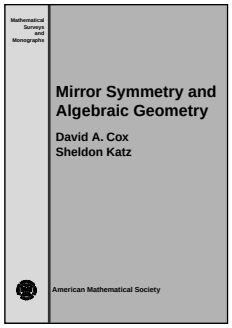
New Publications Offered by the AMS

Algebra and Algebraic Geometry



Mirror Symmetry and Algebraic Geometry

David A. Cox, *Amherst College, MA*, and **Sheldon Katz**, *Oklahoma State University, Stillwater*

Mirror symmetry began when theoretical physicists made some astonishing predictions about rational curves on quartic hypersurfaces in four-dimensional projective space. Understanding the mathematics behind these predictions has been a substantial challenge. This book is the first completely comprehensive monograph on mirror symmetry, covering the original observations by the physicists through the most recent progress made to date. Subjects discussed include toric varieties, Hodge theory, Kähler geometry, moduli of stable maps, Calabi-Yau manifolds, quantum cohomology, Gromov-Witten invariants, and the mirror theorem.

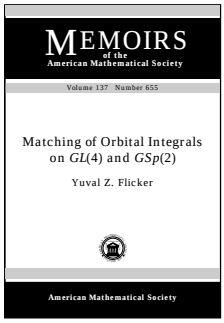
Features:
- Numerous examples worked out in detail
- An appendix on mathematical physics
- An exposition of the algebraic theory of Gromov-Witten invariants and quantum cohomology
- A proof of the mirror theorem

This item will also be of interest to those working in mathematical physics.

Contents (Preliminary): Introduction; The quintic threefold; Toric geometry; Mirror symmetry constructions; Hodge theory and Yukawa couplings; Moduli spaces; Gromov-Witten invariants; Quantum cohomology; Localization; Quantum differential equations; The mirror theorem; Conclusion; Appendices; Bibliography.

Mathematical Surveys and Monographs

March 1999, approximately 483 pages, Hardcover, ISBN 0-8218-1059-6, 1991 *Mathematics Subject Classification*: 14–02; 81-02, **All AMS members $55**, List $69, Order code SURV-COXN



Matching of Orbital Integrals on $GL(4)$ and $GSp(2)$

Yuval Z. Flicker, *Ohio State University, Columbus*

The trace formula is the most powerful tool currently available to establish liftings of automorphic forms, as predicted by Langlands principle of functionality. The geometric part of the trace formula consists of orbital integrals, and the lifting is based on the fundamental lemma. The latter is an identity of the relevant orbital integrals for the unit elements of the Hecke algebras.

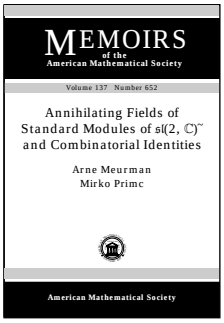
This volume concerns a proof of the fundamental lemma in the classically most interesting case of Siegel modular forms, namely the symplectic group $Sp(2)$. These orbital integrals are compared with those on $GL(4)$, twisted by the transpose inverse involution. The technique of proof is elementary. Compact elements are decomposed into their absolutely semisimple and topologically unipotent parts also in the twisted case; a double coset decomposition of the form $H\backslash G/K$—where H is a subgroup containing the centralizer—plays a key role.

Contents: *Part I. Preparations:* Statement of Theorem; Stable conjugacy; Explicit representatives; Stable θ-conjugacy; Useful facts; Endoscopic groups; Instability; Kazhdan's decomposition; Decompositions for $GL(2)$; Decomposition for $Sp(2)$; *Part II. Main comparison:* Strategy; Twisted orbital integrals of type (I); Orbital integrals of type (I); Comparison in stable case (I), E/F unramified; Comparison in stable case (I), E/F ramified; Endoscopy for $H = GSp(2)$ type (I); Unstable twisted case. Twisted endoscopic group of type I.F.2; Twisted endoscopic group of type I.F.3, E/F unramified; Twisted orbital integrals of type (II); Orbital integrals of type (II); Comparison in case (II), E/E_3 ramified ($e = 2$); Unstable twisted case. Twisted endoscopic group of type I.F.2; Comparison in case (II), E/E_3 unramified ($e = 1$); Unstable twisted case. Twisted endoscopic group of type I.F.3; Endoscopy for $GSp(2)$, type (II); Comparison in case (III); Unstable twisted case. Twisted endoscopic group of type I.F.2; Comparison in case (IV); Unstable twisted case. Twisted endoscopic group of type I.F.2; *Part III. Semi simple reduction:* Review; Case of torus of type (I); Case of torus of type (II); Case of torus of type (III); Case of torus of type (IV); References.

Memoirs of the American Mathematical Society, Volume 137, Number 655

Continued

December 1998, 112 pages, Softcover, ISBN 0-8218-0959-8, LC 98-46542, 1991 *Mathematics Subject Classification*: 11F27, 11R42, 11S40, **Individual member $25**, List $41, Institutional member $33, Order code MEMO/137/655N



Annihilating Fields of Standard Modules of $\mathfrak{sl}(2, \mathbb{C})^{\sim}$ and Combinatorial Identities

Arne Meurman, *University of Lund, Sweden*, and **Mirko Primc**, *University of Zagreb, Croatia*

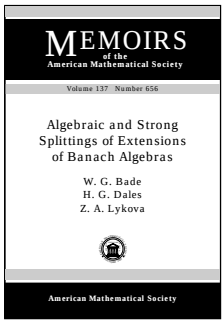
In this volume, the authors show that a set of local admissible fields generates a vertex algebra. For an affine Lie algebra $\tilde{\mathfrak{g}}$, they construct the corresponding level k vertex operator algebra and show that level k highest weight $\tilde{\mathfrak{g}}$-modules are modules for this vertex operator algebra. They determine the set of annihilating fields of level k standard modules and study the corresponding loop $\tilde{\mathfrak{g}}$-module—the set of relations that defines standard modules. In the case when $\tilde{\mathfrak{g}}$ is of type $A_1^{(1)}$, they construct bases of standard modules parameterized by colored partitions, and as a consequence, obtain a series of Rogers-Ramanujan type combinatorial identities.

Contents: Abstract; Introduction; Formal Laurent series and rational functions; Generating fields; The vertex operator algebra $N(k\Lambda_0)$; Modules over $N(k\Lambda_0)$; Relations on standard modules; Colored partitions, leading terms and the main results; Colored partitions allowing at least two embeddings; Relations among relations; Relations among relations for two embeddings; Linear independence of bases of standard modules; Some combinatorial identities of Rogers-Ramanujan type; Bibliography.

Memoirs of the American Mathematical Society, Volume 137, Number 652

December 1998, 89 pages, Softcover, ISBN 0-8218-0923-7, LC 98-45652, 1991 *Mathematics Subject Classification*: 17B67; 05A19, **Individual member $24**, List $40, Institutional member $32, Order code MEMO/137/652N

Analysis



Algebraic and Strong Splittings of Extensions of Banach Algebras

W. G. Bade, *University of California, Berkeley,* **H. G. Dales**, *University of Leeds, UK*, and **Z. A. Lykova**, *University of Newcastle, Newcastle Upon Tyne, UK*

In this volume, the authors address the following:

Let A be a Banach algebra, and let $\sum\colon\ 0 \to I \to \mathfrak{A} \xrightarrow{\pi} A \to 0$ be an extension of A, where $\mathfrak{A}$ is a Banach algebra and I is a closed ideal in $\mathfrak{A}$. The extension splits algebraically (respectively, splits strongly) if there is a homomorphism (respectively, continuous homomorphism) $\theta\colon A \to \mathfrak{A}$ such that $\pi \circ \theta$ is the identity on A.

Consider first for which Banach algebras A it is true that every extension of A in a particular class of extensions splits, either algebraically or strongly, and second for which Banach algebras it is true that every extension of A in a particular class which splits algebraically also splits strongly.

These questions are closely related to the question when the algebra $\mathfrak{A}$ has a (strong) Wedderburn decomposition. The main technique for resolving these questions involves the Banach cohomology group $\mathcal{H}^2(A, E)$ for a Banach A-bimodule E, and related cohomology groups.

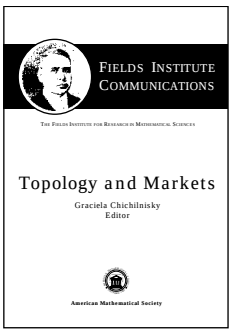
Later chapters are particularly concerned with the case where the ideal I is finite-dimensional. Results are obtained for many of the standard Banach algebras A.

Contents: Introduction; The role of second cohomology groups; From algebraic splittings to strong splittings; Finite-dimensional extensions; Algebraic and strong splittings of finite-dimensional extensions; Summary; References.

Memoirs of the American Mathematical Society, Volume 137, Number 656

December 1998, 113 pages, Softcover, ISBN 0-8218-1058-8, LC 98-46541, 1991 *Mathematics Subject Classification*: 46H10, 46H25, 46H40; 46J15, 46J45, 46L35, 16E40, **Individual member $25**, List $41, Institutional member $33, Order code MEMO/137/656N

Applications



Topology and Markets

Graciela Chichilnisky, *Columbia University, New York, NY*, Editor

This volume presents the proceedings of a workshop on geometry, topology, and markets held at The Fields Institute. The workshop was attended by eminent mathematicians and financial and economic theorists. Using a topological approach, the volume discusses new mathematics and its applications to social sciences and financial markets.

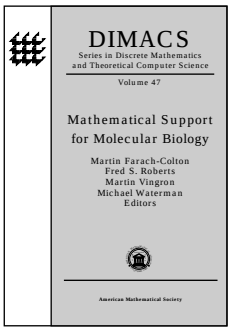
Topics addressed at the workshop included new topological invariants for existence, characterization and computation of market equilibria and their relation to social choice and to other forms of resource allocation, competitive and cooperative systems, algebraic geometry and markets with increasing returns, computational complexity, and stochastic processes and financial markets.

This item will also be of interest to those working in geometry and topology.

Contents: M. W. Hirsch, Applications of dynamical systems to deterministic and stochastic economic models; **G. Chichilnisky**, A unified perspective on resource allocation: Limited arbitrage is necessary and sufficient for the existence of a competitive equilibrium, the core and social choice; **M. Broadie** and **J. Detemple**, American options on dividend-paying assets; **Y. Baryshnikov** and **G. Chichilnisky**, Intergenerational choice: A paradox and a solution.

Fields Institute Communications, Volume 22

January 1999, 110 pages, Hardcover, ISBN 0-8218-1071-5, LC 98-44414, 1991 *Mathematics Subject Classification*: 00A69, 57N65, 57Rxx, 62Cxx, 90D35, 90A60, 90A80, 90Axx, 90Dxx, **Individual member $23**, List $39, Institutional member $31, Order code FIC/22N



Mathematical Support for Molecular Biology

Martin Farach-Colton, *Lucent Technologies Bell Laboratories, Murray Hill, NJ*, **Fred S. Roberts**, *Rutgers University, New Brunswick, NJ*, **Martin Vingron**, *Heidelberg, Germany*, and **Michael Waterman**, *University of Southern California, Los Angeles*, Editors

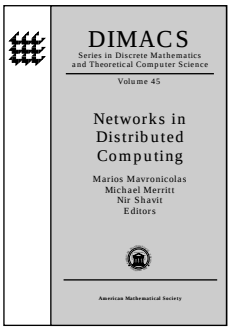
This volume features highlights from the DIMACS Special Year on "Mathematical Support for Molecular Biology". Top researchers presented both new research results and comprehensive overviews on the use of mathematics (especially discrete mathematics) and theoretical computer science in molecular biology. The book provides a unique "snapshot" of this growing area of study. It will be of interest to both experts and novices seeking information on the state of the research.

This item will also be of interest to those working in discrete mathematics and combinatorics.

Contents: W. M. Fitch, An introduction to molecular biology for mathematicians and computer programmers; **D. Gusfield** and **L. Wang**, New uses for uniform lifted alignments; **M. Vingron**, Sequence alignment and phylogeny construction; **D. Durand**, A new look at tree models for multiple sequence alignment; **A. Apostolico** and **R. Giancarlo**, Sequence alignment in molecular biology; **D. B. Searls**, Formal language theory and biological macromolecules; **C. A. Floudas**, **J. L. Klepeis**, and **P. M. Pardalos**, Global optimization approaches in protein folding and peptide docking; **C. J. Benham**, The topologically driven strand separation transition in DNA—Methods of analysis and biological significance; **C. L. Smith**, **T. Sano**, **N. E. Broude**, and **C. R. Cantor**, Parallel strategies for DNA manipulation and analysis; **A. Caprara**, **G. Lancia**, and **S.-K. Ng**, A column-generation based branch-and-bound algorithm for sorting by reversals; **E. M. Jordan**, Visualizing measures of genetic distance; **L. Milanesi**, **M. Marsilli**, **G. Mauri**, **C. Rolfi**, and **L. Uboldi**, Fragment assembly system for DNA sequencing projects; **X. Huang**, Performance of the CAP2 sequence assembly program; **J. Meidanis**, A simple toolkit for DNA fragment assembly.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 47

February 1999, 286 pages, Hardcover, ISBN 0-8218-0826-5, LC 98-32095, 1991 *Mathematics Subject Classification*: 92Bxx, 05–XX, 05Cxx, **Individual member $39**, List $65, Institutional member $52, Order code DIMACS/47N



Networks in Distributed Computing

Marios Mavronicolas, *University of Cyprus, Nicosia,* **Michael Merritt**, *AT&T Bell Labs, Murray Hill, NJ*, and **Nir Shavit**, *Weizmann Institute, Rehovot, Israel*, Editors

This volume presents the proceedings from the DIMACS Workshop in Distributed Computing held at Rutgers University. It provides a broad survey of major topics concerning modern applications of networks in the context of distributed computing. Articles included touch upon fundamental problems and challenges related to recent technological advances in the networking industry which are directly relevant and interesting to research on the mathematical principles of distributed computing.

Included are issues on diverse areas of networking such as ATM networking technology, issues on routing and flow control in communications networks, security, optical networking and mobile computing. This volume provides state-of-the-art research in these significant areas. The material should acquaint the theoretical community of distributed computing with related issues and problems.

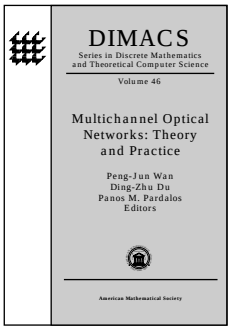
Continued

Treatment is applied and tailored to industrial advances in networking, however the underlying material presents a rich variety of theoretical problems in distributed computing that carry significant interest and challenge for the modern mathematician.

Contents: Y. Afek, **Y. Mansour**, and **Z. Ostfeld**, Virtual-credit: Efficient end-to-end credit based flow control; **T. Anker**, **G. V. Chockler**, **D. Dolev**, and **I. Keidar**, Scalable group membership services for novel applications; **O. M. Cheiner** and **A. A. Shvartsman**, Implementing an eventually-serializable data service as a distributed system building block; **D. Fotakis**, **G. Pantziou**, **G. Pentaris**, and **P. Spirakis**, Frequency assignment in mobile and radio networks; **O. Gerstel**, On limited wavelength conversion in optical ring networks; **G. Hjálmtýsson** and **K. K. Ramakrishnan**, UNITE-An architecture for lightweight signaling in ATM networks; **M. Mavronicolas**, Timing-based connection management; **D. L. Mills**, Cryptographic authentication for real-time network protocols; **S. Zaks**, Path layout in ATM networks–A survey.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 45

December 1998, 160 pages, Hardcover, ISBN 0-8218-0992-X, LC 98-37246, 1991 *Mathematics Subject Classification*: 05C05, 05C10, 05C38, 05C85, 05C90, 68M07, 68M10, 68M20, 68Q05, 68Q10, 68Q22, 68Q25, **Individual member $23**, List $39, Institutional member $31, Order code DIMACS/45N



Multichannel Optical Networks: Theory and Practice

Peng-Jun Wan, *Illinois Institute of Technology, Chicago*, **Ding-Zhu Du**, *University of Minnesota, Minneapolis*, and **Panos M. Pardalos**, *University of Florida, Gainesville*, Editors

Time division multiplexing (TDM) has been the fundamental basis for adding capacity to digital telecommunications networks for decades. However, within the past two years, wavelength division multiplexing (WDM) has been emerging as an important and widely deployed complement to TDM. Sales of systems based on the new technology have risen at breathtaking speed. The driving force behind this sales explosion was the unexpected rapid exhaustion of long distance fiber network capacity. This fiber exhaust, combined with favorable economics for WDM, led to the use of this technology over other alternatives.

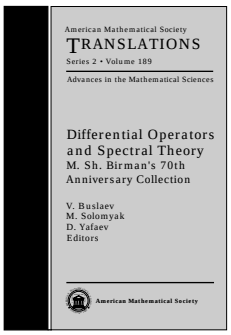
The WDM deployment raises fundamental and challenging problems that require novel and innovative solutions. This volume presents papers from an interdisciplinary workshop held at DIMACS on multichannel optical networks. Leading computer science theorists and practitioners discussed admissions control, routing and channel assignment, multicasting and protection, and fault-tolerance. The book features application of theoretical and/or algorithmical results to practical problems and addresses the influence of practical problems to theoretical/algorithmic studies. The volume can serve as a text for an advanced course in computer science, networking, and operations research.

Contents: V. Auletta, **I. Caragiannis**, **C. Kaklamanis**, and **P. Persiano**, Efficient wavelength routing in trees with low-degree converters; **P.-J. Wan** and **L. Liu**, Maximal throughput in wavelength-routed optical networks; **O. Gerstel**, Minimizing the cost of an optical network; **V. Kumar**, Bandwidth allocation algorithms for tree and ring networks; **K. Sivalingam**, **J. Wang**, **X. Wu**, and **M. Mishra**, Improved on-line scheduling algorithms for optical WDM networks; **B. Beauquier**, Broadcasting in WDM optical rings and tori; **E. J. Harder** and **H.-A. Choi**, Gossiping in WDM all-optical square mesh networks; **C. Zhou** and **Y. Yang**, On the number of wavelengths required to embed multicast assignments in WDM networks; **D. S. Kim**, **D.-Z. Du**, and **P. M. Pardalos**, On conflict-free channel set assignments for optical cluster-based hypercube networks; **S. Ramamurthy** and **B. Mukherjee**, Fault-tolerant design of wavelength-routed optical networks; **O. Crochat**, **J.-Y. Le Boudec**, and **O. Gerstel**, Protection interoperability for WDM optical networks; **J. Skorin-Kapov** and **J.-F. Labourdette**, On minimum congestion routing in broadcast optical networks with regular and arbitrary topologies; **C. Qiao**, **Y. Mei**, **M. Yoo**, and **X. Zhang**, Polymorphic control for cost-effective design of optical networks; **C.-C. Yu**, **S. Bhattacharya**, and **P. Shen**, Adaptive cycle time for real-time TWDM: Tool and performance analysis; **F. Siu** and **R. K. C. Chang**, Optimal node assignment in reconfigurable WDM lightwave networks with regular virtual topologies; **I. Chlamtac**, **A. Fumagalli**, and **V. Elek**, Performance of photonic slot routing networks; **R. Bartoš**, **P. De La Torre**, and **R. Kannan**, Space-time-wavelength network with group communication locality.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 46

January 1999, 249 pages, Hardcover, ISBN 0-8218-1004-9, LC 98-44528, 1991 *Mathematics Subject Classification*: 03B05, 90A05, 68T15, 68Q25, 68Q42, 68R10, 90C27, 90C30, 90B40, 68T01, 68Q15; 68Q22, 68Q25, 68P10, **Individual member $33**, List $55, Institutional member $44, Order code DIMACS/46N

Differential Equations



Differential Operators and Spectral Theory

M. Sh. Birman's 70th Anniversary Collection

V. Buslaev, *St. Petersburg State University, Russia*, **M. Solomyak**, *Weizmann Institute of Science, Rehovot, Israel*, and **D. Yafaev**, *Rennes University, France*, Editors

This volume contains a collection of original papers in mathematical physics, spectral theory, and differential equations. The papers are dedicated to the outstanding mathematician, Professor M. Sh. Birman, on the occasion of his 70th birthday. Contributing authors are leading specialists and close professional colleagues of Birman.

The main topics discussed are spectral and scattering theory of differential operators, trace formulas, and boundary value

problems for PDEs. Several papers are devoted to the magnetic Schrödinger operator, which is within Birman's current scope of interests and recently has been studied extensively. Included is a detailed survey of his mathematical work and an updated list of his publications.

This book is aimed at graduate students and specialists in the above-mentioned branches of mathematics and theoretical physics. The biographical section will be of interest to readers concerned with the scientific activities of Birman and the history of those branches of analysis and spectral theory where his contributions were important and often decisive.

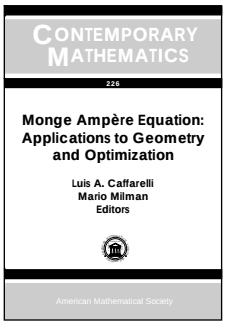
Features:
- The first detailed survey of Birman's mathematical work; includes an updated bibliography.
- New material on the history of some branches of analysis.
- Prominent authors: Lieb, Agmon, Deift, Simon, Ladyzhenskaya, and others.
- All original works, containing new results in fields of great current interest.

This item will also be of interest to those working in analysis.

Contents: V. Buslaev, **M. Solomyak**, and **D. Yafaev**, On the scientific work of Mikhail Shlëmovich Birman; List of publications of M. Sh. Birman; **S. Agmon**, Representation theorems for solutions of the Helmholtz equation on $\mathbb{R}^n$; **V. S. Buslaev**, Kronig-Penney electron in a homogeneous electric field; **E. A. Carlen** and **E. H. Lieb**, A Minkowski type trace inequality and strong subadditivity of quantum entropy; **P. Deift**, Integrable operators; **F. Gesztesy** and **B. Simon**, On the determination of a potential from three spectra; **R. Hempel**, Oscillatory eigenvalue branches for Schrödinger operators with strongly coupled magnetic fields; **I. Herbst** and **S. Nakamura**, Schrödinger operators with strong magnetic fields: Quasi-periodicity of spectral orbits and topology; **V. Ivrii**, Heavy atoms in a superstrong magnetic field; **L. Kapitanski** and **Yu. Safarov**, A parametrix for the nonstationary Schrödinger equation; **V. Kozlov** and **V. Maz'ya**, Comparison principles for nonlinear operator differential equations in Banach spaces; **O. A. Ladyzhenskaya** and **G. A. Seregin**, On disjointness of solutions to the MNS equations; **A. Laptev** and **Yu. Netrusov**, On the negative eigenvalues of a class of Schrödinger operators; **D. Robert**, Semiclassical asymptotics for the spectral shift function; **G. Rozenblum** and **M. Solomyak**, On the number of negative eigenvalues for the two-dimensional magnetic Schrödinger operator; **M. A. Shubin**, Elliptic boundary value problems with relaxed conditions; **A. V. Sobolev**, On the spectrum of the periodic magnetic Hamiltonian; **T. Weidl**, Another look at Cwikel's inequality; **D. Yafaev**, The discrete spectrum in the singular Friedrichs model; **G. Zhislin**, Spectrum of the relative motion of many-particle systems in a homogeneous magnetic field: What do we know about it?.

American Mathematical Society Translations—Series 2 (*Advances in the Mathematical Sciences*), Volume 189

January 1999, 285 pages, Hardcover, ISBN 0-8218-1387-0, LC 91-640741, 1991 *Mathematics Subject Classification*: 35Pxx, 35Qxx, **Individual member $59**, List $99, Institutional member $79, Order code TRANS2/189N



Monge Ampère Equation: Applications to Geometry and Optimization

Luis A. Caffarelli, *New York University, Courant Institute*, and **Mario Milman**, *Florida Atlantic University, Boca Raton*, Editors

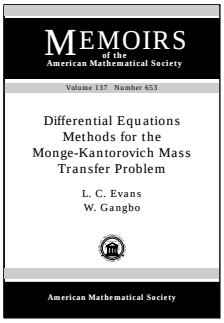
In recent years, the Monge Ampère Equation has received attention for its role in several new areas of applied mathematics:
- As a new method of discretization for evolution equations of classical mechanics, such as the Euler equation, flow in porous media, Hele-Shaw flow, etc.,
- As a simple model for optimal transportation and a div-curl decomposition with affine invariance and
- As a model for front formation in meteorology and optimal antenna design.

These applications were addressed and important theoretical advances presented at a NSF-CBMS conference held at Florida Atlantic University (Boca Raton). L. Cafarelli and other distinguished specialists contributed high-quality research results and up-to-date developments in the field. This is a comprehensive volume outlining current directions in nonlinear analysis and its applications.

Contents: J.-D. Benamou and **Y. Brenier**, A numerical method for the optimal time-continuous mass transport problem and related problems; **L. A. Caffarelli**, **S. A. Kochengin**, and **V. I. Oliker**, On the numerical solution of the problem of reflector design with given far-field scattering data; **M. J. P. Cullen** and **R. J. Douglas**, Applications of the Monge-Ampére equation and Monge transport problem to meterology and oceanography; **M. Feldman**, Growth of a sandpile around an obstacle; **W. Gangbo**, The Monge mass transfer problem and its applications; **B. Guan**, Gradient estimates for solutions of nonparametric curvature evolution with prescribed contact angle condition; **L. G. Hanin**, An extension of the Kantorovich norm; **M. McAsey** and **L. Mou**, Optimal locations and the mass transport problem; **E. Newman** and **L. P. Cook**, A generalized Monge-Ampére equation arising in compressible flow; **J. Urbas**, Self-similar solutions of Gauss curvature flows.

Contemporary Mathematics, Volume 226

October 1998, 172 pages, Softcover, ISBN 0-8218-0917-2, LC 98-38822, 1991 *Mathematics Subject Classification*: 35J60, 35B65, 35A30, 46N10, 49Q20, 58E12, **Individual member $23**, List $39, Institutional member $31, Order code CONM/226N



Differential Equations Methods for the Monge-Kantorovich Mass Transfer Problem

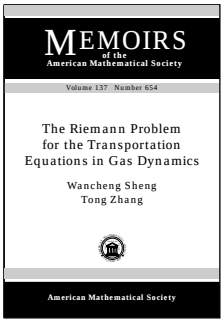
L. C. Evans, *University of California, Berkeley*, and **W. Gangbo**, *Georgia Institute of Technology, Atlanta*

In this volume, the authors demonstrate under some assumptions on f^+, f^- that a solution to the classical Monge-Kantorovich problem of optimally rearranging the measure $\mu^+ = f^+ dx$ onto $\mu^- = f^- dy$ can be constructed by studying the p-Laplacian equation $-\mathrm{div}(|DU_p|^{p-2}Du_p) = f^+ - f^-$ in the limit as $p \to \infty$. The idea is to show $u_p \to u$, where u satisfies $|Du| \le 1$, $-\mathrm{div}(aDu) = f^+ - f^-$ for some density $a \ge 0$, and then to build a flow by solving a nonautonomous ODE involving a, Du, f^+ and f^-.

Contents: Introduction; Uniform estimates on the p-Laplacian, limits as $p \to \infty$; The transport set and transport rays; Differentiability and smoothness properties of the potential; Generic properties of transport rays; Behavior of the transport density along rays; Vanishing of the transport density at the ends of rays; Approximate mass transfer plans; Passage to limits a.e.; Optimality; Appendix: Approximating semiconcave and semiconvex functions by C^2 functions; Bibliography.

Memoirs of the American Mathematical Society, Volume 137, Number 653

December 1998, 66 pages, Softcover, ISBN 0-8218-0938-5, LC 98-45649, 1991 *Mathematics Subject Classification*: 49J15, 49J20, 90B06, **Individual member $22**, List $37, Institutional member $30, Order code MEMO/137/653N



The Riemann Problem for the Transportation Equations in Gas Dynamics

Tong Zhang, *Academia Sinica, Beijing, People's Republic of China*, and **Wancheng Sheng**, *Xinjiang University, Urumuqi, People's Republic of China*

In this volume, the one-dimensional and two-dimensional Riemann problems for the transportation equations in gas dynamics are solved constructively. In either the 1-D or 2-D case, there are only two kinds of solutions: one involves Dirac delta waves, and the other involves vacuums, which has been merely discussed so far. The generalized Rankine-Hugoniot and entropy conditions for Dirac delta waves are clarified with viscous vanishing method. All of the existence, uniqueness and stability for viscous perturbations are proved analytically.

This item will also be of interest to those working in mathematical physics.

Contents: Introduction; 1-D Riemann problem for transportation equations in gas dynamics; 2-D Riemann problem for transportation; References.

Memoirs of the American Mathematical Society, Volume 137, Number 654

December 1998, 77 pages, Softcover, ISBN 0-8218-0947-4, LC 98-45650, 1991 *Mathematics Subject Classification*: 35L65, 35L67, 35L80, 65M25, 76N15; 76N10, **Individual member $23**, List $39, Institutional member $31, Order code MEMO/137/654N

Geometry and Topology

Selections from MSRI's Video Archive, Volume 2

The Chern Symposium, March 5–7, 1998

A publication of MSRI.

Featured speakers: Raoul Bott, Harvard University, Cambridge, MA; Robert Bryant, Duke University, Durham, NC; Xiu-Xiong Chern, Stanford University, CA; S.-S. Chern, MSRI and University of CA, Berkeley; Phillip Griffiths, Institute for Advanced Study, Princeton, NJ; Friedrich Hirzebruch, Max-Planck Institute for Mathematics; Blaine Lawson, State University of New York, Stony Brook; Kefeng Lilu, Stanford University, CA; Eckhard Meinrenken, University of Toronto, ON, Canada; James Simons, Renaissance Technologies, New York; Chuu-Lian Terng, Northeastern University, Boston, MA; Alan Weinstein, University of California, Berkeley.

This CD-ROM features video presentations from the Chern symposium in geometry sponsored jointly by the University of CA (Berkeley) and MSRI. The symposium presented developments in differential geometry over the past few decades. Recent progress and new directions in the field were also covered.

The CD requires Real™Video Player, which can be downloaded for free from the RealNetworks Internet home page. RealVideo Player is available for Windows95/Windows NT, Windows 3.1, MacOS, IRIX 6.2/6.3, Solaris 2.5 and Linux 2.0.

Distributed worldwide by the American Mathematical Society.

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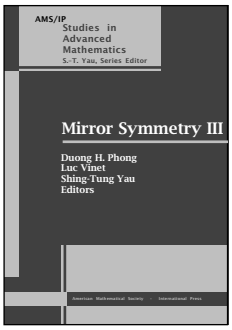
Contents: J. Simons, Introductory remarks; **R. Bott**, Configuration space invariants of knots and 3-manifolds; **R. Bryant**, Finsler manifolds of constant flag curvature; **Xiu-Xiong Chern**, Extremal metrics in Riemann surfaces and the uniformization theorem; **S. S. Chern**, Projective geometry; **F. Hirzebruch**, Why do I like Chern classes?; **B. Lawson**, Algebraic cycles and the classical groups; **K. Liu**, Mirror principle; **E. Meinrenken**, Duistermaat-Heckman formulas for group valued moment maps; **C.-L. Terng**, Backlund transformations and loop ground actions; **A. Weinstein**, From Riemann geometry to Poisson geometry and back again.

July 1998, CD-ROM, 1991 *Mathematics Subject Classification*: 53, List $15, Order code MSRICD/2N



Mirror Symmetry III

Duong H. Phong, *Columbia University, New York, NY*, **Luc Vinet**, *University of Montreal, PQ, Canada*, and **Shing-Tung Yau**, *Harvard University, Cambridge, MA*, Editors

This book presents surveys from a workshop held during the theme year in geometry and topology at the Centre de recherches mathématiques (CRM, University of Montréal). The volume is in some sense a sequel to *Mirror Symmetry I* (1998) and *Mirror Symmetry II* (1996), co-published by the AMS and International Press.

Included are recent developments in the theory of mirror manifolds and the related areas of complex and symplectic geometry. The long introductory articles explain the key physical ideas and motivation, namely conformal field theory, supersymmetry, and string theory. Open problems are emphasized. Thus the book provides an efficient way for a very broad audience of mathematicians and physicists to reach the frontier of research in this fast expanding area.

Features:

- Crucial research pertaining to future developments in algebraic and symplectic geometry and to the physics of unified string theories
- Well-known authors who are leaders in the field
- Introductory article by Greene and Yau
- A solid and even blend of ideas and techniques from both mathematics and physics

This item will also be of interest to those working in mathematical physics.

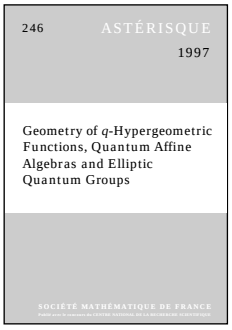
This book is co-published by the AMS, International Press, and Centre de Recherches Mathématiques.

Contents: B. R. Greene, Aspects of quantum geometry; **S.-T. Yau**, Introduction to enumerative invariants; **T. H. Parker**, Compactified moduli spaces of pseudo-holomorphic curves; **M. Verbitsky**, Mirror symmetry for hyper-Kähler manifolds; **M. Gross**, Connecting the web: A prognosis; **A. Klemm** and **P. Mayr**, Strong coupling singularities and non-abelian gauge symmetries in $N = 2$ string theory; **S. Kachru**, Remarks on (0,2) Calabi-Yau models; **K. Liu**, Relations among fixed point; **J. Jorgenson** and **A. Todorov**, An analytic discriminant for polarized algebraic $K3$ surfaces; **D. R. Morrison**, Through the looking glass; **B. Siebert**, An update on (small) quantum cohomology.

AMS/IP Studies in Advanced Mathematics, Volume 10

January 1999, 312 pages, Hardcover, ISBN 0-8218-1193-2, LC 98-37643, 1991 *Mathematics Subject Classification*: 14–06; 32–06, 81–06, **All AMS members $34**, List $42, Order code AMSIP/10N

Mathematical Physics



Geometry of q-Hypergeometric Functions, Quantum Affine Algebras and Elliptic Quantum Groups

V. Tarasov, *Steklov Mathematical Institute, St. Petersburg, Russia*, and **A. Varchenko**, *University of North Carolina, Chapel Hill*

A publication of Société Mathématique de France.

The trigonometric quantized Knizhnik-Zamolodchikov (qKZ) equation associated with the quantum group $U_q(\mathfrak{sl}_2)$ is a system of linear difference equations with values in a tensor product of $U_q(\mathfrak{sl}_2)$ Verma modules. The authors solve the equation in terms of multidimensional q-hypergeometric functions and define a natural isomorphism of the space of solutions and the tensor product of the corresponding evaluation Verma modules over the elliptic quantum group $E_{\rho,\gamma}(\mathfrak{sl}_2)$ where the parameters ρ and γ are related to the parameter q of the quantum group $U_q(\mathfrak{sl}_2)$ and the step p of the qKZ equation via $p = e^{2\pi i\rho}$ and $q = e^{-2\pi i\gamma}$.

The authors construct asymptotic solutions associated with suitable asymptotic zones and compute the transition functions between the asymptotic solution in terms of the dynamical elliptic R-matrices. This description of the transition functions gives a connection between representation theories of the quantum loop algebra $U_q(\widetilde{\mathfrak{gl}_2})$ and the elliptic quantum group $E_{\rho,\gamma}(\mathfrak{sl}_2)$ and is analgous to the Kohno-Drinfeld theorem on the monodromy group of the differential Knizhnik-Zamolodchikov equation.

In order to establish these results, the authors construct a discrete Gauss-Manin connection, in particular, a suitable discrete local system, discrete homology and cohomology groups with coefficients in this local system, and they identify an associated difference equation with the qKZ equations.

This item will also be of interest to those working in algebra and algebraic geometry.

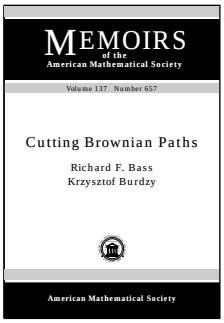
Distributed by the AMS in the United States, Canada, and Mexico. Orders from other countries should be sent to the SMF, Maison de la SMF, B.P. 67, 13274 Marseille cedex 09, France, or to Institut Henri Poincaré, 11 rue Pierre et Marie Curie, 75231 Paris cedex 05, France. Members of the SMF receive a 30% discount from list.

Contents: Introduction; Discrete flat connections and local systems; R-matrices and qKZ connection; Tensor coordinates on the hypergeometric spaces; The hypergeometric pairing and the hypergoemetric solutions of the qKZ equation; Asymptotic solutions of the qKZ equation; Proofs; Appendices; References.

Astérisque, Number 246

October 1998, 135 pages, Softcover, 1991 *Mathematics Subject Classification*: 17B37, 17B65, 33D60, 33D70, 33D80, 81R10, 81R50, **Individual member $23**, List $25, Order code AST/246N

Probability



Cutting Brownian Paths

Richard F. Bass and **Krzysztof Burdzy**, *University of Washington, Seattle*

A long open problem in probability theory has been the following: *Can the graph of planar Brownian motion be split by a straight line?*

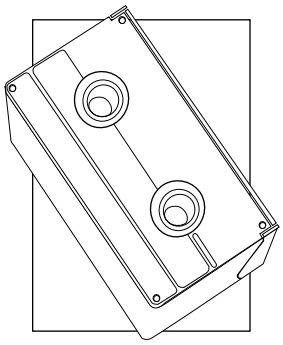
Let Z_t be two-dimensional Brownian motion. Say that a straight line $\mathcal{L}$ is a cut line if there exists a time $t \in (0,1)$ such that the trace of $\{Z_s : 0 \le s < t\}$ lies on one side of $\mathcal{L}$ and the trace of $\{Z_s : t < s < 1\}$ lies on the other side of $\mathcal{L}$. In this volume, the authors provide a solution, discuss related works, and present a number of open problems.

Contents: Introduction; Preliminaries; Decomposition of Bessel processes; Random walk estimates; Estimates for approximate points of increase; Two and three angle estimates; The main estimate; Estimates for wedges; Filling in the gaps; Further results and problems; References.

Memoirs of the American Mathematical Society, Volume 137, Number 657

December 1998, 95 pages, Softcover, ISBN 0-8218-0968-7, LC 98-46548, 1991 *Mathematics Subject Classification*: 60J65; 60G17, **Individual member $24**, List $40, Institutional member $32, Order code MEMO/137/657N

AMS Video



Introduction to Geometric Probability

Gian-Carlo Rota, *Massachusetts Institute of Technology, Cambridge*

This lecture examines the notion of invariant measure from a fresh viewpoint. The most familiar examples of invariant measures are area and volume, which are invariant under the group of rigid motions. Master expositor Gian-Carlo Rota shows how, starting with a few simple axioms, one can concoct new invariant measures and explore their properties. One set of such measures, known as the intrinsic volumes, are quite new and still somewhat mysterious. However, they have intriguing probabilistic interpretations and in fact can be shown to form a basis for the space of all continuous invariant measures. Rota also discusses the remarkable connection between the intrinsic volumes and the Euler characteristic. Reaching deep ideas while remaining at an elementary level, this lecture would be accessible to undergraduate mathematics majors.

This item will also be of interest to those working in geometry and topology.

November 1998, NTSC format on one-half inch VHS videotape, approximately 60 minutes, ISBN 0-8218-1351-X, 1991 *Mathematics Subject Classification*: 52, 60, **Individual member $34.95**, List $54.95, Institutional member $44.95, Order code VIDEO/102N