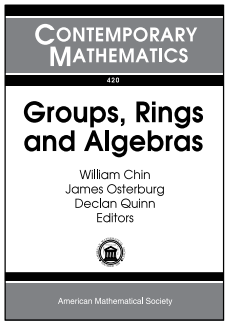
New Publications Offered by the AMS

Algebra and Algebraic Geometry



Groups, Rings and Algebras

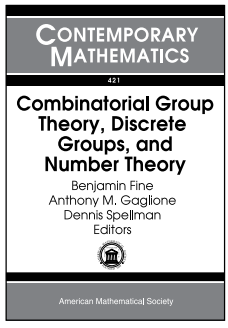
William Chin, *DePaul University, Chicago, IL*, **James Osterburg**, *University of Cincinnati, OH*, and **Declan Quinn**, *Syracuse University, NY*, Editors

This is a companion volume to the conference in honor of Donald S. Passman held in Madison, Wisconsin in June 2005. It contains research papers on Algebras, Group Rings, Hopf Algebras, Invariant Theory, Lie Algebras and their Enveloping Algebras, Noncommutative Algebraic Geometry, Noncommutative Rings, and other topics. The papers represent an important part of the latest research in these areas.

Contents: Y. A. Bahturin and **I. P. Shestakov**, Group gradings on associative superalgebras; **K. I. Beidar**, **S. K. Jain**, and **A. K. Srivastava**, Essential extensions of a direct sum of simple modules; **J. Bergen**, Adjoint actions of cocommutative Hopf algebras; **G. M. Bergman**, Two statements about infinite products that are not quite true; **R. Betz**, **S. Eckel**, **P. Pappas**, and **J. Uyanik**, Cyclic structures with lag-time generators; **O. B. Cristo** and **C. P. Milies**, Central idempotents in group algebras; **D. R. Farkas** and **P. A. Linnell**, Congruence subgroups and the Atiyah conjecture; **E. Formanek**, The adjoint of the Bezoutian; **A. Giambruno** and **S. K. Sehgal**, Group algebras whose Lie algebra of skew-symmetric elements is nilpotent; **J. Z. Gonçalves** and **M. Shirvani**, Free symmetric and unitary pairs in central simple algebras with involution; **R. M. Guralnick** and **M. Lorenz**, Orders of finite groups of matrices; **G. Heide** and **A. E. Zalesskiĭ**, Passman's problem on adjoint representations; **M. Hertweck** and **M. Soriano**, On the modular isomorphism problem: Groups of order 2^6; **W. Kimmerle**, On the prime graph of the unit group of integral group rings of finite groups; **L. Krop** and **D. E. Radford**, Simple modules for the Drinfel'd double of a class of Hopf algebras; **A. I. Lichtman**, The correspondence between groups and restricted Lie algebras for some relatively free groups; **C.-H. Liu**, Semiprime Lie rings of derivations of commutative rings; **I. M. Musson**, Faithful cyclic modules for enveloping algebras and Sklyanin algebras; **D. S. Passman**, Polynomial and inverse forms; **D. Riley** and **H. Usefi**, Restricted Lie algebras with subexponential growth; **M. Ursul**, A few criteria of boundedness of topological rings.

Contemporary Mathematics, Volume 420

December 2006, 301 pages, Softcover, ISBN-10: 0-8218-3904-7, ISBN-13: 978-0-8218-3904-1, LC 2006050359, 2000 *Mathematics Subject Classification:* 08B25, 15A57, 16W25, 17B40, 20C07, 20C15, 20F40; 03C20, 16S34, 16U60, 20B30, 22A05, **All AMS members US$71**, List US$89, Order code CONM/420



Combinatorial Group Theory, Discrete Groups, and Number Theory

Benjamin Fine, *Fairfield University, CT*, **Anthony M. Gaglione**, *U.S. Naval Academy, Annapolis, MD*, and **Dennis Spellman**, *Temple University, Philadelphia, PA*, Editors

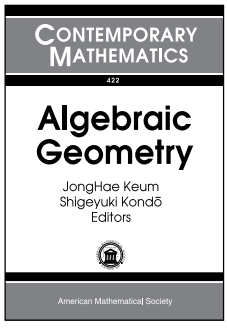
This volume consists of contributions by participants and speakers at two conferences. The first was entitled Combinatorial Group Theory, Discrete Groups and Number Theory and was held at Fairfield University, December 8–9, 2004. It was in honor of Professor Gerhard Rosenberger's sixtieth birthday. The second was the AMS Special Session on Infinite Group Theory held at Bard College, October 8–9, 2005. The papers in this volume provide a very interesting mix of combinatorial group theory, discrete group theory and ring theory as well as contributions to noncommutative algebraic cryptography.

Contents: P. Ackermann, A description of the arithmetic Fuchsian groups with signature (2;—); **R. B. J. T. Allenby**, **G. Kim**, and **C. Y. Tang**, Outer automorphism groups of certain orientable Seifert 3-manifold groups; **M. Anshel** and **A. M. Gaglione**, The search for origins of the commutator calculus; **G. Baumslag**, **B. Fine**, **A. M. Gaglione**, and **D. Spellman**, A note on nondiscrimination of nilpotent groups and Mal'cev completions; **G. Baumslag**, **B. Fine**, and **X. Xu**, A proposed public key cryptosystem using the modular group; **H. Bluhm** and **M. Kreuzer**, Gröbner basis techniques in the computation of two-sided syzygies; **M. Conder**

and **P. Dobcsányi**, Normal subgroups of the modular group and other Hecke groups; **O. B. Cristo** and **C. P. Milies**, Commutativity of units in group rings; **M. J. Evans**, Presentations of groups involving more generators than are necessary. II.; **B. Fine**, **A. M. Gaglione**, and **D. Spellman**, Unions of varieties and quasivarieties; **B. Fine**, **A. M. Gaglione**, and **D. Spellman**, Finitely presented infinite torsion groups and a question of V. H. Dyson; **A. Fonseca** and **R. M. Thomas**, Context-free irreducible word problems in groups; **D. Garrison**, **L.-C. Kappe**, and **D. Yull**, Autocommutators and the autocommutator subgroup; **J. Gilman**, Informative words and discreteness; **R. Goldstein**, An algorithm for potentially positive words in F_2; **G. Kern-Isberner**, Using group theory for knowledge representation and discovery; **M. Kreuzer**, **A. Myasnikov**, **G. Rosenberger**, and **A. Ushakov**, Quotient tests and Gröbner bases; **L. A. Kurdachenko** and **I. Y. Subbotin**, Transitivity of normality and pronormal subgroups; **C. Maclachlan**, Torsion in maximal arithmetic Fuchsian groups; **S. Majewicz**, Nilpotent $\mathbb{Q}[x]$-powered groups; **R. F. Morse**, On the Rosenberger monster; **C. F. Rocca, Jr.**, Density of test elements in finite abelian groups; **R. Weidmann**, Adjoining a root does not decrease the rank.

Contemporary Mathematics, Volume 421

February 2007, 273 pages, Softcover, ISBN-10: 0-8218-3985-3, ISBN-13: 978-0-8218-3985-0, LC 2006043026, 2000 *Mathematics Subject Classification:* 01A60, 03C05, 20E05, 20E06, 20E26, 20F05, 20F12, 20F18, 20H10, **All AMS members US$63**, List US$79, Order code CONM/421



Algebraic Geometry

JongHae Keum, *Korea Institute for Advanced Study, Seoul, Korea*, and **Shigeyuki Kondō**, *Nagoya University, Japan*, Editors

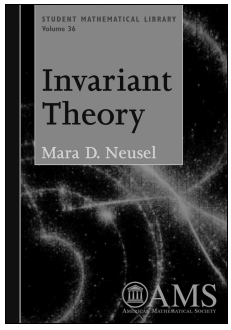
This volume contains the proceedings of the Korea-Japan Conference on Algebraic Geometry in honor of Igor Dolgachev on his sixtieth birthday. The articles in this volume explore a wide variety of problems that illustrate interactions between algebraic geometry and other branches of mathematics. Among the topics covered by this volume are algebraic curve theory, algebraic surface theory, moduli space, automorphic forms, Mordell–Weil lattices, and automorphisms of hyperkähler manifolds. This book is an excellent and rich reference source for researchers.

Contents: **L. A. Borisov**, Holomorphic Eisenstein series with Jacobian twists; **E. Dardanelli** and **B. van Geemen**, Hessians and the moduli space of cubic surfaces; **M. Gizatullin**, On covariants of plane quartic associated to its even theta characteristic; **J. Keum**, A rationality criterion for projective surfaces–Partial solution to Kollár's conjecture; **S. Kondō**, The moduli space of 8 points on $\mathbb{P}^1$ and automorphic forms; **E. Looijenga**, Invariants of quartic plane curves as automorphic forms; **V. V. Nikulin**, On correspondences of a K3 surface with itself. II; **K. Oguiso**, Automorphisms of hyperkähler manifolds in the view of topological entropy; **I. Shimada** and **D.-Q. Zhang**, $K3$ surfaces with ten cusps; **T. Shioda**, Classical Kummer surfaces and Mordell-Weil lattices; **D.-Q. Zhang**, Niemeier lattices and K3 groups.

Contemporary Mathematics, Volume 422

March 2007, approximately 234 pages, Softcover, ISBN-10: 0-8218-4201-3, ISBN-13: 978-0-8218-4201-0, LC 2006049918, 2000 *Mathematics Subject Classification:* 11D25, 11F11, 14H10, 14J15, 14J26, 14J28, 14J50, 14J60, 14L24, 32N15, **All AMS members US$55**, List US$69, Order code CONM/422

COURSE ADOPTION



Invariant Theory

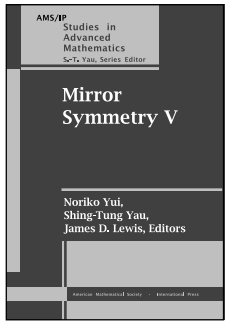
Mara D. Neusel, *Texas Tech University, Lubbock, TX*

This book presents the characteristic zero invariant theory of finite groups acting linearly on polynomial algebras. The author assumes basic knowledge of groups and rings, and introduces more advanced methods from commutative algebra along the way. The theory is illustrated by numerous examples and applications to physics, engineering, numerical analysis, combinatorics, coding theory, and graph theory. A wide selection of exercises and suggestions for further reading makes the book appropriate for an advanced undergraduate or first-year graduate level course.

Contents: Introduction; *Recollections:* Linear representations of finite groups; Rings and algebras; *Introduction and Göbel's bound:* Rings of polynomial invariants; Permutation representations; Application: Decay of a spinless particle; Application: Counting weighted graphs; *The first fundamental theorem of invariant theory and Noether's bound:* Construction of invariants; Noether's bound; Some families of invariants; Application: Production of fibre composites; Application: Gaussian quadrature; *Noether's theorems:* Modules; Integral dependence and the Krull relations; Noether's theorems; Application: Self-dual codes; *Advanced counting methods and the Shephard-Todd-Chevalley theorem:* Poincaré series; Systems of parameters; Pseudoreflection representations; Application: Counting partitions; Appendix A: Rational invariants; Suggestions for further reading; Index.

Student Mathematical Library, Volume 36

January 2007, 314 pages, Softcover, ISBN-10: 0-8218-4132-7, ISBN-13: 978-0-8218-4132-7, LC 2006049944, 2000 *Mathematics Subject Classification:* 13A50; 13-XX, 20-XX, **All AMS members US$39**, List US$49, Order code STML/36



Mirror Symmetry V

Noriko Yui, *Queen's University, Kingston, ON, Canada*, **Shing-Tung Yau**, *Harvard University, Cambridge, MA*, and **James D. Lewis**, *University of Alberta, Edmonton, AB, Canada*, Editors

Since its discovery in the early 1990s, mirror symmetry, or more generally, string theory, has exploded onto the mathematical landscape. This topic touches upon many branches of mathematics and

mathematical physics, and has revealed deep connections between subjects previously considered unrelated. The papers in this volume treat mirror symmetry from the perspectives of both mathematics and physics. The articles can be roughly grouped into four sub-categories within the topic of mirror symmetry: arithmetic aspects, geometric aspects, differential geometric and mathematical physics aspects, and geometric analytic aspects. In these works, the reader will find mathematics addressing, and in some cases solving, problems inspired and influenced by string theory.

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

Titles in this series are co-published with International Press, Cambridge, MA.

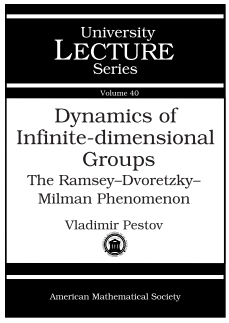
Contents: *Arithmetic aspects:* **M. J. Bertin**, Mahler's measure and L-series of $K3$ hypersurfaces; **K. Hulek**, **H. Verrill**, and **L. V. Dieulefait**, On the modularity of Calabi-Yau threefolds containing elliptic ruled surfaces Appendix A. A Modularity Criterion for Integral Galois Representations and Calabi-Yau Threefolds; **S. Kadir**, Arithmetic mirror symmetry for a two-parameter family of Calabi-Yau manifolds; **K. Kimura**, A rational map between two threefolds; **E. Lee**, A modular non-rigid Calabi-Yau threefold; **M. Lynker** and **R. Schimmrigk**, Arithmetic of algebraic curves and the affine algebra $A_1^{(1)}$; **J. Stienstra**, Mahler measure variations, Eisenstein series and instanton expansions; **J. Stienstra**, Mahler measure, Eisenstein series and dimers; **D. Wan** and **C. D. Haessig**, Mirror symmetry for zeta functions with appendix; **N. Yui** and **Y. Goto**, The L-series of Calabi-Yau orbifolds of CM type Appendix B. The L-series of Cubic Hypersurface Fourfolds; *Geometric aspects:* **V. Batyrev** and **M. Kreuzer**, Integral cohomology and mirror symmetry for Calabi-Yau 3-folds; **X. Chen** and **J. D. Lewis**, The real regulator for a product of $K3$ surfaces; **Y. Kawamata**, Derived equivalence for stratified Mukai flop on $G(2,4)$; **M. Kerr**, A survey of transcendental methods in the study of Chow groups of zero-cycles; **E. Viehweg** and **K. Zuo**, Geometry and arithmetic of non-rigid families of Calabi-Yau 3-folds; Questions and examples; **Y. Zhang**, Some results on families of Calabi-Yau varieties; *Differential geometric and mathematical physical aspects:* **K. Hori**, Boundary RG flows of $\mathcal{N} = 2$ minimal models; **S. Hosono**, Central charges, symplectic forms, and hypergeometric series in local mirror symmetry; **C.-H. Liu** and **S.-T. Yau**, Extracting Gromov-Witten invariants of a conifold from semi-stable reduction and relative GW-invariants of pairs; **W.-D. Ruan**, Generalized special Lagrangian torus fibrations for Calabi-Yau hypersurfaces in toric varieties II; *Geometric analytic aspects: Picard-Fuchs equations:* **G. Almkvist** and **W. Zudilin**, Differential equations, mirror maps and zeta values; **C. F. Doran** and **J. W. Morgan**, Mirror symmetry and integral variations of Hodge structure underlying one-parameter families of Calabi-Yau threefolds; **C. van Enckevort** and **D. van Straten**, Monodromy calculations of fourth order equations of Calabi-Yau type; **B. Forbes**, Open string mirror maps from Picard-Fuchs equations; **N. Yui**, **S.-T. Yau**, and **J. D. Lewis**, Problems.

AMS/IP Studies in Advanced Mathematics, Volume 38

January 2007, 576 pages, Softcover, ISBN-10: 0-8218-4251-X, ISBN-13: 978-0-8218-4251-5, LC 2006047914, 2000 *Mathematics Subject Classification:* 14-XX, 11-XX, 32-XX, 81-XX, **All AMS members US$87**, List US$109, Order code AMSIP/38

Analysis

COURSE ADOPTION



Dynamics of Infinite-dimensional Groups

The Ramsey–Dvoretzky–Milman Phenomenon

Vladimir Pestov, *University of Ottawa, Ontario, Canada*

The "infinite-dimensional groups" in the title refer to unitary groups of Hilbert spaces, the infinite symmetric group, groups of homeomorphisms of manifolds, groups of transformations of measure spaces, etc. The book presents an approach to the study of such groups based on ideas from geometric functional analysis and from exploring the interplay between dynamical properties of those groups, combinatorial Ramsey-type theorems, and the phenomenon of concentration of measure.

The dynamics of infinite-dimensional groups is very much unlike that of locally compact groups. For instance, every locally compact group acts freely on a suitable compact space (Veech). By contrast, a 1983 result by Gromov and Milman states that whenever the unitary group of a separable Hilbert space continuously acts on a compact space, it has a common fixed point.

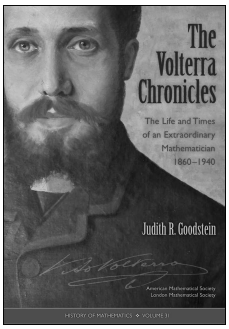
In the book, this new fast-growing theory is built strictly from well-understood examples up. The book has no close counterpart and is based on recent research articles. At the same time, it is organized so as to be reasonably self-contained. The topic is essentially interdisciplinary and will be of interest to mathematicians working in geometric functional analysis, topological and ergodic dynamics, Ramsey theory, logic and descriptive set theory, representation theory, topological groups, and operator algebras.

Contents: Introduction; The Ramsey–Dvoretzky–Milman phenomenon; The fixed point on compacta property; The concentration property; Lévy groups; Urysohn metric space and its group of isometries; Minimal flows; Further aspects of concentration; Oscillation stability and distortion; Bibliography; Index.

University Lecture Series, Volume 40

January 2007, 192 pages, Softcover, ISBN-10: 0-8218-4137-8, ISBN-13: 978-0-8218-4137-2, LC 2006048749, 2000 *Mathematics Subject Classification:* 05D10, 22F05, 43A05, 46B09; 05C55, 20B30, 22A05, 22F10, 22F50, 28D15, 37A15, 37A20, 37A40, 43A07, 46L05, 46L10, 51F25, 54E70, 54H15, 54H25, 60B05, **All AMS members US$31**, List US$39, Order code ULECT/40

General and Interdisciplinary



The Volterra Chronicles

The Life and Times of an Extraordinary Mathematician 1860–1940

Judith R. Goodstein, *California Institute of Technology, Pasadena, CA*

The life of Vito Volterra, one of the finest scientists and mathematicians Italy ever produced, spans the period from the unification of the Italian peninsula in 1860 to the onset of the Second World War—an era of unparalleled progress and unprecedented turmoil in the history of Europe. Born into an Italian Jewish family in the year of the liberation of Italy's Jewish ghettos, Volterra was barely in his twenties when he made his name as a mathematician and took his place as a leading light in Italy's modern scientific renaissance. By his early forties, he was a world-renowned mathematician, a sought-after figure in European intellectual and social circles, the undisputed head of Italy's mathematics and physics school—and still living with his mother, who decided the time was ripe to arrange his marriage. When Italy entered World War I in 1915, the fifty-five-year-old Volterra served with distinction and verve as a lieutenant and did not put on civilian clothes again until the Armistice of 1918. By 1925, he was president of the world's oldest scientific society, the Accademia dei Lincei, the founder and president of Italy's National Research Council, a mentor to the brilliant and restless Enrico Fermi, and "Mr. Italian Science" to the rest of the world. But none of this was enough to keep the government of Benito Mussolini from stripping him of all his honors and affiliations in 1931, when he was one of only twelve professors in the entire country to refuse to sign an oath of loyalty to the Fascist regime.

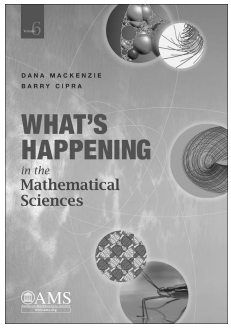
This book, based in part on unpublished personal letters and interviews, traces the extraordinary life and times of one of Europe's foremost scientists and mathematicians, from his teenage struggles to avoid the stifling life of a "respectable" bank clerk in Florence, to his seminal mathematical work—which today influences fields as diverse as economics, physics, and ecology—and from his spirited support of Italy's scientific and democratic institutions during his years as an Italian Senator, to his steadfast defiance of the Fascists and Mussolini. In recounting the life of this outstanding scientist, European Jewish intellectual, committed Italian patriot, and devoted if frequently distracted family man, *The Volterra Chronicles* depicts a remarkable individual in a prodigious age and takes the reader on a vivid and splendidly detailed historical journey.

Co-published with the London Mathematical Society beginning with Volume 4. Members of the LMS may order directly from the AMS at the AMS member price. The LMS is registered with the Charity Commissioners.

Contents: "The Jewish mathematician"; "A new era is dawning," 1860; "This, above all, I promise," 1863-1870; "That damned passion," 1874-1877; "Long live the republic," 1878-1882; "Professor by deed," 1880-1883; "Our professor of small intervals," 1883-1893; "The life I live," 1887-1895; "Demonstrations of their resentment," 1893-1900; "God liberate us from his symbols"; "It is the greatest desire of my life," 1900; "Most important for our fatherland"; "Will they create a new world?"; "A political man"; "A professor in America"; "Empires die"; Epilogue; Illustrations; Sir Edmund Whittaker, "Vito Volterra, 1860-1940"; On the attempts to apply mathematics to the biological and social sciences; Science at the present moment and the new Italian society for the progress of science; Acknowledgments; Selected bibliography; Notes; Index.

History of Mathematics, Volume 31

March 2007, approximately 315 pages, Hardcover, ISBN-10: 0-8218-3969-1, ISBN-13: 978-0-8218-3969-0, LC 2006051752, 2000 *Mathematics Subject Classification:* 01A60, 01A70, **All AMS members US$47**, List US$59, Order code HMATH/31



What's Happening in the Mathematical Sciences

Dana Mackenzie and **Barry Cipra**

The AMS series *What's Happening in the Mathematical Sciences* distills the amazingly rich brew of current research in mathematics down to a few choice samples. This volume leads off with an update on the Poincaré Conjecture, a hundred-year-old problem that has apparently been solved by Grigory Perelman of St. Petersburg, Russia. So what did topologists do when the oldest and most famous problem about closed manifolds was vanquished? As the second chapter describes, they confronted a suite of problems concerning the "ends" of open manifolds... and solved those, too.

Not to be outdone, number theorists accomplished several unexpected feats in the first five years of the new century, from computing a trillion digits of pi to finding arbitrarily long equally-spaced sequences of prime numbers. Undergraduates made key discoveries, as explained in the chapters on Venn diagrams and primality testing. In applied mathematics, the Navier-Stokes equations of fluid mechanics continued to stir up interest. One team proved new theorems about the long-term evolution of vortices, while others explored the surprising ways that insects use vortices to move around. The random jittering of Brownian motion became a little less mysterious. Finally, an old and trusted algorithm of computer science had its trustworthiness explained in a novel way.

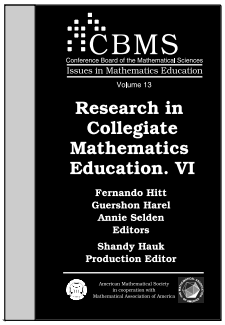
Barry Cipra explains these new developments in his wry and witty style, familiar to readers of Volumes 1–5, and is joined in this volume by Dana Mackenzie. Volume 6 of *What's Happening* will convey to all readers—from mathematical novices to experts—the beauty and wonder that is mathematics.

Contents: D. Mackenzie and **B. Cipra**, Introduction; **B. Cipra**, First of seven millennium problems nears completion; **D. Mackenzie**, Classifying hyperbolic manifolds—All's well that ends well; **B. Cipra**, Digits of pi; **B. Cipra**, Combinatoricists solve a Venn-erable problem; **B. Cipra**, New insights into prime numbers; **D. Mackenzie**, From Rubik's Cube to quadratic number fields...and beyond; **B. Cipra**, Vortices and the Navier-Stokes equations; **D. Mackenzie**, Fluid dynamics explains mysteries of insect motion; **D. Mackenzie**, Brownian motion, phase transitions, and conformal

maps; **B. Cipra**, Smoothed analysis speeds up the simplex method.

What's Happening in the Mathematical Sciences, Volume 6

January 2007, 122 pages, Softcover, ISBN-10: 0-8218-3585-8, ISBN-13: 978-0-8218-3585-2, 2000 *Mathematics Subject Classification:* 00A06, **All AMS members US$18**, List US$23, Order code HAPPENING/6



Research in Collegiate Mathematics Education. VI

Fernando Hitt, *Université du Québec à Montréal, QC, Canada*, **Guershon Harel**, *University of California, San Diego, CA*, and **Shandy Hauk**, *University of Northern Colorado, Greeley, CO*, Editors

The sixth volume of *Research in Collegiate Mathematics Education* presents state-of-the-art research on understanding, teaching, and learning mathematics at the postsecondary level. The articles advance our understanding of collegiate mathematics education while being readable by a wide audience of mathematicians interested in issues affecting their own students. This is a collection of useful and informative research regarding the ways our students think about and learn mathematics.

The volume opens with studies on students' experiences with calculus reform and on the effects of concept-based calculus instruction. The next study uses technology and the van Hiele framework to help students construct concept images of sequential convergence. The volume continues with studies on developing and assessing specific competencies in real analysis, on introductory complex analysis, and on using geometry in teaching and learning linear algebra. It closes with a study on the processes used in proof construction and another on the transition to graduate studies in mathematics.

Whether they are specialists in education or mathematicians interested in finding out about the field, readers will obtain new insights about teaching and learning and will take away ideas that they can use.

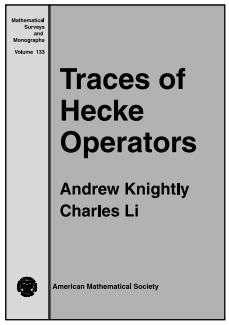
This series is published in cooperation with the Mathematical Association of America.

Contents: J. R. Star and **J. P. Smith III**, An image of calculus reform: Students' experiences of Harvard calculus; **K. K. Chappell**, Effects of concept-based instruction on calculus students' acquisition of conceptual understanding and procedural skill; **M. A. Navarro** and **P. P. Carreras**, Constructing a concept image of convergence of sequences in the van Hiele framework; **N. Grønbæk** and **C. Winslow**, Developing and assessing specific competencies in a first course on real analysis; **P. Danenhower**, Introductory complex analysis at two British Columbia universities: The first week–complex numbers; **G. Gueudet-Chartier**, Using geometry to teach and learn linear algebra; **K. Weber**, Investigating and teaching the processes used to construct proofs; **J. Duffin** and **A. Simpson**, The transition to independent graduate studies in mathematics.

CBMS Issues in Mathematics Education, Volume 13

December 2006, 248 pages, Softcover, ISBN-10: 0-8218-4243-9, ISBN-13: 978-0-8218-4243-0, 2000 *Mathematics Subject Classification:* 00-XX, 97-XX, **All AMS members US$39**, List US$49, Order code CBMATH/13

Number Theory



Traces of Hecke Operators

Andrew Knightly, *University of Maine, Orono, ME*, and **Charles Li**, *Academia Sinica, Taipei, Taiwan*

The Fourier coefficients of modular forms are of widespread interest as an important source of arithmetic information. In many cases, these coefficients can be recovered from explicit knowledge of the traces of Hecke operators. The original trace formula for Hecke operators was given by Selberg in 1956. Many improvements were made in subsequent years, notably by Eichler and Hijikata.

This book provides a comprehensive modern treatment of the Eichler–Selberg/Hijikata trace formula for the traces of Hecke operators on spaces of holomorphic cusp forms of weight $k > 2$ for congruence subgroups of $SL_2(\mathbf{Z})$. The first half of the text brings together the background from number theory and representation theory required for the computation. This includes detailed discussions of modular forms, Hecke operators, adeles and ideles, structure theory for $GL_2(\mathbf{A})$, strong approximation, integration on locally compact groups, the Poisson summation formula, adelic zeta functions, basic representation theory for locally compact groups, the unitary representations of $GL_2(\mathbf{R})$, and the connection between classical cusp forms and their adelic counterparts on $GL_2(\mathbf{A})$.

The second half begins with a full development of the geometric side of the Arthur–Selberg trace formula for the group $GL_2(\mathbf{A})$. This leads to an expression for the trace of a Hecke operator, which is then computed explicitly. The exposition is virtually self-contained, with complete references for the occasional use of auxiliary results. The book concludes with several applications of the final formula.

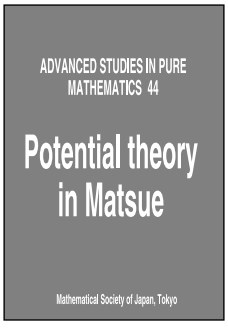
Contents: Traces of Hecke operators; Odds and ends; Groundwork; The trace formula; Computation of the trace; Applications; Bibliography; Tables of notation; Statement of the final result; Index.

Mathematical Surveys and Monographs, Volume 133

January 2007, 378 pages, Hardcover, ISBN-10: 0-8218-3739-7, ISBN-13: 978-0-8218-3739-9, LC 2006047814, 2000 *Mathematics Subject Classification:* 11-XX, **All AMS members US$76**, List US$95, Order code SURV/133

New AMS-Distributed Publications

Analysis



Potential Theory in Matsue

Hiroaki Aikawa, *Hokkaido University, Sapporo, Japan*, **Takashi Kumagai**, *Kyoto University, Japan*, **Yoshihiro Mizuta**, *Hiroshima University, Japan*, and **Noriaki Suzuki**, *Nagoya University, Japan*, Editors

This volume collects, in written form, eight plenary lectures and twenty-five selected contributions from invited and contributed lectures delivered at the International Workshop on Potential Theory 2004. The workshop was held at Shimane University, Matsue, Japan, from August 23 to 28, 2004. The topic of the workshop was potential theory and its related fields. There were stimulus talks from classical potential theory to pluripotential theory and probabilistic potential theory.

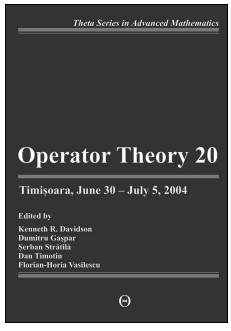
This item will also be of interest to those working in differential equations.

Published for the Mathematical Society of Japan by Kinokuniya, Tokyo, and distributed worldwide, except in Japan, by the AMS.

Contents: Z. Błocki, The Bergman kernel and pluripotential theory; **K. Burdzy**, Neumann eigenfunctions and Brownian couplings; **T. Carroll**, Brownian motion and harmonic measure in conic sections; **S. J. Gardiner**, Radial limits of harmonic functions; **Y. Guivarc′h**, Renewal theorems, products oif random matrices, and toral endomorphisms; **J. Ortega-Cerdà**, Densities and harmonic measure; **N. Shanmugalingam**, Sobolev type spaces on metric measure spaces; **J.-M. Wu**, Quasisymmetric extension, smoothing and applications; **J. Björn**, Wiener criterion for Cheeger p-harmonic functions on metric spaces; **F. Di Biase**, On the sharpness of certain approach regions; **T. Futamura** and **Y. Mizuta**, Continuity of weakly monotone Sobolev functions of variable exponent; **K. Hirata**, Martin kernels of general domains; **K. Ishizaki** and **N. Yanagihara**, Singular directions of meromorphic solutions of some non-autonomous Schröder equations; **K. Janssen**, Integral representation for space-time excessive functions; **T. Kurokawa**, A decomposition of the Schwartz class by a derivative space and its complementary space; **K. Kuwae** and **M. Takahashi**, Kato class functions of Markov processes under ultracontractivity; **E. G. Kwon**, A subharmonic Hardy class and Bloch pullback operator norms; **H. Masaoka**, Quasiconformal mappings and minimal Martin boundary of p-sheeted unlimited covering surfaces of the once punctered Riemann sphere $\hat{\mathbb{C}} \setminus \{0\}$ of Heins type; **H. Masaoka** and **S. Segawa**, Hyperbolic Riemann surfaces without unbounded positive harmonic functions; **I. Miyamoto** and **H. Yosida**, On a covering property of rarefied sets at infinity in a cone; **Y. Miyazaki**, The L^p resolvents for elliptic systems of divergence form; **Y. Mizuta** and **T. Shimomura**, Maximal functions, Riesz potentials and Sobolev's inequality in generalized Lebesgue spaces; **M. Murata**, Representations of nonnegative solutions for parabolic equations; **M. Nakai**, Types of pasting arcs in two sheeted spheres; **M. Nishio**, **K. Shimomura**, and **N. Suzuki**, L^p-boundedness of Bergman projections for α-parabolic operators; **Y. Okuyama**, Vanishing theorem on the pointwise defect of a rational iteration sequence for moving targets; **T. Ono**, Hölder continuity of solutions to quasilinear elliptic equations with measure data; **Y. Pinchover**, On Davies' conjecture and strong ratio limit properties for the heat kernel; **Premaltha** and **A. K. Kalyani**, Some potential theoretic results of an infinite network; **M. Stoll**, The Littlewood-Paley inequalities for Hardy-Orlicz spaces of harmonic functions on domains in $\mathbb{R}^n$; **H. Watanabe**, Estimates of maximal functions by Hausdorff contents in a metric space; **M. Yamada**, Harmonic conjugates of parabolic Bergman functions; **M. Yanagishita**, On the behavior at infinity for non-negative superharmonic functions in a cone.

Advanced Studies in Pure Mathematics, Volume 44

August 2006, 413 pages, Hardcover, ISBN-10: 4-931469-33-7, ISBN-13: 978-4-931469-33-4, 2000 *Mathematics Subject Classification:* 31-XX; 31Bxx, 31Cxx, 32Axx, 32Uxx, 35Bxx, 35Cxx, 35Gxx, 35Jxx, 35Kxx, 35Pxx, 37Fxx, 39Bxx, 42Bxx, 46Exx, 58Jxx, 60Gxx, 60Hxx, 60Jxx, **All AMS members US$83**, List US$104, Order code ASPM/44



Operator Theory 20

Timisoara, June 30–July 5, 2004

Kenneth R. Davidson, *University of Waterloo, ON, Canada*, **Dumitru Gaspar**, *West University of Timisoara, Romania*, **Serban Stratila**, *Institute of Mathematics, Bucharest, Romania*, **Dan Timotin**, *Romanian Academy, Bucharest, Romania*, and **Florian-Horia Vasilescu**, *University of Lille I, Villeneuve d'Ascq, France*, Editors

The volume represents the proceedings of the 20th International Conference on Operator Theory, held in Timisoara (Romania), between June 30 and July 5, 2004. Besides a presentation of the life and works of G. K. Pedersen, it contains twenty-one refereed research papers written by leading experts in the field and by young researchers. These cover a large variety of topics of interest, including: single operator algebras, C* algebras, von Neumann algebras, Hilbert and Banach modules, differential and integral operators, noncommutative probability, and spectral theory.

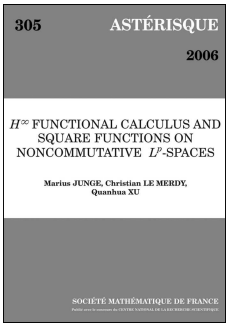
A publication of the Theta Foundation. Distributed worldwide, except in Romania, by the AMS.

Contents: D. Olesen and **E. Størmer**, The life and works of Gert Kjærgaard Pedersen; **H. Bercovici**, On Boolean convolutions; **A. M. Bikchentaev**, Representation of elements of von Neumann algebras in the form of finite sums of products of projections. II;

E. Boasso, On Cartan joint spectra; **J. Bračič**, Reflexivity of the space of module homomorphisms; **M. R. Buneci**, C^*-algebras associated to groupoids with proper orbit space; **G. Cassier** and **N. Suciu**, Analytic functions of a uniformly stable p-contraction; **R. Dumitru**, **C. Peligrad**, and **B. Viinescu**, Automorphisms inner in the local multiplier algebra and Connes spectrum; **D. E. Dutkay** and **G. Picioroaga**, The von Neumann algebra of the canonical equivalence relation of the generalized Thompson group; **S. H. Ferguson** and **R. Rochberg**, Description of certain quotient Hilbert modules; **A. Gomilko**, **I. Wróbel**, and **J. Zemánek**, Numerical ranges in a strip; **A. Khosravi** and **B. Khosravi**, Frames in tensor products of Hilbert C^*-modules; **A. S. Kostenko**, Spectral analysis of some indefinite Sturm-Liouville operators; **V. G. Kravchenko**, **A. B. Lebre**, and **J. S. Rodríguez**, The kernel of singular integral operators with a finite group of linear-fractional shifts; **R. Nicoara**, On the finiteness of the number of N-dimensional Hopf C^*-algebras; **M. Popa**, A non-commutative analogue of Gaussian Hilbert spaces; **D. Popovici**, Dilatable solutions for some operator moment problems; **F. Rădulescu**, Combinatorial aspects of Connes's embedding conjecture and asymptotic distribution of traces of products of unitaries; **A. Sandovici**, Canonical extensions of symmetric linear relations; **L. Suciu**, Ergodic properties and saturation for A-contractions; **N. Suciu**, On the generalized Harnack domination for contractions; **L. Zielinski**, Semiclassical distributions of eigenvalues for elliptic operators with Hölder continuous coefficients, part II: critical case.

International Book Series of Mathematical Texts

August 2006, 274 pages, Hardcover, ISBN-10: 973-85432-9-0, ISBN-13: 978-973-85432-9-4, 2000 *Mathematics Subject Classification:* 46-06, 47-06, **All AMS members US$38**, List US$48, Order code THETA/9



H^∞ Functional Calculus and Square Functions on Noncommutative L^p-Spaces

Marius Junge, *University of Illinois, Urbana, IL*, and **Christian Le Merdy** and **Quanhua Xu**, *Université de Franche-Comté, Besançon, France*

The authors investigate sectorial operators and semigroups acting on noncommutative L^p-spaces. They introduce new square functions in this context and study their connection with H^∞ functional calculus, extending some famous work by Cowling, Doust, McIntoch and Yagi concerning *commutative* L^p-spaces. This requires natural variants of Rademacher sectoriality and the use of the matricial structure of noncommutative L^p-spaces. They mainly focus on noncommutative diffusion semigroups, that is, semigroups $(T_t)_{t\geq 0}$ of normal selfadjoint operators on a semifinite von Neumann algebra $(\mathcal{M}, \tau)$ such that $T_t : L^p(\mathcal{M}) \to L^p(\mathcal{M})$ is a contraction for any $p \geq 1$ and any $t \geq 0$. They discuss several examples of such semigroups for which they establish bounded H^∞ functional calculus and square function estimates. This includes semigroups generated by certain Hamiltonians or Schur multipliers, q-Ornstein-Uhlenbeck semigroups acting on the q-deformed von Neumann algebras of Bozejko-Speicher, and the noncommutative Poisson semigroup acting on the group von Neumann algebra of a free group.

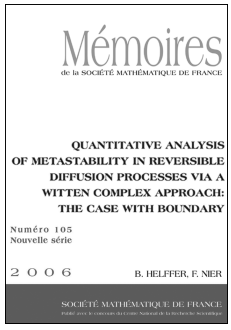
A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

Contents: Introduction; Noncommutative Hilbert space valued L^p-spaces; Bounded and completely bounded H^∞ functional calculus; Rademacher boundedness and related notions; Noncommutative diffusion semigroups; Square functions on noncommutative L^p-spaces; H^∞ functional calculus and square function estimates; Various examples of multipliers; Semigroups on q-deformed von Neumann algebras; A noncommutative Poisson semigroup; The non tracial case; Comparing row and column square functions; Measurable functions in $L^p(L^2)$; Bibliography.

Astérisque, Number 305

September 2006, 138 pages, Softcover, ISBN-10: 2-85629-189-9, ISBN-13: 978-2-85629-189-4, 2000 *Mathematics Subject Classification:* 47A60, 46L53, 46L55, 46L89, 47L25, **Individual member US$34**, List US$38, Order code AST/305

Differential Equations



Quantitative Analysis of Metastability in Reversible Diffusion Processes via a Witten Complex Approach

The Case with Boundary

Bernard Helffer, *Université Paris-Sud, Orsay, France*, and **Francis Nier**, *Université de Rennes 1, France*

This article is a continuation of previous works by Bovier-Eckhoff-Gayrard-Klein, Bovier-Gayrard-Klein and Helffer-Klein-Nier. The main object is the analysis of the small eigenvalues (as $h \to 0$) of the Laplacian attached to the quadratic form

$$C_0^\infty(\Omega) \ni v \mapsto h^2 \int_\Omega |\nabla v(x)|^2 \, e^{-2f(x)/h} dx,$$

where Ω is a bounded connected open set with C^∞-boundary and f is a Morse function on $M = \overline{\Omega}$. The previous works were devoted to the case of a manifold M which is compact but without boundary or $\mathbb{R}^n$. The authors' aim here is to analyze the case with boundary. After the introduction of a Witten cohomology complex adapted to the case with boundary, they give a very accurate asymptotics for the exponentially small eigenvalues. In particular, they analyze the effect of the boundary in the asymptotics.

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

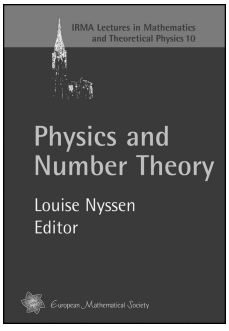
A publication of the Société Mathématique de France, Marseilles (SMF), distributed by the AMS in the U.S., Canada, and Mexico. Orders from other countries should be sent to the SMF. Members of the SMF receive a 30% discount from list.

Contents: Introduction; An appropriate self-adjoint realization of Witten Laplacians with boundary; First localization of the spectrum; Accurate WKB analysis near the boundary for $\Delta_{f,h}^{(1)}$; Saddle sets and main assumptions; Quasimodes; Result and final proof; An example in dimension 1; Biblliography.

Mémoires de la Société Mathématique de France, Number 105

October 2006, 89 pages, Softcover, ISBN-10: 2-85629-218-6, ISBN-13: 978-2-85629-218-1, 2000 *Mathematics Subject Classification:* 58J10, 58J32, 58J65, 60J60, 81Q10, 81Q20, **Individual member US$34**, List US$38, Order code SMFMEM/105

Number Theory



Physics and Number Theory

Louise Nyssen, *Université Montpellier II, France*, Editor

There is a rich and historical relationship between theoretical physics and number theory. This volume presents a selection of problems which are currently in full development and inspire a lot of research. Each of the seven contributions starts with an introductory survey which makes it possible even for non-specialists to understand the results and to gain an idea of the great variety of subjects and techniques used.

Topics covered are: phase locking in oscillating systems, crystallography, Hopf algebras and renormalisation theory, Zeta-function and random matrices, Kloosterman sums and the local Langlands correspondence.

Intended for research mathematicians and theoretical physicists as well as graduate students, this volume gives an overview of recent developments in an exciting subject crossing several disciplines.

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

A publication of the European Mathematical Society. Distributed within the Americas by the American Mathematical Society.

Contents: M. Planat, The phase of oscillations and prime numbers: classical and quantum; **J.-L. Verger-Gaugry**, On self-similar finitely generated uniformly discrete (SFU-)sets and sphere packings; **J.-P. Gazeau**, **Z. Masáková**, and **E. Pelantová**, Nested quasicrystalline discretisations of the line; **C. Bergbauer** and **D. Kreimer**, Hopf algebras in renormalization theory: locality and Dyson–Schwinger equations from Hochschild cohomology; **E. Royer**, Fonction ζ et matrices aléatoires; **P. Michel**, Some recent applications of Kloostermania; **A. Mézard**, Introduction à la correspondance de Langlands locale.

IRMA Lectures in Mathematics and Theoretical Physics, Volume 10

October 2006, 275 pages, Softcover, ISBN-10: 3-03719-028-0, ISBN-13: 978-3-03719-028-9, 2000 *Mathematics Subject Classification:* 11Fxx, 11Lxx, 11Mxx, 81Txx, 52Cxx, 68R15, **All AMS members US$38**, List US$48, Order code EMSILMTP/10