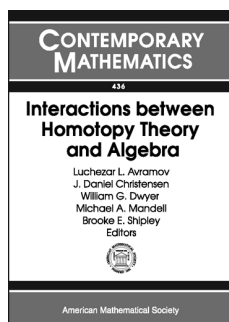


# New Publications Offered by the AMS

To subscribe to email notification of new AMS publications,  
please go to <http://www.ams.org/bookstore-email>.

## Algebra and Algebraic Geometry

September 2007, 334 pages, Softcover, ISBN: 978-0-8218-3814-3,  
LC 2007060682, 2000 *Mathematics Subject Classification*: 13Dxx,  
18Exx, 18Gxx, 55-XX; 13H10, 20J06, 14H52, **AMS members US\$79**,  
List US\$99, Order code CONM/436



### Interactions between Homotopy Theory and Algebra

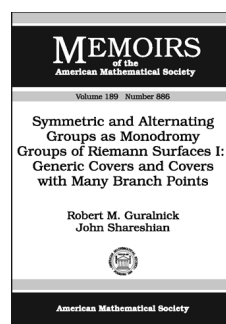
Luchezar L. Avramov, *University of Nebraska-Lincoln, NE*, **J. Daniel Christensen**, *University of Western Ontario, London, Ontario, Canada*, **William G. Dwyer**, *University of Notre Dame, IN*, **Michael A. Mandell**, *Indiana*

*University, Bloomington, IN*, and **Brooke E. Shipley**, *University of Illinois, Chicago, IL*, Editors

This book is based on talks presented at the Summer School on Interactions between Homotopy theory and Algebra held at the University of Chicago in the summer of 2004. The goal of this book is to create a resource for background and for current directions of research related to deep connections between homotopy theory and algebra, including algebraic geometry, commutative algebra, and representation theory. The articles in this book are aimed at the audience of beginning researchers with varied mathematical backgrounds and have been written with both the quality of exposition and the accessibility to novices in mind.

**Contents:** *Introductory lecture series:* **P. Goerss** and **K. Schemmerhorn**, Model categories and simplicial methods; **C. Huneke** and **A. Taylor**, Lectures on local cohomology; **H. Krause**, Derived categories, resolutions, and Brown representability; **H. Krause**, Exercises on derived categories, resolutions, and Brown representability; *Topics lecture series:* **J. P. C. Greenlees**, Spectra for commutative algebraists; **K. Hess**, Rational homotopy theory: A brief introduction; **S. Iyengar**, André-Quillen homology of commutative algebras; **W. G. Dwyer**, Local cohomology in commutative algebra, homotopy theory, and group cohomology; **J. P. C. Greenlees**, First steps in brave new commutative algebra; **M. Hovey**, Cotorsion pairs and model categories; **K. Brüning** and **I. Burban**, Coherent sheaves on an elliptic curve; **A. Adem**, Lectures on the cohomology of finite groups.

**Contemporary Mathematics**, Volume 436



### Symmetric and Alternating Groups as Monodromy Groups of Riemann Surfaces I: Generic Covers and Covers with Many Branch Points

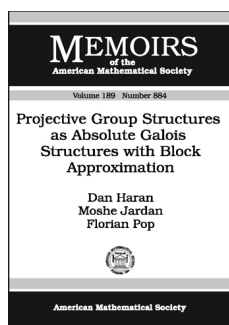
with an Appendix by R.  
Guralnick and R. Stafford

**Robert M. Guralnick**, *University of Southern California, Los Angeles, CA*, and **John Shareshian**, *Washington University, St. Louis, MO*

**Contents:** Introduction and statement of main results; Notation and basic lemmas; Examples; Proving the main results on five or more branch points—Theorems 1.1.1 and 1.1.2; Actions on 2-sets—the proof of Theorem 4.0.30; Actions on 3-sets—the proof of Theorem 4.0.31; Nine or more branch points—the proof of Theorem 4.0.34; Actions on cosets of some 2-homogeneous and 3-homogeneous groups; Actions on 3-sets compared to actions on larger sets; A transposition and an  $n$ -cycle; Asymptotic behavior of  $g_k(E)$ ; An  $n$ -cycle—the proof of Theorem 1.2.1; Galois groups of trinomials—the proofs of Propositions 1.4.1 and 1.4.2 and Theorem 1.4.3; Appendix A. Finding small genus examples by computer search—by R. Guralnick and R. Stafford; Appendix. Bibliography.

**Memoirs of the American Mathematical Society**, Volume 189, Number 886

August 2007, 128 pages, Softcover, ISBN: 978-0-8218-3992-8, LC 2007060802, 2000 *Mathematics Subject Classification*: 14H30, 20B15, **Individual member US\$37**, List US\$62, Institutional member US\$50, Order code MEMO/189/886



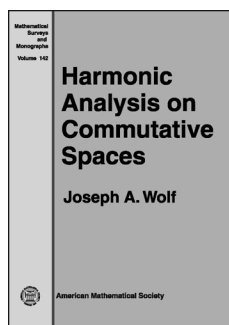
## Projective Group Structures as Absolute Galois Structures with Block Approximation

**Dan Haran** and **Moshe Jarden**,  
*Tel Aviv University, Israel,*  
and **Florian Pop**, *University of Pennsylvania, Philadelphia, PA*

**Contents:** Introduction; Étale topology; Group structures; Completion of a cover to a cartesian square; Projective group structures; Special covers; Unirationally closed fields; Valued fields; The space of valuation of a field; Locally uniform  $v$ -adic topologies; Locally uniform Hensel's lemma; Field valuation structures; Block approximation; Rigid Henselian extensions; Projective group structures as absolute Galois structures; From field structures to field valuation structures; References.

**Memoirs of the American Mathematical Society**, Volume 189, Number 884

August 2007, 56 pages, Softcover, ISBN: 978-0-8218-3995-9, LC 2007060804, 2000 *Mathematics Subject Classification*: 12E30, **Individual member US\$31**, List US\$52, Institutional member US\$42, Order code MEMO/189/884



## Harmonic Analysis on Commutative Spaces

**Joseph A. Wolf**, *University of California, Berkeley, CA*

This book starts with the basic theory of topological groups, harmonic analysis, and unitary representations. It then concentrates on geometric structure, harmonic analysis, and unitary representation theory in commutative

spaces. Those spaces form a simultaneous generalization of compact groups, locally compact abelian groups, and riemannian symmetric spaces. Their geometry and function theory is an increasingly active topic in mathematical research, and this book brings the reader up to the frontiers of that research area with the recent classifications of weakly symmetric spaces and of Gelfand pairs.

Part 1, "General Theory of Topological Groups", is an introduction with many examples, including all of the standard semisimple linear Lie groups and the Heisenberg groups. It presents the construction of Haar measure, the invariant integral, the convolution product, and the Lebesgue spaces.

Part 2, "Representation Theory and Compact Groups", provides background at a slightly higher level. Besides the basics, it contains the Mackey Little-Group method and its application to Heisenberg groups, the Peter-Weyl Theorem, Cartan's highest weight theory, the Borel-Weil Theorem, and invariant function algebras.

Part 3, "Introduction to Commutative Spaces", describes that area up to its recent resurgence. Spherical functions and associated unitary representations are developed and applied to harmonic analysis on  $G/K$  and to uncertainty principles.

Part 4, "Structure and Analysis for Commutative Spaces", summarizes riemannian symmetric space theory as a rôle

model, and with that orientation delves into recent research on commutative spaces. The results are explicit for spaces  $G/K$  of nilpotent or reductive type, and the recent structure and classification theory depends on those cases.

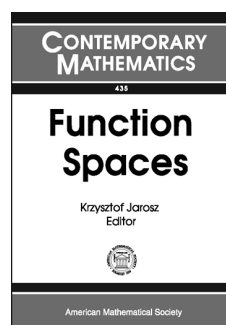
Parts 1 and 2 are accessible to first-year graduate students. Part 3 takes a bit of analytic sophistication but generally is accessible to graduate students. Part 4 is intended for mathematicians beginning their research careers as well as mathematicians interested in seeing just how far one can go with this unified view of algebra, geometry, and analysis.

**Contents:** *General theory of topological groups*: Basic topological group theory; Some examples; Integration and convolution; *Representation theory and compact groups*: Basic representation theory; Representations of compact groups; Compact Lie groups and homogeneous spaces; Discrete co-compact subgroups; *Introduction to commutative spaces*: Basic theory of commutative spaces; Spherical transforms and Plancherel formulae; Special case: Commutative groups; *Structure and analysis for commutative spaces*: Riemannian symmetric spaces; Weakly symmetric and reductive commutative spaces; Structure of commutative nilmanifolds; Analysis on commutative nilmanifolds; Classification of commutative spaces; Bibliography; Subject index; Symbol index; Table index.

**Mathematical Surveys and Monographs**, Volume 142

September 2007, 387 pages, Hardcover, ISBN: 978-0-8218-4289-8, LC 2007060807, 2000 *Mathematics Subject Classification*: 20G20, 22D10, 22Exx, 53C30, 53C35, **AMS members US\$79**, List US\$99, Order code SURV/142

## Analysis



## Function Spaces

**Krzysztof Jarosz**, *Southern Illinois University at Edwardsville, IL*, Editor

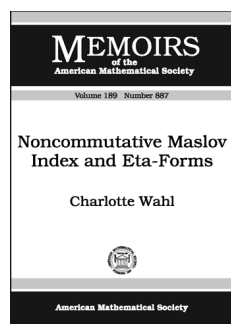
This book consists of contributions by the participants of the Fifth Conference on Function Spaces, held at Southern Illinois University in May of 2006. The papers cover a broad range of topics, including spaces and algebras of analytic functions of one and of many variables (and operators on such spaces),  $L^p$ -spaces, spaces of Banach-valued functions, isometries of function spaces, geometry of Banach spaces, and other related subjects. The goal of the conference was to bring together mathematicians interested in various problems related to function spaces and to facilitate the exchange of ideas between people working on similar problems. Hence, the majority of papers in this book are accessible to non-experts. Some articles contain expositions of known results and discuss open problems; others contain new results.

**Contents:** **Y. I. Alber**, Young-Fenchel transformation and some new characteristics of Banach spaces; **N. Arcozzi**, **R. Rochberg**, and **E. Sawyer**, The diameter space, a restriction of the Drury-Arveson-Hardy space; **H. Arizmendi**, **A. Carrillo**, and **L. Palacios**, An example concerning the boundary of topologically invertible elements; **R. M. Aron**, **J. A. Conejero**, **A. Peris**, and **J. B. Seoane-Sepúlveda**, Sums and products of bad functions;

**D. Atanasiu**, The disc algebra and a moment problem; **A. Blanco** and **N. Grønbæk**, Cohomology of Banach algebras of operators and geometry of Banach spaces; **O. Blasco**, Operators from  $H^p$  to  $\ell^q$  for  $0 < p < 1 \leq q < \infty$ ; **D. P. Blecher** and **L. E. Labuschagne**, von Neumann algebraic  $H^p$  theory; **G. Bulancea**, On the stability of logmodularity for uniform algebras; **P. G. Casazza** and **D. Edidin**, Equivalents of the Kadison-Singer problem; **S. Dutta** and **D. Narayana**, Strongly proximinal subspaces in Banach spaces; **J. F. Feinstein**, Countable linear combinations of characters on commutative Banach algebras; **J. F. Feinstein** and **M. J. Heath**, Regularity and amenability conditions for uniform algebras; **M. González**, **B. Sari**, and **M. Wójciewicz**, Semi-homogeneous bases in Orlicz sequence spaces; **J. J. Grobler**, Closed sums of marginal subspaces of Banach function spaces; **M. Haralampidou**, Strong semisimplicity and finite-dimensionality in Ambrose algebras; **D. Honma**, Surjections on the algebras of continuous functions which preserve peripheral spectrum; **A. Kamińska** and **Y. Raynaud**, Copies of  $\ell_p$  and  $c_0$  in general quasi-normed Orlicz-Lorentz sequence spaces; **A. Y. Karlovich**, Asymptotics of Toeplitz determinants generated by functions with Fourier coefficients in weighted Orlicz sequence classes; **J. Kauppi**, Approximation properties for subalgebras of  $C_0(X)$ ; **L. A. Khan**, The general strict topology on topological modules; **S. Lambert**, **A. Luttmann**, and **T. Tonev**, Weakly peripherally-multiplicative mappings between uniform algebras; **J. S. Manhas**, Topological structures of the spaces of composition operators on spaces of analytic functions; **M. Mathieu** and **C. Ruddy**, Spectral isometries, II; **T. L. Miller**, **V. G. Miller**, and **M. M. Neumann**, When do quasi-similar operators have the same essential spectrum?; **T. Miura** and **D. Honma**, A survey of certain algebraic equations in commutative  $C^*$ -algebras; **R. Mullen**, Examples of Banach spaces that are not Banach algebras; **I. Patyi**, On complex Banach submanifolds of a Banach space; **A. Soltysiak**, Topological joint spectrum of generators and continuous characters; **F. H. Szafraniec**, Moments from their very truncations; **K. Watanabe**, A variation of Takesaki duality for ordered abelian groups and Arveson's spectral subspaces; **N.-C. Wong**, Zero product preserves of  $C^*$ -algebras; **A. Zagorodnyuk**, Spectra of algebras of analytic functions and polynomials on Banach spaces.

#### Contemporary Mathematics, Volume 435

August 2007, 394 pages, Softcover, ISBN: 978-0-8218-4061-0, LC 2007060681, 2000 *Mathematics Subject Classification*: 30H05, 46B04, 46E05, 46E15, 46E30, 46E40, 46H05, 46J10, 47L10, **AMS members US\$87**, List US\$109, Order code CONM/435



## Noncommutative Maslov Index and Eta-Forms

**Charlotte Wahl**, *Virginia Polytechnic Institute and State University, Blacksburg, VA*

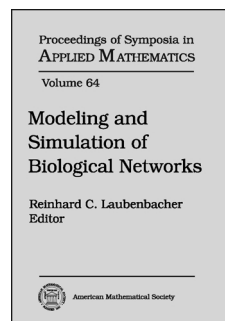
**Contents:** Introduction; Preliminaries; The Fredholm operator and its index; Heat semigroups and kernels; Superconnections and the index theorem; Definitions and techniques; Bibliography.

**Memoirs of the American Mathematical Society**, Volume 189, Number 887

August 2007, 118 pages, Softcover, ISBN: 978-0-8218-3997-3, LC 2007060803, 2000 *Mathematics Subject Classification*: 19K56;

53D12, 58J28, 46L87, **Individual member US\$37**, List US\$61, Institutional member US\$49, Order code MEMO/189/887

## Applications



## Modeling and Simulation of Biological Networks

**Reinhard C. Laubenbacher**, *Virginia Bioinformatics Institute at Virginia Tech, Blacksburg, VA*, Editor

It is the task of computational biology to help elucidate the unique characteristics of biological systems. This process has barely begun, and many researchers are testing computational tools that have been used successfully in other fields. Mathematical and statistical network modeling is an important step toward uncovering the organizational principles and dynamic behavior of biological networks. Undoubtedly, new mathematical tools will be needed, however, to meet this challenge. The workhorse of this effort at present comprises the standard tools from applied mathematics, which have proven to be successful for many problems. But new areas of mathematics not traditionally considered applicable are contributing other powerful tools.

This volume is intended to introduce this topic to a broad mathematical audience. The aim is to explain some of the biology and the computational and mathematical challenges we are facing. The different chapters provide examples of how these challenges are met, with particular emphasis on nontraditional mathematical approaches. The volume features a broad spectrum of networks across scales, ranging from biochemical networks within a single cell to epidemiological networks encompassing whole cities.

Chapter topics include phylogenetics and gene finding using tools from statistics and algebraic geometry, biochemical network inference using tools from computational algebra, control-theoretic approaches to drug delivery using differential equations, and interaction-based modeling and discrete mathematics applied to problems in population dynamics and epidemiology.

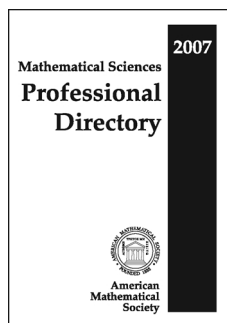
**Contents:** **L. Pachter**, An introduction to reconstructing ancestral genomes; **E. S. Allman** and **J. A. Rhodes**, Phylogenetics; **B. Stigler**, Polynomial dynamical systems in systems biology; **S. Lenhart** and **J. T. Workman**, An introduction to optimal control applied to immunology problems; **C. L. Barrett**, **K. Bisset**, **S. Eubank**, **M. V. Marathe**, **V. S. A. Kumar**, and **H. S. Mortveit**, Modeling and simulation of large biological, information and socio-technical systems: An interaction-based approach.

**Proceedings of Symposia in Applied Mathematics**, Volume 64

September 2007, 151 pages, Hardcover, ISBN: 978-0-8218-3964-5, LC 2007060770, 2000 *Mathematics Subject Classification*: 92B05, **AMS members US\$31**, List US\$39, Order code PSAPM/64

## General and Interdisciplinary

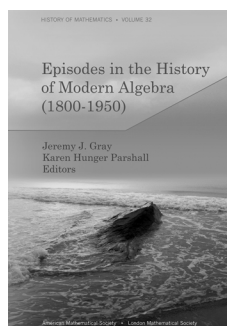




## Mathematical Sciences Professional Directory, 2007

This annual directory provides a handy reference to various organizations in the mathematical sciences community. Listed in the directory are the following: officers of over thirty professional mathematical organizations; addresses of selected government agencies; academic departments in the mathematical sciences; and alphabetic listings of colleges and universities.

June 2007, 159 pages, Softcover, ISBN: 978-0-8218-4283-6, List US\$55, Institutional member US\$44, Order code PRODIR/2007



## Episodes in the History of Modern Algebra (1800-1950)

**Jeremy J. Gray**, *The Open University, Milton Keynes, England*, and **Karen Hunger Parshall**, *University of Virginia, Charlottesville, VA*, Editors

Algebra, as a subdiscipline of mathematics, arguably has a history going back some 4000 years to ancient Mesopotamia. The history, however, of what is recognized today as high school algebra is much shorter, extending back to the sixteenth century, while the history of what practicing mathematicians call "modern algebra" is even shorter still.

The present volume provides a glimpse into the complicated and often convoluted history of this latter conception of algebra by juxtaposing twelve episodes in the evolution of modern algebra from the early nineteenth-century work of Charles Babbage on functional equations to Alexandre Grothendieck's mid-twentieth-century metaphor of a "rising sea" in his categorical approach to algebraic geometry. In addition to considering the technical development of various aspects of algebraic thought, the historians of modern algebra whose work is united in this volume explore such themes as the changing aims and organization of the subject as well as the often complex lines of mathematical communication within and across national boundaries. Among the specific algebraic ideas considered are the concept of divisibility and the introduction of non-commutative algebras into the study of number theory and the emergence of algebraic geometry in the twentieth century.

The resulting volume is essential reading for anyone interested in the history of modern mathematics in general and modern algebra in particular. It will be of particular interest to mathematicians and historians of mathematics.

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.

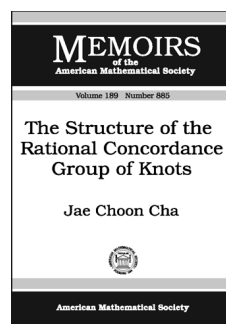
**Contents:** J. J. Gray and K. H. Parshall, Acknowledgments; J. J. Gray and K. H. Parshall, Introduction; E. L. Ortiz, Babbage and French *Idéologie*: Functional equations, language, and the analytical method; S. E. Despeaux, "Very full of symbols": Duncan F. Gregory, the calculus of operations, and the *Cambridge Mathematical*

*Journal*; O. Neumann, Divisibility theories in the early history of commutative algebra and the foundations of algebraic geometry; H. M. Edwards, Kronecker's fundamental theorem of general arithmetic; G. Frei, Developments in the theory of algebras over number fields: A new foundation for the Hasse norm residue symbol and new approaches to both the Artin reciprocity law and class field theory; J. Schwermer, Minkowski, Hensel, and Hasse: On the beginnings of the local-global principle; D. D. Fenster, Research in algebra at the University of Chicago: Leonard Eugene Dickson and A. Adrian Albert; C. W. Curtis, Emmy Noether's 1932 ICM lecture on noncommutative methods in algebraic number theory; L. Corry, From *Algebra* (1895) to *Moderne Algebra* (1930): Changing conceptions of a discipline—A guided tour using the *Jahrbuch über die Fortschritte der Mathematik*; N. Schappacher, A historical sketch of B. L. van der Waerden's work in algebraic geometry: 1926-1946; S. Slembek, On the arithmetization of algebraic geometry; C. McLarty, The rising sea: Grothendieck on simplicity and generality.

**History of Mathematics, Volume 32**

August 2007, 336 pages, Hardcover, ISBN: 978-0-8218-4343-7, LC 2007060683, 2000 *Mathematics Subject Classification*: 01A55, 01A60, 01A70, 01A72, 01A73, 01A74, 01A80, **AMS members US\$55**, List US\$69, Order code HMATH/32

## Geometry and Topology



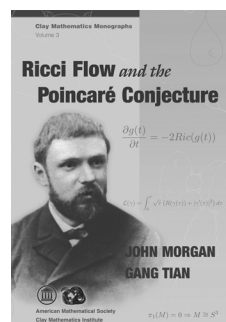
## The Structure of the Rational Concordance Group of Knots

**Jae Choon Cha**, *Information and Communications University, Daejeon, Korea*

**Contents:** Introduction; Rational knots and Seifert matrices; Algebraic structure of  $G_n$ ; Geometric structure of  $C_n$ ; Rational knots in dimension three; Bibliography.

**Memoirs of the American Mathematical Society, Volume 189, Number 885**

August 2007, 95 pages, Softcover, ISBN: 978-0-8218-3993-5, LC 2007060801, 2000 *Mathematics Subject Classification*: 57M25, 57Q45, 57Q60, **Individual member US\$36**, List US\$60, Institutional member US\$48, Order code MEMO/189/885



## Ricci Flow and the Poincaré Conjecture

**John Morgan**, *Columbia University, New York, NY*, and **Gang Tian**, *Princeton University, NJ, and Peking University, Beijing, China*

For over 100 years the Poincaré Conjecture, which proposes a topological characterization of the 3-sphere, has been the central question in

topology. Since its formulation, it has been repeatedly attacked, without success, using various topological methods. Its importance and difficulty were highlighted when it was chosen as one of the Clay Mathematics Institute's seven Millennium Prize Problems. In 2002 and 2003 Grigory Perelman posted three preprints showing how to use geometric arguments, in particular the Ricci flow as introduced and studied by Hamilton, to establish the Poincaré Conjecture in the affirmative.

This book provides full details of a complete proof of the Poincaré Conjecture following Perelman's three preprints. After a lengthy introduction that outlines the entire argument, the book is divided into four parts. The first part reviews necessary results from Riemannian geometry and Ricci flow, including much of Hamilton's work. The second part starts with Perelman's length function, which is used to establish crucial non-collapsing theorems. Then it discusses the classification of non-collapsed, ancient solutions to the Ricci flow equation. The third part concerns the existence of Ricci flow with surgery for all positive time and an analysis of the topological and geometric changes introduced by surgery. The last part follows Perelman's third preprint to prove that when the initial Riemannian 3-manifold has finite fundamental group, Ricci flow with surgery becomes extinct after finite time. The proofs of the Poincaré Conjecture and the closely related 3-dimensional spherical space-form conjecture are then immediate.

The existence of Ricci flow with surgery has application to 3-manifolds far beyond the Poincaré Conjecture. It forms the heart of the proof via Ricci flow of Thurston's Geometrization Conjecture. Thurston's Geometrization Conjecture, which classifies all compact 3-manifolds, will be the subject of a follow-up article.

The organization of the material in this book differs from that given by Perelman. From the beginning the authors present all analytic and geometric arguments in the context of Ricci flow with surgery. In addition, the fourth part is a much-expanded version of Perelman's third preprint; it gives the first complete and detailed proof of the finite-time extinction theorem.

With the large amount of background material that is presented and the detailed versions of the central arguments, this book is suitable for all mathematicians from advanced graduate students to specialists in geometry and topology.

#### Clay Mathematics Institute Monograph Series

The Clay Mathematics Institute Monograph Series publishes selected expositions of recent developments, both in emerging areas and in older subjects transformed by new insights or unifying ideas.

Titles in this series are co-published with the Clay Mathematics Institute (Cambridge, MA).

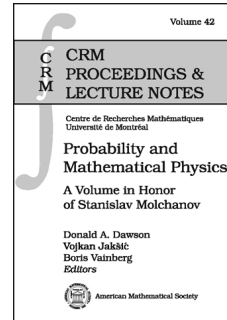
**Contents:** *Background from Riemannian geometry and Ricci flow:* Preliminaries from Riemannian geometry; Manifolds of non-negative curvature; Basics of Ricci flow; The maximum principle; Convergence results for Ricci flow; *Perelman's length function and its applications:* A comparison geometry approach to the Ricci flow; Complete Ricci flows of bounded curvature; Non-collapsed results;  $\kappa$ -non-collapsed ancient solutions; Bounded curvature at bounded distance; Geometric limits of generalized Ricci flows; The standard solution; *Ricci flow with surgery:* Surgery on a  $\delta$ -neck; Ricci flow with surgery: The definition; Controlled Ricci flows with surgery; Proof of non-collapsing; Completion of the proof of Theorem 15.9; *Completion of the proof of the Poincaré conjecture:* Finite-time extinction; Completion of the proof of Proposition 18.24; 3-manifolds covered by canonical neighborhoods; Bibliography; Index.

**Clay Mathematics Monographs**, Volume 3

September 2007, 521 pages, Hardcover, ISBN: 978-0-8218-4328-4, LC 2007062016, 2000 *Mathematics Subject Classification*: 53C44, 57M40, **AMS members US\$55**, List US\$69, **Special Introductory Price US\$48\***, Order code CMIM/3

**\*Offer good until December 7, 2007.**

## Probability



## Probability and Mathematical Physics

A Volume in Honor of Stanislav Molchanov

**Donald A. Dawson**, *Carleton University, Ottawa, ON, Canada*, **Vojkan Jakšić**, *McGill University, Montréal, QC, Canada*, and **Boris Vainberg**, *University of North Carolina, Charlotte, NC*, Editors

This volume is based on talks given at a conference celebrating Stanislav Molchanov's 65th birthday held in June of 2005 at the Centre de Recherches Mathématiques (Montreal, QC, Canada). The meeting brought together researchers working in an exceptionally wide range of topics reflecting the quality and breadth of Molchanov's past and present research accomplishments. This collection of survey and research papers gives a glance of the profound consequences of Molchanov's contributions in stochastic differential equations, spectral theory for deterministic and random operators, localization and intermittency, mathematical physics and optics, and other topics.

*This item will also be of interest to those working in differential equations and mathematical physics.*

Titles in this series are co-published with the Centre de Recherches Mathématiques.

**Contents:** **G. B. Arous**, **S. Molchanov**, and **A. Ramírez**, Transition asymptotics for reaction-diffusion in random media; **L. V. Bogachev**, Extreme value theory for random exponentials; **J. Breuer**, Singular continuous and dense point spectrum for sparse trees with finite dimensions; **J.-M. Combes**, **P. D. Hislop**, and **F. Klopp**, Some new estimates on the spectral shift function associated with random Schrödinger operators; **M. Cranston** and **S. Molchanov**, On phase transitions and limit theorems for homopolymers; **G. Derfel**, **P. J. Grabner**, and **F. Vogl**, Asymptotics of the Poincaré functions; **A. Figotin** and **J. Schenker**, Hamiltonian extension and eigenfunctions for a time dispersive dissipative string; **F. Germinet**, **P. D. Hislop**, and **A. Klein**, Localization at low energies for attractive Poisson random Schrödinger operators; **Y. A. Godin**, **S. Molchanov**, and **B. Vainberg**, On the influence of random perturbations on the propagation of waves described by a periodic Schrödinger operator; **A. Gordon**, **J. L. Holt**, and **S. Molchanov**, Spectral theory of 1-D Schrödinger operators with unbounded potentials; **A. Gordon**, **S. Molchanov**, and **J. Quinn**, Fermi-Dirac generators and tests for randomness; **R. Grigorchuk**, **D. Savchuk**, and **Z. Šunić**, The spectral problem, substitutions and iterated monodromy; **V. Imaykin**, **A. Komech**, and **B. Vainberg**, On scattering of solitons for wave equation coupled to a particle; **U. Kaluzhny** and **Y. Last**, Purely absolutely continuous spectrum

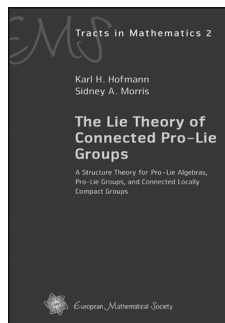
for some random Jacobi matrices; **W. König**, The parabolic Anderson model and its universality classes; **L. Koralov**, An inverse problem for Gibbs fields; **E. Kritchanski**, Hierarchical Anderson model; **P. Kuchment**, Integral representations of solutions of periodic elliptic equations; **A. Laptev**, **R. Shterenberg**, and **V. Sukhanov**, Inverse spectral problems for Schrödinger operators with energy depending potentials; **N. Minami**, Theory of point processes and some basic notions in energy level statistics; **L. Pastur** and **V. Vasilchuk**, On the law of addition of random matrices: Covariance and the central limit theorem for traces of resolvent; **P. Poulin**, Green's functions of generalized Laplacians; **B. Simon**, Orthogonal polynomials with exponentially decaying recursion coefficients; **M. Stoiciu**, Poisson statistics for eigenvalues: From random Schrödinger operators to random CMV matrices.

CRM Proceedings & Lecture Notes, Volume 42

August 2007, 475 pages, Softcover, ISBN: 978-0-8218-4089-4, LC 2007060768, 2000 *Mathematics Subject Classification*: 60-06, 35-06, **AMS members US\$103**, List US\$129, Order code CRMP/42

## New AMS-Distributed Publications

### Algebra and Algebraic Geometry



### The Lie Theory of Connected Pro-Lie Groups

A Structure Theory for Pro-Lie Algebras, Pro-Lie Groups, and Connected Locally Compact Groups

**Karl H. Hofmann**, *Technische Universität Darmstadt, Germany*,  
and **Sidney A. Morris**, *University of Ballarat, Australia*

Lie groups were introduced in 1870 by the Norwegian mathematician Sophus Lie. A century later Jean Dieudonné quipped that Lie groups had moved to the center of mathematics and that one cannot undertake anything without them.

If a complete topological group  $G$  can be approximated by Lie groups in the sense that every identity neighborhood  $U$  of  $G$  contains a normal subgroup  $N$  such that  $G/N$  is a Lie group, then it is called a *pro-Lie group*. Every locally compact connected topological group and every compact group is a pro-Lie group. While the class of locally compact groups is not closed under the formation of arbitrary products, the class of pro-Lie groups is.

For half a century, locally compact pro-Lie groups have drifted through the literature, yet this is the first book which systematically treats the Lie and structure theory of pro-Lie groups irrespective of local compactness. This study fits very well into the current trend which addresses infinite-dimensional Lie groups. The results of this text are based on a theory of pro-Lie algebras which parallels the structure theory of finite-dimensional real Lie algebras to an astonishing degree, even though it has had to overcome greater technical obstacles.

This book exposes a Lie theory of connected pro-Lie groups (and hence of connected locally compact groups) and illuminates the manifold ways in which their structure theory reduces to that of compact groups on the one hand and of finite-dimensional Lie groups on the other. It is a continuation of the authors' fundamental monograph on the structure of compact groups (1998, 2006) and is an invaluable tool for researchers in topological groups, Lie theory, harmonic analysis, and representation theory. It is written to be accessible to advanced graduate students wishing to study this fascinating and important area of current research, which has so many fruitful interactions with other fields of mathematics.



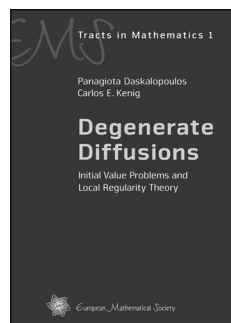
A publication of the European Mathematical Society (EMS). Distributed within the Americas by the American Mathematical Society.

**Contents:** Panoramic overview; Limits of topological groups; Lie Groups and the Lie theory of topological groups; Pro-Lie groups; Quotients of pro-Lie groups; Abelian pro-Lie groups; Lie's third fundamental theorem; Profinite-dimensional modules and Lie algebras; The structure of simply connected pro-Lie groups; Analytic subgroups and the Lie theory of pro-Lie groups; The global structure of connected pro-Lie groups; Splitting theorems for pro-Lie groups; Compact subgroups of pro-Lie groups; Iwasawa's local splitting theorem; Catalog of examples; Appendix 1. The Campbell-Hausdorff formalism; Appendix 2. Weakly complete topological vector spaces; Appendix 3. Various pieces of information on semisimple Lie algebras; Bibliography; List of symbols; Index.

#### EMS Tracts in Mathematics

May 2007, 693 pages, Hardcover, ISBN: 978-3-03719-032-6, 2000 *Mathematics Subject Classification*: 22-02; 17B65, 22D05, 22E20, 22E65, 58B25, **AMS members US\$94**, List US\$118, Order code EMSTM/2

## Differential Equations



### Degenerate Diffusions Initial Value Problems and Local Regularity Theory

**Panagiota Daskalopoulos,**  
*Columbia University, New  
York, NY, and Carlos E. Kenig,*  
*University of Chicago, IL*

The book deals with the existence, uniqueness, regularity, and asymptotic behavior of solutions to the initial value problem (Cauchy problem) and the initial-Dirichlet problem for a class of degenerate diffusions modeled on the porous medium type equation  $u_t = \Delta u^m$ ,  $m \geq 0$ ,  $u \geq 0$ . Such models arise in plasma physics, diffusion through porous media, thin liquid film dynamics, as well as in geometric flows such as the Ricci flow on surfaces and the Yamabe flow. The approach presented to these problems uses local regularity estimates and Harnack type inequalities, which yield compactness for families of solutions. The theory is quite complete in the slow diffusion case ( $m > 1$ ) and in the supercritical fast diffusion case ( $m_c < m < 1$ ,  $m_c = (n-2)_+/n$ ) while many problems remain in the range  $m \leq m_c$ . All of these aspects of the theory are discussed in the book.

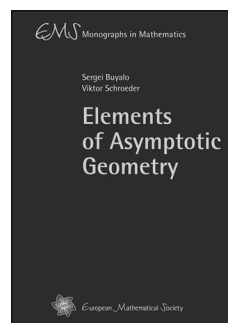
A publication of the European Mathematical Society (EMS). Distributed within the Americas by the American Mathematical Society.

**Contents:** Local regularity and approximation theory; The Cauchy problem for slow diffusion; The Cauchy problem for fast diffusion; The initial Dirichlet problem in an infinite cylinder; Weak solutions; Bibliography; Index.

#### EMS Tracts in Mathematics

May 2007, 207 pages, Hardcover, ISBN: 978-3-03719-033-3, 2000 *Mathematics Subject Classification*: 35-02, 35K55, 35K65, **AMS members US\$50**, List US\$62, Order code EMSTM/1

## Geometry and Topology



### Elements of Asymptotic Geometry

**Sergei Buyalo,** *Russian Academy  
of Sciences, St. Petersburg, Russia,*  
and **Viktor Schroeder,** *University  
of Zurich, Switzerland*

Asymptotic geometry is the study of metric spaces from a large scale point of view, where the local geometry does not come into play. An important class of

model spaces are the hyperbolic spaces (in the sense of Gromov), for which the asymptotic geometry is nicely encoded in the boundary at infinity.

In the first part of this book, in analogy with the concepts of classical hyperbolic geometry, the authors provide a systematic account of the basic theory of Gromov hyperbolic spaces. These spaces have been studied extensively in the last twenty years and have found applications in group theory, geometric topology, Kleinian groups, as well as dynamics and rigidity theory. In the second part of the book, various aspects of the asymptotic geometry of arbitrary metric spaces are considered. It turns out that the boundary at infinity approach is not appropriate in the general case, but dimension theory proves useful for finding interesting results and applications.

The text leads concisely to some central aspects of the theory. Each chapter concludes with a separate section containing supplementary results and bibliographical notes. Here the theory is also illustrated with numerous examples as well as relations to the neighboring fields of comparison geometry and geometric group theory.

The book is based on lectures the authors presented at the Steklov Institute in St. Petersburg and the University of Zürich.

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

**Contents:** Hyperbolic geodesic spaces; The boundary at infinity; Busemann functions on hyperbolic spaces; Morphisms of hyperbolic spaces; Quasi-Möbius and quasi-symmetric maps; Hyperbolic approximation of metric spaces; Extension theorems; Embedding theorems; Basics of dimension theory; Asymptotic dimension; Linearly controlled metric dimension: Basic properties; Linearly controlled metric dimension: Applications; Hyperbolic dimension; Hyperbolic rank and subexponential corank; Appendix. Models of the hyperbolic space  $H^n$ ; Bibliography; Index.

#### EMS Monographs in Mathematics

May 2007, 209 pages, Hardcover, ISBN: 978-3-03719-036-4, 2000 *Mathematics Subject Classification*: 51F99, 53C23, 55M10; 53C23, 54C20, 20F67, 20F69, **AMS members US\$62**, List US\$78, Order code EMSMONO/3

# AMS SHORT COURSE

## Aspects of Statistical Learning



January 4-5, 2008  
San Diego, California

### Organizers:

Dorothy Buck  
Department of Mathematics  
and Centre for Bioinformatics  
Imperial College London

Erica Flapan  
Department of Mathematics  
Pomona College

Over the past twenty years, knot theory has rekindled its historic ties with biology, chemistry, and physics. While the original motivation for understanding and classifying knots came from chemistry, knot theory remained a primarily pure field of mathematics until the 1980s, when chemists, biologists, and physicists began searching for more sophisticated descriptions of entanglements of natural phenomena—from strings to small organic compounds to DNA.

This AMS Short Course will introduce knot theory, and some of its recent applications in molecular biology, chemistry, and physics. No prior knowledge of knot theory, biology, chemistry, or physics is assumed—there will be introductory talks on the first day. Speakers will survey their own work in these areas, as well as describing new avenues for interested researchers (and their students) to explore.

The Short Course will conclude with a panel discussion of the putative trajectories of these applications of knot theory, and summarize the major open problems and challenges. References will be available in advance and lecture notes published afterwards.

### List of speakers:

Colin Adams (Williams College)  
Dorothy Buck (Imperial College London)  
Erica Flapan (Pomona College)  
Lou Kauffman (University of Illinois at Chicago)  
Ned Seeman (New York University)  
Jon Simon (University of Iowa)

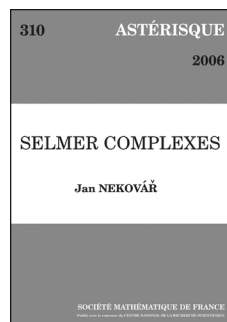
### Advance registration fees:

member/nonmember	\$90/120
Student/unemployed/emeritus	\$40

### On-site registration fees:

member/nonmember	\$120/151
student/unemployed/emeritus	\$60

# Number Theory



## Selmer Complexes

Jan Nekovář, *Université Pierre et Marie Curie, Paris, France*

This book builds new foundations of Iwasawa theory, based on a systematic study of cohomological invariants of big Galois representations in the framework of derived categories. A new duality formalism is developed, which leads to generalized Cassels–Tate pairings and generalized  $p$ -adic height pairings. One of

the applications is a parity result for Selmer groups associated to Hilbert modular forms.

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; Homological algebra: Products and signs; Local duality; Continuous cohomology; Continuous cohomology of pro-finite groups; Duality theorems for Galois cohomology revisited; Selmer complexes; Unramified cohomology; Iwasawa theory; Classical Iwasawa theory; Generalized Cassels–Tate pairings;  $R$ -valued height pairings; Parity of ranks of Selmer groups; Errata; List of symbols; Bibliography.

**Astérisque**, Number 310

May 2007, 559 pages, Softcover, ISBN: 978-2-85629-227-3, 2000 *Mathematics Subject Classification*: 11R23, 11G40, 11F41, **Individual member US\$112**, List US\$124, Order code AST/310