribution to mathematics research by a woman in the previous five years. The amount of the prize is $1,200.

The 1997 Satter Prize has been awarded to Ingrid Daubechies. The prize was presented at the Society's 103rd Annual Meeting in San Diego in January 1997. The prize was awarded by the AMS Council on the recommendation of a selection committee consisting of Peter Sarnak, Carol Wood, and Lai-Sang Young (chair).

The text that follows contains the committee's citation for the award, a brief biographical sketch, and a response from Ingrid Daubechies upon receiving the award.

Citation
The Satter Prize Committee recommends that the 1997 Ruth Lyttle Satter Prize in Mathematics be awarded to Ingrid Daubechies of Princeton University for her deep and beautiful analysis of wavelets and their applications. Her work is a permanent contribution not only to mathematics but to science and engineering. Daubechies' best-known achievement is her construction of compactly supported wavelets in the late 1980s. Over the last five years she has continued their development on the theoretical level and to applications in physics and signal processing. Her continuing research has resulted in the following path-breaking developments. Her discovery with Jaffard and Journe of orthonormal Wilson bases provided the first clues to the existence of cosine packet libraries of orthonormal bases as well as Gaussian bases. These are now standard tools in time frequency analysis as well as in the numerical analysis of partial differential equations. Her work with A. Cohen on biorthogonal wavelet bases provided a more flexible approach to the use of wavelets in image compression algorithms. Biorthogonal basis functions are currently the most common wavelets used in standard compression; they are considered to be superior to orthogonal filters in, for example, fingerprint compression. While continuing to push forward wavelet analysis, Daubechies has also made important contributions in other related areas. Of particular note are her work with Klauder on path integration and her work with her student Anna Gilbert on homogenization, which has contributed to our understanding of multiscale interactions and their computations.

Ingrid Daubechies

INGRID DAUBECHIES

VOLUME 44, NUMBER 3
Biographical Sketch
Ingrid Daubechies received both her bachelor's and Ph.D. degrees (in 1975 and 1980) from the Free University in Brussels, Belgium. She held a research position at the Free University until 1987. From 1987 to 1994 she was a member of the technical staff at AT&T Bell Laboratories, during which time she took leaves to spend six months (in 1990) at the University of Michigan, and two years (1991-93) at Rutgers University. She is now at the mathematics department and the Program in Applied and Computational Mathematics at Princeton University.

She was awarded a Leroy P. Steele prize for exposition in 1994 for her book Ten Lectures on Wavelets. From 1992 to 1997 she was a fellow of the John D. and Catherine T. MacArthur Foundation. She is a member of the American Academy of Arts and Sciences, the American Mathematical Society, the Mathematical Association of America, the Society for Industrial and Applied Mathematics, and the Institute of Electrical and Electronic Engineers. She is married and has two children.

Response from Ingrid Daubechies
I would like to thank the American Mathematical Society as well as the members of the Ruth Lyttle Satter Prize Committee for awarding this prize to me this year. I am particularly grateful that the citation mentions both my theoretical work and my interest in concrete applications. They are both important to me, and it is gratifying to see them both recognized. I would also like to thank my many collaborators: working with them has enriched both my mathematics and my life.

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This tribute to Paul André Meyer and Jacques Neveu displays their wide influence on modern probability theory by gathering nineteen original research papers, drawn from a large range of topics: potential theory, classical stochastic processes and their laws, non-commutative probability, estimates of heat kernels, entropy, ergodic theory, phase transition, stochastic models in financial markets, and excursion theory.

The authors have arranged the contributions so as to emphasize certain themes around which the renaissance of operads took place: homotopy algebra, algebraic topology, polyhedra and combinatorics, and applications to physics.

Partial Order Methods in Verification

This book presents surveys on the theory and practice of modeling, specifying, and validating concurrent systems. It contains surveys of techniques used in tools developed for automatic validation of systems. Other papers present recent developments in concurrency theory, logics of programs, model-checking, automata and formal languages theory.

The volume contains the proceedings from the workshop, Partial Order Methods in Verification, which was held in Princeton, NJ, in July 1996. The workshop focused on both the practical and the theoretical aspects of using partial order models, including automata and formal languages, category theory, concurrency theory, logic, process algebra, program semantics, specification and verification, topology, and trace theory. The book also includes a lively e-mail debate that took place about the importance of the partial order dichotomy in modeling concurrency.

Singularities and Complex Geometry
Qi-keng Lu, Shantou University, Guangdong, People’s Republic of China, Stephen S.-T. Yau, and Anatoly Libgober, University of Illinois at Chicago, Editors

This book represents the proceedings of the joint U.S.–China Seminar on Singularity and Complex Geometry held at the Institute of Mathematics of the Chinese Academy, Beijing, in June 1994. This was the first gathering of Chinese and American mathematicians working in these fields (several Japanese mathematicians also took part). The volume covers a wide range of problems in areas such as CR-manifolds, value distribution theory, holomorphic curves, topology of the complements of algebraic plane curves with singularities and arrangements, topology of non-isolated singularities, gauge theory on resolutions of simple singularities, and residues of foliations. The articles give accounts of research in these fast developing areas. Much of the material appears here for the first time in print.

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Am. Math. Soc.

Recently Published Titles from the AMS

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Dirac Medals Awarded

The International Center for Theoretical Physics (ICTP) in Trieste, Italy, announced last August that the 1996 Dirac Medals would go to TULLIO REGGE of the Polytechnic of Turin and MARTINUS VELTMAN of the University of Michigan.

Tullio Regge was honored "for crucial contributions in theoretical and mathematical physics starting with his seminal investigation of the asymptotic behavior of potential scattering processes through the analytic continuation of the angular momentum to the complex plane. This technique has found many applications in the study of differential equations, while in the physics of the strong interactions, the so-called Regge trajectories have helped in the classification of particles and resonances by grouping together entities with different spin. The so-called Regge behavior was, and still is, an important ingredient in the construction of string theories. In addition, Regge is also known for having introduced the first discretization of space-time with a simple Einstein dynamics (the so-called Regge calculus) and for its formulation of supergravity theories in the geometric language of differential forms."

Martinus Veltman was honored "for his pioneering investigations on the renormalizability of gauge theories and consequently, his analysis of the sensitivity of radiative corrections to both the mass differences in fermion doublets and the Higgs particle mass. These calculations provided the basic prediction in the search for the top quark mass. Towards this goal, Veltman was one of the first to use the computer in Feynman diagram calculations. His software package for manipulations of algebraic symbols has been a privileged tool for a full generation of physicists."

The ICTP instituted the Paul Adrien Maurice Dirac Medals in 1985. These medals are awarded yearly for contributions to theoretical physics and mathematics. The announcement is made on P. A. M. Dirac's birthday (8 August), and the awarding ceremony takes place at a later date at the ICTP. The medalists also receive a cheque for $5,000.

A selection committee including N. Cabibbo, S. Lundqvist, Y. Nambu, S. Weinberg, E. Witten, and Abdus Salam selects the winners from among nominated candidates. The committee invites nominations from anyone working in the areas of theoretical physics or mathematics.

—ICTP Press Release

Keller and Sinai Receive 1997 Wolf Prize

JOSEPH KELLER of Stanford University and YAKOV G. SINAI of the Landau Institute and Princeton University will share the 1997 Wolf Prize in Mathematics.

Keller received the prize for "his profound and innovative contributions, in particular to electromagnetic, optical, acoustic wave propagation and to fluid, solid, quantum and statistical mechanics." Keller is a preeminent applied mathematician in the classical tradition. He has brought a deep understanding of physics and a superb skill at asymptotics to an astonishing range of problems. These include reflection, scattering, and diffraction of waves, whether acoustic, electromagnetic, elastic, or fluid. His outstanding contributions cover problems in mechanics, quantum mechanics, thermodynamics, and statistical mechanics, and include the so-called Keller-Maslov index, the Keller-Rubinov formula for forward scattering, and pioneering work on random media. He is really the model of what a mathematician interested in a wide variety of physical phenomena can and should be.
Joseph Keller

Keller was born in 1923 in Paterson, New Jersey. He received his B.A. in physics in 1943, his M.S. in physics in 1946, and his Ph.D. in mathematics in 1948, all from New York University. He was on the faculty of the Courant Institute of Mathematical Sciences at NYU until 1979. He was a visiting professor at Stanford during 1969-1970 and 1976-1978 before moving there permanently in 1978. He was a Fairchild Scholar at the California Institute of Technology (1973-1974) and has been a research associate at the Woods Hole Oceanographic Institute since 1969. Among Keller's awards and honors are the Lester R. Ford Award of the Mathematical Association of America (1976, 1977), the von Karman Prize of the Society for Industrial and Applied Mathematics (1979), and the Timoshenko Medal of the American Society of Mechanical Engineers (1984). In 1988 he received the National Medal of Science, the highest honor given by the U.S. for scientific achievement. Keller is a member of the Royal Society, the National Academy of Sciences, and the American Academy of Arts and Sciences.

Sinai received the prize for "his fundamental contributions to mathematically rigorous methods in statistical mechanics and the ergodic theory of dynamical systems and their applications in physics." Sinai brings to bear on the problems of mathematical physics the powerful tools of dynamical systems and probability theory, often developing new tools for this purpose. He is generally recognized as the world leader in the mathematics of statistical physics. Working in the tradition of the Kolmogorov school, he first formulated the rigorous definition of the invariant entropy for an arbitrary measure-preserving map. His subsequent work covers areas from the ergodicity of the motion of billiards to spectral properties of quasi-periodic Schrödinger operators. Statistical mechanics is one of the most active and rewarding areas of modern mathematics, and Yakov Sinai is its recognized leader today.

Sinai was born in 1935 in Moscow. He received his B.S. (1957), his Ph.D. (1960), and his doctorate (1963) from Moscow State University. He was a scientific researcher there until 1971, when he became a professor. Also in 1971 he took his present position as senior researcher at the Landau Institute of Theoretical Physics. Since 1993 he has also held a professorship at Princeton University. Among Sinai's awards and honors are the Boltzmann Gold Medal (1986), the Heineman Prize (1989), the Markov Prize (1990), and the Dirac Medal of the International Center for Theoretical Physics, Trieste (1992). He is a member of the American Academy of Arts and Sciences and the Russian Academy of Sciences. He is also an honorary member of the London Mathematical Society and a foreign member of the Hungarian Academy of Sciences.

—from Wolf Foundation News Release

Deaths

L. V. Ahlfors, professor emeritus of Harvard University, died on October 11, 1996. Born in April 1907, he was a member of the Society for 60 years.

Grace E. Bates, professor emeritus of Mt. Holyoke College, died on November 19, 1996. Born August 13, 1914, she was a member of the Society for 51 years.

Garrett Birkhoff, of Water Mill, NY, died on November 22, 1996. Born January 10, 1911, he was a member of the Society for 63 years.

Jeffrey R. Butz, professor at Bridgewater State College, died on October 18, 1996. Born August 27, 1947, he was a member of the Society for 26 years.

J. A. Chao, professor at Cleveland State University, died on December 6, 1996. Born July 8, 1941, he was a member of the Society for 25 years.

Richard J. Duffin, professor at Carnegie Mellon University, died on October 29, 1996. Born October 13, 1909, he was a member of the Society for 58 years.

Alexander Peyserhoff, professor at the University of Ulm, Germany, died on August 13, 1996. Born March 5, 1926, he was a member of the Society for 42 years.

Eric Reissner, professor emeritus of the University of California, San Diego, died on November 1, 1996. Born January 5, 1913, he was a member of the Society for 57 years.

Stefan Schwarz, of the Slovak Academy of Sciences, died on December 6, 1996. Born May 18, 1914, he was a member of the Society for 1 year.

Edwin H. Spanier, professor emeritus of the University of California at Berkeley, died on October 11, 1996. Born August 8, 1921, he was a member of the Society for 50 years.
Mathematics Opportunities

Postdoctoral Grants at the Mittag-Leffler Institute

The Mittag-Leffler Institute in Djursholm, Sweden, announces a number of grants for the year 1997-1998. The program of the Institute starts on September 1 and ends on May 31. The grants are intended for recent Ph.D.s or advanced graduate students and amount to 12,000 Swedish crowns per month. Preference will be given to applications for longer stays, either for one semester or for the whole year.

The subject for 1997-1998 is “Computational Methods for Differential Equations”. In the fall semester the program will focus on applications, such as equations from fluid dynamics, while in the spring partial differential equations will be the main theme. Björn Engquist (fall) and Vidar Thomée (spring) will be the scientific directors. Engquist and Thomée are also on the program committee, along with Claes Johnson and Heinz-Otto Kreiss.


Applicants for these grants must work within the area of the program and must be either an advanced graduate student or a recent Ph.D. (no more than 5 years after the Ph.D. at the start of the program on September 1, 1997). The deadline for the submission of application forms is March 31, 1997. Decisions on awards will be made by mid-April 1997. Inquiries may be directed to: Björn Engquist, NADA, KTH, S-100 44 Stockholm, Sweden (e-mail engquist@nada.kth.se); or to Vidar Thomée, Matematiska Institutionen, CTH, S-412 96 Göteborg, Sweden (e-mail thomee@math.chalmers.se).

Project NExT

Project NExT (New Experiences in Teaching) is a program for new or recent Ph.D.s in the mathematical sciences who are interested in improving the teaching and learning of undergraduate mathematics. Faculty who are just beginning or just completing their first year of full-time teaching at the college/university level are invited to apply to become Project NExT Fellows.

The first event for the 1997-1998 Fellows will be a Workshop, July 30-August 1, 1997, just prior to the MathFest, the summer meeting of the Mathematical Association of America (MAA) in Atlanta, Georgia (August 2-4, 1997). At this workshop, Fellows will explore and discuss issues of special relevance to beginning faculty, including: new approaches to teaching calculus and precalculus; alternative methods of teaching and assessing student learning; using technology in the classroom; lessons from peda-
RAMANUJAN LETTERS and COMMENTARY

Bruce C. Berndt,
University of Illinois, Urbana

Robert A. Rankin,
University of Glasgow, Scotland

Ramanujan's letters of January 16 and February 27 (1913) to G. H. Hardy are two of the most famous letters written in the history of mathematics. After introducing himself as "a clerk in the Accounts Department of the Port Trust Office at Madras," Ramanujan began to relate some of his mathematical discoveries. In these letters, he set forth over 100 of his theorems.

Hardy's receipt of Ramanujan's first letter marks the dawning of the recognition of Ramanujan's remarkable mathematical talents. The book contains many never-before-published letters that still influence contemporary research in mathematics. Berndt and Rankin discuss in detail the history, up to the present, of each mathematical result in the letters.

Mathematics Opportunities

gogical research; and the faculty member as teacher and scholar. The Fellows will also have an opportunity to meet and interact with Fellows who began the program in previous years.

Invited speakers include: Gerald Alexanderson, Santa Clara University, MAA President; Sylvia Bozeman, Spelman College; Joseph Gallian, University of Minnesota-Duluth; Anita Solow, DePauw University; and M. Kathleen Heid, Pennsylvania State University.

Following the workshop, Project NExT Fellows will attend the Mathfest, participating in all the opportunities of that meeting, and choose among special short courses on issues in teaching and learning collegiate mathematics. During the following year, Project NExT Fellows will participate in: a network that links Project NExT Fellows with one another and with distinguished teachers of mathematics; special events at the Joint Mathematics Meetings in Baltimore, MD, January 7-10, 1998; and a second workshop in the summer of 1998.

Approximately sixty Project NExT Fellows will be selected for the 1997-98 year. Funding for room and board at the workshop in Atlanta, GA, and for the short courses at the summer 1997 MathFest will be provided for participants. Institutions employing the Project NExT Fellows are expected to provide financial assistance for travel and attendance at the national meetings. Limited funds are available to assist those institutions unable to afford full or partial support.

The deadline for applications to participate in Project NExT in 1997-98 is April 25, 1997. Applications received after that date will be considered only if space is still available. Applicants will be notified by June 1, 1997, whether they have been selected as Project NExT Fellows. Application forms are available on the Project NExT home page (http://archives.math.utk.edu/projnext/) or from James R. C. Leitzel at the address given below.

For further information contact either of the project coordinators, whose names and addresses follow.

James R. C. Leitzel, Department of Mathematics, University of New Hampshire, Kingsbury Hall, 33 College Road, Durham, NH 03824; telephone 603-862-4546; e-mail rcl@christa.unh.edu.

T. Christine Stevens, Department of Mathematics and Computer Science, Saint Louis University, 221 North Grand Boulevard, Saint Louis, MO 63103; telephone 314-977-2444; e-mail stevensc@slu.edu.

Project NExT is sponsored by the MAA. Funding is pending.

—Project NExT Announcement
Mathematics Awareness Week 1997

Mathematics Awareness Week (MAW) 1997 will be officially celebrated April 20-26. The Joint Policy Board for Mathematics has selected "Mathematics and the Internet" as the 1997 MAW theme. This theme includes such subjects as computer security and encryption, data mining, network analysis, information theory, and the availability of mathematical information on the World Wide Web and other technologies.

Mathematics Awareness Week materials, including the MAW poster and visuals, will be posted on the MAW Web site, http://forum.swarthmore.edu/maw/. Additional information can be found and MAW-related activities discussed on MAW-list, the e-mail discussion list. (To join MAW-list, send mail to majordomo@maa.org, with "subscribe maw-list", without the quotes, in the body of the message.)

Institutions and organizations planning MAW activities may wish to post them on MAW-list and on their WWW sites. Links from and postings to the MAW Web site may be arranged with Melissa Dershewitz, dersh@forum.swarthmore.edu.

To assist in 1997 planning, summaries of 1996 activities are currently posted on the MAW Web site (http://forum.swarthmore.edu/maw/96/participants.html), with links to many individual MAW Web pages.

General questions about Mathematics Awareness Week can be directed by e-mail to mawjpbm@deans.umd.edu.

—JPBM Announcement

Everett Pitcher Lectures

The next series of Everett Pitcher Lectures will be held March 18, 19, and 20, 1997, on the campus of Lehigh University in Bethlehem, Pennsylvania. The speaker will be Benoît Mandelbrot, Abraham Robinson Professor of Mathematical Sciences at Yale University and IBM Fellow Emeritus at the T. J. Watson Research Center. The title of his lectures will be, "Fractals in Mathematics and the Sciences."

The lectures, which are open to the public, are held in honor of Everett Pitcher, who was secretary of the AMS from 1967 until 1988. Pitcher served in the mathematics department at Lehigh from 1938 until 1978, when he retired as Distinguished Professor of Mathematics. Further information can be obtained by writing to Pitcher Lecture Series, Department of Mathematics, Lehigh University, Bethlehem, PA 18015, or by calling 610-758-3753.

—Department of Mathematics
Lehigh University
1996 Reports of the AMS Policy Committees

In 1992, the Council of the AMS decided to reorganize its committee structure. At that time there were already two so-called "policy committees", one on education policy and the other on science policy. To these were added three more policy committees: one on the profession, one on meetings and conferences, and one on publications. The skeleton charge given to all of these committees was as follows:

a. to provide advice to the leadership of the Society and to make recommendations as to Society policy;
b. to be responsible for taking a long-range view in their areas;
c. to conduct an annual high-level review of activities and structure within their areas and evaluate progress towards Society goals;
d. to report regularly to the membership, both in writing and by presentations at meetings;
e. to maintain communications with the membership and to keep aware of their views;
f. to coordinate with other professional organizations.

The Notices of the AMS conceived of itself, as the journal of record for the Society, as an appropriate vehicle to execute (d): reporting regularly to the membership in this, the March issue of the Notices.

Committee on Publications (CPUB)

Steven G. Krantz, Chair

The committee (CPUB) met once in the spring of 1996 and conducted its other business by e-mail.

The committee formulated a resolution to the AMS staff to strive for simplicity in the creation of all electronic products and services. The resolution was adopted by Council at its Seattle meeting.

CPUB also formulated recommendations on the appropriate etiquette for rejecting abstracts and journal submissions.

The committee was asked whether objections to a recent book review in the Bulletin warranted a reconsideration of Bulletin policy toward rebuttals to book reviews. The decision was that no action was necessary.

CPUB recommended to the ECBT that the AMS develop a "Member CD-ROM" to provide information to mathematicians worldwide who have limited or unreliable access to the Internet. The ECBT in turn asked the president to appoint a task force to recommend the editorial content of such a CD-ROM and the AMS staff to provide a technical and financial analysis. Both of these were done, and the ECBT at its November 1996 meeting approved the recommendation of the task force and directed the AMS staff to proceed with the production, promotion, and distribution of the Member CD-ROM.

The chair of CPUB appointed a task force to study the AMS primary journals and report on the role they play in the Society and whether they serve the membership.

The chair of CPUB appointed a task force to study the AMS member journals and report on their role of service to the Society.

Committee on Education (CoE)

Hyman Bass, Chair

The American mathematics community, unlike those of its sister sciences, has historically separated its interests in research (AMS) and in education (MAA). As our profession is changing, in response to economic, demographic, and social pressures, it is recognized that we must adopt more holistic views of professional needs. In education, in particular, there is an important and complex role for the re-
search community. This applies to enhancements of graduate programs to prepare future faculty for their roles as teachers, to greater attention to the quality of undergraduate instruction for diverse student populations, to improved efforts in courses for future school teachers of mathematics, and to outreach in national efforts to improve mathematics instruction in schools.

In these conditions the Committee on Education was created in 1990 to give a locus for focused discussion and review of educational issues of concern to the society. Its activities include advising the society leadership on policy matters, informing the membership through reports and programs at Society meetings, and liaison (and, when appropriate, collaboration) with other organizations such as JPBM, MAA, AMATYC (American Association of Two-Year Colleges), and NCTM (National Council of Teachers of Mathematics). These connections are an important aspect of the bridge building between the research community and the diverse education communities that is needed to facilitate more cohesive progress toward educational improvement. Connections with organizations representing other scientific disciplines are also likely to be strengthened as a result of increased emphasis on undergraduate education and crossdisciplinary interaction.

Following are some prominent items among the current activities of the Committee.

TIMSS (Third International Mathematics and Science Education Study): This is a massive study of both student achievement (of half a million students) and of educational design and practice in mathematics and science teaching at three levels (fourth grade, eighth grade, and last year of high school) in forty-one countries. The rich data base provided, which is susceptible to fruitful secondary analysis, gives an unprecedented opportunity for comparative study of American education in mathematics and science. As the TIMSS data are released in stages over the current year, it will be desirable to orchestrate informed public discussion of their significance and potential. The AMS Committee on Education is collaborating with other organizations in this effort. Reports on TIMSS-related material were presented at its recent meetings, from both Lois Peak, of the National Center for Educational Statistics, and from Joan Ferrini-Mundy and Danny Goroff from MSEP. The Committee on Education is sponsoring a program at the San Diego annual meeting (January 1997) featuring Jim Stigler and A1 Manaster, who were involved in an unprecedented video study of eighth-grade mathematics lessons in the U.S., Japan, and Germany. Another TIMSS-related program is sponsored by MER. Further, the Education home page on the AMS Web site (URL is http://www.ams.org/education/) provides information and links to TIMSS reports.

Other Committee on Education-sponsored programs at the San Diego meeting: a workshop for graduate students on career information (S. Rankin and D. Hughes Hallett), K-12 intervention (J. Roitman and S. Addington), and jointly with the Committee on Professional Programs and Services a session on professional development (C. Bennett).

NCTM, Standards 2000: The NCTM is embarking on a revision and synthesis of its Curriculum, Teaching, and Assessment Standards, to be published as a single volume in the year 2000. These Standards have been the subject of lively public discussion, and some mathematicians have urged a stronger involvement of professional mathematicians in their formulation. The NCTM is seeking feedback from the various professional communities in this effort. To facilitate this, it has invited the AMS, among other organizations, to form a resource group to assist the NCTM writing team, chaired by Joan Ferrini-Mundy. To this end the Committee on Education has formed a Subcommittee on AMS/NCTM2000, chaired by Roger Howe, which will review draft materials from the NCTM. This subcommittee has been given the broader charge of fostering more informed and critical public discussion and review of some of the scholarly literature on teaching and learning that bears on the issues addressed by the Standards. The Subcommittee membership, still being assembled, includes Richard Askey, Hyman Bass, Wayne Bishop, Roger Howe, Alfred Manaster, David Moore, Judy Roitman, and Mark Saul.

MR coverage of educational research: There is a growing community of scholars, some initially trained as research mathematicians, who are turning their attention to research in mathematics education, with an emphasis on undergraduate education. Some of these people hold positions in mathematics departments. Yet there is virtually no professional recognition of, and little convenient access to, this scholarship within the AMS community. As a modest first gesture in this direction, the COE was asked to consider the possibility that MR (Mathematical Reviews) extend coverage to an appropriate sector of the literature on educational research. This is a policy matter that lies within the jurisdiction of the MR Editorial Committee (MREC). It also raises issues of cost and staff expertise. In cooperation with the MREC, the Committee on Education has appointed a subcommittee, chaired by Joan Ferrini-Mundy, to investigate the desirability and feasibility of extending MR coverage in this way.

MAA Project NEXT: The AMS Committee on Education is exploring ways to collaborate with the MAA in support of this very successful program.

Committee meetings: On an experimental basis, partly for reasons of economy, the Committee will have only one plenary meeting in 1997, with a small executive committee meeting once more in conjunction with the meeting of the Committee on Science Policy.

Committee on Meetings and Conferences (COMC)

Sylvia Wiegand, Chair

The Committee on Meetings and Conferences (COMC) reviews and recommends policy for all aspects of the Society's meetings and conferences. COMC provides annual reviews, reports and communicates to the membership, and coordinates its activities with other AMS committees, par-
particularly those activities involving meetings and conferences.

Besides conducting a great deal of its business by electronic mail correspondence, COMC had two face-to-face meetings in 1996, in April and September. Some of the highlights of the year's activities follow. The recommendations listed (I.1.2 and I.2.2) were to be considered by the Council at the January 1997 meeting in San Diego.

I. COMC has a six-year plan for reviews of the various facets of the AMS Meetings and Conferences program. The two items scheduled for 1996 were completed, and work has begun on the items for 1997. Specifically:

I.1. Evan Houston, chair, Deborah Sulsky, and William Harris served on the COMC Subcommittee to Review Co-sponsorship of Meetings and Conferences of Other Organizations (CSSC), which was charged with performing a six-year review of co-sponsorship by the Society of meetings and conferences of other organizations. The committee examined the history of past co-sponsorships and developed goals and guidelines for future ones. The modern history of co-sponsorships dates to 1988, when a Committee on Cooperative Symposia was created to generate and review ideas for co-sponsoring sessions involving applications of mathematics; this committee was discharged in January 1992. Since then simple requests for co-sponsorship have been handled by the Secretariat. This procedure appears to work well.

The CSSC also prepared a guidelines statement concerning co-sponsorship agreements, proceedings, and program committee appointments, which COMC has recommended be adopted by the Council.

I.2. Roy Adler, chair, Robert Daverman, Andy R. Magid, and Jerry Marsden reported for the Subcommittee to Review International Joint Meetings.

The Subcommittee on International Joint Meetings was formed in September 1995 with the charge "To review and report to COMC and, through them, to the Council as appropriate the operation of international joint meetings, including financial, scientific, and organizational aspects." They also considered procedural aspects of international joint meetings.

The committee commented that "international joint meetings are valuable for the AMS membership; this cooperation with other societies enhances the image of the AMS and provides a richer program of meetings and conferences. Mathematicians and scientists in other countries value the opportunity to invite AMS members and to make scientific and personal contacts with them. International joint meetings are a relatively new endeavor for the AMS, and procedures are still being developed. The AMS is doing an excellent job with the meetings, and they have been well received. The subcommittee considered procedural aspects and other issues that may arise during the course of the review. The program seems to be successful and should be continued."

COMC has recommended some procedural and policy items regarding international joint meetings to the Council. These include: the development of written guidelines, the involvement of people who already have contact with the country (e.g., who can speak the language and have substantial scientific contacts), and reports about each international joint meeting for future evaluation and information.

II. The reviews scheduled for 1997 are (1) Sectional Meetings; a subcommittee for this review will be chaired by Evan Houston, with Case, Daverman, and Sulsky; and (2) AMS sessions at Meetings of Other Organizations, to be chaired by Isom Herron, with additional members Hyman and Marsden. The scope of this latter subcommittee will be expanded to include consideration of sessions of other organizations at AMS meetings, because it is important for the AMS to be involved in interdisciplinary mathematics. In addition to these review subcommittees, COMC will form another subcommittee to study national meetings of the future.

III. Other Items

III.1. COMC has initiated the formation of a Joint Task Force on Interdisciplinary Activity with CPUB. When COMC reviewed interdisciplinary conferences, it appeared that the publication of proceedings led to problems. This task force, which will be named soon, will be charged to consider and facilitate proceedings of interdisciplinary conferences.

III.2. COMC has contacted the chair of CoE about the formation of a Joint COMC-CoE Subcommittee on Student Activities. This subcommittee would be charged to catalog and unify existing programs as well as to encourage and suggest new programs.

III.3. In the area of long-range planning for the conferences program, COMC considered the possibility of significant future cuts in funding for the summer conference program by the granting agencies (in view of the budget situation in Washington, DC). COMC discussed past attendance, topics, and organizers of summer conferences. In view of the potential for loss of funds, COMC recommended that only the highest-quality proposals be submitted to granting agencies in the future. In the event of severe cutbacks, the Society itself could perhaps partially support the series for one year, but not on an ongoing basis.

III.4. Some concern has been communicated to COMC that National Meetings no longer appeal to those mathematicians primarily interested in doing research. COMC discussed this issue by e-mail and at its meetings and will continue to explore it. (One question is whether the perception is accurate.)

III.5. COMC has assisted the AMS office with ideas for the Meetings and Conferences page on the WWW. It is hoped that this new technology will make access to information about meetings and conferences easier for members and also that members will assist with obtaining meeting information for the Web.

III.6. Progress has been made on various recommendations from COMC which appeared in previous reports.

II.6a. The Council passed the recommendation from COMC regarding Summer Meetings. For various reasons, such as expense, poor attendance, and a lack of willing organizers for scientific offerings, it was decided that there will be no Joint Summer Meeting in the present MathFest format in the summers of '97, '98, and '99. In the year 2000 there will be a special AMS celebration in conjunction with the International Mathematical Union's World Mathemati-
cal Year 2000 activities, presently being organized by Felix Browder's committee.

As a transitional step toward the discontinuance of Summer Meetings, the AMS participated in the 1996 Mathfest. In fact, the Seattle Mathfest appeared to be better attended than some past Summer Meetings and included a varied and interesting program, with high-quality expository talks and some scientific sessions. Nevertheless, despite various cost-cutting measures, such as reducing the services offered, it was still an expensive meeting for the AMS, and problems arose from the lack of services.

II.6b. COMC has recommended that the AMS hold sessions for graduate students in order to increase the participation of younger mathematicians in meetings; this idea was tried at the Seattle Mathfest and appeared to be quite successful and popular.

II.6c. Special discussion groups for researchers participating in Special Sessions were proposed to encourage interaction between established mathematicians and younger mathematicians and underrepresented minorities; the first of these was planned for San Diego.

II.6d. Another idea was to encourage more interdisciplinary activities and discussion of diverse applications of mathematics at meetings. Two activities related to this were planned for the San Diego meeting: a panel discussion organized by Ruth Williams on "Careers for Mathematicians in Industry, Government, and Business" and a Special Session on the "Mathematics of Industry, Government, and Business", organized by Desire Beck.

II.7. COMC has decided to cut its face-to-face meetings to one per year in order to reduce costs. The next meeting of COMC will be Saturday, September 20, 1997, in Chicago. The new chair of COMC will be Joel Spencer.

II.8. COMC is interested in members' concerns and ideas regarding its activities and regarding meetings and conferences in general. In particular, COMC welcomes comments regarding the topics mentioned here, especially regarding items currently under study, such as Sectional Meetings and the research appeal of National Meetings.

COMC will continue to seek input from various sources. A focus group discussion on National Meetings will be held at the January 1997 meeting in San Diego, with a randomly selected group of meeting participants. This is the fourth such focus group discussion.

The members of COMC as of November 1996 are: Roy Adler, Bettye Anne Case, John H. Ewing (ex-officio/AMS executive director), Robert Fossum (ex-officio/AMS secretary), Isom Herron, Evan Houston, Mac Hyman, Jerry Marsden, Cathleen S. Morawetz (ex-officio/AMS president), Frank Morgan, Deborah Sulsky, Sylvia Wiegand, and Ruth Williams.

Permanent invited guests: Robert Daverman (associate secretary, Southeastern Section), Susan Friedlander (associate secretary, Central Section), William Harris (associate secretary, Western Section), and Lesley Sibner (associate secretary, Northeastern Section).

AMS Staff: Hope Daly (staff support), Heather MacDonald (staff support), and James Maxwell (senior staff liaison).

This report was prepared by Sylvia Wiegand, chair of COMC, with the assistance of the Committee.

Committee on the Profession (CoProf)

Joseph Lipman, Chair

Meetings
CoProf held face-to-face meetings on 3/30-3/31/96 and 10/19-10/20/96. Additional business was conducted by e-mail.

Rochester
Under the leadership of Salah Baouendi (whose term as chair ended February 1, 1996), CoProf was much involved in Society actions related to changes in the mathematics program at the University of Rochester: in the formulation of the January 1996 Council resolution, in communication with the mathematics department at Rochester, in solicitation of letters of support from the whole academic community, and in informing the community through personal contact and through articles in the Notices and in the Chronicle of Higher Education. (The Society's efforts, under the overall direction of President Cathleen Morawetz, were led by President-elect Arthur Jaffe and effectively supported by the Providence office, as well as by members of the Rochester Task Force and other volunteers.)

After the Rochester situation was resolved (see www.ams.org/committee/profession/rochester/rochester.html), the Council approved CoProf's recommendation to continue the Rochester Task Force under the name Mathematics Advocacy Task Force, with the purpose of bringing together prominent representatives from mathematics, the sciences, technology, and business to publicize the role of mathematics in universities and in society at large.

What does the Rochester episode suggest about how mathematics departments can best function in a changing academic environment? CoProf is sponsoring a panel discussion, organized by Frank Gilfeather, on this question at the 1997 annual AMS meeting in San Diego. (Several other sessions on "survival" are scheduled for the same meeting.)

CoProf has begun discussing other ways in which the AMS might offer assistance to individual mathematics departments.

Public Awareness
CoProf prepared a report on AMS activities in the area of public awareness (see www.ams.org/committee/profession/pubaware.html). This component of the mission of the AMS is too wide ranging for one policy committee to deal with in its entirety, and so the report concentrates on communication with the public at large, exclusive of JPBM activities such as "Mathematics Awareness Week". The report contains numerous recommendations, as well as a call for volunteers to help carry them out.

Following up on this report, CoProf established a Working Group on Public Awareness in Mathematics (WGPAM),
chaired by Steven Weintraub, to stimulate and serve as a focal point for public awareness efforts. WGPAM has created the "New-in-Math" e-MATH page, aimed at the general public (www.ams.org/new-in-math/). Though WGPAM is initially a subcommittee of CoProf, it is anticipated that it will develop into a more autonomous AMS entity.

**Employment**

CoProf oversees the maintenance of employment- and career-related information on e-MATH (www.ams.org/committee/profession/).

CoProf sponsored a talk by Linda Thiel, director of the AMS-SIAM, Sloan Foundation-funded career information project (www.ams.org/careers/), on "Nonacademic Career Opportunities in Mathematics" at the 1996 annual meeting in Orlando.

CoProf sponsored a three-hour program, organized by Annalisa Crannell, on "Preparing Ourselves and Our Students for Careers in Mathematics" at the 1996 Mathfest in Seattle. A video of the sessions is being distributed.

CoProf is sponsoring a panel, organized by Ruth Williams, on "Careers for Mathematicians in Industry, Government, and Business" at the 1997 annual meeting in San Diego.

**Professional Development**

A newly formed Professional Development subcommittee is thinking about recommendations for activities in this area.

CoProf is co-sponsoring a panel, organized by Curtis Bennett, on "Continuing Professional Development" at the 1997 annual meeting in San Diego.

**Participation**

Pursuant to Council approval in January 1995 of a CoProf resolution, the AMS established a Task Force on Participation for Underrepresented Minorities in Mathematics, chaired by James Turner. Major Task Force recommendations on the establishment of a Washington Office of Minority Affairs (joint with MAA and NCTM) and on bridge programs for beginning minority graduate students are on their way toward implementation.

**Relations with Other Disciplines**

For the area of its 1997 review of AMS activities, CoProf has chosen "Relations with Other Disciplines". (The two preceding reviews have been on Employment and Public Awareness.) A preliminary report will be discussed at the March 1997 CoProf meeting.

**Tenure, Adjuncts, ...**

CoProf subcommittees are currently considering questions having to do with changing attitudes toward tenure and with the use of adjuncts, especially in the teaching of lower-level mathematics courses. These are large questions affecting all of academia. Any input from the membership on how the AMS might effectively influence the national debate would be most welcome. (Write to coprof@ams.org.)

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**Committee on Science Policy (CSP)**

**William James Lewis, Chair**

As 1996 began, the U.S. government was in its second shutdown in as many months, with serious impacts on the National Science Foundation and therefore on the institutions and individual mathematicians receiving NSF grant support. Moreover, there were grave concerns in the mathematical community about proposed budget cuts for FY97 and beyond. CSP, with the Washington Office and AMS leaders, worked to mobilize mathematicians to encourage Congress to support NSF and science funding. For the first time, an alert to all AMS members about the situation was issued by President Cathleen Morawetz. At the January Joint Mathematics Meetings in Orlando, William Harris (assistant director of NSF's Mathematical and Physical Sciences Directorate) urged mathematicians to become more visible in the political process of funding for science. His speech, along with that of NSF director Neal Lane to the astronomers' annual meeting, President Morawetz's alert, and advice on contacting members of Congress were all posted on the Science Policy home page on the AMS Web site. Information was e-mailed to department chairs and the network of AMS members willing to contact members of critical congressional oversight committees.

Continuing the increased emphasis on congressional contacts, in February CSP members Jean Taylor, James Lewis, and Sam Rankin of the Washington Office participated with other scientific societies and industry representatives in a Congressional Visits Day, developing contacts and presenting a unified message on the importance of support for science. We continue to work to increase coordination with other sciences, both in monitoring and responding to congressional developments and in developing an ongoing and more vocal message.

At the Orlando meeting CSP organized two focus groups in order to provide to the NSF their opinions on establishing priorities for mathematical research. D. J. Lewis, director of the NSF's Division of Mathematical Sciences, was present at these well-attended and lively discussions. CSP also invited a leading astronomer, John Bahcall, to participate in a panel discussion on establishing priorities for federal funding in the mathematical sciences. In his presentation Bahcall described the process used by astronomers to set priorities in their discipline.

Not until April did Congress pass FY96 appropriations, by which time the FY97 budget process was in full swing, and CSP members continued to receive information on developments and requests for action at sensitive times. JPBM requested help in support of DoD funding and the Eisenhower program; their alert was sent to CSP and our contact group, and President Morawetz wrote a letter of support to selected members of Congress. By June we were alerting the community that action was needed in support of the NSF's FY97 budget; this activity intensified and continued over the summer until the bill was passed in Sep-
tember. During the presidential election process CSP received information of interest to the community.

At their May meeting CSP took advantage of contacts developed during the previous months and heard presentations on government relations from the American Chemical Society, American Institute of Physics, IBM, staff members of Congressional Science Committees and Administration (OSTP), in addition to discussions with NSF representatives on current and future developments of interest to the mathematical community.

Revision of the AMS National Policy Statement is being undertaken by the Federal Policy Agenda Subcommittee, who solicited input from the community in the spring and is working to identify issues of concern to mathematicians and to present a draft document of their findings to CSP and ultimately the Council.

At the Seattle Mathfest in August CSP again organized a focus group for mathematicians to comment on the NSF's recompetition for mathematics institutes. Although their invited speaker (Defence Secretary William Perry) was unable to attend, CSP is hopeful that future invitations will bear fruit.

The September CSP meeting provided a chance to reflect on the year's activities and plan strategies for increased visibility of mathematicians in the political process: proposed are 1) "grass roots" networks to function as resources for members of Congress, 2) briefings or lectures on Capitol Hill for congressional staff, 3) identification of a "champion" for mathematics and science in Congress, and 4) more visits by CSP members to their members of Congress, both in Washington and home districts. Five-year projections of federal budgets are speculative; and CSP realizes that the need for ongoing monitoring of the budget process, feeding back crucial information to the mathematical community, and increased pressure on congressional appropriations committees are critical to the funding of mathematics.

CSP activities arranged for the Joint Mathematics Meetings in San Diego, January 1997, include invited addresses by Neal Lane, director, National Science Foundation, and Congressman George E. Brown Jr., ranking Democrat on the House Committee on Science and a long-time supporter of Congress, both in Washington and home districts. Five-year projections of federal budgets are speculative; and CSP realizes that the need for ongoing monitoring of the budget process, feeding back crucial information to the mathematical community, and increased pressure on congressional appropriations committees are critical to the funding of mathematics.

Better communication on matters of science policy is being achieved through development of the Science Policy page on the e-MATH World Wide Web site, where reports on federal budget developments, announcements, and resources are available (URL is http://www.ams.org/).
Add this Cover Sheet to all of your Academic Job Applications

How to use this form

1. Using the facing page or a photocopy, (or a TeX version which can be downloaded from the e-math "Employment Information" menu, http://www.ams.org/committee/profession/employ.html), fill in the answers which apply to all of your academic applications. Make photocopies.

2. As you mail each application, fill in the remaining questions neatly on one cover sheet and include it on top of your application materials.

The Joint Committee on Employment Opportunities has adopted the cover sheet on the facing page as an aid to job applicants and prospective employers. The form is now available on e-math in a TeX format which can be downloaded and edited. The purpose of the cover form is to aid department staff in tracking and responding to each application.

Mathematics Departments in Bachelor's, Master's and Doctorate granting institutions have been contacted and are expecting to receive the form from each applicant, along with any other application materials they require. Obviously, not all departments will utilize the cover form information in the same manner.

Please direct all general questions and comments about the form to: emp-info@ams.org or call the Professional Programs and Services Department, AMS, at 800-321-4267 extension 4105.

JCEO Recommendations for Professional Standards in Hiring Practices

The JCEO believes that every applicant is entitled to the courtesy of a prompt and accurate response that provides timely information about his/her status. Specifically, the JCEO urges all institutions to do the following after receiving an application:

(1) Acknowledge receipt of the application immediately; and
(2) Provide information as to the current status of the application, as soon as possible.

The JCEO recommends a triage-based response, informing the applicant that he/she
(a) is not being considered further;
(b) is not among the top candidates; or
(c) is a strong match for the position.
### Academic Employment in Mathematics

#### AMS Standard Cover Sheet

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**If the Ph.D. is not presently held, date on which you expect to receive**

**Indicate the mathematical subject area(s) in which you have done research using the 1991 Mathematics Subject Classification printed on the back of this form. If listing more than one number, list first the one number which best describes your current primary interest.**

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**Give a brief synopsis of your current research interests (e.g. finite group actions on four-manifolds). Avoid special mathematical symbols and please do not write outside of the boxed area.**

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**Indicate the position for which you are applying and position posting code, if applicable**

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**List the names, affiliations, and e-mail addresses of up to four individuals who will provide letters of recommendation if asked. Mark the box provided for each individual whom you have already asked to send a letter.**

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**This form is provided courtesy of the American Mathematical Society.**

**This cover sheet is provided as an aid to departments in processing job applications. It should be included with your application material.**

**Please print or type. Do not send this form to the AMS.**
1991
Mathematics Subject Classification

| 00 | General                          |
| 01 | History and biography            |
| 03 | Logic and foundations            |
| 04 | Set theory                       |
| 05 | Combinatorics                    |
| 06 | Order, lattices, ordered algebraic structures |
| 08 | General mathematical systems     |
| 11 | Number theory                    |
| 12 | Field theory and polynomials     |
| 13 | Commutative rings and algebras   |
| 14 | Algebraic geometry               |
| 15 | Linear and multilinear algebra, matrix theory |
| 16 | Associative rings and algebras   |
| 17 | Nonassociative rings and algebras |
| 18 | Category theory, homological algebra |
| 19 | K-theory                         |
| 20 | Group theory and generalizations |
| 22 | Topological groups, Lie groups   |
| 26 | Real functions                   |
| 28 | Measure and integration          |
| 30 | Functions of a complex variable  |
| 31 | Potential theory                 |
| 32 | Several complex variables and analytic spaces |
| 33 | Special functions                |
| 34 | Ordinary differential equations  |
| 35 | Partial differential equations   |
| 39 | Finite differences and functional equations |
| 40 | Sequences, series, summability   |
| 41 | Approximations and expansions    |
| 42 | Fourier analysis                 |
| 43 | Abstract harmonic analysis       |
| 44 | Integral transforms, operational calculus |
| 45 | Integral equations               |
| 46 | Functional analysis              |
| 47 | Operator theory                  |
| 49 | Calculus of variations, optimal control |
| 51 | Geometry                         |
| 52 | Convex and discrete geometry     |
| 53 | Differential geometry            |
| 54 | General topology                 |
| 55 | Algebraic topology               |
| 57 | Manifolds and cell complexes     |
| 58 | Global analysis, analysis on manifolds |
| 60 | Probability theory and stochastic processes |
| 62 | Statistics                       |
| 65 | Numerical analysis               |
| 68 | Computer science                 |
| 70 | Mechanics of particles and systems |
| 73 | Mechanics of solids              |
| 76 | Fluid mechanics                  |
| 78 | Optics, electromagnetic theory   |
| 80 | Classical thermodynamics, heat transfer |
| 81 | Quantum theory                   |
| 82 | Statistical mechanics, structure of matter |
| 83 | Relativity and gravitational theory |
| 85 | Astronomy and astrophysics       |
| 86 | Geophysics                       |
| 90 | Economics, operations research, programming, games |
| 92 | Biology and other natural sciences, behavioral sciences |
| 93 | Systems theory, control          |
| 94 | Information and communication, circuits |
The prize is awarded each year to an undergraduate student (or students having submitted joint work) for outstanding research in mathematics. Any student who is an undergraduate in a college or university in the United States or its possessions, or Canada or Mexico, is eligible to be considered for this prize.

The prize recipient's research need not be confined to a single paper; it may be contained in several papers. However, the paper (or papers) to be considered for the prize must be submitted while the student is an undergraduate; they cannot be submitted after the student's graduation. The research paper (or papers) may be submitted for consideration by the student or a nominator. All submissions for the prize must include at least one letter of support from a person, usually a faculty member, familiar with the student's research. Publication of research is not required.

The recipients of the prize are to be selected by a standing joint committee of the AMS, MAA, and SIAM. The decisions of this committee are final. The 1997 prize will be awarded for papers submitted for consideration no later than March 31, 1997, by (or on behalf of) students who were undergraduates in December 1996.

Nominations and submissions should be sent to:

Morgan Prize Committee
c/o Robert M. Fossum, Secretary
American Mathematical Society
University of Illinois
Department of Mathematics
1409 West Green Street
Urbana, IL 61801-2975

Questions may be directed to the chairperson of the Morgan Prize Committee:

Martha J. Siegel
Department of Mathematics
Towson State University
Towson, MD 21204-7097
telephone 410-830-2980
e-mail: siegel-m@toe.towson.edu
Call for Nominations

The selection committees for these prizes request nominations for consideration for the 1998 awards. Further information about these prizes is included with the Bylaws, which can be found in the November 1995 Notices, pp. 1317-1332 (also available at http://www.ams.org/notices/, then go to November 1995, "From the AMS” section, and then to “Bylaws of the AMS”).

Three Leroy P. Steele Prizes are awarded each year in the following categories: (1) the Steele Prize for Lifetime Achievement: for the cumulative influence of the total mathematical work of the recipient, high level of research over a period of time, particular influence on the development of a field, and influence on mathematics through Ph.D. students; (2) the Steele Prize for Mathematical Exposition; for a book or substantial survey or expository-research paper; and (3) the Steele Prize for Seminal Contributions to Research: for a paper, whether recent or not, that has proved to be of fundamental or lasting importance in its field, or a model of important research.

The Award for Distinguished Public Service is presented every two years to a research mathematician who has made a distinguished contribution to the mathematics profession during the preceding five years.

The George David Birkhoff Prize is awarded every five years for an outstanding contribution to applied mathematics in the highest and broadest sense. The award is made jointly by the American Mathematical Society and the Society for Industrial and Applied Mathematics. The recipient must be a member of one of these societies and a resident of the United States, Canada, or Mexico.

Nominations with supporting information should be submitted to the Secretary, Robert M. Fossum, Department of Mathematics, University of Illinois, 1409 West Green Street, Urbana, IL 61801. For Steele and Birkhoff Prizes, include a short description on the work that is the basis of the nomination, including complete biographic citations. For Public Service Award, include a short description of the pertinent activities of the nominee. A curriculum vitae should be included for all nominees. The nominations will be forwarded by the Secretary to the appropriate prize selection committee, which will, as in the past, make final decisions on the awarding of prizes.

Deadline for nominations is March 31, 1997.
Reference

The Reference section of the Notices is intended to provide the reader with frequently sought information in an easily accessible manner. New information is printed as it becomes available and is referenced after the first printing. As soon as information is updated or otherwise changed, it will be noted in this section.

Upcoming Deadlines

March 31, 1997: Deadline for applications for postdoctoral grants from the Mittag-Leffler Institute for the program years 1997-1998. Direct e-mail inquiries to Börn Engquist (engquist@nada.kth.se) or Vidar Thomée (thomee@math.chalmers.se).

March 31, 1997: Deadline for nominations for Leroy P. Steele Prizes, Distinguished Public Service Award, George David Birkhoff Prize in Applied Mathematics, Frank and Brennie Morgan Prize. Robert M. Fossum, Dept. of Mathematics, Univ. of Illinois, 1409 West Green Street, Urbana, IL 61801-2975.


April 15, August 15, 1997: Deadline for applications for NRC Resident, Cooperative, and Postdoctoral Research Associateship Programs. Information and application materials: e-mail: rap@nas.edu; World Wide Web http://www.nas.edu/rap/welcome.html.


Where to Find It

A brief index to information which appears in this and previous issues of the Notices.

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March 1997

10-12 Workshop on Scientific Computing 97, Hong Kong. (Oct. 1996, p. 1203)


10-15 Workshop on Calugero-Moser-Sutherland Models, Centre de recherches mathématiques (CRM), Université de Montréal, Canada. (Feb. 1997, p. 259)


13-14 21st SPEEDUP Workshop on Distributed Computing: HP Capabilities at the Desktop for Everybody, Hotel Cadro Panoramica, Cadro-Lugano, Switzerland. (Feb. 1997, p. 259)


14-17 Eighth SIAM Conference on Parallel Processing for Scientific Computing, Hyatt Regency Minneapolis on Nicollet Mall, Minneapolis, Minnesota. (Nov. 1996, p. 1383)

17-21 Fields Institute Workshop on Model Theory of Analytic Functions, The Fields Institute, Toronto, Ontario, Canada.

Purpose: Workshop concentrates on applications of model theory to real analytic geometry. There will be survey talks on the relevant areas of model theory and real analytic geometry, as well as talks on current developments.

Topics: O-minimality, model theory and exponentiation, logarithmic-exponential series, subanalytic geometry, Pfaffian geometry, analogs in rigid analytic geometry, and new o-minimal expansions of the reals.

Organizers: L. van den Dries (Univ. of Illinois at Urbana-Champaign), A. Macintyre (Oxford Univ.), D. Marker (Univ. of Illinois at Chicago).

Information: This workshop is part of the 1996-97 program on Algebraic Model Theory at The Fields Institute. Visit http://www.fields.utoronto.ca for more information, or e-mail: analyticfields.utoronto.ca for registration information.


17-21 Workshop on the Bispectral Problem, Centre de Recherches Mathématiques, Université de Montréal, Montreal, Quebec, Canada. (Feb. 1997, p. 259)


21-22 Southeastern Section, University of Memphis, Memphis, Tennessee. (Dec. 1996, p. 1356)


Organizing Committee: K. Kato, V. Kolyvagin, T. Ono, and T. Shioda.

Information: Department of Mathematics, University of Central Florida, Orlando, Florida.

This section contains announcements of meetings and conferences of interest to any segment of the mathematical public, including ad hoc, local, or regional meetings, and meetings and symposia devoted to specialized topics, as well as announcements of regularly scheduled meetings of national or international mathematical organizations. A complete listing of meetings of the Society, and of meetings sponsored by the Society, will be found on the first page of the Meetings and Conferences section.

An announcement will be published in the Notices if it contains a call for papers and specifies the place, date, subject (when applicable), and the speakers; a second announcement will be published only if there are changes or necessary additional information. Once an announcement has appeared, the event will be briefly noted in every third issue until it has been held and a reference will be given in parentheses to the month, year, and page of the issue in which the complete information appeared. Asterisks (*) mark those announcements containing new or revised information.

In general, announcements of meetings and conferences held in North America carry only the date, title of meeting, place of meeting, names of speakers (or sometimes a general statement on the program), deadlines for abstracts or contributed papers, and source of further information. Meetings held outside the North American area may carry more detailed information. In any case, if there is any application deadline with respect to participation in the meeting, this fact should be noted. All communications on meetings and conferences in the mathematical sciences should be sent to the Editor of the Notices in care of the American Mathematical Society in Providence or electronically to notices@ams.org or mathcal@ams.org.

In order to allow participants to arrange their travel plans, organizers of meetings are urged to submit information for these listings early enough to allow them to appear in more than one issue of the Notices prior to the meeting in question. To achieve this, listings should be received in Providence six months prior to the scheduled date of the meeting.

The complete listing of the Mathematics Calendar will be published only in the September issue of the Notices. The March, June, and December issues will include, along with new announcements, references to any previously announced meetings and conferences occurring within the twelve-month period following the month of those issues. New information about meetings and conferences that will occur later than the twelve-month period will be announced once in full and will not be repeated until the date of the conference or meeting falls within the twelve-month period.

The Mathematics Calendar, as well as Meetings and Conferences of the AMS, is now available electronically through e-MATH on the World Wide Web. To access e-MATH, use the URL: http://e-math.ams.org/ (or http://www.ams.org/). (For those with VT100-type terminals or for those without WWW browsing software, connect to e-MATH via Telnet (telnet e-math.ams.org; login and password e-math) and use the lynx option from the main menu.)

23-27 Current Trends In Algebraic Topology With Applications To Algebraic Geometry and Theoretical Physics, Northwestern University, Evanston, Illinois. (Feb. 1997, p. 250)


Focus: This workshop will focus on new developments and directions at the interface between statistical physics and the fields of discrete probability, combinatorics, information theory and theoretical computer science. The workshop will bring together both established and young researchers in various fields with the intention of developing a common language and recognizing parallels among the fundamental problems being addressed by these researchers.

Organizers: J. T. Chayes, jchayes@math.ucla.edu and D. Randall, randall@math.gatech.edu.

Sponsors: DIMACS, JAS.


23-29 Georgia Tech-UBA International Conference on Differential Equations and Mathematical Physics, Georgia Institute of Technology, Atlanta, Georgia. (Oct. 1996, p. 1204)

24-28 CIMAF’97 International Conference on Science and Technology for Development, International Conference Center of Havana, Cuba. (June 1996, p. 701)


April 1997

1-July 10 Algebraic Logic and Model Theory Semester, Cen­tre de Recerca Matematica, Barcelona, Spain. (Jan. 1997, p. 54)

1-3 IMACS Seminar on Monte Carlo Methods, Brussels, Belgium. (July 1996, p. 793)


2-4 British Topology Meeting, Mathematical Institute, Oxford University, England. (Feb. 1997, p. 260)


3-5 Thirty-First Biennial Kappa Mu Epsilon National Convention, Springfield, Missouri. (Jan. 1997, p. 54)


4-5 21st Annual Meeting, Southeast­Atlantic Section of SIAM. North Carolina State University, Raleigh, North Carolina. (Jan. 1997, p. 54)

5-13 Workshop on General Combinatorial Group Theory, Centre de recherches mathematiques (CRM), Universite de Mon­tral, Quebec, Canada. (Feb. 1997, p. 260)

6-11 Eighth Copper Mountain Conference on Multigrid Methods, Copper Mountain, Colorado.

Information: For information such as registration, author instructions, and lodging arrangements including a lodging bulletin board, please access http://www.math.colorado.edu/80/appm/faculty/copper/. You may also contact us by e-mail at ca97@boulder.colorado.edu.


11-13 Southwest Dynamical Systems Conference, University of North Texas, Denton, Texas. (Nov. 1996, p. 1383)

12-13 Eastern Section, University of Maryland, College Park, Maryland. (Dec. 1996, p. 1556)

14-16 Bring Your Own Code Workshop on the Parallel Solution of PDEs, Cornell Theory Center, Cornell University, Ithaca, New York.

Sponsors: Cornell Theory Center, Institute for Computer Applications in Science & Engineering, Argonne National Laboratory.

Focus: A workshop designed for computational engineers and scientists with an interest in distributed computation for large-scale problems in partial differential equations. The workshop will introduce participants to PETSc, the Portable, Extensible Toolkit for Scientific Computation. It will consist of a day of presentations by PETSc developers and users and two days of "hands-on" coaching to port codes brought by participants to parallel machines.

Information: For additional information, including registration form visit: http://www.tc.cornell.edu/edu/Workshops/PDE97/ apr/index.html or contact A. Levy, Conference Assistant, Cornell Theory Center; tel: 607-254-8686; e-mail: alevy@tc.cornell.edu.


19-20 AMS Western Sectional Meeting, Oregon State University, Corvallis, Oregon. (Dec. 1996, p. 1550)


21-25 SPIE's 1997 International Symposium on Aerospace/Defense Sensing and
May 1997

2-4 AMS Central Sectional Meeting, Wayne State University, Detroit, Michigan. (Dec. 1996, p. 1557)


5-6 Sixth Workshop on Hot Topics in Operating Systems (HotOS-VI), The Wequasset Inn, Chatham (Cape Cod), Massachusetts. (Jan. 1997, p. 55)

5-11 Fields Institute Workshop on Geometry and Complexity, The Fields Institute, Toronto, Ontario, Canada.

Purpose: This workshop will be a synergetic meeting intended to bring together researchers interested in various algorithmic and constructive aspects of geometry, topology, geometric group theory, and related subjects.

Organizers: A. Khojanskii (Univ. of Toronto), A. Nabutovsky (Univ. of Toronto).

Information: This workshop is part of the January-June 1997 program on Singularity Theory and Geometry at The Fields Institute. Visit http://www.fields.utoronto.ca for more information, or e-mail: complex@fields.utoronto.ca for registration information.


12-July 18 Variational Problems and Applications, Universita' di Napoli, Italy. (Jan. 1997, p. 55)

13-16 Intl. Conf. on Analytic Tableaux and Related Methods (TABLEAUX'97), Abbaye des Premontres, Pont-a-Mousson, France. (Nov. 1996, p. 1383)

15-17 DIMACS Workshop on Combinatorial Optimization and Disordered Materials: Recent Progress and Algorithmic Challenges, DIMACS Center, Rutgers University, Piscataway, New Jersey. (Feb. 1997, p. 261)

16-17 Third Mississippi State Conference on Differential Equations & Computational Simulations, Mississippi State University, Mississippi State, Mississippi.

Organizers: Department of Mathematics and Statistics and NSF Engineering Research Center, Mississippi State University.


Principal Speakers: W. Allegretto (Univ. of Arkansas, Canada), J. L. Bona (Univ. of Texas), D. de Figueiredo (Univ. of Campinas, Brazil), S. Godunov (Sobolev Institute of Mathematics, Russia), A. Jameson (Princeton Univ.), J. Mawhin (Univ. of Louvain, Belgium), S. Osher (Univ. of California), K. Schmitt (Univ. of Utah), J. Shang (Wright Patterson Air Force Base).

Forum: This is an interdisciplinary conference involving theoretical and applied developments in differential equations and computational simulations. In addition to the nine principal lectures, there will be sessions of contributed talks.

Abstracts: Abstracts for contributed papers should be submitted electronically no later than March 11, 1997, to the program chairman, J. Zhu, jzhu@math.msstate.edu.

Information: For further information on the conference organization, program, and submission of abstracts, visit the conference home page at http://www.math.msstate.edu/Dept/Math/conf.html or contact the organizers: R. Shivaji, Dept. of Mathematics & Statistics, Mississippi State, MS 39762; shivaji@math.msstate.edu; tel: 601-325-3414; fax: 601-325-0005; R. Soni, NSF Engineering Research Center, Mississippi State, MS 39762; bsoni@erc.msstate.edu; tel: 601-325-8278; fax: 601-325-7692.

16-17 Symposium in Honour of Professor W. T. Tutte's 80th Birthday, University of Waterloo, Waterloo, Ontario, Canada. (Feb. 1997, p. 261)

17-18 Sixth Southern California Geometric Analysis Seminar, Mathematics Department, University of California, Irvine, California.


Support: Some support is available for graduate students and postdocs. The SCGAS particularly encourages the participation of women and members of underrepresented groups.

Information: Contact R. Wentworth, Department of Mathematics, University of California, Irvine, Irvine, CA 92697-3875; math.uci.edu; fax: 714-824-7993; WWW home page: http://www.math.uci.edu/SCGAS.html.


19-30 Experimental Mathematics and Combinatorics, Centre de recherches mathématiques (CRM), Université de Montréal, Québec, Canada.

20-22 International Conference Yerungsiyevi chteniya-IV, Vitebsk, Belarus.


Organizers: Ministry of Education and Science Belarus, Belarusian Mathematical Society, Belarusian State University, Institute of Mathematics of Academy of Sciences of Belarus, Vitebsk State University.

Information: For further information contact A. L. Gladkov, e-mail: gladkov@vgpl.vitebsk.belpak.by.

21-23 Sixth Viennese Workshop on Optimal Control, Dynamic Games and Nonlinear Dynamics Theory and Applications in Economics and OR/MS, Vienna, Austria. (July 1996, p. 794)


22-23 Nineteenth Symposium on Mathematical Programming with Data Perturbations, The George Washington University, Washington, DC.

Objective: The objective is to bring together practitioners who use mathematical programming optimization models and deal with questions of sensitivity analysis with researchers who are developing techniques applicable to these problems.

Contributed Papers: Contributed papers in mathematical programming are solicited in the following areas: sensitivity and stability analysis and their applications, solution methods for problems involving implicitly defined functions, solution methods for problems involving deterministic or stochastic parameter changes, solution approximation techniques and error analysis. "Clinical" presentations that describe problems in sensitivity analysis encountered in applications are also invited.


Registration Fee: US$50 payable at the meeting.

Information: To register and/or submit an abstract, please use the electronic form at the URL: http://rutcor.rutgers.edu:80/"birsrael/MPPD-19.html#form, or mail...


Focus: The objective of this symposium is to bring together researchers from various fields actively involved in the area of differential-algebraic equations (DAE). The symposium is organized by the Computer Algebra Team of the Laboratoire de Modelisation et Calcul, Institut de Mathematiques Appliques de Grenoble (IMAG).

Themes: Mathematical tools (index, canonical forms, singularities...), algebraic algorithms and computation, numerical methods, software for the analysis and integration of DAEs, applications (physical, mechanics, chemistry, control...).

Invited Speakers: S. L. Campbell (N. Carolina State Univ.), B. J. Leimkuhler (Univ. of Kansas), R. Marz (Humboldt Univ., Berlin), S. Reich (Konrad-Zuse Zentrum, Berlin).

Abstracts: Send a one-page abstract or a full paper (10 pages maximum) before the end of March 1997.

Information: For information please contact: DAE 97, R. Coleman, Equipe de Calcul Formal, Laboratoire LMC, 46 Av. Felix Viallet, F38031 Grenoble Cedex, France. tel: +33-4-76-57-48-69; fax: +33-4-76-57-48-03; e-mail: dae97@imag.fr; WWW: http://wu.wu.imag.fr/dae97/.

26-29 The International Conference on Mathematical Biology, Hangzhou, China. (June 1996, p. 702)


27-28 Workshop on Computational Science and Engineering, Hefei, China. (Jan. 1997, p. 56)

27-30 17th International Conference on Distributed Computing Systems, Switcher Hotel, Baltimore, Maryland. (July 1996, p. 794)

27-30 Asilomar Conference on Radial Basis Functions, Asilomar Conference Center, Pacific Grove, California.

Focus: Radial basis functions are becoming widely used in neural networks, approximations, interpolation, partial and integral differential equations, etc. It is anticipated that this conference will be an excellent opportunity for theoreticians and practitioners to meet and exchange ideas in a setting conducive to in-depth discussion.

Information: If you are not presently on the distribution list, please send your e-mail address (or regular mail, if necessary), to get the housing form and other information about the meeting. R. Franke, Mathematics Dept., Naval Postgraduate School, Monterey, CA 93943-5216; e-mail:franke@nps.navy.mil; E. J. Kansa, Mail Stop L-200, Lawrence Livermore Nat. Lab., Livermore, CA 94551-9900; e-mail: kansa111ll.gov.


28-31 Mathematical Models in Medical and Health Sciences, Vanderbilt University, Nashville, Tennessee. (Jan. 1997, p. 56)

29-31 Symposium on Current and Future Challenges in the Applications of Mathematics, Brown University, Providence, Rhode Island.

Focus: To mark the fiftieth anniversary of the establishment of its Division of Applied Mathematics, a symposium, supported by the Sloan Foundation, on "Current and Future Challenges in the Applications of Mathematics" will be held at Brown University on Thursday, May 29, through noon, Saturday, May 31, 1997. For information about the symposium, including how to obtain accommodation, etc. please contact David Mumford or Walter Freiberger at Brown Univ., Providence R.I. 02912, by mail, fax(401-863-1355) or e-mail: Walter.Freiberger@brown.edu.

Speakers: The following have accepted invitations to speak at the symposium: Sir Michael Atiyah O.M., F.R.S., Robert Azencott, John Ball F.R.S., Alexandre Chorin, Persi Diaconis, James Glimm, Ulf Grenander, Nancy Kopell, Peter Lax, Pierre-Louis Lions, Stephen A. Ross, Peter W. Shor, J. Trevor Stuart F.R.S.

Information: For more information as it becomes available, please contact one of the organizers by mail, fax, or e-mail: D. Mumford, Mumford@brown.edu; W. Freiberger, Walter.Freiberger@brown.edu; fax: 401-863-1355; address: Division of Applied Mathematics, Brown University, Providence, RI 02912.

29-June 1 Prague-Czechon-Torun Algebra Symposium, Nicholas Copernicus University, Torun, Poland. (Feb. 1997, p. 262)

29-June 1 CAMS/SCMA 18th Annual Meeting, The Fields Institute, Toronto, Ontario, Canada.

Features: One-day short course on cryptography and data security (May 29), featuring R. Mullin (ICR Data Encryption Group), B. Di Stefano (Nuptek Systems Ltd.); annual CAMS/SCMA Doctoral Dissertation Award Lecture; poster session, with a prize for the best graduate student poster; coordination with the 1997 Canadian Workshop on Information Theory, held at Fields Inst., June 3-6, 1997.

Plenary Lecturers: M. Barnsley (Iterated Systems), B. Char (Drexel Univ.), M. Fortin (Univ. de Laval), P. Gwynn (Stanford Univ.), W. Newman (Univ. of California at Los Angeles), G. Papanicolaou (Stanford Univ.), A. Perelson (Los Alamos Nat’l Lab.), C. Rackoff (Univ. of Toronto), T. Shepherd (Univ. of Toronto), M. Wright (Bell Labs); Banquet Address: J. Casti (Santa Fe Inst.).


Co-hosts: Univ. of Guelph, Univ. of Western Ontario, Fields Inst. for Research in Mathematical Sciences.

Information: For more information contact CAMS97@fields.utoronto.ca and see http://www.fields.utoronto.ca/cams97.html.

June 1997

1-5 ITICSE’97 Integrating Technology into Computer Science Education, Uppsala, Sweden. (Jan. 1997, p. 56)

1-6 1997 NSF Calculus Reform Workshop: Integrated/Core Approach to Calculus, Location to be announced.

Program: In January 1985 at the Anaheim Math Meetings, the AMS/MAA panel on "Calculus Instruction, Crucial But Ailing" launched a movement to reform the way calculus is taught in this country. Numerous reform programs have been developed, several with seed money from the NSF, in which content has been streamlined, applications have been stressed, technology has been exploited, and pedagogy has been changed. Small group projects, writing assignments, multiple representation of functions, and a renewed emphasis on learning how to learn mathematics are characteristics of these reform programs.

The NSF sponsors a program of 5-day Calculus Reform Workshops. The program, directed by D. Small, U.S. Military Academy, seeks to disseminate the fruits of the reform programs on a national level. All expenses, except for participant travel, will be paid by the NSF.

Topics: The following five important threads will be woven through the work-
shop: 1. history and present state of the Calculus Reform Movement; 2. participant involvement as a student under the pedagogy being promoted by the Calculus Reform Movement; 3. in-depth experience in the reform program associated with the workshop instructors and a general overview of the major reform programs; 4. experience in the use of technology for teaching mathematics; 5. participant input ("My favorite problem", development of a curriculum topic, etc.).

Local Coordinator: J. Wilkerson, Dept. of Math., 4525 Downs Dr., Missouri Western St., St. Joseph, MO 64507; tel: 816-271-4374. Information: For more information, contact the local coordinator or contact D. Small, Dept. of Mathematical Sciences, USMA, West Point, NY 10996.

1–6 Seventh International Workshop in Analysis and its Applications (IWAAN), University of Maine, Orono, Maine. (Feb. 1997, p. 262)

1–7 Spring School on Analysis, Paseky, Czech Republic. (Feb. 1997, p. 262)

2–4 8th Intl Conf on Rewriting Techniques and Applications (RTA-97), Sitges, Barcelona, Spain. (Nov. 1996, p. 1384)

2–6 ISAAC Congress, University of Delaware, Newark, Delaware. (Sept. 1996, p. 1204)

2–6 Partial Differential Equations Meeting, Saint Jean de Monts, France.


Lodging: The Village Vacances Familles of St. Jean de Monts will provide lodging facilities.

Information: G. Métivier, IRMAR-Université de Rennes I, Campus de Beaulieu 35 042, Rennes cedex, France; tel: 02-99-28-60-10; fax: 02-99-28-67-50; e-mail: metivier@univ-rennes1.fr.


Participants: The school is intended for mathematicians, metallurgists, geophysicists, and researchers in related areas at the postdoctoral level who work with dynamical mixed phase systems. Participants will be expected to take part in the whole three-week program. The number taking the advanced school will be restricted to about twelve.

Admission: To apply for the advanced school, please complete the application form on the I.C.M.S. Web site, http://www.ma.hw.ac.uk/icms/, and send it to the organizer by February 28, 1997. The scientific committee will select participants based on the applications. The school and workshop are free of charge, but there will be a small conference fee. A limited number of participants from universities and academies who are not supported by their institutions may be offered travel and subsistence support.

Organizer: R. N. Hills, Department of Mathematics, Heriot-Watt University, Riccarton, Edinburgh EH14 4AS, U.K.; e-mail: r.n.hills@benalys.hw.ac.uk.

6–8 Annual Meeting, Canadian Society for History and Philosophy of Mathematics, Memorial University of Newfoundland, St. John’s, Newfoundland.

Special Theme: Mathematics and Science.

Invited Speaker: R. Thiele (Leipzig).

Deadline: Deadline for abstracts of contributed papers: March 1, 1997.

Program Chair: T. Drucker, 304 South Hanover St., Carlisle, PA 17013; tel: 717-243-1331.

Information: G. Van Brummelen (secretary/treasurer), gvanbrum@kingssu.ab.ca, tel: 403-465-3500, fax: 403-465-3534.

7–9 CMS Summer 1997 Meeting, University of Manitoba, Winnipeg, Manitoba. (Feb. 1997, p. 262)

9–13 1997 NSF Calculus Reform Workshop: Calculus Reform: Activities and Projects, Location to be announced.

Program and Topics: See entry for June 1–6, this issue, page 372.

Local Coordinator: A. Flue llen, Chair, Dept. of Math. Sciences, Clark Atlanta Univ., Atlanta, GA 30314; tel: 404-880-8007; fax: 404-880-8109.

Information: For more information, contact the local coordinator for the workshop or contact D. Small, Dept. of Mathematical Sciences, U.S. Military Academy, West Point, NY 10996; small@euler.math.usma.edu; tel: 914-938-2227; fax: 914-938-2409.


Chairman: N. Yanov, Institute of Mathematics and Informatics, Bulgarian Academy of Sciences, 1113 Sofia, Bulgaria; e-mail: iasp@math.acad.bg; Web page: http://www.math.acad.bg/~iasp/iasps97.html.

Invited Lecture: M. Neuts (Tucson, Arizona), A. Roualt (Versailles, France), and E. Waymire (Corvallis, Oregon).

8–13 1997 NSF Calculus Reform Workshop: Calculus Reform: Activities and Projects, Location to be announced.

Program and Topics: See entry for June 1–6, this issue, page 372.

Local Coordinator: A. Flue llen, Chair, Dept. of Math. Sciences, Clark Atlanta Univ., Atlanta, GA 30314; tel: 404-880-8007; fax: 404-880-8109.

Information: For more information, contact the local coordinator for the workshop or contact D. Small, Dept. of Mathematical Sciences, U.S. Military Academy, West Point, NY 10996; small@euler.math.usma.edu; tel: 914-938-2227; fax: 914-938-2409.


9–13 Workshop: Homotopy and Geometry, Banach Center, Warsaw, Poland. (Jan. 1997, p. 56)

9–20 Algebraic Combinatorics, Centre de recherches mathématiques, Université de Montréal, Québec, Canada. (Feb. 1997, p. 262)

11–13 IRREGULAR’97 4th International Symposium on Solving Irregularly Structured Problems in Parallel, University of Paderborn, Germany.

Scope: The symposium focuses on algorithmic and system aspects arising in the development of efficient parallel solutions to irregularly structured problems. It aims, in particular, at fostering the cooperation among practitioners and theoreticians of the field.

Topics: Papers are solicited in all research areas related to the parallelism of irregular problems, including but not limited to: algorithms and models, applications, approximation and randomization, automatic program synthesis, combinatorial optimization, compiling, imaging, load balancing, memory management, parallel data structures, scheduling and mapping, sparse matrices, symbolic computation, tree-structured computations.

Invited Speakers: C. Leiserson (MIT), B. Monien (Univ. of Paderborn), F. Meyer auf
Program and Topics: See entry for June 1-6, this issue, page 372.
Local Coordinator: T. Bailey, Dept. of Math., Ohio State Univ., Columbus, OH 43210; tel: 614-292-2254.

For more information, contact the local coordinator for the workshop or contact D. Small, Dept. of Mathematical Sciences, U.S. Military Academy, West Point, NY 10996; small@euler.math.usma.edu; tel: 914-938-2227; fax: 914-938-2409.


16-18 Fifth Bar-Ilan Symposium on Foundations of Artificial Intelligence, Bar-Ilan University, Ramat-Gan, Israel. (Feb. 1997, p. 263)


16-18 Fourth SIAM Conference on Mathematical and Computational Issues in the Geosciences (tentative), Albuquerque, New Mexico. (June 1996, p. 702)

16-20 First International Conference on Problems of Logic-Linguistic Control (DOLLC-97), St. Petersburg, Russia. (Jan. 1997, p. 57)


16-20 Topological Fixed Point Theory and Topological Methods in Nonlinear Analysis, Cortona, Italy. (Feb. 1997, p. 263)

16-27 Workshop on the Conley Index Theory, Stefan Banach International Mathematical Center, Warsaw, Poland.

19-21 Lehigh University Conference on Geometry and Topology, Lehigh University, Bethlehem, Pennsylvania. (Feb. 1997, p. 263)

21-22 The Second Asian Technology Conference in Mathematics (ATCM-2), Universiti Sains Malaysia, Penang, Malaysia. (Sept. 1996, p. 1057)


22-27 1997 NSF Calculus Reform Workshop: An Active Approach with Projects, Location to be announced.

Program and Topics: See entry for June 1-6, this issue, page 372.

For more information, contact the local coordinator for the workshop or contact D. Small, Dept. of Mathematical Sciences, U.S. Military Academy, West Point, NY 10996; small@euler.math.usma.edu; tel: 914-938-2227; fax: 914-938-2409.

22-28 Advanced Numerical Approximation of Nonlinear Hyperbolic Equations, Cetraro (Cosenza), Italy.

Director: A. Quarteroni (Politecnico di Milano).

Speakers: B. Cockburn (Univ. of Minnesota, Minneapolis), Discontinuous Galerkin methods for nonlinear conservation laws; C. Johnson (Chalmers Univ. of Technology, Göteborg, Sweden), Adaptive methods for differential equations with application to compressible low problems; C.-W. Shu (Brown Univ., Providence), Essentially non-oscillatory (ENO) and weighted, essentially non-oscillatory (WENO) schemes for hyperbolic conservation laws; E. Tadmor (UCLA and Tel Aviv Univ.), High-resolution methods for the approximate solution of nonlinear conservation laws and related equations.

Information: C.I.M.E., c/o Dipartimento di Matematica “U. Dini”, v. le Morgagni 67/A, 50134 Firenze, Italy; tel: 39-55-434975; fax 39-55-434975, 4222695; e-mail: cime@udini.math.unifi.it; http://www.math.unifi.it/CIME/Welcome.to.CIME.

23-25 Third International Conference on Coastal Engineering (COASTAL 97), La...
Coruña, Spain. (Dec. 1996, p. 1557)


23-27 Reform Calculus Short Course: Calculus Enhanced with Computer-Algebra and Graphing Using the TI-92, University of Massachusetts, Amherst, Massachusetts. (Feb. 1997, p. 263)


24-27 Nonlinear Modeling and Control, An International Seminar, Nayanova University, Samara, Russia.

Languages: English and Russian.

Invited Speakers: V. Gol'dstein (Beer-Sheva), M. Krasnosel'skii (Regensburg, Moscow), A. Krasovskii (Moscow), V. Matrosov (Moscow), A. McIntosh (Leeds), Yu. Reshetnyak (Novosibirsk), G. Rizhichenko (Moscow), K. Schneider (Berlin), G. Sivashinsky (New York), Tel-Aviv), V. Yakubovich (St. Petersburg).

Purpose: The seminar's aim is the exchange of information about recent trends in mathematical modeling and control theory and their applications to various problems in physics, chemistry, biology, medicine, economy, and industrial concerns.

Call for Papers: Original papers related to the aim of the seminar are solicited. Potential speakers should submit an abstract before April 30. The cover page should contain title, affiliation, and e-mail address of each author. Electronic submissions in PostScript format are encouraged.

Sponsors: Nayanova University, Samara State University, Russian Academy of Natural Sciences, International Federation of Nonlinear Analysts.

Information and Submissions: V. Sobolev (organizer) or He. Gorelova (seminar coordinator), e-mail: modeling@nau.samara. ennet.ru; Nayanova University, Molodogvardeiskaia 196, Samara, 443001, Russia.

24-27 17th Biennial Conference on Numerical Analysis, University of Dundee, Scotland. 

Invited Lecture: The special invited lecture in honour of A. R. Mitchell will be presented by G. Strang.


Information: Details of registration/accommodation fees are now available either by accessing the conference Web page/ftp site: WWW; http://www.aca.dundee.ac. uk:8080/~naco/; ftp address: ftp.aca. dundee.ac.uk ftp directory: pub/naco/conf or by contacting e-mail preferred D. F. Giffiths, Numerical Analysis Conference, Dept. of Mathematics and Computer Science, The University, Dundee DD1 4HN, Scotland, UK; tel: +44-1382-344674/34471; fax: +44-1382-345516; e-mail: na.griffiths@ma-net.orl.gov, dfg@nc.ac.dundee.ac.uk. These details have already been circulated to those on the conference e-mailing list, but there have been problems with outdated e-mail addresses that have caused many messages to be bounced.

24-29 Chance Workshop, Dartmouth College, Hanover, New Hampshire. (Jan. 1997, p. 57)

24-30 International Algebraic Conference Dedicated to the Memory of D. K. Faddeev, St. Petersburg, Russia. (Feb. 1997, p. 264)


30-July 3 Conference in Operator Theory in Honour of Moshe Livsic's 60th Birthday, Ben-Gurion Univ. of the Negev, Beer-Sheva, Israel.

Organizers: D. Alpay (dany@math.bgu. ac.il), V. Vinnikov (vinnikov@wolfram. wellmann.ac.il), Information: Conference WWW page:http://www.cs.bgu.ac.il/~dany/conf.html.

30-July 8 Quantum Cohomology, Cetraro (Cosenza), Italy.

Course Directors: P. De Bartolomeis (Univ. di Firenze), B. Dubin (SISSA, Trieste), C. Reina (SISSA, Trieste)

Speakers: M. Gromov (IHES), GW-invariants; D. Salomon (Univ. of Warwick), J-form; holomorphic curves and symplectic geometry; C. Taubes (Harvard), 4-dimensional symplectic geometry; G. Tian (MIT), Quantum cohomology and WDVV equations; E. Witten (Princeton), SW-invariants.

Information: C.I.M.E., c/o Dipartimento di Matematica “U. DINE”, v. le Morgagni 67/A, 50134 Firenze, Italy; tel +39-55-434975; fax +39-55-434975, 4222695; e-mail: cime@udini.math.unifi.it; http://www.math.unifi.it/CIME/Welcome.to. CIME/.

*30-July 9 International Number Theory Conference, Zakopane-Koscielisko, Poland.

Topics: Diophantine problems and polynomials: elementary and analytic number theory.

Dedication: Dedicated to A. Schinzel on the occasion of his 60th birthday.

Local Organizers: J. Browkin (Warsaw), W. Narkiewicz (Wrocław), J. Urbanowicz (Warsaw).


July 1997


*2-6 International Conference on Nonlinear Phenomena in Dynamical Systems and Variational Problems, Methods and Applications, Whitehorse, Yukon, Canada.

Organizing Committee: S. Alama (McMaster), N. Ghousoub (British Columbia), C. Gui (British Columbia), W. Krawcewicz (Alberta), J. Mawhin (Louvain), J. Macki (Alberta), H. Smith (Arizona State), and P. Zecca (Firenze).

Focus: This conference will be devoted to various aspects of dynamical systems and variational problems involving nonlinear phenomena connections to bifurcation theory; functional/ordinary/partial differential equations, with particular focus on topological and geometrical methods; applications to mathematical biology; optimization and mathematical physics.

Invited Speakers: B. Venci (Pisa), S.-N. Chow (Georgia Tech), E. N. Dancer (Sydney), M. DeFouer (Montreal), H. M. Hastings (Hofstra), J. Zee (U.N.A.M.), J. Kennedy (Univ. Delaware), J. Mallet-Paret (Brown), J. Mawhin (Louvain), V. Obukhovskii (Voronezh), P. H. Robinowitz (Univ. Wisconsin), R. T. Rock-
The Mathematics Calendar

4-9 International Conference on Mathematical Methods for Curves and Surfaces, Lillehammer, Norway.

Focus: The conference will focus on spline and Bézier methods for curve and surface approximation, scattered data modeling, multidimensional modeling, decomposition techniques and visualization. There will be eighteen invited speakers.

Information: For registration forms or further information, please contact: by e-mail: wkrascev@regu.math.ualberta.ca (W. Krawcewicz), jmacki@gru.srv.ualberta.ca (J. Macki); by mail: Nonlinear Phenomena Conference, Department of Mathematical Sciences, University of Alberta, Edmonton, Alberta, Canada T6G 2G1; by phone: 403-492-0566 (W. Krawcewicz), 403-492-5725 (J. Macki); by fax: 403-492-6826. More conference and travel information, as well as links to various Yukon sites, can be found on our Web site at: http://www.math.ualberta.ca/~yukon97/

7-11 Harmonic Morphisms, Harmonic Maps and Related Topics, Université de Bretagne Occidentale, Brest, France. (Feb. 1997, p. 264)

7-13 Symmetry in Nonlinear Mathematical Physics, Kyiv, Ukraine. (Feb. 1997, p. 264)

7-August 22 (excluding Aug. 11-14) IMA Summer Program: Statistics in the Health Sciences, Institute for Mathematics, Minneapolis, Minnesota. (Jan. 1997, p. 58)

9-11 Computational Fluid Dynamics Workshop, University of Twente, Enschede, The Netherlands. (Jan. 1997, p. 58)


11-12 RANDOM'97, 1st International Symposium on Randomization and Approximation Techniques in Computer Science, University of Bologna, Italy.

Scope: The workshop focuses on algorithmic and complexity aspects arising in the development of efficient randomized solutions to computationally difficult problems. It aims, in particular, at fostering the cooperation among practitioners and theoreticians and among algorithmic and complexity researchers of the field. RANDOM'97 co-locates with ICALP'97.

Topics: Papers are solicited in all research areas related to randomization and approximation, including but not limited to: design and analysis of randomized algorithms, randomized complexity, derandomization techniques, design and analysis of approximation algorithms, complexity of approximation problems, parallel and network algorithms, various applications.


Local Organizers: A. Clementi (Univ. Roma "La Sapienza"), e-mail: clementi@dsi.uniroma1.it.

Information: For further information see: http://www.csie.unige.ch/~ran dom97/.

12-20 Arithmetic Theory of Elliptic Curves, Cetraro (Cosenza), Italy.

Course Director: C. Viola (Università di Pisa).

Speakers: J. Coates (Univ. of Cambridge), Iwasawa theory for elliptic curves without complex multiplication; R. Greenberg (Univ. of Washington), Iwasawa theory for elliptic curves; K. Ribet (Univ. of California at Berkeley), Two-dimensional representations of $\Gamma$; E. Rubin (Ohio State Univ.), Elliptic curves with complex multiplication.

Information: C.I.M.E., c/o Dipartimento di Matematica "U. Dini", V. le Morgagni 67/A, 50134 Firenze, Italy; tel: +39-55-434975; fax +39-55-434975, 4222695; e-mail: cime@udini.math.unifi.it; http://www.math.unifi.it/CIME/Welcome.to.CIME/.


14-18 9th International Conference on Formal Power Series and Algebraic Combinatorics (FPSAC'97), University of Vienna, Vienna, Austria. (Nov. 1996, p. 1384)

14-18 SIAM 45th Annual Meeting, Stanford University, Stanford, California. (June 1996, p. 702)


15-17 Third International Conference on Computer Methods and Experimental Measurements for Surface Treatment Effects (SURFACE TREATMENT 97), St. Edmund Hall, Oxford University, Oxford, UK. (Jan. 1997, p. 58)


20-25 1997 NSF Calculus Reform Workshop: Calculus Resources, Location to be announced.

Program and Topics: See entry for June 1-6, this issue, page 372.


Information: For more information, contact the local coordinator for the workshop or contact D. Small, Dept. of Mathematical Sciences, U.S. Military Academy, West Point, NY 10996; small@euler.math.usma.edu; tel: 914-938-2227; fax: 914-938-2409.


Focus: ISSAC is an annual international symposium that provides an opportunity to learn of new developments and to present original research results in all areas of symbolic mathematical computation.

Topics: Topics of the meetings include, but are not limited to: algorithmic mathematics, computer science, and applications.

Conference Activities: Planned activities include invited presentations, research and survey papers, poster sessions, tutorial courses, vendor exhibits, and software demonstrations. Proceedings will be distributed at the symposium. ISSAC will be held in federation with PASCO'97, the Second International Symposium on Parallel Symbolic Computation. There will be plenary speak-
ers, including some who will address the joint audience. Papers to ISSAC’97 and PASCO’97 are submitted normally to the respective PC chairs. Electronic submission in ftp:// or PostScript form is encouraged.

General Chair: B. Char, Department of Mathematics and Computer Science, Drexel University, 3141 Chestnut Street, Philadelphia, PA 19104; e-mail: isacc97@general_char@macs.drexel.edu; tel: 215-895-2670; fax: 215-895-1582.

22–25 18th IFIP TC7 Conference on System Modelling and Optimization, The Westin Hotel, Renaissance Center, Detroit, Michigan. (Feb. 1997, p. 264)


28–August 8 SMS NATO ASI: Representation Theories and Algebraic Geometry, Université de Montréal, Canada. (Jan. 1997, p. 59)


August 1997


* 1–4 International Conference on Differential Equations and Dynamical Systems, University of Waterloo, Ontario, Canada.

Program Scope: This conference will focus on recent advances in the theory and applications of differential equations and dynamical systems, including ordinary differential equations, partial differential equations, functional differential equations, impulsive differential equations and their corresponding discrete analogs. There will be invited expository addresses, organized special sessions, invited lectures, and contributed talks covering recent trends and problems of current interest and important applications in various disciplines.


*Confirmed speakers

Call for Papers: Contributed papers are invited. Abstracts must be submitted by April 30, 1997.

Registration: An online registration form is available at http://jees@uwatertoo.ca/~deds/register.html.

Conference Coordinators: X. Liu and D. Siegel, Dept. of Applied Mathematics, University of Waterloo, Waterloo, Ontario N2L 3G1, Canada.

Information: Future updates will be posted on the DEDS Web page located at http://jees.uwaterloo.ca/~deds/. For further information please contact us by any of the following means: tel: 519-888-4567 ext. 2700; fax: 519-746-4319; conference e-mail: info@deds@uwatertoo.ca.

1–4 MAA MathFest, Renaissance Atlanta Hotel, Atlanta, Georgia. (Feb. 1997, p. 265)


* 3–8 1997 NSF Calculus Reform Workshop: Oregon State Project, Location to be announced.

Program and Topics: See entry for June 1–6, this issue, page 372.

Local Coordinator: R. Edidin, Dept. of Mathematics, Morgan State University, Cold Spring Lane & Hillen Road, Baltimore, MD 21239-4098; tel: 410-319-3952; fax: 410-319-4323.

Information: For further information, contact the local coordinator for the workshop or contact D. Small, Dept. of Mathematical Sciences, U.S. Military Academy, West Point, NY 10996; small@dulmar.nath.usma.edu; tel: 914-938-2227; fax: 914-938-2409.


* 5–9 1997 NSF Calculus Reform Workshop: Harvard Consortium Project, Location to be announced.

Program and Topics: See entry for June 1–6, this issue, page 372.

Local Coordinator: D. Lomen (Arizona).

Information: For further information, contact the local coordinator for the workshop or contact D. Small, Dept. of Mathematical Sciences, U.S. Military Academy, West Point, NY 10996; small@dulmar.nath.usma.edu; tel: 914-938-2227; fax: 914-938-2409.


Information: A. A. Samarskii, Chairman of Int. Programme Committee. Contacts: F. N. Vabishchevich, Russian Academy of Sciences, Moscow; e-mail: vab@iamod.msk.su; and L. G. Volkov, University of Rouse; e-mail: volkov@rmi.rua.acad.bg.

*11–15 International Conference on Recent Progress in Algebra, Taejon, S. Korea.

Topics: The conference focuses on central topics in algebra which made important contributions in recent progress in algebra, including algebraic geometry, number theory, and combinatorics.

Sponsors: Korea Science and Engineering Foundation, Korea Institute for Advanced Study, and Korea Advanced Institute of Science and Technology.

Invited Speakers: Confirmed: G. Anderson (Minnesota), G. Andrews (Penn State), G. M. Benkart (Wisconsin), T. Chinberg (Univ. Penn), I. Dolgachev (Michagin), A. Elduque (Zaragoza), A. Lubotzky (Israel), C. Martinez (Oviedo), R. v. Moody (Alberta), K. Rubin (Ohio State), E. Taft (Rutgers), E. Zelmanov (Yale); Tentative: G. Frey (Essen), V. F. Jones (Berkeley), C. Procesi (Pisa).

Contributed Talks: The organizers are soliciting contributed talks of 25 minutes duration within the topics of the conference. Abstracts of a half-page prepared in AMS-TeX should be sent electronically or on disks by April 30, 1997, to conference secretary: S. Hahn, e-mail: gopher@math.kai.ac.kr or Department of Mathematics, KAIST, Yusung, Taejon, S. Korea 305-701. Abstracts should contain authors’ affiliations and e-mail addresses.

Information: There will be a registration fee of 40 US$. For further information about the conference, please contact S. Hahn at the above e-mail address or fax: 82-42-869-2710. A registration form may be obtained from the Web page: http://mathnet.kaist.ac.kr/conference/register.html.


13–17 Sixth International Colloquium on Numerical Analysis, Plovdiv, Bulgaria. (Feb. 1996, p. 247)


Purpose: The purpose of this workshop is to stimulate research and, in an informal setting, to foster the interaction of researchers in the interface between matrix theory and statistics. This workshop will provide a forum for statisticians working in the areas of linear algebra and matrix theory to become better informed of the latest developments and newest techniques and to exchange ideas.

Information: For further information on this workshop, please contact H. J. Werner, Institute for Econometrics and Operations Research, Econometrics Unit, University of Bonn, Adenauerallee 24-42, D-53113

24-29 ISMP 97 International Symposium on Mathematical Programming, Swiss Federal Institute of Technology (EPFL), Lausanne, Switzerland. (Oct. 1996, p. 1205)

24-31 Secondary Calculus and Cohomological Physics, Moscow, Russia. Organizers: Moscow State University, Russian Academy of Natural Sciences, and the Diffiety Institute.

Focus: The term secondary calculus refers to such topics as higher symmetries of PDEs, the C- spectral sequence (variational bicomplex) which are secondary analogues of usual vector fields and differential forms, respectively. Recently it became clear that there exist secondary counterparts of all ingredients of the standard calculus which are various type cohomology classes living on infinite prolongations of appropriate equations. Among them are BRST-anti-fields, Batalin-Vilkovisky bracket and similar cohomology constructions which are natural to be called cohomological physics. The conference is thought to be a forum of both mathematicians and physicists to fix the state of the art and perspectives in this extremely promising area.


Accommodation: The Moscow State University is going to offer low-price accommodations and board for the participants of the conference. Exact prices are to be announced.

Information: You can find current information at the conference home page: http://ecfor.rsmi.ru/~diffiety/conf/conf.htm. If you plan to participate in the conference or wish to get the second announcement, fill in the preliminary registration form and send it by e-mail to conf@ecfor.mak.su or to B. I. Sadovnikov, Chair of Quantum Statistics and Field Theory, Dept. of Physics, Moscow State University, Vorobyevy Gory, 119899 Moscow, Russia, not later than February 28, 1997. The second announcement containing all details will be distributed in March 1997. Because of malfunctioning of the conventional mail in Russia, please use e-mail.

25-29 The Conference on Differential Equations and Their Applications (EQUADIFF 9), Brno, Czech Republic. (Feb. 1997, p. 266)

25-29 Hue Conference on Modules and Rings, HueUniversity, Hue, Vietnam. Organizers: D. V. Huynh (Kuwait Univ.), J. K. Park (Pusan National Univ.), N. X. Puyen (Hue Univ.), R. Wishauer (Univ. of Dusseldorf).

Participation: Participation is by invitation only.

Information: For more information, e-mail: tuan@math.uni-duesseldorf.de.


26-29 Euro-Par'97: Parallel Numerical Algorithms, Passau, Germany.

Focus: Euro-Par is the annual European conference in parallel processing. Like the 1996 conference in Lyon, the 1997 version will consist of a number of highly focused workshops on all aspects of parallel processing, from theory to practice, from academy to industry. The workshops will present the latest advances in their respective domains. In addition, there will be a number of high-level tutorials of general interest plus a series of invited talks. This workshop will be a forum for the presentation and discussion of new developments in the area of parallel numerical algorithms, covering all aspects from the algorithmic idea and the software prototyping to the efficient implementation on modern parallel architectures and the performance analysis. Due to its significance in the field of parallel differential equations and others, the solution of large linear systems will be the center of interest, but contributions concerning other problems from numerical linear algebra or topics like numerical quadrature, nonlinear systems, integral equations, or differential equations in general are very welcome too.

Program Committee: U. Langer (Univ. of Linz), chair; H.-J. Bungartz (TU Munich, Germany), local chair; D. E. Keyes (CASE and Old Dominion Univ.), vice-chair; M. Vajtersic (Slovak Academy), vice-chair.

Information: Official address and further information: Euro-Par'97, Universitaet Passau, D-94030 Passau, Germany; tel: +49-851-509-3107; fax: +49-851-509-3092; e-mail: europar97@imi.uni-passau.de; URL: http://www.uni-passau.de/europar97.

27-29 Fourth International Conference on Computational Modelling of Free and Moving Boundary Problems (MOVING BOUNDARIES 97), University of Ghent, Ghent, Belgium. (Jan. 1997, p. 59)

27-31 International Conference on Non-
September 1997

1-5 Third International Conference on Difference Equations, Institute of Mathematics, Academia Sinica, Nankang, Taipei, Taiwan.
Organizer: M.-P. Chen.
Scientific Committee: S. Elaydi (Trinity), G. Ladra (Rhode Island), M.-P. Chen (Academia Sinica).
Topics: Mathematical biology, nonlinear dynamics, numerical analysis, oscillation theory, asymptotic theory, stability and control theory, computational linear algebra, orthogonal polynomials and special functions, combinatorics and other areas that lie under the scope of the Journal of Difference Equations and Applications.

Main Speakers (tentative): B. Aulbach (Augsburg), R. L. Graham (AT&T Bell Labs), V. Kolmanovsky (Moscow), G. Ladra (Rhode Island), D. Trigiante (Florence), J. A. Yorke (Maryland), Yu (China), D. Zeilberger (Temple).

Deadlines: Deadline for submitting papers for the proceedings is October 1, 1997. Papers may be submitted to any member of the scientific committee. Deadline for submission of abstracts and registration forms: March 15, 1997.

Information: To receive a registration form and more information about the conference, please contact M.-P. Chen, Institute of Mathematics, Academia Sinica, Taipei, Taiwan 11529; tel: (office) 02-785-1211 ext. 8852; fax: 02-782-4734; e-mail: mapeq@cvx.sinica.edu.tw.

1-10 Advanced Course on Stochastic Analysis, Centre de Recerca Matematica, Campus of the Universitat Autonoma de Barcelona, Bellaterra, Spain. (Jan. 1997, p. 59)

8-11 Numerical Modelling in Continuum Mechanics, Theory, Algorithms, Applications, Prague, Czech Republic.

Call for Papers: The program of the conference will include invited 50-minute lectures and 20-minute communications. If you are interested in giving a communication, please send a 15-line abstract. All invited lectures and communications can be published in the conference proceedings.

Invited Plenary Speakers: I. Babuška (USA), H.-G. Bock (FRG), R. Glowinski (USA), P. Le Tallec (France), A. Quarteroni (Italy), V. Rokicki (Russia), Ch. Schwab (Switzerland), J. Strakmeier (FRG), A. Valli (Italy), W.-L. Wendland (FRG), J.-R. Whiteman (Great Britain).

Topics: Fluid dynamics; non-Newtonian and viscoelastic flows; porous media flows; material, structures and optimization; structural mechanics.

Fees: The basic fee is US $500. The basic fee for accompanying persons is US $250. Some reduction of the conference fee will be possible for a limited number of Ph.D. students and participants from East European countries.

Important Dates: February 28, 1997: submission of the registration form and 15-line abstract; April 30: notification of acceptance of the communication; May 31: payment of the conference fee; September 7: arrival; registration; September 8-11: scientific program; September 11 or 12: departure.

Information: M. Feistauer, Charles University Prague, Faculty of Mathematics and Physics, Institute of Numerical Mathematics, Malostranske nam. 25, 118 00 Prague 1, Czech Republic; e-mail: mfeistau@karlin.mff.cuni.cz; tel: +42-2-21914223; +42-2-535229; fax: +42-2-535229.

8-12 PanAmerican Workshop in Applied and Computational Mathematics, Serrano, Gramado, Brazil.

Organizers: Organized in cooperation with SIAM, the Society for Industrial and Applied Mathematics.

Focus: Applications of mathematics to industry, technology, science and society.

Information: http://www.ime.usp.br/panam.html; e-mail: panam97@mat.ufrgs.br.

9-12 19th World Conference on the Boundary Element Method, University of Rome, Italy. (Feb. 1997, p. 260)


11-13 Workshop on Algorithm Engineering, Venice, Italy. (Feb. 1997, p. 260)

15-October 5 Analysis and Geometry on Complex Homogeneous Domains and Related Topics, Capital Normal University, Beijing, China.
Program: Invited lecturers will give survey lectures on current and future trends in their research fields.

Topics: Analysis and geometry on complex symmetric domains, related algebraic structures; reproducing kernels, heat kernels, Hua equations; compactifications, analysis on pseudo-hermitian symmetric spaces.

Scientific Committee and Lecturers: J. Faraut (Paris, France), S. Kaneyuki (Tokyo, Japan), A. Koranyi (New York), Q. Lu (Beijing, China), G. Roos (Poitiers, France), W. Yin (Beijing, China).


Information: wuyn@sun.ihep.ac.ca. To obtain more information and the application form, please e-mail the following one-line message: "GetCIMPAPROG97tolistserv@math.unice.fr."

17-19 Second International Conference on Simulation and Design of Microsystems and Microstructures (MICROSIM'97), Lausanne, Switzerland. (Feb. 1997, p. 267)

18-29 Eighth Crimean Fall Mathematical School-Symposium on Spectral and Evolutional Problems and on Mathematical Problems in Economics, Crimea, Ukraine. (Feb. 1997, p. 267)

22-26 VIII Symposium Sobre Polinomios Ortogonales y Aplicaciones, Departamento de Analisis Matematico, Universidad de Seville, Seville, Spain. (Jan. 1997, p. 59)

22-28 9th International Symposium on Classical Analysis, Kazimierz Dolny, Poland. (Jan. 1997, p. 60)


24-26 Int'l Sympos. on Theoretical Aspects of Computer Software (TACS’97), Tohoku University, Sendai, Japan. (Nov. 1996, p. 1384)

26-28 AMS Eastern Sectional Meeting, University of Montreal, Montreal, Canada. (Dec. 1996, p. 1500)

29-October 3 Second European Conference on Numerical Mathematics and Advanced Applications (ENUMATH 97), Heidelberg, Germany.

Objectives: The ENUMATH conferences were established in 1995 in order to provide a forum for discussion on recent aspects of numerical mathematics. They seek to convene leading experts and young scientists, with special emphasis on contributions from Europe. Recent results and new trends in the analysis of numerical algorithms as well as their application to challenging scientific and industrial problems will be discussed. Apart from theoretical aspects, a major part of the conference will be devoted to numerical methods for interdisciplinary applications.

Invited Speakers: A. Bachem (Germany), N. Balakhov (Russia), C. Canuto (Italy), P. van Dooren (Belgium), J. Douglas (USA), C. M. Elliott (UK), G. Leugering (Germany), P.-L. Lions (France), M. Luskin (USA), P. Maaß (Germany), G. A. Mikhailov (Russia), K. W. Morton (UK), J. Sethian (USA), P. Le Tallec (France).

Planned Minisymposia: Finite elements on nonmatching grids, spectral finite element methods, least squares methods for PDE, stabilization methods, optimization in PDE, multiscale analysis, computational electromagnetics, new materials, benchmarking, numerical education.

Submission of Contributions: Abstracts of papers and posters (1-2 pages) may be submitted until February 28, 1997, to be considered for presentation. Abstracts will be subject to evaluation directly after
October 1997

10–12 AMS Southeastern Sectional Meeting, Georgia Institute of Technology, Atlanta, Georgia. (Dec. 1996, p. 1560)


Information: This meeting will consist of six one-hour lectures given by B. Cockburn (Minnesota), C. M. Elliott (Sussex), T. Hou (Cal. Tech.), P. L. Lions (Paris), R. C. Ranacher (Heidelberg), E. Suli (Oxford). The meeting will be held at the Scientific Societies' Lecture Theatre, New Burlington Place, London W1, UK. All interested are very welcome (no registration fee). There will be a dinner on Friday evening (details/cost to be arranged). A list of moderately priced hotels will also be available at a later date.

24–26 Central Section, University of Wisconsin, Milwaukee, Wisconsin. (Dec. 1996, p. 1560)

29–November 1 Sixth SIAM Conference on Applied Linear Algebra, Snowbird Sl and Summer Resort, Snowbird, Utah. (June 1996, p. 702)

November 1997


7–8 St. Norbert College Regional Pi Mu Epsilon Undergraduate Math Conference, St. Norbert College, De Pere, Wisconsin.

Program: The program will begin on Friday evening at 7:00 with sessions for student speakers. Following these, about 9:00, Paul Humke, from St. Olaf College, will give the first of his invited addresses, "A Voyager from the Fourth Dimension".

On Saturday morning there will be student presentations from about 9:00 until 11:00. At 11:00, Professor Humke will give his second address, "Fractionating Fractal Facts".

Information: The conference is free and open to the public. Students who wish to attend can receive free housing, provided they bring their own sleeping bags. An announcement with further details will be mailed out to interested parties sometime in September.

7–9 1997 Midwest Algebraic Geometry Conference, University of Notre Dame, Indiana.


Invited Principal Speakers: L. Ein (Univ. of Illinois at Chicago), E. Friedlander (Northwestern Univ.), W. Fulton (Univ. of Chicago), A. Geramita (Queen's Univ./Universita di Genova), J. Harris (Harvard Univ.), C. Huneke (Purdue Univ.), K. Smith (Univ. of Michigan/MIT).

Call for Contributed Short Talks: Please send an abstract by August 15, 1997.

Information: To register, send an abstract, or just ask a question, send e-mail to magc97@kenna.math.nd.edu. A Web page with up-to-date information can be found at http://www.science.nd.edu/magc97.

December 1997

December International Symposium on Mathematical Physics in Memory of S. Chandrasekhar, Calcutta, India.

Program Outline: The program will include invited lectures from distinguished scientists from India and abroad and also contributed papers. A number of scientists have been invited to be members of different committees of the forthcoming symposium.

Registration Fee: Rs. 400.00 for Indian; Rs. 600.00 (Indian rupees) for persons from SARC country; $400.00 for others. Registration fee includes symposium materials, breakfast, lunch, and local transport. All payments should be made payable to the Calcutta Mathematical Society.


8–9 AMS Western Sectional Meeting, University of New Mexico, Albuquerque, New Mexico. (Dec. 1996, p. 1560)

January 1998

7–10 Joint Mathematics Meetings, Baltimore, Maryland (including the annual meetings of the AMS, AWM, MAA, and NAMS). (Dec. 1995, p. 1570)

11-16 AMS-SIAM Summer Seminar in Applied Mathematics: Neuroengineering and Dynamical Systems in Neuroscience, Arizona State University, Tempe, Arizona.

February 1998

9–13 Seventh International Conference on Hyperbolic Problems Theory, Numerics, Applications, ETH Zurich, Switzerland. (Feb. 1997, p. 267)

The following new announcements will not be repeated until the criteria in the next to the last paragraph at the bottom of the first page of this section are met.

June 1998


Focus: Sessions are being planned for general lectures, symposia, and contributed papers covering all aspects of research which are of general interest to the applied mechanics community. Contributed research papers will be selected from 300–500-word summaries, which must be submitted for
Program in Probability and Its Applications, The Fields Institute, Toronto, Ontario, Canada.

Organizing Committee: D. Dawson (Fields), N. Madras (York), T. Salisbury (York), G. Slade (McMaster).

Program Committee: D. Dawson (Fields), G. Grimmett (Cambridge), T. Lyons (Imperial), T. Kurtz (Wisconsin), N. Madras (York), E. Perkins (U.B.C.), T. Salisbury (York), G. Slade (McMaster), S. S. Varadhan (Courant).


Conference Chairmen: A. S. Alfa, tel: 204-474-9803; fax: 204-275-7507; e-mail: alfa@cc.umanitoba.ca; S. Chakravarty, tel: 313-762-7906, fax: 810-762-9796, e-mail: schnakov@msu.edu.

Conference Secretary: B. Dunlop, tel: 204-474-6630, fax: 204-275-7507, e-mail: bdunlop@bldeg eng. lau. umanitoba.ca.
New Publications Offered by the AMS

Contemporary Mathematics

Multidimensional Complex Analysis and Partial Differential Equations
Paulo D. Cordaro and Howard Jacobowitz, Editors
Volume 205

This collection of papers by outstanding contributors in analysis, partial differential equations, and several complex variables is dedicated to Professor Treves in honor of his 65th birthday. There are five excellent survey articles covering analytic singularities, holomorphically nondegenerate algebraic hypersurfaces, analyticity of CR mappings, removable singularities of vector fields, and local solvability for systems of vector fields. The other papers are original research contributions on topics such as Klein-Gordon and Dirac equations, Toeplitz operators, elliptic structures, complexification of Lie groups, and pseudo-differential operators.

Contents

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science

Parallel Algorithms
Sandeep N. Bhatt, Editor
Volume 30

This volume is the result of the Third DIMACS Implementation Challenge that was conducted as part of the 1993-1994 Special Year on Parallel Algorithms. The Implementation Challenge was formulated in order to provide a forum for a concerted effort to study effective algorithms for combinatorial problems and to investigate opportunities for massive speedups on parallel computers. The challenge included two problem areas for research study: tree searching algorithms, used in game search and combinatorial optimization, for example, and algorithms for sparse graphs.

Participants at sites in the U.S. and Europe undertook projects from November 1993 through October 1994. The workshop was held at DIMACS in November 1994. Participants were encouraged to share test results, to rework their implementations considering feedback at the workshop, and to submit a final report for the proceedings. Nine papers were selected for this volume.

Contents
A. Krishnamurthy, S. S. Lumetta, D. E. Culler, and K. Yelick, Connected components on distributed memory machines; T.-S. Lumetta, D. E. Culler, and K. Yelick, Connected components on distributed memory machines; T.-S.

March 1997, 162 pages (hardcover).
ISBN 0-8218-0447-2, LC 96-52111, ISSN 1052-1798
1991 Mathematics Subject Classification: 68-06; 68Q22, 68-04
Individual member $27, List $45, Institutional member $36
To order, please specify DIMACS/301N

Memoirs of the American Mathematical Society

Gauge Theory on Compact Surfaces
Ambar Sengupta
Volume 126, Number 600

This work represents a rigorous account of quantum gauge field theory for bundles (possibly non-trivial) over compact surfaces. The Euclidean quantum field measure describing this theory is constructed and loop expectation values for a broad class of Wilson loop configurations are computed explicitly. Both the topology of the surface and the topology of the bundle are encoded in these loop expectation values. The effect of well-behaved area-preserving homeomorphisms of the surface is to take these loop expectation values into those for the pullback bundle. The quantum gauge field measure is constructed by conditioning an infinite-dimensional Gaussian measure to satisfy constraints imposed by the topologies of the surface and of the bundle. Holonomies, in this setting, are defined by interpreting the usual parallel-transport equation as a stochastic differential equation.

Contents

Introduction; Terminology and basic facts; The structure of bundles and connections over compact surfaces; Quantum gauge theory on the disk; A conditional probability measure; The Yang-Mills measure; Invariants of systems of curves; Loop expectation values I; Some tools for the Abelian case; Loop expectation values II; Appendix; Figures 1, 2, 3; References.

March 1997, 85 pages (softcover).
ISBN 0-8218-0556-8, LC 96-37447, ISSN 0065-9266
1991 Mathematics Subject Classification: 81T13
Individual member $22, List $36, Institutional member $29
To order, please specify MEMO/126/601N

Crossed Products of von Neumann Algebras by Equivalence Relations and Their Subalgebras
Igor Fulman
Volume 126, Number 602

In this book, the author introduces and studies the construction of the crossed product of a von Neumann algebra $M = \int_x M(x)d\mu(x)$ by an equivalence relation on $X$ with countable cosets. This construction is the generalization of the construction of the crossed product of an abelian von Neumann algebra by an equivalence relation introduced by J. Feldman and C. C. Moore. Many properties of this construction are proved in the general case. In addition, the generalizations of the Spectral Theorem on Bimodules and of the theorem on dilations are proved.

Contents

Introduction; Preliminaries; Unitary realization of $\alpha(x,\cdot)$; Construction of $M^x$; Coordinate representation of elements of $M$; The
expectation $E$; Coordinates in $\hat{M}^\vee$; The expectation $E'$; Tomita-Takesaki theory for $M$ and $M^\vee$; $(\hat{M})$-automorphisms of $\hat{M}$; Flows of automorphisms; The Feldman-Moore-type structure theorem; Isomorphisms of crossed products; Bimodules and subalgebras of $\hat{M}$; Spectral theorem for bimodules; Analytic algebra of a flow of automorphisms; Properties of $\hat{M}$; Hyperfiniteness and dilations; The construction of Yamanouchi; Examples and particular cases.

March 1997, 107 pages (softcover), ISBN 0-8218-0557-6, LC 96-47955, ISSN 0065-9266

1991 Mathematics Subject Classification: 47D25, 46L10, 47A20

Individual member $23$, List $38$, Institutional member $30$

To order, please specify MEMO/126/602N

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Extended Affine Lie Algebras and Their Root Systems
Bruce N. Allison,
Saeid Azam,
Stephen Berman,
Yun Gao, and
Arturo Pianzola

Volume 126, Number 603

This work is about extended affine Lie algebras (EALA’s) and their root systems. EALA’s were introduced by Hueh-Krohn and Torresani under the name irreducible quasi-simple Lie algebras. The major objective is to develop enough theory to provide a firm foundation for further study of EALA’s.

The first chapter of the paper is devoted to establishing some basic structure theory. It includes a proof of the fact that, as conjectured by Kac, the invariant symmetric bilinear form on an infinite, simple relation algebra with a decidable equational theory; A finitely generated, infinite, simple relation algebra with a decidable equational theory; Bibliography; Index of symbols; Index of names and subjects.

March 1997, 126 pages (softcover), ISBN 0-8218-0595-9, LC 96-37450, ISSN 0065-9266

1991 Mathematics Subject Classification: 03G15, 03B25

Individual member $23$, List $39$, Institutional member $31$

To order, please specify MEMO/126/604N

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Decision Problems for Equational Theories of Relation Algebras
Hajnal Andréska,
Steven Givant, and
István Németh

Volume 126, Number 604

This work presents a systematic study of decision problems for equational theories of algebras of binary relations (relation algebras). For example, an easily applicable but deep method, based on von Neumann’s coordinatization theorem, is developed for establishing undecidability results. The method is used to solve several outstanding problems posed by Tarski. In addition, the complexity of intervals of equational theories of relation algebras with respect to questions of decidability is investigated. Using ideas that go back to Jonsson and Lyndon, the authors show that such intervals can have the same complexity as the lattice of subsets of the set of the natural numbers. Finally, some new and quite interesting examples of decidable equational theories are given.

The methods developed in the monograph show promise of broad applicability. They provide researchers in algebra and logic with a new arsenal of techniques for resolving decision questions in various domains of algebraic logic.

Contents
Introduction; Preliminaries; Undecidability; A lattice embedding that preserves decidability and undecidability; A finitely generated, infinite, simple relation algebra with a decidable equational theory; Bibliography; Index of symbols; Index of names and subjects.

March 1997, 126 pages (softcover), ISBN 0-8218-0595-9, LC 96-37450, ISSN 0065-9266

1991 Mathematics Subject Classification: 03G15, 03B25, 03C05, 08B15

Individual member $23$, List $39$, Institutional member $31$

To order, please specify MEMO/126/604N

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AMS Publications not in Series

Introduction to Probability, Second Revised Edition
Charles M. Grinstead and J. Laurie Snell

This text is designed for an introductory probability course at the university level for sophomores, juniors, and seniors in mathematics, the physical and social sciences, engineering, and computer science. It presents a thorough treatment of probability ideas and techniques necessary for a firm understanding of the subject.

The text is also recommended for use in discrete probability courses. The material is organized so that the discrete and continuous probability discussions are presented in a separate, but parallel, manner. This organization doesn’t emphasize an overly rigorous or formal view of probability and therefore offers
some strong pedagogical value. Hence, the discrete discussions can sometimes serve to motivate the more abstract continuous probability discussions.

Features:

- Key ideas are developed in a somewhat leisurely style, providing a variety of interesting applications to probability and showing some nonintuitive ideas.
- Over 600 exercises provide the opportunity for practicing skills and developing a sound understanding of ideas.
- Numerous historical comments deal with the development of discrete probability.
- Text includes many computer programs that illustrate the algorithms or the methods of computation for important problems.

Contents

Discrete probability distributions; Continuous probability densities; Combinatorics; Conditional probability; Distributions and densities; Expected value and variance; Sums of random variables; Law of large numbers; Central limit theorem; Generating functions; Markov chains; Random walks.

May 1997, approximately 500 pages (hardcover), ISBN 0-8218-0749-8
1991 Mathematics Subject Classification: 60-01
All AMS members $39, List $49
To order, please specify IPROBN

International Press

Basic Partial Differential Equations
David Bleecker and George Csordas

This undergraduate text is self-contained for students who have had three semesters of calculus. No previous course in ordinary differential equations or linear algebra is necessary. Nevertheless, rigorous proofs of nearly all results are given after ample physical motivation. In particular, students can read and understand the proofs of the maximum principles for solutions of the heat and Laplace equations, along with results on the continuous dependence of solutions with respect to variation of initial and boundary data. Moreover, complete proofs of convergence theorems (e.g., pointwise and uniform) for Fourier series are provided.

This book is for those who believe that a PDE course should do more than disseminate facts and recipes. However, it easily accommodates different levels of rigor which instructors may deem more appropriate for their students. Besides all of the standard topics, there is coverage of traffic flow shocks, evolution of population densities, minimal surfaces, gravitation, quantum mechanics of the hydrogen atom, and vibrations of round drums, spheres and manifolds.

There are approximately 280 examples worked out in detail, and 600 exercises ranging from routine to quite challenging. All graphs of mathematical functions of one or several variables were computer generated, including surfaces of various spherical harmonics, Bessel functions, and nodal curves for vibrating drums. There is a solutions manual with complete solutions (including many intervening steps and calculations) to all but the most straightforward problems.

International Press publications are distributed worldwide, except in Japan, by the American Mathematical Society.

Contents

Review and introduction; First-order PDEs; The heat equation; Fourier series and Sturm-Liouville theory; The wave equation; Laplace's equation; Fourier transforms; Numerical solutions of PDEs — An introduction; PDEs in higher dimensions; Appendix; References; Selected answers; Index of notation; Index.

1991 Mathematics Subject Classification: 35
All AMS members $34, List $42
To order, please specify INPR/23N

International Press

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1991 Mathematics Subject Classification: 35
All AMS members $34, List $42
To order, please specify INPR/23N
Elliptic Curves, Modular Forms & Fermat's Last Theorem
John Coates, University of Cambridge, England, and S.-T. Yau, Harvard University, Cambridge, MA, Editors

International Press publications are distributed worldwide, except in Japan, by the American Mathematical Society.

International Press; 1995; ISBN 1-57146-026-8; 191 pages (hardcover); List $42; All AMS members $34; Order code INPR/SNP

Fermat's Last Theorem
Barry Mazur

Videotapes; 1995; ISBN 0-8218-0446-4; NTSC format on one-half inch VHS videotape, approximately 60 minutes; List $49.95; Individual member $29.95; Order code VIDEO/97NP

Fermat's Last Theorem—The Theorem and its Proof: An Exploration of Issues and Ideas*

"Fermat Fest: The Video" successfully brings to life one of the most dramatic episodes in the history of mathematics. A superb cast of speakers and a lively soundtrack featuring such hits as Tom Lehrer's "There's a Delta for every epsilon" and "That's mathematics" (with original lyrics to celebrate Wiles' achievement) make this an ideal entertainment and educational value for the undergraduate classroom, mathematical parties, and indeed for the whole family... All in all, "Fermat Fest: the Video" definitely rates an enthusiastic "thumbs-up", and is sure to delight mathematicians and non-scientists alike.

—Mathematical Reviews

Videotapes; 1994; ISBN 0-9639903-0-6; NTSC format on one-half inch VHS videotape, approximately 90 minutes; List $29.95; Order code VIDEO/90NP

Fermat's Last Theorem: Unlocking the Secret of an Ancient Mathematical Problem
Amir D. Aczel, Bentley College, Waltham, MA

... Aczel sets out the whole story clearly and concisely ... there's a surprising amount of drama ... [Wiles' proof] employs a staggering range of abstract devices, which Mr. Aczel is a dab hand at explaining ... [Mathematics] operates very close to religion ... Maybe that is the final justification for the quest Mr. Aczel chronicles so well...

—The Wall Street Journal

Maps the strange, beautiful byways of modern mathematical thought...

—Publishers Weekly

Published by Four Wall Eight Windows. 1997; ISBN 1-56858-077-0; 147 pages (hardcover); List $18; All individuals $14; Order code FERMATNP

Modular Elliptic Curves and Fermat's Last Theorem*
Kenneth A. Ribet

... accessible to advanced undergraduates and graduate students with some background in algebra and number theory.

—Zentralblatt für Mathematik

Videotapes, 1993; ISBN 0-8218-8087-X; NTSC format on one-half inch VHS videotape, approximately 100 minutes; List $49.95; Individual member $29.95; Order code VIDEO/89NP

Seminar on Fermat's Last Theorem
V. Kumar Murty, University of Toronto, ON, Canada, Editor

Conference Proceedings, Canadian Mathematical Society, Volume 17; 1995; ISBN 0-8218-0313-1; 265 pages (softcover); List $49; All AMS members $39; Order code CMSAMS/17NP

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Videotapes, 1994; ISBN 0-8218-8089-6; NTSC format on one-half inch VHS videotape, approximately 190 minutes; List $54.95; Order code VIDEO/91NP

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Classified Advertisements

Positions available, items for sale, services available, and more

**CALIFORNIA**

UNIVERSITY OF CALIFORNIA
Riverside, California
Department of Mathematics

Applications are invited for possibly one or more visiting assistant professor positions beginning September 1997 contingent upon available funding. Applicants must show demonstrated skill or strong promise in research and teaching. The positions are open to applicants from all research areas in mathematics. The teaching load is six quarter courses per year. Candidates must have received a Ph.D. degree by September 1997.

Applicants should send their curriculum vitae, including publications list, and have at least three letters of recommendation send to:

Temporary Faculty Search Committee
Department of Mathematics
University of California, Riverside
Riverside, CA 92521-0135

by Friday, April 18, 1997. The University of California, Riverside, is an Affirmative Action/Equal Opportunity Employer.

Inquiries (not applications) can be sent to linda@math.ucr.edu or lterry@acrcl.ucr.edu.

**INDIANA**

UNIVERSITY OF NOTRE DAME
Department of Mathematics
Notre Dame, IN 46556

The Department of Mathematics of the University of Notre Dame invites applications for several visiting positions to begin in the fall of 1997. These are one-year positions with the possibility for renewal for an additional year. They carry a teaching load of two courses per semester. The department is particularly interested in applicants in fields compatible with its interests: algebra, algebraic geometry, complex analysis, partial differential equations, differential geometry, logic, algebraic topology, and several areas of applied mathematics. Salaries are competitive. The evaluation of candidates will begin on March 1, but late and/or incomplete applications will be considered. To apply, send a curriculum vitae along with a letter of application, a completed AMS Standard Cover Sheet to: Alexander J. Hahn, Chair, at the above address. Please arrange for three letters of recommendation to be sent to the same location. These letters should address the applicant’s research accomplishments and at the same time supply evidence that the applicant has the ability to communicate effectively in the classroom. Notre Dame is an Equal Opportunity Employer. Women and minorities are urged to apply.

**LOUISIANA**

LOUISIANA TECH UNIVERSITY
Junior and Senior Positions

The College of Engineering and Science invites nominations and applications for anticipated tenure-track openings. The assistant professor position is in statistics with particular emphasis on interdisciplinary research and campuswide consulting. The successful applicant will have demonstrated high-quality research potential appropriate for participating in the Ph.D. program. Invitations to apply (ACAM) and have evidence of teaching effectiveness. The associate/full professor position is for an accomplished researcher who has initiated curricular reform projects. Evidence of external funding in curriculum development is desirable. The successful candidate will assume a leadership role in reforming the mathematics program at Louisiana Tech.

The mathematics program offers a B.S., an M.S., and is a major player in the ACAM Ph.D. program. Class sizes are small, and the computing facilities include UNIX workstations and networked PCs.

Louisiana Tech is located in the beautiful piney hills region of northern Louisiana in Ruston, a warm and vital community on I-20 between Shreveport and Monroe. The cost of living is moderate, and housing costs are well below the national average.

Send your CV and a list of three references to: Math/Stat Faculty Search Committee, College of Engineering and Science, 112 NOTRE DAME, South College, Ruston, LA 71272-4655.

**Suggested uses** for classified advertising are positions available, books or lecture notes for sale, books being sought, exchange or rental of houses, and typing services.

**The 1995 rate is** $100 per inch or fraction thereof on a single column (one-inch minimum), calculated from top of headline. Any fractional text of 1/2 inch or more will be charged at the next inch rate. No discounts for multiple ads or the same ad in consecutive issues. For an additional $10 charge, announcements can be placed anonymously. Correspondence will be forwarded.

Advertisements in the "Positions Available" classified section will be set with a minimum one-line headline, consisting of the institution name above body copy, unless additional headline copy is specified by the advertiser. Headlines will be centered in boldface at no extra charge. Ads will appear in the language in which they are submitted.

There are no member discounts for classified ads. Dictation over the telephone will not be accepted for classified advertising.


U.S. laws prohibit discrimination in employment on the basis of color, age, sex, race, religion, or national origin. "Positions Available" advertisements from institutions outside the U.S. cannot be published unless they are accompanied by a statement that the institution does not discriminate on these grounds whether or not it is subject to U.S. laws. Details and specific wording may be found near the Classified Advertisements in the January and July issues of the Notices.

**Situations wanted advertisements** from involuntarily unemployed mathematicians are accepted under certain conditions for free publication. Call toll-free 800-321-4AMS (321-4267) in the U.S. or 401-455-4084 worldwide, for further information.

Submission: Promotions Department, AMS, P.O. Box 6248, Providence, Rhode Island 02940, or via fax, 401-331-3842, or send e-mail to clasads@ams.org. AMS location for express delivery packages is 201 Charles Street, Providence, Rhode Island 02904. Advertisers will be billed upon publication.

March 1997 Notices of the AMS 387
MASSACHUSETTS

UNIVERSITY OF MASSACHUSETTS
Amherst
Tenure-Track Faculty Positions
Department of Mathematics & Statistics
College of Natural Sciences & Mathematics

The Department of Mathematics & Statistics (http://www.math.umass.edu) invites applications for several tenure-track positions at the assistant professor level. In addition, several one-year (possibly renewable) postdoctoral positions will be available. The search will focus within the following areas: algebraic geometry, applied analysis, geometric analysis, Lie theory, number theory, probability, scientific computation, and statistics. Exceptional promise in research and in teaching (at all levels of the curriculum) is required. Applicants should send a curriculum vitae and three letters of recommendation to: Search Committee, Department of Mathematics and Statistics, University of Massachusetts, Amherst, MA 01003-4515. Review of applications will begin immediately. Applications will continue to be accepted until all positions are filled. Please include the AMS Application Cover Sheet. Equal Opportunity/Affirmative Action Employer.

MICHIGAN

OAKLAND UNIVERSITY
Chairperson

Applications and nominations are invited for the position of chairperson of the Department of Mathematical Sciences beginning August 15, 1997. The chairperson is appointed for a three-year renewable term and is sought to lead the implementation of a recently approved Ph.D. program in applied mathematical sciences with an emphasis on industrial applications and collaboration. Candidates must have an earned Ph.D. in a mathematical science and significant post-Ph.D. academic experience in the mathematical sciences or comparable activity. They must have a substantial research record and an active commitment to research; a strong commitment to quality instruction and the ability to foster the development of innovative and effective teaching; including a willingness to explore ways to integrate technology into instruction; have demonstrated experience in various academic or professional leadership positions; and the ability to interact effectively with the various components of an academic community. The academic record must justify appointment at the rank of professor in the Department of Mathematical Sciences with tenure.

Oakland University is a vital, growing public institution with nearly 14,000 students offering baccalaureate, master’s, and doctoral programs. The Department has 26 full-time faculty members and offers baccalaureate degrees in mathematics and statistics and master’s degrees in mathematics, industrial and applied mathematics, and applied statistics. Further information can be obtained at its Web site http://www.oakland.edu/math.

Applications should submit a curriculum vitae and the names, addresses, and telephone numbers of at least three references. Please send nominations and applications to: Darrell Schmidt, Chairperson, Search Committee, Department of Mathematical Sciences, Oakland University, Rochester, MI 48309-4401; phone: 810-370-4343; fax: 810-370-4184; e-mail: schmidt@oakland.edu. Review of applications will begin on February 1, 1997, and will continue until a successful candidate is identified.

Oakland University is an Affirmative Action and Equal Opportunity Employer. The search committee especially encourages women and minorities to apply.

OAKLAND UNIVERSITY

The Department of Mathematical Sciences invites applications for a tenure-track position at the rank of assistant professor or associate professor (without tenure) in the area of applied discrete mathematics.

Responsibilities of this position include teaching, research, and contribution to the Department’s collaborative efforts with industry. For appointment at the assistant rank, candidates must have a Ph.D. in mathematics or a closely related field (or its requirements completed) by August 15, 1997. For appointment at the associate rank, candidates must also demonstrate the professional growth the Department expects of its faculty during the assistant rank. Preference will be given to applicants with strong research potential in applied discrete mathematics and evidence of experience and/or ability in developing research links and student internships with industry. Areas for preferred consideration are discrete optimization, network algorithms, and queueing theory.

Please send a vita and transcripts and arrange for three letters of reference to be sent to: J. Curtis Chipman, Chair, Applied Discrete Mathematics Search Committee, Department of Mathematical Sciences, Oakland University, Rochester, MI 48309-4401; phone: 810-370-3440; fax: 810-370-4184; e-mail: chipman@oakland.edu. Applications should be received by March 1, 1997, to ensure full consideration.

Oakland University is a vital, growing public institution with approximately 14,000 students offering baccalaureate, master’s, and doctoral programs. A Ph.D. in applied mathematical sciences has recently been approved. The Department has 26 full-time faculty members and offers baccalaureate degrees in mathemat-
ics and statistics and master's degrees in mathematics, industrial and applied mathematics, and applied statistics. Further information about the Department can be obtained at its Web site http://www.ams.org/links/math/

Oakland University is an Affirmative Action/Equal Opportunity Employer and especially encourages applications from women and minorities.

NORTH CAROLINA

NORTH CAROLINA STATE UNIVERSITY
Department of Mathematics

The Department of Mathematics invites applications for a tenure-track appointment in symbolic computation, beginning in the fall of 1997. Applicants at all levels will be considered. Candidates should have a strong ongoing research program and a demonstrated skill in teaching. Applications should send a vita and letters of reference to Symbolic Computation Search Committee, Mathematics Department, Box 8205, NC State University, Raleigh, NC 27695-8205. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, veteran status, or disability.

OHIO

THE OHIO STATE UNIVERSITY
Mansfield Campus

Tenure-track assistant professorship in mathematics. Ph.D. required. The candidate should have a research program in algebraic geometry and be able to work with current faculty in this area, both at Mansfield and at the main campus in Columbus. A strong commitment to both undergraduate teaching and math research is essential. The successful candidate will hold rank in the Ohio State University's Department of Mathematics. To apply, send letter, vita, and three letters of reference to Dr. Gary Kennedy, OSU Mansfield, 1680 University Drive, Mansfield, OH 44906. To ensure full consideration, arrange for all materials to arrive by March 1, 1997. The Ohio State University is an Equal Opportunity/Affirmative Action Employer.

OKLAHOMA

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Publishers of textbooks for elementary school/high school market


PHOTO

NORTH CAROLINA

NORTH CAROLINA STATE UNIVERSITY
Department of Mathematics

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OKLAHOMA

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Publishers of textbooks for elementary school/high school market

Walter Rudin, University of Wisconsin, Madison

Walter Rudin's memoirs should prove to be a delightful read specifically to mathematicians, but also to historians who are interested in learning about his colorful history and ancestry. Characterized by his personal style of elegance, clarity, and brevity, Rudin presents in the first part of the book his early memories about his family history, his boyhood in Vienna throughout the 1920s and 1930s, and his experiences during World War II.

Part II offers samples of his work, in which he relates where problems came from, what their solutions led to, and who else was involved. As those who are familiar with Rudin's writing will recognize, he brings to this book the same care, depth, and originality that is the hallmark of his work.

Co-published with the London Mathematical Society: Members of the AMS may order directly from the AMS at the AMS member price. The LMS is registered with the Charity Commissioners.

History of Mathematics, Volume 12; 1997; 191 pages; Hardcover; ISBN-0-8218-0633-5: List $29; All AMS members $23; Order code HMATH/12NA

Classified Advertisements

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CANADA

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Head Department of Mathematics and Statistics

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Professor U. Haussman, Head
Department of Mathematics
University of British Columbia
#121-1984 Mathematics Road
Vancouver, B.C., Canada V6T 1Z2

Applications must be received by March 31, 1997.
Stephen D. Cohen

These proceedings give a state-of-the-art account of the area of finite fields. This book concentrates on the theory and application of generating functions. Well-thought-out exercises and advanced topics treated in appendices are devoted to enumeration, sieve methods (including the Principle of Inclusion-Exclusion), partially ordered sets, and rational generating functions. There are a large number of exercises, almost all with solutions, which greatly augment the text and provide entry into many areas not covered directly.

Cambridge Studies in Advanced Mathematics 122
1996 c.320 pp. 56088-8 Hardback $59.95

Enumerative Combinatorics
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Richard P. Stanley

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This book concentrates on the theory and application of generating functions, a fundamental tool in enumerative combinatorics. Chapters are devoted to enumeration, sieve methods (including the Principle of Inclusion-Exclusion), partially ordered sets, and rational generating functions. There are a large number of exercises, almost all with solutions, which greatly augment the text and provide entry into many areas not covered directly.

Cambridge Studies in Advanced Mathematics 49
1996 336 pp. 55309-1 Hardback $59.95

A Primer of Probability Logic
Ernest W. Adams

Well-thought-out exercises and advanced topics treated in appendices make this text a comprehensive discussion of probability logic. It discusses most of the important ramifications of the subject and tie-ins with current research.

CSLI Lecture Notes
1997 c.376 pp. 1-57856-066-X Paperback $24.95

Finite Fields and Applications
Stephen D. Cohen and Harald Niederreiter, Editors

These proceedings give a state-of-the-art account of the area of finite fields and their applications in communications, combinatorics, design theory, quasi-random points, algorithms, and their complexity. Theory and application are tightly interwoven in the survey articles and original research papers included here.

London Mathematical Society Lecture Note Series 233
1996 421 pp. 56736-X Paperback $42.95

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Spectral Theory and Differential Operators
E. B. Davies

A completely new proof of the spectral theorem for unbounded self-adjoint operators is followed by its application to a variety of second order elliptic differential operators. The book contains a detailed account of the application of variational methods to estimate the eigenvalues of operators with measurable coefficients defined by the use of quadratic form techniques.

Cambridge Studies in Advanced Mathematics 42
1996 196 pp. 58710-7 Paperback $24.95

Finite Fields

Second Edition

Rudolf Lidl and Harald Niederreiter

This book is devoted entirely to the theory of finite fields and provides comprehensive coverage of the subject. Worked-out examples and lists of exercises found throughout the book make it useful as a text for advanced level courses.

Encyclopedia of Mathematics and its Applications 20
1996 769 pp. 39231-4 Hardback $95.00

Eigenspaces of Graphs

Dragos Cvetkovic, Peter Rowlinson, and Slobodan Simic

This book describes how the spectral theory of finite graphs can be strengthened by exploiting properties of the eigenspaces of adjacency matrices associated with a graph. Current research on this topic may be seen as part of a wider effort to forge closer links between algebra and combinatorics.

Encyclopedia of Mathematics and its Applications 66
1997 271 pp. 57352-1 Hardback $69.95

Sperner Theory

Konrad Engel

This book presents Sperner theory from a unified point of view, bringing combinatorial techniques together with methods from programming, linear algebra, Lie-algebra representations and eigenvalue methods, probability theory, and enumerative combinatorics.

Encyclopedia of Mathematics and its Applications 65
1996 c.350 pp. 45206-6 Hardback $69.95

Acta Numerica 1996

Arieh Iserles, Editor

Acta Numerica is an annual publication containing invited survey papers by leading researchers in numerical mathematics and scientific computing. The papers present overviews of recent developments in their area and provide "state of the art" techniques and analysis.

1996 c.400 pp. 57234-7 Hardback $59.00

Lectures on Vector Bundles

J. Le Potier

This work consists of two courses on the moduli spaces of vector bundles. The first part tackles the classification of vector bundles on algebraic curves; the second centers on the structure of the moduli space of semi-stable sheaves on the projective plane.

Cambridge Studies in Advanced Mathematics 56
1996 259 pp. 48182-1 Hardback $59.95

Low Rank Representations and Graphs for Sporadic Groups

Cheryl E. Praeger and Leonard H. Soicher

The book gives a classification of all permutation representations of low rank of the sporadic groups, together with the parameter values for all associated vertex-transitive graphs. Sufficient information is given about most of the groups and graphs to enable readers to re-construct and study these representations themselves.

Australian Mathematical Society Lecture Series 8
1997 c.160 pp. 56737-8 Paperback $39.95
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20 Group theory and generalizations
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28 Measure and integration
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34 Ordinary differential equations
35 Partial differential equations
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41 Approximations and expansions
42 Fourier analysis
43 Abstract harmonic analysis
44 Integral transforms, operational calculus
45 Integral equations
46 Functional analysis
47 Operator theory
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51 Geometry
52 Convex and discrete geometry
53 Differential geometry
54 General topology
55 Algebraic topology
57 Manifolds and cell complexes
58 Global analysis, analysis on manifolds
60 Probability theory and stochastic processes
62 Statistics
65 Numerical analysis
66 Computer science
70 Mechanics of particles and systems
73 Mechanics of solids
76 Fluid mechanics
78 Optics, electromagnetic theory
80 Classical thermodynamics, heat transfer
81 Quantum theory
82 Statistical mechanics, structure of matter
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Meetings & Conferences of the AMS

Memphis, Tennessee

University of Memphis

March 21–22, 1997

Meeting #919
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: January 1997
Program issue of Notices: March 1997
Issue of Abstracts: Volume 18, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Registration and Meeting Information
Registration has been moved to the Psychology Building. The hours of operation will remain the same: 8:00 a.m. to noon and 1:00 p.m. to 5:00 p.m. on Friday, and 8:00 a.m. to noon on Saturday. Lectures will take place in Dunn Hall and the Psychology Building.

College Park, Maryland

University of Maryland, College Park

April 12–13, 1997

Meeting #920
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: February 1997
Program issue of Notices: April 1997
Issue of Abstracts: Volume 18, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Program Updates
AMS Council Meeting: Saturday, April 12, 1997, at 6:00 p.m. at the Holiday Inn College Park, 10000 Baltimore Blvd., College Park.

Registration and Meeting Information
Registration will take place in the rotunda on the main level of the Mathematics Building from 8:00 a.m. to noon and from 1:00 p.m. to 4:00 p.m. on Saturday, and from 8:00 a.m. to noon on Sunday. Sessions will take place in the Mathematics Building; invited lectures will be held in the Physics Building.
Meetings & Conferences

Corvallis, Oregon
Oregon State University
April 19–20, 1997

Meeting #921
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: February 1997
Program issue of Notices: April 1997
Issue of Abstracts: Volume 18, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses
Jerrold E. Marsden, California Institute of Technology, Stabilization and dynamics of balance systems.
Robert E. O'Malley, University of Washington, Exponential asymptotics.
Harold R. Parks, Oregon State University, Advances in computing area-minimizing hypersurfaces.
Pavel Pevzner, University of Southern California, Combinatorics of genome rearrangements.

Special Sessions
Actuarial and Financial Mathematics, Donald Jones, Enrique A. Thomann, and Edward C. Waymire, Oregon State University.
Algebraic and Elementary Number Theory, Richard A. Mollin, University of Calgary, and Peter J. Shiue, University of Nevada, Las Vegas.
Combinatorial Methods in Molecular Biology, Pavel Pevzner and Michael S. Waterman, University of Southern California.
Geometric Analysis, Harold R. Parks and Donald C. Solmon, Oregon State University.
Geometric Mechanics, Judith M. Arms, University of Washington, and John V. Leahy, University of Oregon.
Geometric Methods in Mathematical Physics, Juha Pohjanketo, Oregon State University.
Inverse Problems, Adel Faridani and David V. Finch, Oregon State University.
Mathematical Issues in Physical Oceanography, Robert L. Higdon, Oregon State University.
Octonions and Clifford Algebras, Tevian Dray and Corinne Manogue, Oregon State University.
Operator Algebras, Huaxin Lin and Christopher Phillips, University of Oregon.

Detroit, Michigan
Wayne State University
May 2–4, 1997

Meeting #922
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: March 1997
Program issue of Notices: May 1997
Issue of Abstracts: Volume 18, Issue 2

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: Expired
For abstracts: Expired

Invited Addresses
Harold P. Boas, Texas A&M University, Title to be announced.
Carlos E. Kenig, University of Chicago, Title to be announced.
Ernest E. Shult, Kansas State University, Title to be announced.
A. L. Volberg, Michigan State University, Title to be announced.

Special Sessions
Algebraic Combinatorics, Devadatta M. Kulkarni, Oakland University.
Algebraic Topology, Robert R. Bruner and David Handel, Wayne State University.
Analysis and Geometry, Carlos E. Kenig, University of Chicago, and Tatiana Toro, University of Washington.
C*-Algebras, Jerry Kaminker, Indiana University-Purdue University at Indianapolis, and Claude L. Schochet, Wayne State University.
Groups and Geometries, Daniel E. Frohardt and Kay Magaard, Wayne State University, and Robert L. Griess Jr., University of Michigan.
Optimization and Variational Analysis, Boris S. Mordukhovich, Wayne State University, and Jay S. Treiman and Qiji Zhu, Western Michigan University.
Partial Differential Equations: Theories, Applications and Numerical Approaches, Frank J. Massey III and Jennifer Zhao,
University of Michigan-Dearborn, and Daoqi Yang, Wayne State University.

Recent Advances in Noncommutative Ring Theory, Peter Malcolmson and Frank Okoh, Wayne State University.

Representation Theory of Finite Groups and Related Topics, David Howard Gluck, Wayne State University.

Stochastic Processes in Finance and Control, Raoul LePage, Michigan State University, and Bert M. Schreiber, Wayne State University.

VOA's Monstrous Moonshine and Related Topics, Chongying Dong, University of California, Santa Cruz, and Robert L Griess Jr., University of Michigan.

Wavelets and Applications, Gregory F. Bachelis and Tze-Chien Sun, Wayne State University, and Grant Gerhart, Tardec, Tacoma, U.S. Army.

Accommodations
Participants should make their own arrangements directly with the hotel of their choice and state that they will be attending the AMS Central Section meeting. All rooms will be on a space available basis after the deadline given. The AMS is not responsible for rate changes or for the quality of the accommodations.

Hotel St. Regis, 3071 W. Grand Blvd.; tel. 313-873-3000; $69/single, double, triple, or quad; 15-minute walk to meetings. Deadline is March 20.

Westin Hotel, Renaissance Center; tel. 313-568-8000; $85/single or double; four miles from campus. Deadline is April 11.

Food Service
There are several restaurants available within walking distance. There will be information available at the registration desk.

Local Information
Please visit the Web site maintained by Wayne State University at http://www.wayne.edu/ or by the Department of Mathematics at http://www.math.wayne.edu/.

Other Activities
AMS Book Sale: Examine the newest titles from the AMS! Most books will be available at a special 50% discount offered only at meetings. Complimentary coffee will be served, courtesy of AMS Membership Services.

Parking
There are several University parking lots within easy walking distance to the meeting. Parking Lot K is the most convenient and is located directly across from State Hall. The parking fee is $1.

Registration and Meeting Information
Registration will take place in the lobby area of State Hall from 11:00 a.m. to 4:00 p.m. on Friday, from 7:30 a.m. to 3:00 p.m. on Saturday, and from 8:00 a.m. to 11:00 a.m. on Sunday. Registration times are tentative. Registration fees (payable on-site only): $30/AMS members; $45/non-members; $10/emeritus members, students, or unemployed mathematicians. Fees are payable by cash, check, VISA, MasterCard, Discover, or American Express. Invited Addresses will take place in Upper DeRoy Auditorium. All other sessions will take place in State Hall.

Travel
Air: The Detroit Metro Airport serves most major airlines. Commuter Transportation (313-941-3252) provides shuttle service to the hotels. Fares are approximately $12-$13 one-way; shuttle runs hourly until midnight.

USAir has been designated as the official airline for this meeting. The following specially negotiated rates are available: 5% discount off first class and any published USAir promotional round-trip fare, or 10% discount off unrestricted coach fares with seven-day advance reservations and ticketing required. These discounts are valid providing all rules and restrictions are met and are applicable for travel from the continental U.S., Bahamas, Canada, and San Juan, P.R. Discounts are not combinable with other discounts or promotions. Additional restrictions may apply on international travel. For reservations call (or have your travel agent call) 800-334-8644 between 8:00 a.m. and 9:00 p.m. Eastern Daylight Time. Refer to Gold File Number 41380118.

Driving: State Hall is a short block north of Warren Avenue on Cass Avenue. To get to Warren Avenue from US-10 (Lodge Freeway), take the Forest/Warren exit and proceed one block north and turn right onto Warren Avenue. From I-94 take the Woodward/John R east. If driving from the west, turn right onto John R, go south for 5 blocks, and turn right onto Warren Avenue. If driving from the east, turn left onto John R and follow the preceding directions, or go another block to Woodward Avenue, turn left onto Woodward Avenue, and proceed to Warren Avenue. From I-75 take the Warren Avenue exit and proceed west on Warren Avenue.

Cab fare from the airport is approximately $35. There is no public transportation available from the airport to the University.

Weather
The weather is extremely variable in Michigan in early May, and either rain or snow is possible; however, temperatures are likely to range from a low of 50 degrees F. to the mid-60 degrees F.
Pretoria, Republic of South Africa
University of Pretoria
June 26–28, 1997

Meeting #923

Associate secretary: Susan J. Friedlander
Announcement issue of Notices: March 1997
Program issue of Notices: June/July 1997
Issue of Abstracts: None

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: March 1, 1997
For abstracts: April 30, 1997

Invited Addresses
Hyman Bass, Columbia University, Title to be announced.
Armand Borel, Institute for Advanced Study, Title to be announced.
Percy Deift, Courant Institute of Mathematical Sciences, New York University, Title to be announced.
G. F. R. Ellis, University of Cape Town, South Africa, Title to be announced.
David Epstein, University of Warwick, United Kingdom, Title to be announced.
W. Goddard, University of Natal, Durban, South Africa, Title to be announced.
Doron Lubinsky, University of Witwatersrand, South Africa, Title to be announced.
Robert Mackay, University of Cambridge, United Kingdom, Title to be announced.
Peter Sarnak, Princeton University, Title to be announced.

Special Sessions
Algebraic K-Theory (Code: AMS SS F1), Eric M. Friedlander, Northwestern University, eric@math.nwu.edu and Aderemi O. Kuku, ICTP, Trieste, Italy, kuku@ictp.trieste.it.

Commutative Algebra and Algebraic Geometry (Code: AMS SS K1), James W. Brewer, Florida Atlantic University, jim@kafka.ac.fau.edu, Barry Green, University of Stellenbosch, and Sylvia Margaret Wiegand, University of Nebraska, Lincoln, swiegand@unlinfo.unl.edu.

Dynamical Systems and Ergodic Theory (Code: AMS SS B1), Harvey B. Keynes, University of Minnesota, keynes@math.umn.edu, Michael Sears, University of Witwatersrand, South Africa, 036mis@cosmos.wits.ac.za, and Lionel Slammert, University of the Western Cape, South Africa, lslammert@math.ucw.ac.za.

Finite Groups and Representation Theory (Code: AMS SS J1), Jamshid Moori, University of Natal, South Africa, moori@math.unp.ac.za and Kenchukwu Kenneth Nwabueze, Mathematical Sciences Research Institute, nwabueze@msri.org.

Fluid Dynamics (Code: AMS SS D1), Susan J. Friedlander, University of Illinois at Chicago, susan@math.nwu.edu, Andrew Gilbert, University of Exeter, United Kingdom, adg@maths.exeter.ac.uk, and David Mason, University of Witwatersrand, South Africa, dpmason@gauss.cam.wits.ac.za.

Geometry, Topology and Physics (Code: AMS SS A1), Steven B. Bradlow, University of Illinois-Urbana, bradlow@uiuc.edu, George Ellis, University of Cape Town, South Africa, ellis@maths.uct.ac.za, Nigel Hitchin, University of Cambridge, England, n.hitchin@pmms.cam.ac.uk, and Joao Rodrigues, University of Witwatersrand, South Africa, joao@physnet.phys.wits.ac.za.

Invariant Subspaces and Collections of Operators (Code: AMS SS G1), Peter Rosenthal, University of Toronto, rosent@math.toronto.edu and Graeme Philip West, University of Witwatersrand, South Africa, 036weg@cosmos.wits.ac.za.

Number Theory (Code: AMS SS E1), John Knopfmacher, University of Witwatersrand, South Africa, 036KNJ@cosmos.wits.ac.za and Peter Sarnak, Princeton University, sarnak@math.princeton.edu.

Operator Spaces and Related Structures (Code: AMS SS H1), David P. Blecher, University of Houston, Allan M. Sinclair, University of Edinburgh, and Johan Swart, University of Pretoria, South Africa, jswart@scientia.up.ac.za.

Partial Differential Equations (Code: AMS SS H1), Percy Alec Deift, deift@cims4.cims.nyu.edu and Jalal Shatah, New York University-Courant Institute, shatah@cims.nyu.edu.

Ramsey Theory and Set Theory (Code: AMS SS H1), Willem Fouche, University of Pretoria, wlfouche@scientia.up.ac.za, Marion Scheepers, Boise State University, marion@cantor.idbsu.edu, and Pieter Maritz, University of Stellenbosch, pmin@maties.sun.ac.za.

Secondary and Postsecondary Curriculum Reform (Code: AMS SS C1), Johann Engelbrecht, University of Pretoria, South Africa, jengelbr@scientia.up.ac.za, Deborah Hughes Hallet, Harvard University, dbh@math.harvard.edu, and Harvey B. Keynes, University of Minnesota, keynes@math.umn.edu.

Please note that there will be a session for contributed papers.

Information Update
For more information regarding the program, registration, and local information, please refer to the South African Mathematical Society's Web site: http://science.up.ac.za/sams/.

Abstracts for contributed paper sessions should be sent to joint@math.up.ac.za.
Accommodations

Accommodation and transportation arrangements have been made with a number of hotels in Pretoria. Information will be sent to people who indicate that they are interested (joint@math.up.ac.za). Transportation between the hotels and the campus, as well as transportation between the airport and the hotels will be arranged.

Local Information

The conference will take place on the main campus of the University of Pretoria. The campus is situated in Hatfield, a suburb east of downtown Pretoria. Pretoria is the administrative capital of South Africa and is situated in the Gauteng province. Johannesburg is about 70 km and Johannesburg international airport approximately 45 km from Pretoria. Please visit the Web site maintained by the South African Mathematical Society at http://science.up.ac.za/sams/joint.html. The local organisers at Pretoria University are Johann Engelbrecht and Johan Swart. All enquiries should be sent to either of them at joint@math.up.ac.za.

Registration and Meeting Information

Early registration fee is R300 (South African Rands, approximately US$65) if registered by March 15, 1997; after that date the registration fee is R380 (approximately US$70). Registration forms are available on request. Registration will also be possible through http://science.up.ac.za/sams/joint.html.

Security

The following is a quotation from the SAMS Web site for this meeting: "We do not want to deny that violence is a problem all over South Africa at the moment. Our feeling however is that it is blown out of proportion by the media right now. The campus of the University of Pretoria is as safe as any campus in the world. The area around the campus is bustling with business and amusement which reflects the safety of this part of the city. It is, however, not advisable to venture into the downtown area of Pretoria at night unless you are accompanied by a local person who knows where not to go."

"The time of the meeting is in the winter recess with almost no students around. In case you are worried about student protests (of which we have had virtually none at the University of Pretoria), we talked to our university registrar, who is the official spokesman on the security situation. His comment, in short: No further unrest or disturbance is expected."

Social Events

Social events in the evenings will include a conference reception, a performance by an African jazz band, and happy hour meetings. Excursions are planned to visit some interesting places, including some of the popular casinos in the vicinity.

Arrangements have been made for those whose travel plans allow for a visit to South Africa's well known national game parks or other scenic areas. The famed Kruger National Park (about 5 hours drive from Pretoria on a good national road) is the largest natural game reserve in the world.

Weather

June is winter in Pretoria. The average night temperature is 4 degrees C (39 degrees F) and the average day temperature is 19.5 degrees C (67 degrees F).

Montreal, Quebec, Canada

University of Montreal

September 26–28, 1997

Meeting #924

Eastern Section

Associate secretary: Lesley M. Sibner
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: To be announced

Deadlines

For organizers: Expired
For consideration of contributed papers in Special Sessions: May 1, 1997
For abstracts: June 26, 1997

Invited Addresses

Jacob E. Goodman, City University of New York, City College, Title to be announced.
Dieter Kotschick, University of Basel, Title to be announced.
Francois Lalonde, University of Quebec at Montreal, Title to be announced.
I. Moerdijk, University of Utrecht, Netherlands, Title to be announced.

Special Sessions

Algebraic Methods in Statistics (Code: AMS SS H1), Gerard G. Letac, Université Paul Sabatier, France.
Category Theory and Its Applications (Code: AMS SS E1), Michael Barr, McGill University, Ieke Moerdijk, University of Utrecht, Netherlands, and Myles Tierney, Rutgers University.
Combinatorial Geometry (Code: AMS SS C1), David Avis, McGill University, Jacob E. Goodman, City University of New York, City College, and Richard Pollack, Courant Institute-New York University.
Commutative Algebra (Code: AMS SS D1), Irena V. Peeva, Massachusetts Institute of Technology, and Hema Srinivasan, University of Missouri.
Invariant Theory (Code: AMS SS G1), Abraham Broer, University of Montreal, Yannis Y. Papaconstantinou, C.R.M., Uni-
Claremont, California
Claremont Colleges
October 4, 1997

Meeting #925
Joint meeting with the Mathematical Association of America.

Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: To be announced

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: May 2, 1997
For abstracts: June 27, 1997

Atlanta, Georgia
Georgia Institute of Technology
October 10–12, 1997

Meeting #926
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: To be announced

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: May 14, 1997
For abstracts: July 9, 1997

Invited Addresses
Irene Fonseca, Carnegie-Mellon University, Title to be announced.
Michael T. Lacey, Georgia Institute of Technology, Title to be announced.
Marek T. Rychlik, University of Arizona, Title to be announced.
J. Ernest Wilkins Jr., Clark Atlanta University, Title to be announced.

Special Sessions
Computer Proofs in Set Theory and Logic (Code: AMS SS E1), Johan G. F. Belinfante, Georgia Institute of Technology.
Concrete Aspects of Real Polynomials (Code: AMS SS H1), Victoria Ann Powers, Emory University, and Bruce A. Reznick, University of Illinois, Champaign-Urbana.
Discrete Conformal Geometry (Code: AMS SS G1), Philip Lee Bowers, Florida State University.
Harmonic Analysis and Its Applications (Code: AMS SS D1), Michael Lacey, Georgia Institute of Technology.
Modern Banach Space Theory (Code: AMS SS C1), Stephen Dilworth and Maria K. Girardi, University of South Carolina.
Set-Theoretic Techniques in Topology and Analysis (Code: AMS SS A1), Gary F. Gruenhage and Piotr Koszmider, Auburn University.
Stochastic Inequalities and Their Applications (Code: AMS SS F1), Theodore P. Hill and Christian Houdré, Georgia Institute of Technology.

Milwaukee, Wisconsin
University of Wisconsin
October 24–26, 1997

Meeting #927
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: August 1997
Program issue of Notices: October 1997
Issue of Abstracts: To be announced

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: May 21, 1997
For abstracts: July 16, 1997
Invited Addresses

Spencer J. Bloch, University of Chicago, Title to be announced.
Henri Moscovici, Ohio State University, Title to be announced.
Wei Ming Ni, University of Minnesota, Title to be announced.
Andrei Suslin, Northwestern University, Title to be announced.

Special Sessions

Analysis with Wavelets (Code: AMS SS M1), Gilbert G. Walter, University of Wisconsin-Milwaukee, and Ahmed I. Zayed, University of Central Florida.

Applications of Model Theory to Analysis and Topology (Code: AMS SS Q1), Paul J. Bankston, Marquette University, and H. Jerome Keisler, University of Wisconsin.

Computability Theory (Code: AMS SS A1), Steffen Lempp, University of Wisconsin-Madison, and Robert I. Soare, University of Chicago.

Concentration Phenomena in Differential Equations (Code: AMS SS E1), Lia Bronsard, McMaster University, and Wei-Ming Ni, University of Minnesota.

Differential Geometry (Code: AMS SS N1), Hongyou Wu, Northern Illinois University.

Eigenvalue Problems for Differential Equations (Code: AMS SS K1), Paul A. Binding, University of Calgary, and Hans W. Volkmer, University of Wisconsin-Milwaukee.

Enveloping Algebras and Quantum Groups (Code: AMS SS J1), Ian M. Musson and Yi Ming Zou, University of Wisconsin-Milwaukee.

Geometric Topology and Geometric Group Theory (Code: AMS SS H1), Fredric Davis Ancel and Craig R. Guilbault, University of Wisconsin-Milwaukee.

Harmonic Analysis and Its Applications (Code: AMS SS F1), Lung-Kee Chen, Oregon State University, Dashan Fan, University of Wisconsin-Milwaukee, and Yi-Blao Pan, University of Pittsburgh.


Low Dimensional Dynamics (Code: AMS SS C1), Karen M. Brucks, University of Wisconsin-Milwaukee, and Beverly E. J. Diamond, University of Charleston.

Number Theory and Cryptography (Code: AMS SS D1), Eric Bach and Rene Peralta, University of Wisconsin-Milwaukee.

Operator Theory and Function Spaces (Code: AMS SS G1), Zeljko Cuckovic, University of Toledo.

Rings and Modules (Code: AMS SS I1), Karl Andrew Kosler and Shubhangi S. Stalder, University of Wisconsin Centers-Waukesha.

Semigroups and Their Applications (Code: AMS SS P1), Karl E. Byleen and Peter R. Jones, Marquette University.

Symplectic Topology and Quantum Cohomology (Code: AMS SS L1), Yong-Geun Oh, University of Wisconsin, and Yongbin Ruan, University of Utah.

Albuquerque, New Mexico
University of New Mexico
November 8–9, 1997

Meeting #928
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: September 1997
Program issue of Notices: November 1997
Issue of Abstracts: To be announced

Deadlines
For organizers: Expired
For consideration of contributed papers in Special Sessions: June 12, 1997
For abstracts: August 7, 1997

Oaxaca, Mexico
Oaxaca, Mexico
December 4–7, 1997

Meeting #929
Third Joint Meeting of the American Mathematical Society and the Sociedad Mathematica Mexicana.
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Baltimore, Maryland
Baltimore Convention Center
January 7–10, 1998

Meeting #930
Joint Mathematics Meetings, including the 104th Annual Meeting of the AMS, 81st Annual Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM), and the winter meeting of the Association for Symbolic Logic (ASL).
Associate secretary: Robert J. Daverman
Meetings & Conferences

Announcement issue of Notices: October 1997
Program issue of Notices: January 1998
Issue of Abstracts: To be announced

Deadlines
For organizers: April 10, 1997
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Invited Addresses
Edward Witten, Institute for Advanced Study (AMS Josiah Willard Gibbs Lecture).

Louisville, Kentucky
University of Louisville
March 20–21, 1998
Southeastern Section
Associate secretary: Robert J. Daverman
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Special Sessions
Boundary Value Problems for Differential Equations (Code: AMS SS J1), Paul W. Eloe, University of Dayton.
Combinatorics and Enumerative Geometry (Code: AMS SS A1), Kequan Ding, University of Illinois, Urbana-Champaign, and Chi Wang, University of Louisville.
Combinatorics and Graph Theory (Code: AMS SS B1), Andre E. Kezdy, Grzegorz Kubicki, and Jenoe Lehel, University of Louisville.
Discrete Mathematics, Classification Theory and Consensus (Code: AMS SS C1), Robert C. Powers, University of Louisville.
Fractal Geometry and Related Topics (Code: AMS SS D1), Ka-Sing Lau, University of Pittsburgh, and Weibin Zeng, University of Louisville.
Functional Equations and Inequalities (Code: AMS SS E1), Thomas Riedel and Prasanna Sahoo, University of Louisville.
Real Analysis (Code: AMS SS G1), Udayan B. Darji and Lee Larson, University of Louisville.

Semigroups, Algorithms, and Universal Algebra (Code: AMS SS H1), Ralph N. McKenzie, Vanderbilt University, and Steven Seif, University of Louisville.
Spectral Geometry (Code: AMS SS K1), Ruth Gornet, Texas Tech University, and Peter Anton Perry, University of Kentucky.
Spectral Theory, Mathematical Physics and Disordered Media (Code: AMS SS L1), Peter A. Hislop, University of Kentucky, and Gunter H. Stolz, University of Alabama at Birmingham.
The Use of the History of Mathematics and Science in the University and School Classroom (Code: AMS SS M1), Richard M. Davitt, University of Louisville.

Manhattan, Kansas
Kansas State University
March 27–28, 1998
Central Section
Associate secretary: Susan J. Friedlander
Announcement issue of Notices: January 1998
Program issue of Notices: March 1998
Issue of Abstracts: To be announced

Deadlines
For organizers: June 26, 1997
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

Special Sessions

Philadelphia, Pennsylvania
Temple University
April 4–6, 1998
Meeting #933
Eastern Section
Associate secretary: Lesley M. Sibner
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

**Invited Addresses**

Tobias H. Colding, Courant Institute-New York University.
Martin Davis, University of California, Berkeley.
Ezra Getzler, Max Planck Institute and Northwestern University.
Yanyan Li, Rutgers University, New Brunswick.

**Special Sessions**

Harmonic Analysis and Its Applications to PDE's (Code: AMS SS G1), Cristian E. Gutierrez, Temple University, and Guozhen Lu, Wright State University.

Heat Kernel Analysis on Lie Groups (Code: AMS SS H1), Leonard Gross, Cornell University, and Omar Hijab, Temple University.

Modular Identities and Q-Series in Number Theory (Code: AMS SS A1), Boris Datskovsky and Marvin I. Knopp, Temple University.

PDE's in Several Complex Variables (Code: AMS SS B1), Shiferaw Berhanu and Gerardo Mendoza, Temple University.

Radon Transforms and Tomography (Code: AMS SS C1), Eric L. Grinberg, Temple University, and Eric Todd Quinto, Tufts University.

Rings and Representations (Code: AMS SS E1), Maria E. Lorenz, Ursinus College, and Martin Lorenz, Temple University.

The History of American Mathematics (Code: AMS SS D1), Karen H. Parshall, University of Virginia, and David E. Zitarelli, Temple University.

Topology of Manifolds (Code: AMS SS F1), Georgia Triantafillou, Temple University.

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**Chicago, Illinois**

*DePaul University-Chicago*

September 12-13, 1998

Central Section

Associate secretary: Susan J. Friedlander

Announcement issue of Notices: August 1998

Program issue of Notices: October 1998

Issue of Abstracts: To be announced

**Deadlines**

For organizers: To be announced

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

**Tucson, Arizona**

*University of Arizona-Tucson*

November 14-15, 1998

Western Section

Associate secretary: William A. Harris Jr.

Announcement issue of Notices: September 1998

Program issue of Notices: November 1998

Issue of Abstracts: To be announced

**Deadlines**

For organizers: To be announced

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced

**San Antonio, Texas**

*San Antonio Convention Center*

January 13-16, 1999

Joint Mathematics Meetings, including the 105th Annual Meeting of the AMS, 82nd Meeting of the Mathematical Association of America (MAA), and annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).

Associate secretary: Susan J. Friedlander

Announcement issue of Notices: October 1998

Program issue of Notices: January 1999

Issue of Abstracts: To be announced

**Deadlines**

For organizers: To be announced

For consideration of contributed papers in Special Sessions: To be announced

For abstracts: To be announced
Meetings & Conferences

For summaries of papers to MAA organizers: To be announced

Las Vegas, Nevada
University of Nevada-Las Vegas

April 10–11, 1999
Western Section
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: February 1999
Program issue of Notices: April 1999
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced

New Orleans, Louisiana
New Orleans Marriott and ITT Sheraton New Orleans Hotel

January 10–13, 2001
Joint Mathematics Meetings, including the 107th Annual Meeting of the AMS, 84th Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced

Washington, District of Columbia
Sheraton Washington Hotel and Omni Shoreham Hotel

January 19–22, 2000
Joint Mathematics Meetings, including the 106th Annual Meeting of the AMS, 83rd Meeting of the Mathematical Association of America (MAA), annual meetings of the Association for Women in Mathematics (AWM) and the National Association of Mathematicians (NAM).
Associate secretary: William A. Harris Jr.
Announcement issue of Notices: To be announced
Program issue of Notices: To be announced
Issue of Abstracts: To be announced

Deadlines
For organizers: To be announced
For consideration of contributed papers in Special Sessions: To be announced
For abstracts: To be announced
For summaries of papers to MAA organizers: To be announced
Notices of the AMS

March 1997

Presenters of Papers

Memphis, Tennessee; March 21-22, 1997

Numbers following the name indicate the speaker’s position on the program.

- AMS Invited Lecturer, • Other Invited Lecturer, ☆ Special Session Speaker, ▲ Graduate Student
Fundamental Groups of Compact Kähler Manifolds

J. Amorós, I-UPC, ETSIEB, Barcelona, Spain, M. Burger, Université de Lausanne, Switzerland, K. Corlette, University of Chicago, IL, D. Kotschick, Universität Basel, Switzerland, and D. Toledo, University of Utah, Salt Lake City

This book is an exposition of what is currently known about the fundamental groups of compact Kähler manifolds. This class of groups contains all finite groups and is strictly smaller than the class of all finitely presentable groups. For the first time ever, this book collects together all the results obtained in the last few years, which aim to characterize those infinite groups which can arise as fundamental groups of compact Kähler manifolds.

The methods and techniques used form an attractive mix of topology, differential and algebraic geometry, and complex analysis. The book would be useful to researchers and graduate students interested in any of these areas, and it could be used as a textbook for an advanced graduate course. One of its outstanding features is a large number of concrete examples.

Introduction to Intersection Theory in Algebraic Geometry

William Fulton, University of Chicago, IL

This book presents expository lectures from the CBMS regional conference held at George Mason University during the summer of 1983. This volume has been reprinted by the AMS with updates and corrections. In the work, Fulton gives references to many further developments in the field.

Topology of Real Algebraic Varieties and Related Topics

V. Kharlamov, University Louis Pasteur, Strasbourg Cedex, FR, A. Korchagin, Brooklyn, NY, G. Polotovskii Gorky State University, Russia, and O. Viro, University of California, Riverside, Editors

This volume is dedicated to the memory of the Russian mathematician D. A. Gudkov. It contains papers written by his friends, students, and collaborators and is devoted mainly to the areas where D. A. Gudkov made important contributions. The main topic is the topology of real algebraic varieties. Several papers include new results on the topology of real plane algebraic curves (the Hilbert 16th problem).

All prices subject to change. Charges for delivery are $3.00 per order, or for air delivery outside of the continental U.S., please include $6.50 per item. Prepayment required. Order from: American Mathematical Society, P.O. Box 614, Providence, RI 02940. For credit card orders, fax (401) 384-2875 or call toll free 800-321-4AMS (4267) in the U.S. and Canada, (401) 455-4300 worldwide. Residents of Canada, please include 7% GST.
Program of the Sessions
Memphis, Tennessee, March 21-22, 1997

Friday, March 21

AMS Book Sale and Electronic Products
7:30 AM - 5:00 PM  Ground Floor Lobby, Psychology Building

Registration
7:30 AM - 5:00 PM  Ground Floor Lobby, Psychology Building

Special Session on Dynamical Systems and Fractal Geometry, I
8:00 AM - 10:50 AM  Room 109, Dunn Hall
Organizer: Fernanda Botelho, University of Memphis

8:00 AM  The boundaries of self-similar tilings of \( \mathbb{R}^n \).
(1) James E. Keesling, University of Florida (919-28-14)

8:30 AM  Boundary of self-similar sets.
(2) Chithra A. Krishnamurthi, University of Florida, Gainesville (919-28-15)

9:00 AM  Solving the sextic by iteration: A study in complex geometry and dynamics.
Scott Crass, Denison University (919-51-22)

9:30 AM  Conservative exact rational maps of the sphere.
(3) Preliminary report.
Julia A. Barnes, Western Carolina University (919-28-20)

10:00 AM  Dynamics of lattice differential equations.
(5) Erik S. Van Vleck, Colorado School of Mines (919-34-16)

10:30 AM  Annulus diffeomorphisms with many non-Denjoy minimal sets.
Mark Turpin, University of Hartford (919-68-37)

Special Session on Topology of Manifolds and Singular Spaces, I
8:00 AM - 10:50 AM  Room 129, Dunn Hall
Organizers: Bruce Hughes, Vanderbilt University

Andrew A. Ranicki, Edinburgh University
8:00 AM  Relative controlled end and \( h \)-cobordism theorems.
(7) Frank S Quinn, Virginia Tech (919-57-34)

8:30 AM  Generalized assembly maps. Preliminary report.
(8) Erik K. Pedersen, Binghamton University (919-55-117)

9:00 AM  On assembly maps for lattices and their analogues.
(9) Boris Goldfarb, Stanford University (919-19-55)

9:30 AM  Families of hypersurfaces with non-isolated singularities.
(10) Terence J. Gaffney, Northeastern University (919-32-106)

10:00 AM  The topology of some nonsingular algebraic spaces.
(11) John W. Wood, University of Illinois at Chicago (919-57-107)

10:30 AM  Controlling Thom's \( a_f \) condition.
(12) David B. Massey, Northeastern University (919-32-21)

Special Session on Graph Theory, I
8:00 AM - 10:50 AM  Room 233, Dunn Hall
Organizers: Ralph J. Faudree, Jr., University of Memphis
Richard H. Schelp, University of Memphis

8:00 AM  \( P_4 \)-isomorphisms for graphs.
(13) R. E. L. Aldred, University of Otago, and M. N. Ellingham*, Vanderbilt University (919-05-35)

8:30 AM  Infinite paths in planar graphs.
(14) Xingxing Yu, Vanderbilt University (919-05-114)

9:00 AM  Graphical knockouts.
(15) Peter J. Slater, University of Alabama in Huntsville (919-05-104)

9:30 AM  Some results on minimal rankings.
(16) Renu Laskar* and Daniel J Pillone, Clemson University (919-05-64)

10:00 AM  Group connectivity of chordal graphs.
(17) Hong-Jian Lai, West Virginia University (919-05-170)

The time limit for each contributed paper in the sessions is ten minutes. In the Special Sessions the time limit varies from session to session and within sessions. To maintain the schedule, time limits will be strictly enforced.

For papers with more than one author, an asterisk follows the name of the author who plans to present the paper at the meeting.

Papers flagged with a solid triangle (**) have been designated by the author as being of possible interest to undergraduate students.

Abstracts of papers presented in the sessions at this meeting will be found in the issue of Abstracts of papers presented to the American Mathematical Society, ordered according to the numbers in parentheses following the listings. The middle two digits, e.g., 897-20-1136, refer to the Mathematical Reviews subject classification assigned by the individual author. Groups of papers for each subject are listed chronologically in the Abstracts. The last one to four digits, e.g., 897-20-1136, refer to the receipt number of the abstract; abstracts are further sorted by the receipt number within each classification.
### Program of the Sessions – Memphis, TN, Friday, March 21 (cont’d.)

**Special Session on Partial Differential Equations, I**

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Organizers</th>
</tr>
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<tbody>
<tr>
<td>8:00 AM</td>
<td>Model equations related to KdV.</td>
<td>G. Simonett, University of Maryland</td>
</tr>
<tr>
<td>8:30 AM</td>
<td>The global behavior of positive solution to certain elliptic systems.</td>
<td>G. Simonett, University of Maryland</td>
</tr>
<tr>
<td>9:00 AM</td>
<td>Some generalizations of the Kadomtsev-Petviashvili equations.</td>
<td>Jerome A. Goldstein, University of Memphis</td>
</tr>
<tr>
<td>9:30 AM</td>
<td>Motion by curvature. A center manifold analysis.</td>
<td>James York, University of Texas</td>
</tr>
<tr>
<td>10:00 AM</td>
<td>Quenching and blow-up.</td>
<td>Jan Jonsson, University of Alabama</td>
</tr>
<tr>
<td>10:30 AM</td>
<td>A Picard-Maclaurin theorem for initial value PDEs.</td>
<td>G. Edgar Parker, James Madison University</td>
</tr>
</tbody>
</table>

**Special Session on Numerical Solutions for Partial Differential Equations, I**

<table>
<thead>
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<tr>
<td>8:30 AM</td>
<td>Implementing the Picard-Maclaurin Theorem for initial value PDEs.</td>
<td>James S. Sochacki, James Madison University</td>
</tr>
<tr>
<td>9:00 AM</td>
<td>Adaptive finite elements in 3D and the binary black hole initial data problem.</td>
<td>Douglas N. Arnold, Pennsylvania State University</td>
</tr>
<tr>
<td>9:45 AM</td>
<td>A two-level finite element method. Preliminary report.</td>
<td>Leonel V. Franco, University of Texas</td>
</tr>
<tr>
<td>10:15 AM</td>
<td>Convergence analysis of orthogonal spline collocation for elliptic boundary value problems.</td>
<td>Bernard Bialecki, Colorado School of Mines</td>
</tr>
</tbody>
</table>

**Special Session on Complex Analysis in One and Several Variables, I**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>8:30 AM</td>
<td>Pick-Nevanlinna interpolation.</td>
<td>Stephen D. Fisher, Northwestern University</td>
</tr>
</tbody>
</table>

**Special Session on Harmonic Analysis and Convexity, I**

<table>
<thead>
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<tr>
<td>8:30 AM</td>
<td>A special case ofMahler’s conjecture.</td>
<td>Marlo A. Lopez, University of Texas</td>
</tr>
<tr>
<td>9:00 AM</td>
<td>Banach space operators preserving the extreme points of the unit ball.</td>
<td>Vania Mascioni, University of Texas</td>
</tr>
<tr>
<td>9:30 AM</td>
<td>Discrepancy estimates and the Radon transform.</td>
<td>Allen D. Rogers, University of Windsor</td>
</tr>
<tr>
<td>10:00 AM</td>
<td>Continuity of Steiner symmetrization.</td>
<td>Almutt Burchard, Pennsylvania State University</td>
</tr>
<tr>
<td>10:30 AM</td>
<td>Convexity and extremals of zeta functions of Laplacians.</td>
<td>John A. Baker, University of Texas</td>
</tr>
</tbody>
</table>

**Special Session on Chaotic Dynamics, I**

<table>
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<tr>
<th>Time</th>
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<tr>
<td>8:30 AM</td>
<td>Dynamics of spatial averages.</td>
<td>Leonid B. Kupinovich, University of Texas</td>
</tr>
<tr>
<td>9:00 AM</td>
<td>Torsion in the isentropic Euler fluid and the impulsively started cylinder.</td>
<td>Philip N. Balbin, University of Akron</td>
</tr>
<tr>
<td>10:00 AM</td>
<td>Cocyclic subshifts.</td>
<td>Jaroslaw Kwapisz, Center for Dynamical Systems and Nonlinear Studies, Georgia Institute of Technology</td>
</tr>
<tr>
<td>10:30 AM</td>
<td>Substitution dynamics, tilings, and symmetry.</td>
<td>Charles Radin, University of Texas</td>
</tr>
</tbody>
</table>
Special Session on Random Graphs, I

8:30 AM - 10:50 AM  Room 227, Dunn Hall
Organizers: Shuntang Wu, Zhenjiang Normal University, and Jeong Han Kim, AT&T Labs-Research (919-05-265)

9:00 AM  Special Session on Random Graphs, I
8:45 AM - 9:30 AM  Room 227, Dunn Hall
Shuntang Wu, Zhenjiang Normal University, and Jeong Han Kim, AT&T Labs-Research (919-05-265)

Special Session on Invariants of 3-Manifolds, I

8:45 AM - 10:55 AM  Room 125, Dunn Hall
Organizers: Richard Martin Hain, Duke University, Jun Yang, Duke University, Stavros Garoufalidis, Brown University

9:00 AM  Special Session on Invariants of 3-Manifolds, I
8:45 AM - 9:30 AM  Room 125, Dunn Hall
Richard Martin Hain, Duke University, Jun Yang, Duke University, and Stavros Garoufalidis, Brown University

Special Session on Approximation in Mathematics, I

9:00 AM - 10:50 AM  Room 351, Dunn Hall
Organizer: George A. Anastassiou, University of Memphis

9:00 AM  Special Session on Approximation in Mathematics, I
8:30 AM - 9:30 AM  Room 351, Dunn Hall
George A. Anastassiou, University of Memphis

Special Session on Convergence and Recurrence in Ergodic Theory, I

9:00 AM - 10:50 AM  Room 244, Psychology Building
Organizers: Mate Wierdl, University of Memphis, and James T. Campbell, University of Memphis

9:00 AM  Special Session on Convergence and Recurrence in Ergodic Theory, I
8:30 AM - 9:30 AM  Room 244, Psychology Building
Mate Wierdl, University of Memphis, and James T. Campbell, University of Memphis

Invited Address

11:05 AM - 11:55 AM  Psychology Lecture Hall, next to Psychology Building
Organizer: George A. Anastassiou, University of Memphis

11:05 AM  Invited Address
11:00 AM - 11:55 AM  Psychology Lecture Hall, next to Psychology Building
George A. Anastassiou, University of Memphis (64)

Special Session on Approximation in Mathematics, II

2:30 PM - 5:20 PM  Room 351, Dunn Hall
Organizer: George A. Anastassiou, University of Memphis

2:30 PM  Special Session on Approximation in Mathematics, II
2:30 PM - 5:20 PM  Room 351, Dunn Hall
George A. Anastassiou, University of Memphis
Special Session on Symbolic Dynamics, II

2:30PM - 4:20PM Room 107, Dunn Hall
Organizer: Paul B. Trow, University of Memphis

2:30PM
Flow equivalence of reducible SFTs and filtered SL(2) equivalence of their defining infinite matrices.
Mike M. Boyle*, Univ. of Maryland at College Park, and Danrun Huang, University of Washington (919-54-140)

3:00PM
Jewett-Krieger: One step beyond and outer limits.
Nicholas S. Ormes, University of Maryland, College Park (919-58-139)

3:30PM
A $\mathbb{Z}^2$ embedding theorem.
Samuel J. Lightwood, University of Maryland, College Park (919-58-142)

4:00PM
Kathleen Madden*, Lafayette College, and Aimee Johnson, Swarthmore College (919-58-43)

Special Session on Numerical Solutions for Partial Differential Equations, II

2:30PM - 6:00PM Room 225, Dunn Hall
Organizers: Ohannes Karakashian, University of Tennessee
Xiaobing Feng, University of Tennessee

2:30PM
Finite element methods for approximating a model of ferro-magnetism.
Peter B. Monk, University of Delaware (919-65-188)

3:00PM
Effects of discretization on solving the Ericksen's bar problem. Preliminary report.
Charles R. Collins, University of Tennessee (919-65-190)

3:45PM
A conservative form of the modified method of characteristics.
Jim Douglas, Jr.*, Purdue University, and Felipe Pereira, Laboratory Nacional de Computacao Cientifica, Brazil (919-65-191)

4:15PM
Numerical approximation of stationary MHD flow with a nonideal boundary.
Amnon J. Meir* and Paul G. Schmidt, Auburn University (919-65-192)

5:00PM
Numerical simulation of blowup for the nonlinear Schrodinger equation. Preliminary report.
Ohannes Karakashian* and Michael Plexousakis, University of Tennessee (919-65-298)

5:30PM
A posteriori error estimation and adaptivity for degenerate parabolic problems.
Ricardo H. Nochetto, The University of Tennessee (919-65-332)

Special Session on Convergence and Recurrence in Ergodic Theory, II

2:30PM - 4:20PM Room 244, Psychology Building
Organizers: Mate Wierdl, University of Memphis
James T. Campbell, University of Memphis

2:30PM
A non-linear version of Szemerédi's Theorem for sets of positive density in the real line.
Vitaly Bergelson, The Ohio State University, and Randall G. McCutcheon*, Case Western University (919-28-132)

3:10PM
Some recent developments and questions in the theory of almost everywhere convergence of weighted ergodic averages. Preliminary report.
James H. Olsen, North Dakota State University (919-47-95)

3:50PM
$L^p$ bounds for the bilinear Hilbert transform.
Michael T. Lacey*, Georgia Institute of Technology, and Christoph M. Thiele, Universitat Kiel (919-28-127)

Special Session on Complex Analysis in One and Several Variables, II

2:30PM - 5:20PM Room 204, Psychology Building
Organizer: Dmitry Khavinson, University of Arkansas

2:30PM
Bohr's power series theorem in several variables.
Harold P. Boas*, Texas A&M University, and Dmitry Khavinson, University of Arkansas (919-32-05)

3:00PM
On elliptic and parabolic measure.
John L. Lewis, University of Kentucky (919-30-58)

3:30PM
The $\partial$-Neumann problem in the Sobolev topology.
Steve Krantz*, Washington University, Luigi Fontana, Università di Milano, and Marco M Peloso, Politecnico di Torino (919-32-184)

4:00PM
Pluri-subharmonic functions and subellipticity of the $\partial$-Neumann problem on nonsmooth domains.
Emil J. Straube, Texas A&M University (919-32-245)

4:30PM
A Frobenius-type theorem for some singular partial differential equations.
Jill E. Hemmati, University of Arkansas (919-35-92)

5:00PM
Mizohata structures on $S^2$: Automorphisms and standardness.
Abdelhamid Meziani, Florida International University (919-30-157)

Special Session on Harmonic Analysis and Convexity, II

2:30PM - 4:50PM Room 206, Psychology Building
Organizers: Eric A. Carlen, Georgia Institute of Technology
Erwin Lutwak, Polytechnic University
Elisabeth Werner, Case Western Reserve University
### Special Session on Invariants of 3-Manifolds, II

**2:30 PM - 4:40 PM** Room 125, Dunn Hall

**Organizers:** Richard Martin Hain, Duke University, Jun Yang, Duke University, Stavros Garoufalidis, Brown University

- **3:05 PM** - Finite type 3-manifold invariants and holomorphic functions. Ruth Lawrence, University of Michigan, Ann Arbor (919-57-301)
- **3:40 PM** - Hyper-Kähler geometry and invariants of 3-manifolds. Edward Witten, Institute for Advanced Study, and Lev Rozansky*, University of Illinois at Chicago (919-57-210)

### Special Session on Recurrent Neural Networks and Applications, I

**2:30 PM - 4:50 PM** Room 109, Dunn Hall

**Organizers:** Fernanda Botelho, University of Memphis, Max H. Garzon, University of Memphis

- **2:30 PM** - A language that recurrent neural networks can’t recognize in less than exponential time. Cristopher Moore, Santa Fe Institute (919-68-195)
- **3:00 PM** - Decoding discrete structures from fixed points of analog Hopfield networks. Arun K Jagota, University of California, Santa Cruz (919-68-39)
- **4:00 PM** - Fault-tolerance in neural networks with two neurons. Preliminary report. Fernanda Botelho, Max Garzon and Mi Zhou* (919-68-240)
- **4:30 PM** - Primal-target recurrent neural nets for hypergraph optimization problems. Dmitri Kaznacheev*, St. Jude / University of Memphis, and Arun Jagota, University of California, Santa Cruz (919-68-216)

### Special Session on Topology of Manifolds and Singular Spaces, II

**2:30 PM - 5:50 PM** Room 129, Dunn Hall

**Organizers:** Bruce Hughes, Vanderbilt University, Andrew A. Ranicki, Edinburgh University

- **2:30 PM** - Higher analytic torsion. Preliminary report. Mel Rothenberg, University of Chicago (919-57-163)
- **3:00 PM** - Orthogonal calculus and index theory. Preliminary report. Michael S Weiss, University of Notre Dame (919-57-60)
- **3:30 PM** - h-Cobordisms and mapping cylinder obstructions. Bogdan Vajiac, University of Notre Dame (919-57-112)
- **4:00 PM** - Which C-spheres are suspensions? Frank Connolly, University of Notre Dame (919-57-174)
- **4:30 PM** - Obstructions to transversality for some singular spaces. Heather M. Johnston, Rutgers University (919-57-102)
- **5:00 PM** - Universal formulas for the generalized Casson’s invariants of knots. Hans U. Boden* and Andrew J. Nicas, McMaster University (919-55-159)
- **5:30 PM** - Ring structure on Floer homology for symplectic fixed points. Matthias Schwarz, Stanford University (919-58-100)

### Special Session on Chaotic Dynamics, II

**2:30 PM - 5:20 PM** Room 123, Dunn Hall

**Organizers:** Nikolai I. Chernov, University of Alabama at Birmingham, Sergei Tabetzkov, University of Alabama at Birmingham

- **3:00 PM** - Horseshoes and the Conley index spectrum. Konstantin Mischaikow, Georgia Tech (919-58-250)
- **3:30 PM** - Entropy and the number of geodesics joining two points. Keith Howard Burns*, Northwestern University, and Gabriel Paternain, Universidad de la Republica, Montevideo, Uruguay (919-58-203)
- **4:00 PM** - Graph substitutions. Joseph Peter Previte, University of Maryland (919-57-147)
- **4:30 PM** - Some results and many questions about renormalization in dynamics. Charles P. Tresser, IBM, Yorktown Heights, NY (919-58-165)
- **5:00 PM** - Using a finite horizon to make embedded surfaces with ergodic geodesic flow. Preliminary report. Victor J. Donnay, Bryn Mawr College (919-58-305)

### Special Session on Graph Theory, II

**2:30 PM - 5:20 PM** Room 233, Dunn Hall

**Organizers:** Ralph J. Faudree, Jr., University of Memphis, Richard H. Schelp, University of Memphis

- **2:30 PM** - Some results on the Ramsey number for graphs. Paul Erdős, Hungarian Academy of Sciences (919-58-233)
- **3:00 PM** - The number of edges in an n-connected graph. Frank Harary, Bell Laboratories (919-58-147)
- **3:30 PM** - Graphs of degree one. Frank Harary, Bell Laboratories (919-58-147)
- **4:00 PM** - The number of K1,1,2 subgraphs in a graph. Frank Harary, Bell Laboratories (919-58-147)
- **4:30 PM** - The number of edges in a graph. Frank Harary, Bell Laboratories (919-58-147)
- **5:00 PM** - The number of edges in a graph. Frank Harary, Bell Laboratories (919-58-147)
Program of the Sessions – Memphis, TN, Friday, March 21 (cont’d.)

2:30 PM – 3:50 PM Room 227, Dunn Hall

Special Session on Random Graphs, II

Organizers: Bela Bollobas, University of Memphis
           Cecile C. Rousseau, University of Memphis

2:30 PM
           Rod Canfield, University of Georgia (919-05-318)

3:00 PM
(125) Endomorphisms of partially ordered sets.
           Dwight Duffus, Tomasz Luczak*, Akira Saito*, Nihon University, Japan, and
           Richard H. Schelp, The University of Memphis (919-05-83)

3:30 PM
(126) Quadrilaterals in the cube and directed graphs.
           Richard H. Schelp, University of Memphis, and
           Andrew Thomason*, University of Cambridge and University of Memphis (919-05-328)

Special Session on Partial Differential Equations, II

2:30 PM – 5:20 PM Room 209, Dunn Hall

Organizers: Gisele Ruiz Goldstein, University of Memphis
           Jerome A. Goldstein, University of Memphis

2:30 PM
(127) Inverse spectral problems and Herglotz functions. Preliminary report.
           Fritz Gesztesy, University of Missouri - Columbia (919-34-202)

3:00 PM
(128) Spectral and growth bounds for the linearized Eulerian kinematic dynamo operator. Preliminary report.
           Yuri Latushkin*, University of Missouri-Columbia, and
           Mishra Vishik, University of Texas-Austin (919-58-207)

3:30 PM
(129) The spectrum of the Laplacian on a class of Riemannian manifolds.
           Robert M. Kauffman*, UAB, Birmingham, and
           Alberto G. Setti, University of Milan, Italy (919-47-183)

4:00 PM
(130) Lower gradient bound for ground state eigenfunctions of Dirichlet Laplacians. Preliminary report.
           Rodrigo Banuelos, Purdue University, and Michael M.H. Pang*, University of Missouri-Columbia (919-35-260)

Session on Contributed Papers, I

2:30 PM – 5:10 PM Room 230, Psychology Building

2:30 PM
(133) Multiple spike layer solutions to semilinear elliptic equation with Neuman boundary conditions.
           Michael Kowalczyk, University of Minnesota (919-35-317)

2:45 PM
           Aurora Breazna, Louisiana State University (919-35-123)

3:00 PM
           Andrei Breazna, Louisiana State University (919-35-70)

3:15 PM
(136) Summation of functional series which occur in thermomechanical problem with respect to nonomogeneous structures.
           Andriy Mikolaevich Blazhievskiy, Technological University of Podillya, Khmelnytsky, Ukraine (919-35-07)

3:30 PM
           Boris S Khots (919-22-297)

3:45 PM
(138) Strong convergence of copulas.
           Piotr Mikusinski, University of Central Florida (919-28-243)

4:00 PM
(139) Sharp subelliptic estimate for n-1 forms on finite type domains.
           Lop-Hing Ho, Wichita State University (919-32-18)

4:15 PM
           Allan Fryant, Greensboro College (919-42-54)

4:30 PM
(141) Minimal length normal forms for braid words. Preliminary report.
           Margaret A. Yoder, Eastern Kentucky University (919-20-44)

4:45 PM
(142) Geometric representations of substitution dynamical systems.

5:00 PM
(143) Directed graphs and geometric representations of substitutions.
           Charles G. Holton, Jr.*, University of California, and
           Luca Q. Zamboni, University of North Texas (919-58-299)

Special Session on Dynamical Systems and Fractal Geometry, II

5:00 PM – 6:20 PM Room 109, Dunn Hall

Organizer: Fernanda Botelho, University of Memphis

5:00 PM
           Louis J. Block*, James E. Keeling, University of Florida, and Vladimir V. Uspenskij, International Moscow University (919-54-228)
5:30 PM Generalized crises: how planar invariant sets merge
istema system parameter is varied.
Kathleen Allgood, George Mason University
(919-58-241)

6:00 PM Denjoy minimal sets are far from affine.
Alec Norton, University of Texas, Austin
(919-58-23)

Paul Erdős Lecture Series
7:30 PM – 8:30 PM Room 123, Dunn Hall
(147) Extremal problems for graphs and integers.
Vera T. Sós, Hungarian Academy of Science

Saturday, March 22

AMS Book Sale and Electronic Products
7:30 AM – NOON Ground Floor Lobby, Psychology Building

Registration
7:30 AM – NOON Ground Floor Lobby, Psychology Building

Special Session on Dynamical Systems and Fractal Geometry, III
8:00 AM – 8:50 AM Room 109, Dunn Hall
Organizer: Fernanda Botelho, University of Memphis

8:00 AM
The Hausdorff dimension of the boundary of the Lévy dragon.
Paul F. Duvall*, University of North Carolina at Greensboro, and James E. Kealsling, University of Florida (919-28-149)

8:30 AM
Geometric approach to global qualitative investigation of polynomial dynamical systems. Preliminary report.
Valery A. Gaiko, Belarus State University of Informatics & Radioelectronics, Minsk, Belarus (919-34-171)

Special Session on Complex Analysis in One and Several Variables, III
8:00 AM – 10:50 AM Room 204, Psychology Building
Organizer: Dmitry Khavinson, University of Arkansas

8:00 AM
On dilatations and substantial boundary points of homeomorphisms of Jordan curves. Preliminary report.
Shanshuang Yang, Emory University (919-30-38)

8:30 AM
The Hardy class of König maps.
Pietro Poggi-Corradini, University of Virginia (919-30-63)

9:00 AM
Quasi-self-similar Jordan curves. Preliminary report.
David A. Herron, University of Cincinnati (919-30-67)

9:30 AM
The existence of Hayman directions for entire functions of slow growth. Preliminary report.
John Rossi, Virginia Tech (919-30-283)

10:00 AM
A “regular” pentagonal tiling of the plane. Preliminary report.
Kenneth Stephenson*, University of Tennessee, and Phil Bowers, Florida State University (919-30-161)

10:30 AM
Composition operators and measures.
Joseph A. Cima, University of North Carolina, and Alec L. Matheson*, Lamar University (919-42-62)

Special Session on Topology of Manifolds and Singular Spaces, III
8:00 AM – 10:50 AM Room 129, Dunn Hall
Organizers: Bruce Hughes, Vanderbilt University
Andrew A. Ranicki, Edinburgh University

8:00 AM
Analysis and topological manifolds. Preliminary report.
John Roe, Jesus College, England (919-58-41)

8:30 AM
Nonvanishing of K-theoretic index and applications. Preliminary report.
Guoliang Yu, University of Colorado, Boulder (919-19-65)

9:00 AM
Geometry and homotopy functors. Preliminary report.
Christopher W. Stark, University of Florida (919-58-105)

9:30 AM
Cartesian products of 3-manifolds.
Slawomir Kwasik*, Tulane University, and Reinhard Schultz, University of California, Riverside (919-57-94)

10:00 AM
Stable diffeomorphisms of 4-manifolds.
James F. Davis, Indiana University (919-57-66)

10:30 AM
Stabilized fixed point neighborhoods in 4-manifolds. Preliminary report.
Reinhard Schultz*, University of California, Riverside, and Slawomir Kwasik, Tulane University (919-57-97)

Special Session on Graph Theory, III
8:00 AM – 10:50 AM Room 233, Dunn Hall
Organizers: Ralph J. Faudree, Jr., University of Memphis
Richard H. Schelp, University of Memphis

8:00 AM
Ramsey colorings for diagonals of convex sets.
Heiko Harborth, Technische Universität Braunschweig, Germany (919-05-155)

8:30 AM
The largest matroid circuit-cocircuit Ramsey number. Preliminary report.
Joseph E. Bonin, George Washington University, Jennifer McNulty, University of Montana, and Talmage J. Reid*, University of Mississippi (919-05-118)

9:00 AM
The order of magnitude of some Ramsey functions. Preliminary report.
Yusheng Li* and Cecil C. Rousseau, University of Memphis (919-05-48)

9:30 AM
Line graphs and forbidden induced subgraphs.
Lubo Soltes* and Hong-Jian Lai, West Virginia University (919-05-84)

10:00 AM
Forbidden ordered subgraph versus forbidden subgraph characterizations of graph classes.
Mark C. Ginn, Austin Peay State University (919-05-27)

10:30 AM
Aharoni’s duality theorem and partially ordered sets. Preliminary report.
Dwight A. Duffus* and Edward W. Goddard, Emory University (919-05-101)

Special Session on Partial Differential Equations, III
8:00 AM – 10:50 AM Room 209, Dunn Hall
Organizers: Gisele Ruiz Goldstein, University of Memphis
Jerome A. Goldstein, University of Memphis
Program of the Sessions – Memphis, TN, Saturday, March 22 (cont’d.)

8:00AM  Uniqueness of the solution of the Schrödinger equation with discontinuous coefficients.  
Yoshimi Saitō, University of Alabama at Birmingham (919-35-259)  
8:30AM  Inequalities for the Dirichlet and Neumann eigenvalues of the Laplacian for domains on spheres. Preliminary report.  
Mark S. Ashbaugh, University of Missouri (919-35-264)

9:00AM  On second order linear differential equations with inverse square singularities.  
Rudi Weikard, University of Alabama at Birmingham (919-34-229)

9:30AM  Radial solutions to a Dirichlet problem arising in astrophysics.  
Alfonso Castro, University of North Texas (919-35-320)

10:00AM  Finding critical points of the Ginzburg-Landau functional by means of Sobolev gradients.  
John W. Neuberger* and Renka J. Robert, University of North Texas (919-35-166)

10:30AM  Asymptotics of the resolvent of the Dirac operator with scalar short-range and bounded potentials.  
Christopher Pladdy, Nicholls State University (919-81-309)

Special Session on Approximation in Mathematics, II

8:30 AM – 10:50 AM  Room 351, Dunn Hall  
Organizer:  George A. Anastassiou, University of Memphis

8:30AM  Convergence of subdivision and dilation equations.  
Marian Neamtu, Vanderbilt University (919-65-40)

9:00AM  Macrelements and orthogonal multiresolutional analysis.  
Tian-Xiao He, Illinois Wesleyan University (919-41-42)

9:30AM  Approximating a bandlimited function in terms of its samples. Preliminary report.  
Rudolf Stens, RWTH Aachen, Lehrstuhl A für Mathematik, Germany (919-94-206)

10:00AM  Weak copositive and intertwining approximation. Preliminary report.  
Ying K. Hu, Georgia Southern University, Kirill A. Kopotun, Vanderbilt University, and Xiang M. Yu*, Southwest Missouri State University (919-41-45)

10:30AM  Joint spectral radius and Hölder regularity of multiresolution analyses. Preliminary report.  
Mohsen Maesumi, Lamar University (919-41-74)

Special Session on Chaotic Dynamics, III

8:30 AM – 10:50 AM  Room 123, Dunn Hall  
Organizers:  Nikolai I. Chernov, University of Alabama at Birmingham  
Serge Troubetzkoy, University of Alabama at Birmingham

8:30AM  On the dynamics of infinite dimensional Hamiltonian particle systems. Preliminary report.  
Oliver R. Knill, University of Arizona, Tucson (919-82-269)

9:00AM  Conformally symplectic dynamics. Preliminary report.  
Carlangelo Liverani, University of Rome II, Italy, and Maciej P. Wojtkowski*, University of Arizona (919-52-284)

9:30AM  The number of periodic orbits in a polygonal billiard table with pockets. Preliminary report.  
Gregory Galperin, Eastern Illinois University (EIU) (919-70-267)

10:00AM  Periodic orbits for billiards in polygons. Preliminary report.  
Eugene Gutkin, USC, Los Angeles (919-58-173)

10:30AM  Geometry of projective billiards.  
Serge Tabachnikov, University of Arkansas (919-58-279)

Special Session on Numerical Solutions for Partial Differential Equations, III

8:30 AM – 10:45 AM  Room 225, Dunn Hall  
Organizers:  Ohannes Karakashian, University of Tennessee  
Xiaobing Feng, University of Tennessee

8:30AM  Stability and convergence of higher order finite element methods for partial differential equations.  
Tadeusz J. Janik, University of Alabama in Huntsville (919-65-213)

9:00AM  Space-time finite elements for a problem in surface diffusion.  
Bernard D. Coleman, Richard S. Falk* and Maher Moakher, Rutgers University (919-65-201)

9:45AM  Analysis and computation of flow control and optimization problems.  
Max D. Gunzburger (919-65-214)

Special Session on Invariants of 3-Manifolds, III

8:45 AM – 10:55 AM  Room 125, Dunn Hall  
Organizers:  Richard Martin Hain, Duke University  
Jun Yang, Duke University  
Stavros Garoufalidis, Brown University

8:45AM  Finite-type 3-manifold invariants and the lower central series of the Torelli group.  
Jerome Paul Levine*, Brandeis University, and Stavros Garoufalidis, Harvard University (919-57-239)
9:00AM - 10:50AM Room 107, Dunn Hall
Special Session on Symbolic Dynamics, III
Organizer: Paul B. Trow, University of Memphis
K. H. Kim, F. W. Roush, Alabama State University, and Susan G. Williams, University of South Alabama (919-58-258)
Duality and ordered cohomology of shifts of finite type.
9:30AM - 10:30AM Room 244, Psychology Building
Special Session on Convergence and Recurrence in Ergodic Theory, III
Organizers: Mate Wierdl, University of Memphis, James T. Campbell, University of Memphis
Karl Petersen*, University of North Carolina, and Jean-Paul Thouvenot, Université Pierre et Marie Curie (919-28-129)
Tail fields generated by symbol counts in measure-preserving systems. Preliminary report.
9:40AM - 10:40AM Room 109, Dunn Hall
Special Session on Recurrent Neural Networks and Applications, II
Organizers: Fernanda Botelho, University of Memphis, Max H. Garzon, University of Memphis
Halbert White*, University of California, San Diego, and Xiaohong Chen (919-68-29)
Nonparametric adaptive learning with feedback.
9:55AM - 10:55AM Room 219, Psychology Building
Special Session on Mathematical Methods in Computer Vision, I
Organizer: Benjamin B. Kimia, Brown University
Gregory Budzban and William A. Casey, University of San Diego (919-60-234)
Hierarchical Markov random fields and stochastic optimization with stable points. Preliminary report.
11:00AM - 12:00PM Room 136, Fogelman Center
Invited Address
J. M. Hain, Duke University (919-20-148)
2:30PM - 3:30PM Room 351, Dunn Hall
Special Session on Approximation in Mathematics, III
Organizer: George A. Anastassiou, University of Memphis
Ioannis K. Argyros, Cameron University (919-65-93)
On the mesh independence principle for a certain class of Newton methods and applications.
3:00PM - 4:00PM Room 107, Dunn Hall
Special Session on Symbolic Dynamics, IV
Organizer: Paul B. Trow, University of Memphis
B. Le Bailly, Facultes Universitaires Notre-Dame de la Paix, NAMUR, and Jean-Pierre Thiran*, Facultes Universitaires Notre-Dame de la Paix, NAMUR (919-41-271)
Linear semigroups associated with 2-dimensional shifts. Preliminary report.
Special Session on Numerical Solutions for Partial Differential Equations, IV

2:30 PM - 5:15 PM Room 225, Dunn Hall

Organizers: Ohannes Karakashian, University of Tennessee
Xiaobing Feng, University of Tennessee

Pierre A. Gremaud, North Carolina State University (919-65-200)

3:00PM Finite element superconvergence for the Reissner-Mindlin plate model. preliminary report.
Zhimin Zhang, Texas Tech University (919-85-252)

3:45PM Mixed finite element methods on non-matching multiblock grids.
Todd Arbogast*, Texas Inst. for Computational and Applied Math., The University of Texas at Austin, Lawrence C. Cowsar, Lucent Technologies Bell Laboratories, Mary F. Wheeler and Ivan Yotov, Texas Institute for Computational and Applied Mathematics, The University of Texas at Austin (919-65-276)

4:15PM On the reliability of FEM-solutions for Helmholtz equation.
Frank Ihlenburg, The University of Texas (919-65-281)

4:45PM Finite element methods and domain decomposition algorithms for a fluid solid interaction problem. Preliminary report.
Xiaobing Feng, The University of Tennessee (919-65-236)

Special Session on Convergence and Recurrence in Ergodic Theory, IV

2:30 PM - 3:40 PM Room 244, Psychology Building
Organizers: Mate Wierdl, University of Memphis
James T. Campbell, University of Memphis

2:30PM Multiparameter superadditive ergodic theorems for mean ergodic $L_1$-contractions.
Doğan GÖmez, North Dakota State University (919-28-124)

3:10PM Random averages.
Máte Wierdl, University of Memphis (919-28-167)

Special Session on Complex Analysis in One and Several Variables, IV

2:30 PM - 5:20 PM Room 204, Psychology Building
Organizer: Dmitry Khavinson, University of Arkansas

2:30PM Sums of kernel functions. Preliminary report.
Daniel H. Luecking, University of Arkansas (919-30-110)

3:00PM Cyclic vectors for crescent domains.
Alexandru Aleman, Fernuniversitaet Hagen, Germany, Stefan Richter, University of Tennessee, Knoxville, and William T. Ross*, University of Richmond (919-30-61)

Richard Rochberg*, Washington University, and Finbarr Holland, Cork University, Ireland (919-46-198)

4:00PM Extremal functions in some weighted Bergman spaces.
Carl Sundberg, University of Tennessee (919-32-237)

4:30PM Compact composition operators between weighted Bergman spaces on convex domains in $\mathbb{C}^n$.
Peter R. Mercer, St. Mary's College of Maryland (919-32-143)

5:00PM Distortion theorems and coefficient bounds for subclasses of univalent functions. Preliminary report.
Bruce O'Neill, Mississippi Valley State University (919-30-291)

Special Session on Harmonic Analysis and Convexity, IV

2:30 PM - 4:50 PM Room 206, Psychology Building
Organizers: Eric A. Carlen, Georgia Institute of Technology
Erwin Lutwak, Polytechnic University
Elisabeth Werner, Case Western Reserve University

2:30PM The Fourier transform formula for the volume of sectionsof star bodies, and minimal sections of the $l_p^n$-balls with $0 < p < 2$.
Alexander Koldobsky, University of Texas at San Antonio (919-52-56)
3:00PM Minkowski sums of projections of convex bodies.  
(240) Preliminary report.  
Paul R. Goodey, University of Oklahoma  
(919-52-212)

3:30PM Even valuations on convex bodies.  
(241) Preliminary report.  
Daniel A. Klain, Georgia Institute of Technology  
(919-52-99)

4:00PM The Santalo body of a convex body (joint work of E. Werner and M. Meyer).  
(242) Mathieu Meyer*, Universite de Marne-la-Vallee, France, and Elisabeth M. Werner, Case Western Reserve University (919-52-303)

4:30PM A general geometric construction for affine surface area.  
(243) Elisabeth M. Werner, Case Western Reserve University (919-52-314)

Special Session on Invariants of 3-Manifolds, IV

2:30 PM – 4:40 PM Room 125, Dunn Hall  
Organizers: Richard Martin Hain, Duke University  
Jun Yang, Duke University  
Stavros Garoufalidis, Brown University

2:30PM The Kauffman bracket skein algebra of links and arcs.  
(244) Józef H. Przytycki, George Washington University  
(919-57-313)

3:05PM The quest for the minimum volume orientable cusped hyperbolic 3-manifolds. Preliminary report.  
(245) Chun Christopher Cao and G. Robert Meyerhoff*, Boston College (919-57-311)

3:40PM Construction and classification of 1+1+1-dim TQFT’s.  
(246) Thomas Kerler*, Ohio State University, and Volodimir Lyubashenko, Kansas State University (919-55-302)

4:15PM Four vertex theorem and contact topology.  
(247) Preliminary report.  
Thomas K.-K. Au, The Chinese University of Hong Kong, and Xiao-Song Lin*, University of California, Riverside (919-57-270)

Special Session on Chaotic Dynamics, IV

2:30 PM – 4:50 PM Room 123, Dunn Hall  
Organizers: Nikolai I. Chernov, University of Alabama at Birmingham  
Serge Troubetzkoy, University of Alabama at Birmingham

2:30PM Building higher degree Julia sets. Preliminary report.  
(248) John C. Mayer, University of Alabama at Birmingham (919-54-277)

3:00PM Intertwining surgery and the geometry of the cubic connectedness locus.  
(249) Michael Yampolsky* and Adam Epstein, SUNY at Stony Brook (919-58-185)

3:30PM Calculating topological entropy. Preliminary report.  
(250) Stewart L. Baldwin*, Auburn University, Auburn, and Edward E Slaminka (919-59-268)

4:00PM Typical limit sets of critical points for smooth interval maps. Preliminary report.  
(251) Alexander Blokh*, University of Alabama at Birmingham, and Michal Misiurewicz, Indiana University - Purdue University Indianapolis (919-58-292)

4:30PM Typical limit sets of critical points for smooth interval maps. Preliminary report.  
(252) Alexander Blokh*, University of Alabama at Birmingham, and Michal Misiurewicz*, Indiana University - Purdue University Indianapolis (919-58-290)

Special Session on Topology of Manifolds and Singular Spaces, IV

2:30 PM – 5:50 PM Room 129, Dunn Hall  
Organizers: Bruce Hughes, Vanderbilt University  
Andrew A. Ranicki, Edinburgh University

2:30PM The stratified structure of Alexandrov spaces.  
(253) Conrad P. Plaut, University of Tennessee (919-53-176)

3:00PM Finiteness theorems for hyperbolic manifolds.  
(254) Igor Belegradek, University of Maryland, College Park (919-57-133)

3:30PM Algebraic topology for controlled spaces.  
(255) Hans J. Munkholm, IMADA, Odense University, Denmark (919-55-46)

4:00PM The geometric finiteness obstruction for boundedly controlled CW complexes. Preliminary report.  
(256) Jill H. Wiesner, Guilford College (919-57-109)

4:30PM A comparison of Steenrod homology theories.  
(257) Douglas Mennella, SUNY at Binghamton (919-55-86)

5:00PM On the exponent of the topological equivariant K-groups.  
(258) Francis X. Connolly, University of Notre Dame, and Stratos Prassidis*, Vanderbilt University (919-19-71)

5:30PM Embedding theorems for Poincaré complexes.  
(259) Preliminary report.  
John R. Klein, Bielefeld University (919-55-51)

Special Session on Graph Theory, IV

2:30 PM – 5:20 PM Room 233, Dunn Hall  
Organizers: Ralph J. Faudree, Jr., University of Memphis  
Richard H. Schelp, University of Memphis

2:30PM Crossings in the complete graph. Preliminary report.  
(260) Barry L. Plazza, University of Southern Mississippi, Sam Stueckle, Travecca Nazarene University, Richard D. Ringeisen*, East Carolina University, Helko Harborth, Tech Universität Braunschweig, and Richard Guy, University of Calgary (919-05-57)

3:00PM Uniform maximum degree and edge density.  
(261) Debra Knisley, East Tennessee State University (919-05-146)

3:30PM Clique covering the edges of a locally cobipartite graph. Preliminary report.  
(262) Guantao Chen*, Georgia State University, Michael Jacobson, André Kézdy*, Jenö Lehel, University of Louisville, Edward Scheinerman, The Johns Hopkins University, and Chi Wang, University of Louisville (919-05-51)

4:00PM Heavy transversals in weighted hypergraphs with an application to consensus.  
(263) André E. Kézdy*, Jenö Lehel and Robert Powers, University of Louisville (919-05-85)

4:30PM Minimal directed graphs of specified diameter.  
(264) Zoltán Füredi, University of Illinois and Math. Inst. of the Hungarian Academy (919-05-152)
Call for Papers

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Program of Sessions

5:00 PM On the number of vertices with specified eccentricity. Preliminary report.
Dhruv Mubayi and Douglas B. West*, University of Illinois (919-05-98)

Special Session on Partial Differential Equations, IV

2:30 PM - 5:20 PM Room 209, Dunn Hall
Organizers: Gisele Ruiz Goldstein, University of Memphis
Jerome A. Goldstein, University of Memphis

2:30 PM Piecewise C1 viscosity solutions of some Bellman equations.
James R. Dorroh* and Guillermo S. Ferreyra, Louisiana State University (919-35-274)

3:00 PM A free boundary problem with both smooth and nonsmooth fit.
J. R. Dorroh and Guillermo Ferreyra*, Louisiana State University, Baton Rouge (919-49-261)

4:00 PM Existence results for classes of constrained semipositone problems.
Ratnasingham Shivaji, Mississippi State University (919-35-257)

William E. Fitzgibbon, III*, University of Houston, and Michel Langlais, Universite Bordeaux 2 (919-35-153)

5:00 PM Large diffusive models of resource and sexual competition.
Wei Feng* and Wei Liu, University of North Carolina at Wilmington (919-35-319)

Robert J. Daverman
Associate Secretary
Knoxville, Tennessee
American Mathematical Society

GENERAL INTEREST

On Being a Department Head, a Personal View
John B. Conway, University of Tennessee, Knoxville

For years, higher education prospered. It loudly proclaimed that college graduates command far greater lifetime incomes. Ample funding followed. We produced. But that argument has begun to sour. A college degree has long since stopped being a guarantee of prosperity or even job security. Society has begun to question its support of universities. In this environment, mathematicians and all academics must begin to change, compete, and seek resources that will be used with greater care. It is the only solution if we hope to maintain the integrity of the enterprise...

I want to offer advice to department heads out there. I want to try to educate the rank and file about a variety of aspects of the job of being a department head. I also want to tell you my opinion about this job and perhaps also a little about life, death, and the vagaries of the human condition.

—from the Preface

This unique book presents a witty, well-written personal view about the experience of being a department head. Those in academia will profit from the author’s inside view, and other department heads and chairs—new and old—will benefit from the experiences of this keenly observant colleague.

1997; 207 pages; Softcover; ISBN 0-8218-0615-7; List $24; All AMS members $19; Order code AHEADNA

A Primer of Mathematical Writing
Steven G. Krantz, Washington University, St. Louis, MO

This book is about writing in the professional mathematical environment. There are few people equal to this task, yet Steven Krantz is one who qualifies. While the book is nominally about writing, it’s also about how to function in the mathematical profession. Those who are familiar with Krantz’s writing will recognize his lively, inimitable style.

Rudin’s frank and straightforward approach makes this particularly suitable as a textbook. He outlines how to write grant proposals that are persuasive and compelling, how to write a letter of recommendation describing the research abilities of a candidate for promotion or tenure, and what a dean is looking for in a letter of recommendation. He further addresses some basic issues such as writing a book proposal to a publisher or applying for a job.

Readers will find in reading this text that Krantz has produced a quality work which makes evident the power and significance of writing in the mathematics profession.

1997; 225 pages; Softcover; ISBN 0-8218-0635-1; List $19; All AMS members $15; Order code AXWNA

Techniques of Problem Solving
Steven G. Krantz, Washington University, St. Louis, MO

... the subject of problem solving ... is more than just a disconnected list of brainteasers and recreations. It is a way of life. Scientists of every stripe—chemists, physicists, psychologists, social engineers, and many others— ply their trade by considering a set of data, deciding what techniques are relevant to these data, and then solving a problem. It is this view of problem solving that will be promulgated in the present book.

—from the Preface

The purpose of this book is to teach the basic principles of problem solving, including both mathematical and non-mathematical problems. This book will help students to...

• translate verbal discussions into analytical data.
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Problems are included for readers to tackle at the end of each chapter. There are more than 350 problems in all.

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1997; 465 pages; Softcover; ISBN 0-8218-0619-X; List $29; All AMS members $23; Order code TFSNA

The Way I Remember It
Walter Rudin, University of Wisconsin, Madison

Walter Rudin’s memoirs should prove to be a delightful read specifically to mathematicians, but also to historians who are interested in learning about his colorful history and ancestry. Characterized by his personal style of elegance, clarity, and brevity, Rudin presents in the first part of the book his early memories about his family history, his boyhood in Vienna throughout the 1920s and 1930s, and his experiences during World War II.

Part II offers samples of his work, in which he relates where problems came from, what their solutions led to, and who else was involved. As those who are familiar with Rudin’s writing will recognize, he brings to this book the same carefulness, depth, and originality that is the hallmark of his work.

Co-published with the London Mathematical Society. Members of the LMS may order directly from the AMS at the LMS member price. The LMS is registered with the Charity Commissioners.

History of Mathematics, Volume 12; 1997; 191 pages; Hardcover; ISBN 0-8218-0633-5; List $29; All AMS members $23; Order code HMATH/12NA

All prices subject to change. Charges for delivery are $3.00 per order. For air delivery outside of the continental U.S., please include $6.50 per item. Prepayment required. Order from: American Mathematical Society, P.O. Box 602, Providence, RI 02906. For credit card orders, call (401) 331-3842. Prepayment required. Order from: American Mathematical Society, P.O. Box 602, Providence, RI 02906. For credit card orders, call (401) 331-3842. Prepayment required. Order from: American Mathematical Society, P.O. Box 602, Providence, RI 02906. For credit card orders, call (401) 331-3842. Prepayment required. Order from: American Mathematical Society, P.O. Box 602, Providence, RI 02906. For credit card orders, call (401) 331-3842.
Meetings and Conferences of the AMS

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The Meetings and Conferences section of the Notices gives information on all AMS meetings and conferences approved by press time for this issue. Please refer to the page numbers cited in the table of contents on this page for more detailed information on each event. Invited Speakers and Special Sessions are listed as soon as they are approved by the cognizant program committee; the codes listed are needed for electronic abstract submission. For some meetings the list may be incomplete. Up-to-date meeting and conference information is available on the World Wide Web via the Internet at URL http://www.ams.org/.

Meetings:

1997

March 21-22
Memphis, Tennessee
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April 12-13
College Park, Maryland
p. 399

April 19-20
Corvallis, Oregon
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May 2-4
Detroit, Michigan
p. 400

June 26-28
Republic of South Africa
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September 26-28
Montreal, Canada
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October 4
Claremont, California
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October 10-12
Atlanta, Georgia
p. 404

October 24-26
Milwaukee, Wisconsin
p. 404

November 8-9
Albuquerque, New Mexico
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December 4-7
Oaxaca, Mexico
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1998

January 7-10
Baltimore, Maryland
Annual Meeting
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March 20-21
Louisville, Kentucky
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March 27-28
Manhattan, Kansas
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April 4-5
Philadelphia, Pennsylvania
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April 25-26
Davis, California
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September 12-13
Chicago, Illinois
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November 14-15
Tucson, Arizona
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Important Information Regarding AMS Meetings

Potential organizers, speakers, and hosts should refer to page 183 in the January issue of the Notices for general information regarding participation in AMS meetings and conferences.

Abstracts

Several options are available for speakers submitting abstracts, including an easy-to-use interactive Web form. No knowledge of TeX is necessary to submit an electronic form, although those who use plain TeX, AMS-TeX, LaTeX, or AMS-LaTeX may submit abstracts with TeX coding. To see descriptions of the forms available, visit http://www.ams.org/abstracts/instructions.html or send mail to abs-submit@ams.org, typing help as the subject line, and descriptions and instructions on how to get the template of your choice will be e-mailed to you.

Completed abstracts should be sent to abs-submit@ams.org, typing submission as the subject line. Questions about abstracts may be sent to abs-info@ams.org.

Paper abstract forms may be sent to Abstracts Coordinator, AMS, P.O. Box 6887, Providence, RI 02940. Note that all abstract deadlines are strictly enforced. Close attention should be paid to specified deadlines in this issue. Unfortunately, late abstracts cannot be accommodated.

Conferences:

See http://www.ams.org/committee/meetings/ for the most up-to-date information on these conferences.

1997:


June 29-July 19: Summer Research Institute, Differential Geometry and Control, University of Colorado at Boulder. See October 1996, p. 1304, for details.

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UNIVERTEXT

GREG NABER,
California State University, Chico, CA

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Foundations

The book weaves together rudimentary notions from the classical gauge theory of physics with the topological and geometrical concepts that became the mathematical models of these notions.

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JEAN-PIERRE SERRE,
Collège de France, Paris

Galois Cohomology
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