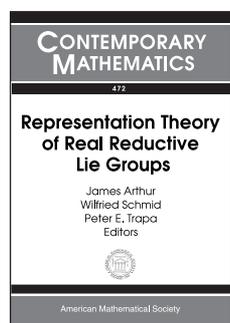


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Algebra and Algebraic Geometry



Representation Theory of Real Reductive Lie Groups

James Arthur, *University of Toronto, ON, Canada*, **Wilfried Schmid**, *Harvard University, Cambridge, MA*, and **Peter E. Traapa**, *University of Utah, Salt Lake City, UT*, Editors

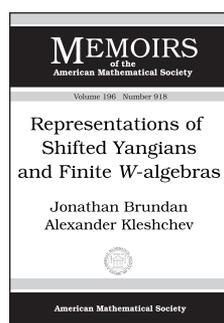
The representation theory of real reductive groups is still incomplete, in spite of much progress made thus far. The papers in this volume were presented at the AMS-IMS-SIAM Joint Summer Research Conference "Representation Theory of Real Reductive Lie Groups" held in Snowbird, Utah in June 2006, with the aim of elucidating the problems that remain, as well as explaining what tools have recently become available to solve them. They represent a significant improvement in the exposition of some of the most important (and often least accessible) aspects of the literature.

This volume will be of interest to graduate students working in the harmonic analysis and representation theory of Lie groups. It will also appeal to experts working in closely related fields.

Contents: **J. Adams**, Guide to the Atlas software: Computational representation theory of real reductive groups; **J. Arthur**, Problems for real groups; **D. Barbasch**, **D. Ciubotaru**, and **A. Pantano**, Unitarizable minimal principal series of reductive groups; **B. Casselman**, Computations in real tori; **W. Hoffmann**, Weighted orbital integrals; **J.-P. Labesse**, Introduction to endoscopy; **D. Shelstad**, Tempered endoscopy for real groups I: Geometric transfer with canonical factors.

Contemporary Mathematics, Volume 472

November 2008, 246 pages, Softcover, ISBN: 978-0-8218-4366-6, LC 2008024593, 2000 *Mathematics Subject Classification*: 22E15, 22E30, 22E45, 22E46, 22E47, 22E50, 20G05, **AMS members US\$63**, List US\$79, Order code CONM/472



Representations of Shifted Yangians and Finite W -algebras

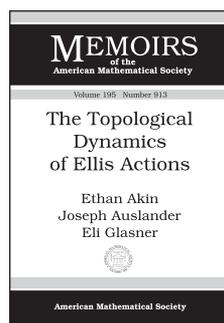
Jonathan Brundan and
Alexander Kleshchev, *University of Oregon, Eugene, OR*

Contents: Introduction; Shifted Yangians; Finite W -algebras; Dual canonical bases; Highest weight theory; Verma modules; Standard modules; Character formulae; Notation; Bibliography.

Memoirs of the American Mathematical Society, Volume 196, Number 918

November 2008, 107 pages, Softcover, ISBN: 978-0-8218-4216-4, LC 2008030300, 2000 *Mathematics Subject Classification*: 17B37, 17B10, **Individual member US\$38**, List US\$63, Institutional member US\$50, Order code MEMO/196/918

Analysis



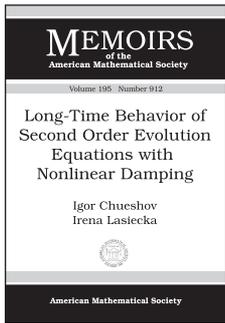
The Topological Dynamics of Ellis Actions

Ethan Akin, *City College, CUNY, New York, NY*, **Joseph Auslander**, *University of Maryland, College Park, MD*, and **Eli Glasner**, *Tel Aviv University, Israel*

Contents: Introduction; Semigroups, monoids and their actions; Ellis semigroups and Ellis actions; Continuity conditions; Applications using ideals; Classical dynamical systems; Classical actions: The group case; Classical actions: The Abelian case; Iterations of continuous maps; Table; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 195, Number 913

August 2008, 152 pages, Softcover, ISBN: 978-0-8218-4188-4, LC 2008021012, 2000 *Mathematics Subject Classification*: 20M20, 37B05, 37B20, 54H20, **Individual member US\$41**, List US\$69, Institutional member US\$55, Order code MEMO/195/913



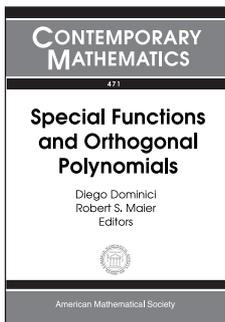
Long-Time Behavior of Second Order Evolution Equations with Nonlinear Damping

Igor Chueshov, *Kharkov University, Ukraine*, and **Irena Lasiecka**, *University of Virginia, Charlottesville, VA*

Contents: Introduction; Abstract results on global attractors; Existence of compact global attractors for evolutions of the second order in time; Properties of global attractors for evolutions of the second order in time; Semilinear wave equation with a nonlinear dissipation; Von Karman evolutions with a nonlinear dissipation; Other models from continuum mechanics; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 195, Number 912

August 2008, 183 pages, Softcover, ISBN: 978-0-8218-4187-7, LC 2008020750, 2000 *Mathematics Subject Classification*: 37L30; 34G20, 47H20, **Individual member US\$44**, List US\$74, Institutional member US\$59, Order code MEMO/195/912



Special Functions and Orthogonal Polynomials

Diego Dominici, *State University of New York at New Paltz, NY*, and **Robert S. Maier**, *University of Arizona, Tucson, AZ*, Editors

This volume contains fourteen articles that represent the AMS Special Session on

Special Functions and Orthogonal Polynomials, held in Tucson, Arizona in April of 2007. It gives an overview of the modern field of special functions with all major subfields represented, including: applications to algebraic geometry, asymptotic analysis, conformal mapping, differential equations, elliptic functions, fractional calculus, hypergeometric and q -hypergeometric series, nonlinear waves, number theory, symbolic and numerical evaluation of integrals, and theta functions. A few articles are expository, with extensive bibliographies, but all contain original research.

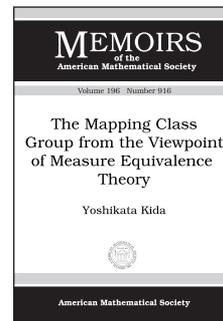
This book is intended for pure and applied mathematicians who are interested in recent developments in the theory of special functions. It covers a wide range of active areas of research and demonstrates the vitality of the field.

Contents: C. Balderrama and W. O. Urbina R., Fractional integration and fractional differentiation for d -dimensional Jacobi expansions; K. G. Boreskov, A. V. Turbiner, and J. C. López Vieyra, Sutherland-type trigonometric models, trigonometric invariants, and multivariate polynomials; R. P. Boyer and

W. M. Y. Goh, Polynomials associated with partitions: Asymptotics and zeros; S. Chakravarty and Y. Kodama, A generating function for the N -soliton solutions of the Kadomtsev-Petviashvili II equation; P. A. Clarkson, Asymptotics of the second Painlevé equation; M. W. Coffey, Evaluation of certain Mellin transformations in terms of the trigamma and polygamma functions; D. Crowdy and J. Marshall, Conformal maps to generalized quadrature domains; Á Elbert and M. E. Muldoon, Approximations for zeros of Hermite functions; H. Kazi and E. Neuman, Inequalities and bounds for elliptic integrals II; R. S. Maier, P-symbols, Heun identities, and ${}_3F_2$ identities; D. Manna and V. H. Moll, An iterative method for numerical integration of rational functions; M. J. Schlosser, A Taylor expansion theorem for an elliptic extension of the Askey-Wilson operator; S. H. Son, Ramanujan's symmetric theta functions in his lost notebook; V. Varlamov, Integral representations for products of Airy functions and their fractional derivatives.

Contemporary Mathematics, Volume 471

November 2008, 218 pages, Softcover, ISBN: 978-0-8218-4650-6, LC 2008022201, 2000 *Mathematics Subject Classification*: 33-06, **AMS members US\$55**, List US\$69, Order code CONM/471



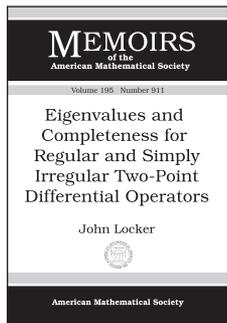
The Mapping Class Group from the Viewpoint of Measure Equivalence Theory

Yoshikata Kida, *Kyoto University, Japan, and Tohoku University, Sendai, Japan*

Contents: Introduction; Property A for the curve complex; Amenability for the actions of the mapping class group on the boundary of the curve complex; Indecomposability of equivalence relations generated by the mapping class group; Classification of the mapping class groups in terms of measure equivalence I; Classification of the mapping class groups in terms of measure equivalence II; Appendix A. Amenability of a group action; Appendix B. Measurability of the map associating image measures; Appendix C. Exactness of the mapping class group; Appendix D. The cost and ℓ^2 -Betti numbers of the mapping class group; Appendix E. A group-theoretic argument for Chapter 5; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 196, Number 916

November 2008, 190 pages, Softcover, ISBN: 978-0-8218-4196-9, LC 2008030042, 2000 *Mathematics Subject Classification*: 20F38, 37A20, **Individual member US\$44**, List US\$74, Institutional member US\$59, Order code MEMO/196/916



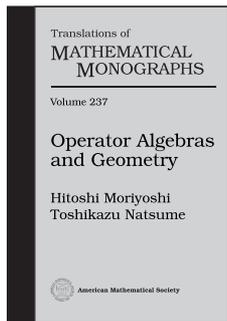
Eigenvalues and Completeness for Regular and Simply Irregular Two-Point Differential Operators

John Locker, *Colorado State University, Fort Collins, CO*

Contents: Introduction; Birkhoff approximate solutions; The approximate characteristic determinant; Classification; Asymptotic expansion of solutions; The characteristic determinant; The Green's function; The eigenvalues for n even; The eigenvalues for n odd; Completeness of the generalized eigenfunctions; The case $L = T$, degenerate irregular examples; Unsolved problems; Appendix; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 195, Number 911

August 2008, 177 pages, Softcover, ISBN: 978-0-8218-4171-6, LC 2008020748, 2000 *Mathematics Subject Classification*: 34L10, 34L20; 47E05, **Individual member US\$43**, List US\$71, Institutional member US\$57, Order code MEMO/195/911



Operator Algebras and Geometry

Hitoshi Moriyoshi, *Keio University, Yokohama, Japan*, and Toshikazu Natsume, *Nagoya Institute of Technology, Japan*

In the early 1980's topologists and geometers for the first time came across unfamiliar words like C^* -algebras and von Neumann algebras through the

discovery of new knot invariants (by V. F. R. Jones) or through a remarkable result on the relationship between characteristic classes of foliations and the types of certain von Neumann algebras. During the following two decades, a great deal of progress was achieved in studying the interaction between geometry and analysis, in particular in noncommutative geometry and mathematical physics. The present book provides an overview of operator algebra theory and an introduction to basic tools used in noncommutative geometry. The book concludes with applications of operator algebras to Atiyah-Singer type index theorems. The purpose of the book is to convey an outline and general idea of operator algebra theory, to some extent focusing on examples.

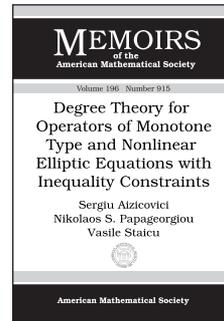
The book is aimed at researchers and graduate students working in differential topology, differential geometry, and global analysis who are interested in learning about operator algebras.

Contents: C^* -algebras; K -theory; KK -theory; Von Neumann algebras; Cyclic cohomology; Quantizations and index theory; Foliation index theorems; References; Index.

Translations of Mathematical Monographs, Volume 237

December 2008, approximately 159 pages, Hardcover, ISBN: 978-0-8218-3947-8, LC 2008029381, 2000 *Mathematics Subject Classification*: 46L87, 46L80; 46L05, 46L10, **AMS members US\$55**, List US\$69, Order code MMONO/237

Differential Equations



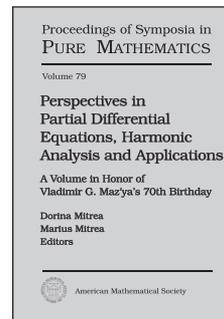
Degree Theory for Operators of Monotone Type and Nonlinear Elliptic Equations with Inequality Constraints

Sergiu Aizicovici, *Ohio University, Athens, OH*, Nikolaos S. Papageorgiou, *National Technical University, Athens, Greece*, and Vasile Staicu, *University of Aveiro, Portugal*

Contents: Introduction; Mathematical background; Degree theoretic results; Variational-hemivariational inequalities; Hemivariational inequalities with an asymmetric subdifferential; Bibliography.

Memoirs of the American Mathematical Society, Volume 196, Number 915

November 2008, 70 pages, Softcover, ISBN: 978-0-8218-4192-1, LC 2008030040, 2000 *Mathematics Subject Classification*: 35J85, 35J60, **Individual member US\$35**, List US\$59, Institutional member US\$47, Order code MEMO/196/915



Perspectives in Partial Differential Equations, Harmonic Analysis and Applications

A Volume in Honor of Vladimir G. Maz'ya's 70th Birthday

Dorina Mitrea and Marius Mitrea, *University of Missouri, Columbia, MO*, Editors

V. G. Maz'ya is widely regarded as a truly outstanding mathematician whose work spans 50 years and covers many areas of mathematical analysis.

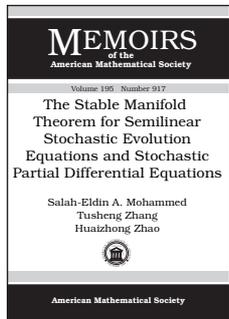
This volume contains a unique collection of papers contributed on the occasion of Maz'ya's 70th birthday by a distinguished group of experts of international stature in the fields of Harmonic Analysis, Partial Differential Equations, Function Theory, Spectral Analysis, and History of Mathematics, reflecting the state of the art in these areas, in which Maz'ya himself has made some of his most significant contributions.

Contents: N. Arcozzi, R. Rochberg, and E. Sawyer, Capacity, Carleson measures, boundary convergence, and exceptional sets; J. Bourgain, On the absence of dynamical localization in higher dimensional random Schrödinger operators; H. Brezis and J. Van Schaftingen, Circulation integrals and critical Sobolev spaces; Problems of optimal constants; L. Capogna, N. Garofalo,

and **D.-M. Nhieu**, Mutual absolute continuity of harmonic and surface measures for Hörmander type operators; **L. Gårding**, Soviet-Russian and Swedish mathematical contacts after the war. A personal account; **F. Gesztesy** and **M. Mitrea**, Generalized Robin boundary conditions, Robin-to-Dirichlet maps, and Krein-type resolvent formulas for Schrödinger operators on bounded Lipschitz domains; **S. Hofmann**, A local Tb theorem for square functions; **J.-P. Kahane**, Partial differential equations, trigonometric series, and the concept of function around 1800: A brief story about Lagrange and Fourier; **C. E. Kenig**, Quantitative unique continuation, logarithmic convexity of Gaussian means and Hardy's uncertainty principle; **J. L. Lewis**, **N. Lundström**, and **K. Nyström**, Boundary Harnack inequalities for operators of p -Laplace type in Reifenberg flat domains; **M. Lilli** and **J. F. Toland**, Waves on a steady stream with vorticity; **F. Nazarov** and **A. Volberg**, On analytic capacity of portions of continuum and a question of T. Murai; **B. Simon**, The Christoffel-Darboux kernel; **M. E. Taylor**, A saint-Venant principle for Lipschitz cylinders; **H. Triebel**, Wavelets in function spaces; **I. E. Verbitsky**, Weighted norm inequalities with positive and indefinite weights; **M. Venouziou** and **G. C. Verchota**, The mixed problem for harmonic functions in polyhedra of \mathbb{R}^3 .

Proceedings of Symposia in Pure Mathematics, Volume 79

November 2008, approximately 432 pages, Hardcover, ISBN: 978-0-8218-4424-3, 2000 *Mathematics Subject Classification*: 01A50, 26D10, 31B15, 34L40, 42B25, 46-06, 46E35, 35J25, 35Q53, 74J15, **AMS members US\$76**, List US\$95, Order code PSPUM/79



The Stable Manifold Theorem for Semilinear Stochastic Evolution Equations and Stochastic Partial Differential Equations

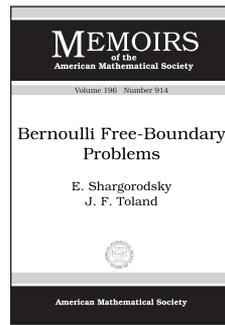
Salah-Eldin A. Mohammed, Southern Illinois University at Carbondale, IL, **Tusheng Zhang**, University of Manchester, England, and **Huaizhong Zhao**, Loughborough University, Leicestershire, England

University of Manchester, England, and Huaizhong Zhao, Loughborough University, Leicestershire, England

Contents: Introduction; *Part 1. The stochastic semiflow:* Basic concepts; Flows and cocycles of semilinear see's; Semilinear spde's: Lipschitz nonlinearity; Semilinear spde's: Non-Lipschitz nonlinearity; *Part 2. Existence of stable and unstable manifolds:* Hyperbolicity of a stationary trajectory; The nonlinear ergodic theorem; Proof of the local stable manifold theorem; The local stable manifold theorem for see's and spde's; Acknowledgments; Bibliography.

Memoirs of the American Mathematical Society, Volume 196, Number 917

November 2008, 105 pages, Softcover, ISBN: 978-0-8218-4250-8, LC 2008030290, 2000 *Mathematics Subject Classification*: 60H10, 60H20; 60H25, **Individual member US\$38**, List US\$63, Institutional member US\$50, Order code MEMO/196/917



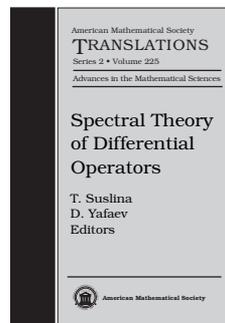
Bernoulli Free-Boundary Problems

E. Shargorodsky, King's College, London, England, and **J. F. Toland**, University of Bath, England

Contents: Introduction; Bernoulli free boundaries; Type-(I) problems; Proofs of main results; Appendix A. Auxiliary results; Bibliography; Index.

Memoirs of the American Mathematical Society, Volume 196, Number 914

November 2008, 70 pages, Softcover, ISBN: 978-0-8218-4189-1, LC 2008030033, 2000 *Mathematics Subject Classification*: 35R35, 76B07; 35Q15, **Individual member US\$35**, List US\$59, Institutional member US\$47, Order code MEMO/196/914



Spectral Theory of Differential Operators

M. Sh. Birman 80th Anniversary Collection

T. Suslina, St. Petersburg State University, Russia, and **D. Yafaev**, Université de Rennes I, France, Editors

This volume is dedicated to the eightieth birthday of Professor M. Sh. Birman. It contains original articles in spectral and scattering theory of differential operators, in particular, Schrödinger operators, and in homogenization theory. All articles are written by members of M. Sh. Birman's research group who are affiliated with different universities all over the world. A specific feature of the majority of the papers is a combination of traditional methods with new modern ideas.

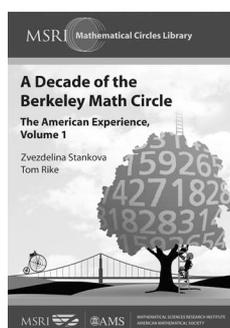
Contents: **M. Solomyak** and **T. Suslina**, On the scientific work of M. Sh. Birman in 1998–2007; **T. Suslina** and **D. Yafaev**, Continuation of the list of publications of M. Sh. Birman; **M. Sh. Birman**, Perturbations of the continuous spectrum of a singular elliptic operator by varying the boundary and the boundary conditions; **V. S. Buslaev** and **S. B. Levin**, Asymptotic behavior of the eigenfunctions of many-particle Schrödinger operator. I. One-dimensional particles; **M. N. Demchenko** and **N. D. Filonov**, Spectral asymptotics of the Maxwell operator on Lipschitz manifolds with boundary; **R. L. Frank** and **A. Laptev**, Spectral inequalities for Schrödinger operators with surface potentials; **L. Friedlander** and **M. Solomyak**, On the spectrum of the Dirichlet Laplacian in a narrow infinite strip; **A. Laptev** and **A. V. Sobolev**, Hardy inequalities for simply connected planar domains; **E. Korotyaev** and **A. Kutsenko**, Lyapunov functions of periodic matrix-valued Jacobi operators; **A. Pushnitski**, The spectral flow, the Fredholm index, and the spectral shift function; **G. Raikov**, On the spectrum of a translationally invariant Pauli operator; **G. Rozenblum** and **A. V. Sobolev**, Discrete spectrum distribution of the Landau operator perturbed by an expanding electric potential; **Y. Safarov**, On the comparison of the Dirichlet and Neumann counting functions; **O. Safronov**, Absolutely continuous spectrum of multi-dimensional Schrödinger operators

with slowly decaying potentials; **R. Shterenberg**, On discrete spectrum of the perturbed periodic magnetic Schrödinger operator with degenerate lower edge of the spectrum; **T. A. Suslina**, Homogenization of periodic second order differential operators including first order terms; **T. Weidl**, Improved Berezin-Li-Yau inequalities with a remainder term; **D. R. Yafaev**, Spectral and scattering theory of fourth order differential operators.

American Mathematical Society Translations—Series 2
(*Advances in the Mathematical Sciences*), Volume 225

December 2008, approximately 298 pages, Hardcover, ISBN: 978-0-8218-4738-1, LC 91-640741, 2000 *Mathematics Subject Classification*: 47-06, 47F05; 81-06, **AMS members US\$87**, List US\$109, Order code TRANS2/225

General and Interdisciplinary



A Decade of the Berkeley Math Circle

The American Experience, Volume I

Zvezdelina Stankova, Mills College, Oakland, CA, and University of California, Berkeley, and **Tom Rike**, Oakland, CA, Editors

Many mathematicians have been drawn to mathematics through their experience with *math circles*: extracurricular programs exposing teenage students to advanced mathematical topics and a myriad of problem-solving techniques and inspiring in them a lifelong love for mathematics. Founded in 1998, the *Berkeley Math Circle* (BMC) is a pioneering model of a U.S. math circle, aspiring to prepare our best young minds for their future roles as mathematics leaders. Over the last decade, 50 instructors—from university professors to high school teachers to business tycoons—have shared their passion for mathematics by delivering more than 320 BMC sessions full of mathematical challenges and wonders.

Based on a dozen of these sessions, this book encompasses a wide variety of enticing mathematical topics: from inversion in the plane to circle geometry; from combinatorics to Rubik’s cube and abstract algebra; from number theory to mass point theory; from complex numbers to game theory via invariants and monovariants. The treatments of these subjects encompass every significant method of proof and emphasize ways of thinking and reasoning via 100 problem-solving techniques. Also featured are 300 problems, ranging from beginner to intermediate level, with occasional peaks of advanced problems and even some open questions.

The book presents possible paths to studying mathematics and inevitably falling in love with it, via teaching two important skills: thinking creatively while still “obeying the rules,” and making connections between problems, ideas, and theories. The book encourages you to apply the newly acquired knowledge to problems and guides you along the way, but rarely gives you ready answers. “Learning from our own mistakes” often occurs through discussions of non-proofs and common problem-solving pitfalls. The reader has to commit to mastering the new theories and techniques by “getting your hands dirty” with the problems, going back and reviewing

necessary problem-solving techniques and theory, and persistently moving forward in the book. The mathematical world is huge: you’ll never know everything, but you’ll learn *where* to find things, how to connect and use them. The rewards will be substantial.

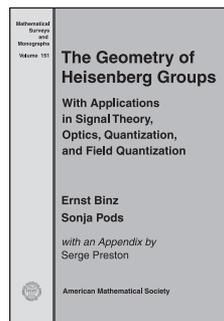
Titles in this series are co-published with the Mathematical Sciences Research Institute (MSRI).

Contents: Inversion in the plane. Part I; Combinatorics. Part I; Rubik’s cube. Part I; Number theory. Part I: Remainders, divisibility, congruences and more; A few words about proofs. Part I; Mathematical induction; Mass point geometry; More on proofs. Part II; Complex numbers. Part I; Stomp. Games with invariants; Favorite problems at BMC. Part I: Circle geometry; Monovariants. Part I: Mansion walks and frog migrations; Epilogue; Symbols and notation; Abbreviations; Biographical data; Bibliography; Credits; Index.

MSRI Mathematical Circles Library, Volume 1

December 2008, approximately 332 pages, Softcover, ISBN: 978-0-8218-4683-4, LC 2008030521, 2000 *Mathematics Subject Classification*: 00-01, 00A07; 00A08, **AMS members US\$39**, List US\$49, Order code MCL/1

Geometry and Topology



The Geometry of Heisenberg Groups

With Applications in Signal Theory, Optics, Quantization, and Field Quantization

Ernst Binz and Sonja Pods, University of Mannheim, Germany

The three-dimensional Heisenberg group, being the simplest non-commutative Lie group, appears prominently in various applications of mathematics. The goal of this book is to present basic geometric and algebraic properties of the Heisenberg group and its relation to other important mathematical structures (the skew field of quaternions, symplectic structures, and representations) and to describe some of its applications. In particular, the authors address such subjects as well as signal analysis and processing, geometric optics, and quantization. In each case, the authors present necessary details of the applied topic being considered.

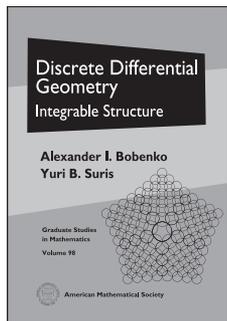
With no prerequisites beyond the standard mathematical curriculum, this book manages to encompass a large variety of topics being easily accessible in its fundamentals. It can be useful to students and researchers working in mathematics and in applied mathematics.

Contents: The skew field of quaternions; Elements of the geometry of S^3 , Hopf bundles and spin representations; Internal variables of singularity free vector fields in a Euclidean space; Isomorphism classes, Chern classes and homotopy classes of singularity free vector fields in three-space; Heisenberg algebras, Heisenberg groups, Minkowski metrics, Jordan algebras and $SL(2, \mathbb{C})$; The Heisenberg group and natural C^* -algebras of a vector field in

3-space; The Schrödinger representation and the metaplectic representation; The Heisenberg group—A basic geometric background of signal analysis and geometric optics; Quantization of quadratic polynomials; Field theoretic Weyl quantization of a vector field in 3-space; Thermodynamics, geometry and the Heisenberg group by Serge Preston; Bibliography; Index.

Mathematical Surveys and Monographs, Volume 151

December 2008, approximately 284 pages, Hardcover, ISBN: 978-0-8218-4495-3, LC 2008030289, 2000 *Mathematics Subject Classification*: 22B05, 22E70, 43A40, 43A65, 46L05, 46L65, 53D55, 57R25, 78A05, 80M99, **AMS members US\$68**, List US\$85, Order code SURV/151



Discrete Differential Geometry

Integrable Structure

Alexander I. Bobenko,
*Technische Universität Berlin,
Germany*, and **Yuri B. Suris**,
*Technische Universität München,
Garching bei München, Germany*

An emerging field of discrete differential geometry aims at the development of discrete equivalents of notions and methods of classical differential geometry. The latter appears as a limit of a refinement of the discretization. Current interest in discrete differential geometry derives not only from its importance in pure mathematics but also from its applications in computer graphics, theoretical physics, architecture, and numerics. Rather unexpectedly, the very basic structures of discrete differential geometry turn out to be related to the theory of integrable systems. One of the main goals of this book is to reveal this integrable structure of discrete differential geometry.

For a given smooth geometry one can suggest many different discretizations. Which one is the best? This book answers this question by providing fundamental discretization principles and applying them to numerous concrete problems. It turns out that intelligent theoretical discretizations are distinguished also by their good performance in applications.

The intended audience of this book is threefold. It is a textbook on discrete differential geometry and integrable systems suitable for a one semester graduate course. On the other hand, it is addressed to specialists in geometry and mathematical physics. It reflects the recent progress in discrete differential geometry and contains many original results. The third group of readers at which this book is targeted is formed by specialists in geometry processing, computer graphics, architectural design, numerical simulations, and animation. They may find here answers to the question "How do we discretize differential geometry?" arising in their specific field.

Prerequisites for reading this book include standard undergraduate background (calculus and linear algebra). No knowledge of differential geometry is expected, although some familiarity with curves and surfaces can be helpful.

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

Contents: Classical differential geometry; Discretization principles. Multidimensional nets; Discretization principles. Nets in quadrics; Special classes of discrete surfaces; Approximation; Consistency as integrability; Discrete complex analysis. Linear theory; Discrete

complex analysis. Integrable circle patterns; Foundations; Solutions of selected exercises; Bibliography; Notations; Index.

Graduate Studies in Mathematics, Volume 98

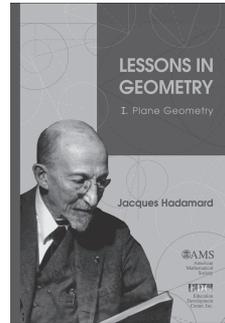
January 2009, approximately 401 pages, Hardcover, ISBN: 978-0-8218-4700-8, 2000 *Mathematics Subject Classification*: 53-01, 53-02; 51Axx, 51Bxx, 53Axx, 37Kxx, 39A12, 52C26, **AMS members US\$55**, List US\$69, Order code GSM/98



Lessons in Geometry

I. Plane Geometry

Jacques Hadamard



This is a book in the tradition of Euclidean synthetic geometry written by one of the twentieth century's great mathematicians. The original audience was pre-college teachers, but it is useful as well to gifted high school students and college students, in particular, to mathematics majors

interested in geometry from a more advanced standpoint.

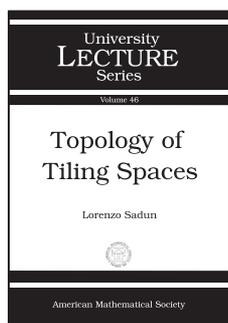
The text starts where Euclid starts, and covers all the basics of plane Euclidean geometry. But this text does much more. It is at once pleasingly classic and surprisingly modern. The problems (more than 450 of them) are well-suited to exploration using the modern tools of dynamic geometry software. For this reason, the present edition includes a CD of dynamic solutions to select problems, created using Texas Instruments' TI-Nspire™ Learning Software. The TI-Nspire™ documents demonstrate connections among problems and—through the free trial software included on the CD—will allow the reader to explore and interact with Hadamard's Geometry in new ways. The material also includes introductions to several advanced topics. The exposition is spare, giving only the minimal background needed for a student to explore these topics. Much of the value of the book lies in the problems, whose solutions open worlds to the engaged reader.

And so this book is in the Socratic tradition, as well as the Euclidean, in that it demands of the reader both engagement and interaction. A forthcoming companion volume that includes solutions, extensions, and classroom activities related to the problems can only begin to open the treasures offered by this work. We are just fortunate that one of the greatest mathematical minds of recent times has made this effort to show to readers some of the opportunities that the intellectual tradition of Euclidean geometry has to offer.

TI-Nspire™ is a trademark of Texas Instruments.

Contents: Introduction; On the straight line; On the circle; On similarity; Complements to book III; On areas; On the methods of geometry; On Euclid's postulate; On the problem of tangent circles; On the notion of area; Miscellaneous problems and problems proposed in various contests; Malfatti's problem.

December 2008, approximately 339 pages, Hardcover, ISBN: 978-0-8218-4367-3, LC 2008030263, 2000 *Mathematics Subject Classification*: 01A73, 51-01; 51-03, **AMS members US\$47**, List US\$59, Order code MBK/57



Topology of Tiling Spaces

Lorenzo Sadun, *University of Texas, Austin, TX*

Aperiodic tilings are interesting to mathematicians and scientists for both theoretical and practical reasons. The serious study of aperiodic tilings began as a solution to a problem in logic. Simpler aperiodic tilings eventually revealed

hidden “symmetries” that were previously considered impossible, while the tilings themselves were quite striking.

The discovery of quasicrystals showed that such aperiodicity actually occurs in nature and led to advances in materials science. Many properties of aperiodic tilings can be discerned by studying one tiling at a time. However, by studying *families* of tilings, further properties are revealed. This broader study naturally leads to the topology of tiling spaces.

This book is an introduction to the topology of tiling spaces, with a target audience of graduate students who wish to learn about the interface of topology with aperiodic order. It isn't a comprehensive and cross-referenced tome about everything having to do with tilings, which would be too big, too hard to read, and far too hard to write! Rather, it is a review of the explosion of recent work on tiling spaces as inverse limits, on the cohomology of tiling spaces, on substitution tilings and the role of rotations, and on tilings that do not have finite local complexity. Powerful computational techniques have been developed, as have new ways of thinking about tiling spaces.

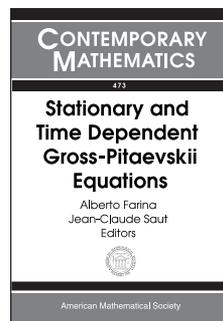
The text contains a generous supply of examples and exercises.

Contents: Basic notions; Tiling spaces and inverse limits; Cohomology of tilings spaces; Relaxing the rules I: Rotations; Pattern-equivariant cohomology; Tricks of the trade; Relaxing the rules II: Tilings without finite local complexity; Solutions to selected exercises; Bibliography.

University Lecture Series, Volume 46

October 2008, 118 pages, Softcover, ISBN: 978-0-8218-4727-5, LC 2008029389, 2000 *Mathematics Subject Classification*: 52C22, 55-02, 52C23, 55N99, 55N05, **AMS members US\$23**, List US\$29, Order code ULECT/46

Mathematical Physics



Stationary and Time Dependent Gross-Pitaevskii Equations

Alberto Farina, *Université de Picardie J. Verne, Amiens, France*, and Jean-Claude Saut, *University of Paris-Sud, Orsay, France*, Editors

This volume is based on a thematic program on the Gross-Pitaevskii equation which was held at the Wolfgang Pauli Institute in Vienna in 2006. The program consisted of two workshops and a one-week Summer School.

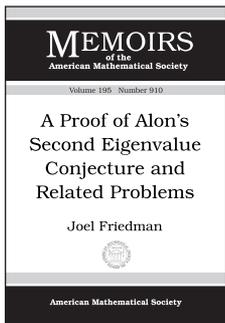
The Gross-Pitaevskii equation, an example of a defocusing nonlinear Schrödinger equation, is a model for phenomena such as the Bose-Einstein condensation of ultra cold atomic gases, the superfluidity of Helium II, or the “dark solitons” of Nonlinear Optics. Many interesting and difficult mathematical questions associated with the Gross-Pitaevskii equation, linked for instance to the nontrivial boundary conditions at infinity, arise naturally from its modeling aspects.

The articles in this volume review some of the recent developments in the theory of the Gross-Pitaevskii equation. In particular the following aspects are considered: modeling of superfluidity and Bose-Einstein condensation, the Cauchy problem, the semi-classical limit, scattering theory, existence and properties of coherent traveling structures, and numerical simulations.

Contents: W. Bao, Analysis and efficient computation for the dynamics of two-component Bose-Einstein condensates; N. G. Berloff, Quantised vortices, travelling coherent structures and superfluid turbulence; F. B ethuel, P. Gravejat, and J.-C. Saut, Existence and properties of travelling waves for the Gross-Pitaevskii equation; R. Carles, On the semi-classical limit for the nonlinear Schrödinger equation; P. G erard, The Gross-Pitaevskii equation in the energy space; K. Nakanishi, Scattering theory for the Gross-Pitaevskii equation; D. E. Pelinovsky and P. Kevrekidis, Periodic oscillations of dark solitons in parabolic potentials.

Contemporary Mathematics, Volume 473

December 2008, 180 pages, Softcover, ISBN: 978-0-8218-4357-4, LC 2008024618, 2000 *Mathematics Subject Classification*: 35Q55, 35Q40, 35Q60, 37K40, 35J60, **AMS members US\$47**, List US\$59, Order code CONM/473



A Proof of Alon's Second Eigenvalue Conjecture and Related Problems

Joel Friedman, *University of British Columbia, Vancouver, BC, Canada*

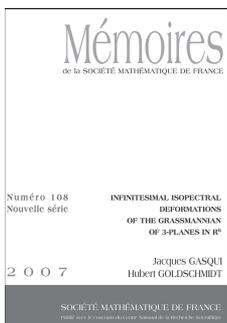
Contents: Introduction; Problems with the standard trace method; Background and terminology; Tangles; Walk sums and new types; The selective trace; Ramanujan functions; An expansion for some selective traces; Selective traces in graphs with (without) tangles; Strongly irreducible traces; A sidestepping lemma; Magnification theorem; Finishing the $G_{n,d}$ proof; Finishing the proofs of the main theorems; Closing remarks; Glossary; Bibliography.

Memoirs of the American Mathematical Society, Volume 195, Number 910

August 2008, 100 pages, Softcover, ISBN: 978-0-8218-4280-5, LC 2008020746, 2000 *Mathematics Subject Classification*: 68R10, 05C50, **Individual member US\$37**, List US\$62, Institutional member US\$50, Order code MEMO/195/910

New AMS-Distributed Publications

Analysis



Infinitesimal Isospectral Deformations of the Grassmannian of 3-Planes in \mathbb{R}^6

Jacques Gasqui, *Université Joseph Fourier, Saint-Martin d'Herès, France*, and Hubert Goldschmidt, *Columbia*

University, New York, NY

The authors study the real Grassmannian $G_{n,n}^{\mathbb{R}}$ of n -planes in \mathbb{R}^{2n} , with $n \geq 3$, and its reduced space. The latter is the irreducible symmetric space $\tilde{G}_{n,n}^{\mathbb{R}}$, which is the quotient of the space $G_{n,n}^{\mathbb{R}}$ under the action of its isometry which sends a n -plane into its orthogonal complement. One of the main results of this monograph asserts that the irreducible symmetric space $\tilde{G}_{3,3}^{\mathbb{R}}$ possesses non-trivial infinitesimal isospectral deformations; it provides the first example of an irreducible reduced symmetric space which admits such

deformations. The authors also give a criterion for the exactness of a form of degree one on $\tilde{G}_{n,n}^{\mathbb{R}}$ in terms of a Radon transform.

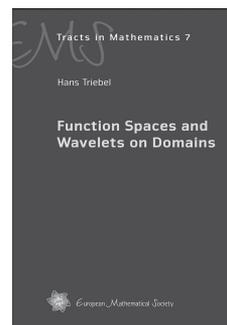
This item will also be of interest to those working in geometry and topology.

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; Symmetric spaces of compact type and the Guillemin condition; Invariant symmetric forms on symmetric spaces; The real Grassmannians; The Stiefel manifolds and the real Grassmannians; Functions and forms of degree one on the real Grassmannians; Isospectral deformations of the real Grassmannian of 3-planes in \mathbb{R}^6 ; Forms of degree one; A family of polynomials; Exactness of the forms of degree one; Branching laws; The special Lagrangian Grassmannian $SU(4)/SO(4)$; The complex quadric of dimension three; Bibliography.

Mémoires de la Société Mathématique de France, Number 108

August 2008, 92 pages, Softcover, ISBN: 978-2-85629-232-7, 2000 *Mathematics Subject Classification*: 44A12, 53C35, 58A10, 58J53, **Individual member US\$34**, List US\$38, Order code SMFMEM/108



Function Spaces and Wavelets on Domains

Hans Triebel, *University of Jena, Germany*

Wavelets have emerged as an important tool in analyzing functions containing discontinuities and sharp spikes. They were developed independently in the fields of mathematics, quantum physics, electrical engineering, and seismic

geology. Interchanges between these fields during the last ten years have led to many new wavelet applications such as image compression, turbulence, human vision, radar, earthquake prediction, and pure mathematics applications such as solving partial differential equations.

This book develops a theory of wavelet bases and wavelet frames for function spaces on various types of domains. Starting with the usual spaces on Euclidean spaces and their periodic counterparts, the exposition moves on to so-called thick domains (including Lipschitz domains and snowflake domains). Specifically, wavelet expansions and extensions to corresponding spaces on Euclidean n -spaces are developed. Finally, spaces on smooth and cellular domains and related manifolds are treated.

Although the presentation relies on the recent theory of function spaces, basic notation and classical results are repeated in order to make the text self-contained.

This book is addressed to two types of readers: researchers in the theory of function spaces who are interested in wavelets as new effective building blocks for functions and scientists who wish to use wavelet bases in classical function spaces for various applications. Adapted to the second type of reader, the preface contains a guide on where to find basic definitions and key assertions.

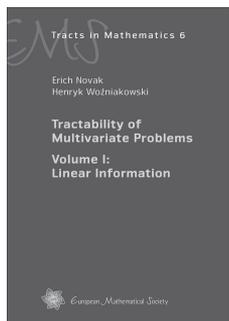
A publication of the European Mathematical Society (EMS). Distributed within the Americas by the American Mathematical Society.

Contents: Spaces on \mathbb{R}^n and \mathbb{T}^n ; Spaces on arbitrary domains; Spaces on thick domains; The extension problem; Spaces on smooth domains and manifolds; Complements; Bibliography; Symbols; Index.

EMS Tracts in Mathematics, Volume 7

August 2008, 265 pages, Hardcover, ISBN: 978-3-03719-019-7, 2000 *Mathematics Subject Classification:* 46-02, 46E35, 42C40, 42B35, 28A80, AMS members US\$62, List US\$78, Order code EMSTM/7

Applications



Tractability of Multivariate Problems

Volume I: Linear Information

Erich Novak, *University of Jena, Germany*, and Henryk Woźniakowski, *Columbia University, New York, NY*

Multivariate problems occur in many applications. These problems are defined on spaces of d -variate functions and d can be huge—in the hundreds or even in the thousands. Some high-dimensional problems can be solved efficiently to within ε , i.e., the cost increases polynomially in ε^{-1} and d . However, there are many multivariate problems for which even the minimal cost increases exponentially in d . This exponential dependence on d is called *intractability* or the *curse of dimensionality*.

This is the first volume of a three-volume set comprising a comprehensive study of the tractability of multivariate problems. It is devoted to tractability in the case of algorithms using linear information and develops the theory for multivariate problems in various settings: worst case, average case, randomized and probabilistic. A problem is tractable if its minimal cost is *not* exponential in ε^{-1} and d . There are various notions of tractability, depending on how we measure the lack of exponential dependence. For example, a problem is polynomially tractable if its minimal cost is polynomial in ε^{-1} and d . The study of tractability was initiated about 15 years ago. This is the first and only research monograph on this subject.

Many multivariate problems suffer from the curse of dimensionality when they are defined over classical (unweighted) spaces. In this case, all variables and groups of variables play the same role, which causes the minimal cost to be exponential in d . But many practically important problems are solved today for huge d in a reasonable time. One of the most intriguing challenges of the theory is to understand why this is possible. Multivariate problems may become weakly tractable, polynomially tractable or even strongly polynomially tractable if they are defined over *weighted* spaces with properly decaying weights. One of the main purposes of this book is to study weighted spaces and obtain necessary and sufficient conditions on weights for various notions of tractability.

The book is of interest for researchers working in computational mathematics, especially in approximation of high-dimensional problems. It may be also suitable for graduate courses and seminars. The text concludes with a list of thirty open problems that can be good candidates for future tractability research.

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

Contents: Overview; Motivation for tractability studies; Twelve examples; Basic concepts and survey of IBC results; Worst case setting; Average case setting; Randomized setting; Generalized tractability; Appendices; Bibliography; Index.

EMS Tracts in Mathematics, Volume 6

August 2008, 395 pages, Hardcover, ISBN: 978-3-03719-026-5, 2000 *Mathematics Subject Classification:* 65-02, 65Y20, 68Q17, 68Q25, 41A63, 46E22, 28C20, 46E30, AMS members US\$78, List US\$98, Order code EMSTM/6

Geometry and Topology

Surveys in Differential Geometry, Volume XI

Metric and Comparison Geometry

Jeffrey Cheeger, *New York University-Courant Institute, NY*, and Karsten Grove, *University of Maryland, College Park, MD*, Editors

The works included in this volume, edited by Jeffrey Cheeger and Karsten Grove, treat important recent developments in metric geometry and comparison geometry. Both these areas are vital and expanding components of modern geometry.

A publication of International Press. Distributed worldwide by the American Mathematical Society.

Contents: X. Rong, Collapsed manifolds with bounded sectional curvature and applications; B. Wilking, Nonnegatively and positively curved manifolds; W. Ziller, Examples of manifolds with non-negative sectional curvature; V. Kapovitch, Perelman's stability theorem; A. Petrunin, Semiconcave functions in Alexandrov's geometry; G. Wei, Manifolds with a lower Ricci curvature bound; J. Lott, Optimal transport and Ricci curvature for metric-measure spaces; J. Rosenberg, Manifolds of positive scalar curvature: A progress report; S. Buyalo and V. Schroeder, Spaces of curvature bounded above; F. T. Farrell, L. E. Jones, and P. Ontaneda, Negative curvature and exotic topology.

International Press

October 2007, 347 pages, Hardcover, ISBN: 978-1-57146-117-9, 2000 *Mathematics Subject Classification:* 53C20, 53C21, 53C23, 51F99, 51K05, 51K10, AMS members US\$68, List US\$85, Order code INPR/70

Survey In Differential Geometry, Volume X

Essays in Geometry in Memory of S.-S. Chern

Shing-Tung Yau, *Harvard University, Cambridge, MA*, Editor

This volume includes lectures on geometry and topology related to the works of the late and venerated S.-S. Chern. The lectures were

presented at the 2005 Journal of Differential Geometry conference at Harvard University.

A publication of International Press. Distributed worldwide by the American Mathematical Society.

Contents: B. Dai, C.-L. Terng, and K. Uhlenbeck, On the space-time monopole equation; V. Guillemin, S. Sternberg, and J. Weitsman, The Erhardt function for symbols; K. Liu, Recent results on the moduli spaces of Riemann surfaces; W. Meeks, Applications of minimal surfaces to the topology of three-manifolds; V. Moncrief, An integral equation for spacetime curvature in general relativity; A. Nietzke and C. Vafa, Topological strings and their physical applications; R. P. Thomas, Notes on GIT and symplectic reduction for bundles and varieties; S.-T. Yau, Perspectives on geometric analysis; S.-W. Zhang, Distributions in algebraic dynamics.

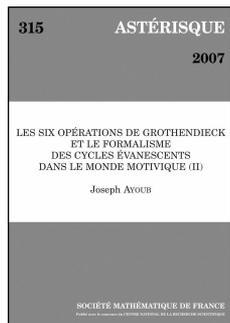
International Press

November 2006, 430 pages, Hardcover, ISBN: 978-1-57146-116-2, 2000 *Mathematics Subject Classification*: 03-02, **AMS members US\$76**, List US\$95, Order code INPR/69

Astérisque, Number 315

October 2007, 362 pages, Softcover, ISBN: 978-2-85629-245-7, 2000 *Mathematics Subject Classification*: 14-02, 14C25, 14F20, 14F35, 14F42, 18A40, 18F10, 18F20, 18F25, 18G55, 19E15, **Individual member US\$105**, List US\$117, Order code AST/315

Number Theory



Les Six Opérations de Grothendieck et le Formalisme des Cycles Évanescents dans le Monde Motivique (II)

Joseph Ayoub, *Université Paris 13, CNRS, France*

This second volume contains chapters 3 and 4 of the author's study of the functoriality of the stable homotopy categories of schemes. In the previous volume, he concentrated on the six operations f^* , f_* , $f_!$, $f^!$, $- \otimes -$ and $\mathbf{Hom}(-, -)$, their constructibility and exactness.

This volume begins with the construction of the nearby motive functors Ψ_f which are the analogue of the nearby cycles functors, well-known in étale cohomology. The author then extends the vanishing cycles formalism to these functors. In particular, he computes the effect of the functor Ψ_f in the case where f has semi-stable reduction. He also shows that Ψ_f preserves constructible motives and commutes with external tensor product and duality. He then defines a monodromy operator and proves that this operator is nilpotent.

The last chapter, which is of a different nature than the previous ones, recalls in full detail the construction of the stable homotopy category of S -schemes.

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: La théorie des foncteurs cycles proches dans un cadre motivique; La construction de 2-foncteurs homotopiques stables; Bibliographie.

AMERICAN MATHEMATICAL SOCIETY

2009 Spring AMS Sectional Meetings

March 27–29, 2009 (Friday–Sunday)
University of Illinois at Urbana-Champaign, Urbana, IL
 (2009 Spring Central Section Meeting)

April 4–5, 2009 (Saturday–Sunday)
North Carolina State University, Raleigh, NC
 (2009 Spring Southeastern Section Meeting)

April 25–26, 2009 (Saturday–Sunday)
Worcester Polytechnic Institute, Worcester, MA
 (2009 Spring Eastern Section Meeting)

April 25–26, 2009 (Saturday–Sunday)
San Francisco State University, San Francisco, CA
 (2009 Spring Western Section Meeting)