# New Publications <br> Offered by the AMS 

## Algebra and Algebraic Geometry



## Infinite-Dimensional Aspects of Representation Theory and Applications

Stephen Berman, University of Saskatchewan, SK, Canada, and Brian Parshall, Leonard Scott, and Weiqiang Wang, University of Virginia, Charlottesville, VA, Editors

The University of Virginia (Charlottesville) hosted an international conference on Infinite-dimensional Aspects of Representation Theory and Applications. This volume contains papers resulting from the mini-courses and talks given at the meeting.
Beyond the techniques and ideas related to representation theory, the book demonstrates connections to number theory, algebraic geometry, and mathematical physics. Specific topics covered include Hecke algebras, quantum groups, infinitedimensional Lie algebras, quivers, modular representations, and Gromov-Witten invariants.
The book is suitable for graduate students and researchers interested in representation theory.
Contents: S. Ariki, Modular representation theory of Hecke algebras, a survey; V. Chari and J. Greenstein, An application of free Lie algebras to polynomial current algebras and their representation theory; N. Jacon, Canonical basic sets for Hecke algebras; M. Lau, On universal central extensions of $\mathfrak{s l}_{n}(A)$; H. Li, Pseudoderivations, pseudoautomorphisms and simple current modules for vertex algebras; W.-P. Li, Z. Qin, and W. Wang, Hilbert scheme intersection numbers, Hurwitz numbers, and Gromov-Witten invariants; K. C. Misra, On Demazure crystals for $U_{q}\left(D_{4}^{(3)}\right)$; E. Mukhin and A. Varchenko, Populations of solutions of the $X X X$ Bethe equations associated to Kac-Moody algebras; R. Rouquier,

Representations of rational Cherednik algebras; A. Savage, A geometric construction of crystal graphs using quiver varieties: Extension to the non-simply laced case.
Contemporary Mathematics, Volume 392
December 2005, 154 pages, Softcover, ISBN 0-8218-3701-X, LC 2005053615, 2000 Mathematics Subject Classification: 14C05, 14N35, 16E40, 16G20, 16G60, 17B37, 17B69, 20C08, 82B23, All AMS members US\$39, List US\$49, Order code CONM/392


Representation Theory of Finite Groups and Associative Algebras

## Charles W. Curtis and Irving Reiner

First published in 1962, this classic book remains a remarkably complete introduction to various aspects of the representation theory of finite groups. One of its main advantages is that the authors went far beyond the standard elementary representation theory, including a masterly treatment of topics such as general noncommutative algebras, Frobenius algebras, representations over non-algebraically closed fields and fields of non-zero characteristic, and integral representations. These and many other subjects are treated extremely thoroughly, starting with basic definitions and results and proceeding to many important and crucial developments. Numerous examples and exercises help the reader of this unsurpassed book to master this important area of mathematics.
Contents: Background from group theory; Representations and modules; Algebraic number theory; Semi-simple rings and group algebras; Group characters; Induced characters; Induced representations; Non-semi-simple rings; Frobenius algebras; Splitting fields and separable algebras; Integral representations; Modular representations; Bibliography; Index.

## AMS Chelsea Publishing

December 2005, 689 pages, Hardcover, ISBN 0-8218-4066-5, 2000 Mathematics Subject Classification: 16-02; 11R33, 20-02, 20Cxx, All AMS members US\$80, List US\$89, Order code CHEL/356.H


The first Joint AMS-India Mathematics Meeting was held in Bangalore (India). This book presents articles written by speakers from a special session on commutative algebra and algebraic geometry. Included are contributions from some leading researchers around the world in this subject area. The volume contains new and original research papers and survey articles suitable for graduate students and researchers interested in commutative algebra and algebraic geometry.
Contents: S. S. Abhyankar and M. Kumar, Simultaneous surface resolution in quadratic and biquadratic Galois extensions; J. Asadollahi and T. J. Puthenpurakal, An analogue of a theorem due to Levin and Vasconcelos; R. Basu, R. A. Rao, and R. Khanna, On Quillen's local global principle; M. Brodmann, Asymptotic behaviour of cohomology: Tameness, supports and associated primes; W. Bruns, Conic divisor classes over a normal monoid algebra; S. D. Cutkosky, Multi-graded algebras associated to surface singularities;
A. K. Dutta, Some results on subalgebras of polynomial algebras; S. Goto, F. Hayasaka, K. Kurano, and Y. Nakamura, Rees algebras of the second syzygy module of the residue field of a regular local ring; J. N. Iyer, A note on syzygies of projective varieties; S. Jose and R. A. Rao, A local global principle for the elementary unimodular vector group; V. Kodiyalam and K. N. Raghavan, Picture invariants and the isomorphism problem for complex semisimple Lie algebras; C. S. Seshadri, Geometric reductivity (Mumford's conjecture)-revisited; A. K. Singh and U. Walther, On the arithmetic rank of certain Segre products; B. Singh, On a question of Huneke-Jaffe concerning seminormality; V. Trivedi, Strong semistability and Hilbert-Kunz multiplicity for singular plane curves.
Contemporary Mathematics, Volume 390
January 2006, approximately 192 pages, Softcover, ISBN 0-8218-3629-3, LC 2005053623, 2000 Mathematics Subject Classification: 13-XX, 14-XX, All AMS members US\$47, List US\$59, Order code CONM/390

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Quasi-Ordinary
Power Series and Their Zeta Functions

Enrique Artal Bartolo
Pierrette Cassou-Noguès Ignacio Luengo Alejandro Melle Hernández


American Mathematical societ

# Quasi-Ordinary Power Series and Their Zeta Functions 

Enrique Artal Bartolo, University of Zaragoza, Spain, Pierrette Cassou-Noguès, Bordeaux, France, and Ignacio Luengo and Alejandro Melle Hernández, Universidad Complutense de Madrid, Spain

This item will also be of interest to those working in number theory.
Contents: Introduction; Motivic integration; Generating functions and Newton polyhedra; Quasi-ordinary power series; Denef-Loeser motivic zeta function under the Newton maps; Consequences of the main theorems; Monodromy conjecture for quasi-ordinary power series; Bibliography.
Memoirs of the American Mathematical Society, Volume 178, Number 841

October 2005, 85 pages, Softcover, ISBN 0-8218-3876-8, LC 2005050801, 2000 Mathematics Subject Classification: 14B05, 14E15, 32S50, Individual member US\$31, List US\$52, Institutional member US\$42, Order code MEMO/178/841

## MEMOIRS

Lax-Phillips Scattering and Conservative Linear Systems: A Cuntz-Algebra Multidimensional Setting $\underset{\substack{\text { Joseph A. Ball } \\ \text { Victor Vinnikov }}}{\text {. }}$ ( )

American Mathematical Society University, Blacksburg, VA, and Victor Vinnikov, Ben Gurion University of the Negev, Be'er Sheva, Israel

Contents: Introduction; Functional models for row-isometric/row-unitary operator tuples; Cuntz scattering systems; Unitary colligations; Scattering, systems and dilation theory: the Cuntz-Toeplitz setting; Bibliography.
Memoirs of the American Mathematical Society, Volume 178, Number 837
October 2005, 101 pages, Softcover, ISBN 0-8218-3768-0, LC 2005051349, 2000 Mathematics Subject Classification: 47A48; 13F25, 47A40, 47L30, 47L55, 93C05, Individual member US\$34, List US\$56, Institutional member US\$45, Order code MEMO/178/837


Complex Manifolds

James Morrow, University of Washington, Seattle, WA, and Kunihiko Kodaira

This volume serves as an introduction to the Kodaira-Spencer theory of deformations of complex structures. Based on notes taken by James Morrow from lectures given by Kunihiko Kodaira at Stanford University in 1965-1966, the book gives the original proof of the Kodaira embedding theorem, showing that the restricted class of Kähler manifolds called Hodge manifolds is algebraic. Included are the semicontinuity theorems and the local completeness theorem of Kuranishi.
Readers are assumed to know some algebraic topology. Complete references are given for the results that are used from elliptic partial differential equations. The book is suitable for graduate students and researchers interested in abstract complex manifolds.
Contents: Definitions and examples of complex manifolds; Sheaves and cohomology; Geometry of complex manifolds; Applications of elliptic partial differential equations to deformations; Bibliography; Index; Errata.

## AMS Chelsea Publishing

January 2006, 194 pages, Hardcover, ISBN 0-8218-4055-X, LC 2005053671, 2000 Mathematics Subject Classification: 32Qxx, All AMS members US\$26, List US\$29, Order code CHEL/355.H

## Applications



## Graphs and Discovery

Siemion Fajtlowicz, University of Houston, TX, Patrick W. Fowler, University of Sheffield, UK, Pierre Hansen, HEC Montréal, Quebec, Canada, and Melvin F. Janowitz and Fred S. Roberts, Rutgers University, Piscataway, NJ, Editors

This volume presents topics addressed at the working group meeting and workshop on Computer-generated Conjectures from Graph Theoretic and Chemical Databases held at Rutgers University (Piscataway, NJ). The events brought together theoreticians and practitioners working in graph theory and chemistry to share ideas and to set an agenda for future developments in the use of computers for generating scientific conjectures.

Articles included in the volume were written by developers of some of the most important programs used around the world today. The disciplines represented include theoretical and applied computer science, statistics, discrete and non-discrete mathematics, chemistry, and information science.

The book is suitable for researchers and students interested in the use of computers in graph theory.
This item will also be of interest to those working in discrete mathematics and combinatorics.

Contents: J. W. Berry, Considerations for future designers of general purpose graph software; E. Breimer, M. Goldberg, D. Hollinger, and D. Lim, Discovering optimization algorithms through automated learning; G. Brinkmann, O. DelgadoFriedrichs, and U. von Nathusius, Numbers of faces and boundary encodings of patches; D. Cvetković and S. Simić, Graph theoretical results obtained by the support of the expert system "graph"-An extended survey; E. DeLaVina, Graffiti.pc: A variant of graffiti; E. DeLaVina, Some history of the development of graffiti; E. DeLaVina, S. Fajtlowicz, and W. Waller, On some conjectures of Griggs and graffiti;
S. Fajtlowicz, On the representation and characterization of fullerene $\mathrm{C}_{60}$; J. E. Graver, The structure of fullerene signatures; J. E. Graver, Catalog of all fullerenes with ten or more symmetries; P. Hansen, How far is, should and could be conjecture-making in graph theory an automated process?; P. Hansen, M. Aouchiche, G. Caporossi, H. Mélot, and D. Stevanović, What forms do interesting conjectures have in graph theory?; P. Hansen and H. Mélot, Variable neighborhood search for extremal graphs. 9. Bounding the irregularity of a graph; S. M. Husband, C. P. Husband, N. Dean, and J. M. Tour, Mathematics for the nanocell approach to molecular electronics; R. J. Kingan and S. R. Kingan, A software system for matroids; C. E. Larson, A survey of research in automated mathematical conjecture-making; R. Laue, T. Grüner,
M. Meringer, and A. Kerber, Constrained generation of molecular graphs; W. Myrvold, T. Prsa, and N. Walker, A dynamic programming approach for timing and designing clique algorithms; R. D. Pepper, On new didactics of mathematics: Learning graph theory via graffiti; T. Pisanski,
M. Boben, and A. Zitnik, Interactive conjecturing with Vega; D. Stevanović and G. Caporossi, On the $(1,2)$-spectral spread of fullerenes.

DIMACS: Series in Discrete Mathematics and Theoretical Computer Science, Volume 69

January 2006, 370 pages, Hardcover, ISBN 0-8218-3761-3, 2000 Mathematics Subject Classification: 68R10, 68T05, 68T35, 05C35, 05C30, 05C62, All AMS members US\$87, List US\$109, Order code DIMACS/69

## Differential Equations



Contents: Introduction; Cartan decomposition and the generalized elastic problems; The maximum principle and the Hamiltonians; The left-invariant symplectic form; Symmetries and the conservation laws; Part 2. Complex Lie groups and complex Hamiltonians: Complexified elastic problems; Complex elasticae of Euler and its $n$-dimensional extensions; Cartan algebras, root spaces and extra integrals of motion; Elastic curves for the case of Lagrange; Elastic curves for the case of Kowalewski; Bibliography.
Memoirs of the American Mathematical Society, Volume 178, Number 838
October 2005, 133 pages, Softcover, ISBN 0-8218-3764-8, LC 2005050811, 2000 Mathematics Subject Classification: 51N30, 53C30, 53D05, 70S10, Individual member US\$36, List US\$60, Institutional member US\$48, Order code MEMO/178/838


## Integrable Hamiltonian Systems on Complex Lie Groups

V. Jurdjevic, University of Toronto, ON, Canada

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December 2005, 347 pages, Hardcover, ISBN 0-8218-3724-9, LC 2005048294, 2000 Mathematics Subject Classification: 57-06, 53-06, 58-06, 14-06; 57M27, 57R58, 57R57, 57R17, 57M25, 57N13, 53D45, 14N35, 32S25, 57M50, 57R15, 57R55, 57R40, 57R65, 57R67, 57R80, 57M60, 57N10, 53D35, 53D40, 58D15, 58D27, 58D29, 14J28, 14E15, 14B15, 14J17, 32S45, All AMS members US\$87, List US\$109, Order code FIC/47


## Geometry and Dynamics

James Eells, Cambridge, England, Etienne Ghys, Ecole Normale Superieure de Lyon, France, Mikhail Lyubich, SUNY at Stony Brook, NY, Jacob Palis, IMPA, Rio de Janeiro, Brazil, and José Seade, UNAM, Mexico City, Mexico, Editors

This volume is based on talks given at the Conference in Honor of the 60th Anniversary of Alberto Verjovsky, a prominent mathematician in Latin America who made significant contributions to dynamical systems, geometry, and topology. Articles in the book present recent work in these areas and are suitable for graduate students and research mathematicians.

Contents: A. Avila and C. G. Moreira, Phase-parameter relation and sharp statistical properties for general families of unimodal maps; N. M. Atakishiyev and A. U. Klimyk, Hamiltonian operators in noncommutative world; O. Baues and W. M. Goldman, Is the deformation space of complete affine structures on the 2-torus smooth?; M. Brunella, Some remarks on parabolic foliations; A. Douady, Geometría y dinámica en el complemento de un compacto en $\mathbb{C}$; C. D. Hill and E. Porten, The H-principle and pseudoconcave CR manifolds; G. Hinojosa, Wild knots as limit sets of Kleinian groups; C. Kapoudjian and V. Sergiescu, An extension of the Burau representation to a mapping class group associated to Thompson's group T; F. Loray, Sur les théorèmes I et II de Painlevé; G. P. Paternain and J. Petean, On the growth rate of contractible closed geodesics on reducible manifolds; Program.
Contemporary Mathematics, Volume 389
November 2005, 200 pages, Softcover, ISBN 0-8218-3851-2, LC 2005053624, 2000 Mathematics Subject Classification: 17B37, 20Fxx, 32V10, 34Mxx, 37E05, 37Fxx, 53C10, 53D25, 57M30, All AMS members US\$47, List US\$59, Order code CONM/389


Differential Geometry
Curves - Surfaces Manifolds, Second Edition

Wolfgang Kühnel, University of Stuttgart, Germany

## From a review of the German edition:

The book covers all the topics which could be necessary later for learning higher level differential geometry. The material is very carefully sorted and easy-to-read.
-Mathematical Reviews
Our first knowledge of differential geometry usually comes from the study of the curves and surfaces in $\mathbb{R}^{3}$ that arise in calculus. Here we learn about line and surface integrals, divergence and curl, and the various forms of Stokes' Theorem. If we are fortunate, we may encounter curvature and such things as the Serret-Frenet formulas.
With just the basic tools from multivariable calculus, plus a little knowledge of linear algebra, it is possible to begin a much richer and rewarding study of differential geometry, which is what is presented in this book. It starts with an introduction to the classical differential geometry of curves and surfaces in Euclidean space, then leads to an introduction to the Riemannian geometry of more general manifolds, including a look at Einstein spaces. An important bridge from the low-dimensional theory to the general case is provided by a chapter on the intrinsic geometry of surfaces.
The first half of the book, covering the geometry of curves and surfaces, would be suitable for a one-semester undergraduate course. The local and global theories of curves and surfaces are presented, including detailed discussions of surfaces of rotation, ruled surfaces, and minimal surfaces.
The second half of the book, which could be used for a more advanced course, begins with an introduction to differentiable manifolds, Riemannian structures, and the curvature tensor. Two special topics are treated in detail: spaces of constant curvature and Einstein spaces.
The main goal of the book is to get started in a fairly elementary way, then to guide the reader toward more sophisticated concepts and more advanced topics. There are many examples and exercises to help along the way. Numerous figures help the reader visualize key concepts and examples, especially in lower dimensions. For the second edition, a number of errors were corrected and some text and a number of figures have been added.
Contents: Notations and prerequisites from analysis; Curves in $\mathbb{R}^{n}$; The local theory of surfaces; The intrinsic geometry of surfaces; Riemannian manifolds; The curvature tensor; Spaces of constant curvature; Einstein spaces; Bibliography; List of notation; Index.

## Student Mathematical Library, Volume 16

January 2006, 380 pages, Softcover, ISBN 0-8218-3988-8, LC 2005052798, 2000 Mathematics Subject Classification: 53-01, All AMS members US\$39, List US\$49, Order code STML/16.R

Mathematical Physics


## A Random Tiling Model for Two Dimensional Electrostatics

Mihai Ciucu, Atlanta, GA

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

Contents: Part A. A Random Tiling Model for Two Dimensional Electrostatics: Introduction; Definitions, statement of results and physical interpretation; Reduction to boundary-influenced correlations; A simple product formula for correlations along the boundary; A $(2 m+2 n)$-fold sum for $\omega_{b}$; Separation of the $(2 m+2 n)$-fold sum for $\omega_{b}$ in terms of $4 m n$ fold integrals; The asymptotics of the $T^{(n)}$ 's and $T^{\prime(n)}$ 's; Replacement of the $T^{(k)}$ 's and $T^{\prime(k)}$ 's by their asymptotics; Proof of Proposition 7.2; The asymptotics of a multidimensional Laplace integral; The asymptotics of $\omega_{b}$. Proof of Theorem 2.2; Another simple product formula for correlations along the boundary; The asymptotics of $\bar{\omega}_{b}$. Proof of Theorem 2.1; A conjectured general two dimensional Superposition Principle; Three dimensions and concluding remarks; Bibliography; Part B. Plane Partitions I: A Generalization of MacMahon's Formula: Introduction; Two families of regions; Reduction to simplyconnected regions; Recurrences for $\mathrm{M}\left(R_{\mathbf{l}, \mathbf{q}}(x)\right)$ and $\mathrm{M}\left(\bar{R}_{\mathbf{l}, \mathbf{q}}(x)\right)$; Proof of Proposition 2.1; The guessing of $\mathrm{M}\left(R_{\mathbf{l}, \mathbf{q}}(x)\right)$ and $\mathrm{M}\left(\bar{R}_{\mathbf{l}, \mathbf{q}}(x)\right)$; Bibliography.
Memoirs of the American Mathematical Society, Volume 178, Number 839
October 2005, 144 pages, Softcover, ISBN 0-8218-3794-X, LC 2005050800, 2000 Mathematics Subject Classification: 05A15, 82B23, 82D99; 05A16, 41A63, 60F99, 82B23, Individual member US\$36, List US\$60, Institutional member US\$48, Order code MEMO/178/839


> Noncommutative Geometry and Representation Theory in Mathematical Physics

## Jürgen Fuchs, Karlstads

 Universitet, Sweden, Jouko Mickelsson, KTH, AlbaNova-SCFAB, Stockholm, Sweden, Grigori Rozenblioum and Alexander Stolin, Göteborgs Universitet, Sweden, and Anders Westerberg, Karlstads Universitet, Sweden, EditorsMathematics provides a language in which to formulate the laws that govern nature. It is a language proven to be both
powerful and effective. In the quest for a deeper understanding of the fundamental laws of physics, one is led to theories that are increasingly difficult to put to the test.
In recent years, many novel questions have emerged in mathematical physics, particularly in quantum field theory. Indeed, several areas of mathematics have lately become increasingly influential in physics and, in turn, have become influenced by developments in physics. Over the last two decades, interactions between mathematicians and physicists have increased enormously and have resulted in a fruitful cross-fertilization of the two communities.
This volume contains the plenary talks from the international symposium on Noncommutative Geometry and Representation Theory in Mathematical Physics held at Karlstad University (Sweden) as a satellite conference to the Fourth European Congress of Mathematics.
The scope of the volume is large and its content is relevant to various scientific communities interested in noncommutative geometry and representation theory. It offers a comprehensive view of the state of affairs for these two branches of mathematical physics. The book is suitable for graduate students and researchers interested in mathematical physics.
Contents: N. Bazunova, Construction of graded differential algebra with ternary differential; C. Blohmann, Calculation of the universal Drinfeld twist for quantum su(2); M. Cederwall, Thoughts on membranes, matrices and non-commutativity; C. Chryssomalakos and E. Okon, Stable quantum relativistic kinematics; A. Davydov, Cohomology of crossed algebras; T. Ekedahl, Kac-Moody algebras and the cde-triangle; L. D. Faddeev, Discretized Virasoro algebra; G. Felder and A. Varchenko, Multiplication formulae for the elliptic gamma function; G. Fiore, New approach to Hermitian $q$-differential operators on $\mathbb{R}_{q}^{N}$; J. Fröhlich, J. Fuchs, I. Runkel, and C. Schweigert, Picard groups in rational conformal field theory; A. Gerasimov, S. Kharchev, D. Lebedev, and S. Oblezin, On a class of representations of quantum groups; M. Gorelik and V. Serganova, Shapovalov forms for Poisson Lie superalgebras; T. J. Hodges and M. Yakimov, Triangular Poisson structures on Lie groups and symplectic reduction; Y.Z. Huang, Vertex operator algebras, fusion rules and modular transformations; L. Kadison, Depth two and the Galois coring; N. Kamiya, Examples of Peirce decomposition of generalized Jordan triple system of second order-Balanced cases; I. Kantor and G. Shpiz, Graded representations of graded Lie algebras and generalized representations of Jordan algebras; E. Karolinsky, A. Stolin, and V. Tarasov, Dynamical YangBaxter equation and quantization of certain Poisson brackets; R. Kashaev and N. Reshetikhin, Braiding for quantum $g l_{2}$ at roots of unity; C. Korff, Solving Baxter's TQ-equation via representation theory; P. P. Kulish, Noncommutative geometry and quantum field theory; E. Langmann, Conformal field theory and the solution of the (quantum) elliptic CalogeroSutherland system; D. Larsson and S. D. Silvestrov, Quasi-Lie algebras; O. A. Laudal, Time-space and space-times;
J. Lukierski and V. D. Lyakhovsky, Two-parameter extension of the $\kappa$-Poincaré quantum deformation; V. E. Nazaikinskii, A. Y. Savin, B.-W. Schulze, and B. Y. Sternin, The index problem on manifolds with edges; D. Proskurin, Y. Savchuk, and L. Turowska, On $C^{*}$-algebras generated by some deformations of CAR relations; O. K. Sheinman, KricheverNovikov algebras and their representations;
S. D. Sinel'shchikov and L. Vaksman, Quantum groups and bounded symmetric domains; D. Sternheimer, Quantization is deformation; K. Szlachányi, Monoidal Morita equivalence;
V. N. Tolstoy, Fortieth anniversary of extremal projector method for Lie symmetries.

Contemporary Mathematics, Volume 391
December 2005, 384 pages, Softcover, ISBN 0-8218-3718-4, LC 2005053625, 2000 Mathematics Subject Classification: 16Dxx, 16Gxx, 16W30, 17Bxx, 17Cxx, 18D10, 32Gxx, 53D55, 81Rxx, 81Txx, All AMS members US\$79, List US\$99, Order code CONM/391


Quantum Algebras and Poisson Geometry in Mathematical Physics

M. V. Karasev, Moscow Institute of Electronics and Mathematics, Russia, Editor

This collection presents new and interesting applications of Poisson geometry to some fundamental well-known problems in mathematical physics. In addition to advanced Poisson geometry, the methods used by the authors include unexpected algebras with non-Lie commutation relations, nontrivial (quantum) Kählerian structures of hypergeometric type, dynamical systems theory, semiclassical asymptotics, and more.

The volume is suitable for graduate students and researchers interested in mathematical physics.
Other AMS publications by M. Karasev include Nonlinear Poisson Brackets. Geometry and Quantization, Coherent Transform, Quantization, and Poisson Geometry, and Asymptotic Methods for Wave and Quantum Problems.
This item will also be of interest to those working in differential equations and geometry and topology.
Contents: M. Karasev, Noncommutative algebras, nanostructures, and quantum dynamics generated by resonances; M. Karasev and E. Novikova, Algebras with polynomial commutation relations for a quantum particle in electric and magnetic fields; Y. Vorobjev, Poisson structures and linear Euler systems over symplectic manifolds; Y. Vorobjev, Poisson equivalence over a symplectic leaf.

American Mathematical Society Translations-Series 2 (Advances in the Mathematical Sciences), Volume 216
December 2005, 277 pages, Hardcover, ISBN 0-8218-4040-1, LC 91-640741, 2000 Mathematics Subject Classification: 53Dxx, 81Rxx, 81Sxx; 33Cxx, 53Cxx, All AMS members US\$87, List US $\$ 109$, Order code TRANS2/216



## Topics in Kinetic Theory

Thierry Passot, CNRS, Nice, France, Catherine Sulem, University of Toronto, ON, Canada, and Pierre-Louis Sulem, Observatoire de la Cote d'Azur, Nice, France, Editors

This book covers a variety of topics related to kinetic theory in neutral gases and magnetized plasmas, with extensions to other systems such as quantum plasmas and granular flows. A comprehensive presentation is given for the Boltzmann equations and other kinetic equations for a neutral gas, together with the derivations of compressible and incompressible fluid dynamical systems, and their rigorous justification. Several contributions are devoted to collisionless magnetized plasmas. Rigorous results concerning the wellposedness of the Vlasov-Maxwell system are presented. Special interest is devoted to asymptotic regimes where the scales of variation of the electromagnetic field are clearly separated from those associated with the gyromotion of the particles. This volume collects lectures given at the Short Course and Workshop on Kinetic Theory organized at the Fields Institute of Mathematical Sciences in Toronto during the Spring of 2004.

Titles in this series are published by the AMS for The Fields Institute for Research in Mathematical Sciences (Toronto, Ontario, Canada).
Contents: F. Golse and C. D. Levermore, Hydrodynamic limits of kinetic models; R. T. Glassey, Collisionless plasmas and the Vlasov Maxwell system; Y. Elskens, Irreversible behaviours in Vlasov equation and many-body Hamiltonian dynamics: Landau damping, chaos and granularity; P. L. Sulem, Introduction to the guiding center theory; A. J. Brizard, Variational formulations of exact and reduced Vlasov-Maxwell equations; H. Qin, A short introduction to general gyrokinetic theory; W. M. Tang, Introduction to gyrokinetic theory with applications in magnetic confinement research in plasma physics; T. Passot, From kinetic to fluid descriptions of plasmas; A. I. Smolyakov, M. Yagi, and J. D. Callen, Nonlocal closures in long mean free path regimes; G. Manfredi, How to model quantum plasmas; I. Goldhirsch, Inelastic kinetic theory: The granular gas.
Fields Institute Communications, Volume 46
December 2005, 312 pages, Hardcover, ISBN 0-8218-3723-0, 2000 Mathematics Subject Classification: 82C40, 76P05, 82D10; 82C70, All AMS members US\$87, List US\$109, Order code FIC/46

## Number Theory



## Harmonic Analysis, the Trace Formula, and Shimura Varieties

James Arthur, University of Toronto, ON, Canada, David Ellwood, Clay Mathematics Institute, Cambridge, MA, and Robert Kottwitz, University of Chicago, IL, Editors

The modern theory of automorphic forms, embodied in what has come to be known as the Langlands program, is an extraordinary unifying force in mathematics. It proposes fundamental relations that tie arithmetic information from number theory and algebraic geometry with analytic information from harmonic analysis and group representations. These "reciprocity laws", conjectured by Langlands, are still largely unproved. However, their capacity to unite large areas of mathematics insures that they will be a central area of study for years to come.
The goal of this volume is to provide an entry point into this exciting and challenging field. It is directed, on the one hand, at graduate students and professional mathematicians who would like to work in the area. The longer articles in particular represent an attempt to enable a reader to master some of the more difficult techniques. On the other hand, the book will also be useful to mathematicians who would like simply to understand something of the subject. They will be able to consult the expository portions of the various articles.

The volume is centered around the trace formula and Shimura varieties. These areas are at the heart of the subject, but they have been especially difficult to learn because of a lack of expository material. The volume aims to rectify the problem. It is based on the courses given at the 2003 Clay Mathematics Institute Summer School. However, many of the articles have been expanded into comprehensive introductions, either to the trace formula or the theory of Shimura varieties, or to some aspect of the interplay and application of the two areas.
This book is suitable for independent study.
This item will also be of interest to those working in algebra and algebraic geometry.
Titles in this series are published by the AMS for the Clay Mathematics Institute (Cambridge, MA).

Contents: J. Arthur, An introduction to the trace formula; J. S. Milne, Introduction to Shimura varieties; F. Murnaghan, Linear algebraic groups; R. E. Kottwitz, Harmonic analysis on reductive $p$-adic groups and Lie algebras; S. DeBacker, Homogeneity for reductive $p$-adic groups: An introduction; M. Goresky, Compactifications and cohomology of modular varieties; T. J. Haines, Introduction to Shimura varieties with bad reduction of parahoric type; T. C. Hales, A statement of the fundamental lemma; P. Sarnak, Notes on the generalized Ramanujan conjectures; List of participants.

Clay Mathematics Proceedings, Volume 4
January 2006, 689 pages, Softcover, ISBN 0-8218-3844-X, 2000
Mathematics Subject Classification: 11-02; 11F70, 11F72, 11F85, 11G18, 14G35, 22E35, 22E50, 22E55, All AMS members US\$95, List US\$119, Order code CMIP/4

# New AMS-Distributed Publications 

# Algebra and Algebraic Geometry 

## Séminaire Bourbaki

## Volume 2003/2004, Exposés 924-937

As in the preceding volumes of this seminar, one finds here fourteen survey lectures on topics of current interest: three lectures on algebraic geometry, four on partial differential equations, one on probability, one on number theory, one on dynamical systems, one on operator algebras, one on geometric inequalities, one on the representation theory of groups and one on harmonic analysis. The volume is suitable for graduate students and research mathematicians.
This item will also be of interest to those working in differential equations, probability, geometry and topology, number theory, and analysis.
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: Novembre 2003: A. Beauville, La conjecture de Green générique; J. Bertoin, SLE et Invariance conforme; I. Gallagher, Résultats récents sur la limite incompressible; R. Krikorian, Déviations de moyennes ergodiques, flots de Teichmüller et cocycle de Kontsevich-Zorich; B. Maurey, Inégalité de Brunn-Minkowski-Lusternik, et autres inégalités géométriques et fonctionnelles; Mars 2004: Y. André, Motifs de dimension finie; P. Gérard, Équations de champ moyen pour la dynamique quantique d'un grand nombre de particules; E. Peyre, Obstructions au principe de Hasse et à l'approximation faible; J. Serre, Complète réductibilité; N. Tzvetkov, On the long time behavior of KdV type equations; Juin 2004: S. Alinhac, Méthodes géométriques dans l'étude des équations d'Einstein; K. Belabas, Paramétrisation de structures algébriques et densité de discriminants; H. Pajot, Capacité analytique et le problème de Painlevé; S. Vaes, États quasi-libres libres et facteurs de type III.
Astérisque, Number 299
September 2005, 350 pages, Softcover, ISBN 2-85629-173-2, 2000 Mathematics Subject Classification: 14H51, 13D02, 60K35, 82Bxx, 43-XX, 30C35, 76B03, 76N10, 78M35, 37F30, 32G15, 37H15, 58A14, 14D07, 26D15, 39B62, 52A40, 46Bxx, 60E15, 60G15, 14C15, 14C25, 16B50, 19D23, 35Q40, 35Q55, 81Q05, 81V70, 14G05, 11Dxx, 20-XX, 57M07, 35Q53, 35B35, 35L60, 35L70, 35Q75, 11R04, 11R45, 11R29, 28A75, 30C85, 42B20, 46L54, 46L30, 46L35, Individual member US\$86, List US\$95, Order code AST/299

## Differential Equations

## Dirac Operators

J. P. Bourguignon, Institut des Hautes Études Scientifiques, Bures-Sur-Yvette, France, T. Branson, University of Iowa, Iowa City, IA, A. Chamseddine, American University of Beirut, Lebanon, O. Hijazi, Université Henri Poincaré, Vandoeuvre-Les-Nancy, France, and R. J. Stanton, Ohio State University, Columbus, OH, Editors

This volume represents the proceedings of a summer school and workshop on Dirac operators held at the American University of Beirut in 2001. An introduction to all necessary background material to begin research in Dirac operators is presented including elementary differential geometry, Clifford algebras, Lie groups, special geometries, leading to a presentation of the fundamental role of Dirac operators in the Atiyah-Singer Index Theorem and particle physics. More advanced topics are presented in the proceedings of the workshop where, for example, topics on the spectrum of Dirac operators, pseudo-Riemannian geometry, and first eigenvalue estimates are presented. This book is suitable for self-study by students and non-experts as a panorama on Dirac operators, but also contains, for experts, an outstanding bibliography on the subject.
This item will also be of interest to those working in geometry and topology.
A publication of International Press. Distributed worldwide by the American Mathematical Society.

Contents: Part 1. Summer School: H. B. Lawson, Jr., Introduction to the Dirac operator; C. Bär, Introduction to differential manifolds; O. Hijazi, Clifford algebras and spinor representations; J.-P. Bourguignon, A brief introduction to Riemannian and spinorial geometries; R. Bryant, Holonomy and special geometries; R. J. Stanton, A visit to representation theory; H. B. Lawson, Jr., The Atiyah-Singer index theorem and applications; C. Bär, The spectrum of the Dirac operator; T. Branson, Conformal structure and spin geometry;
A. H. Chamseddine, A brief introduction to particle interactions; Part 2. Workshop: B. Ammann, Ambient Dirac eigenvalue estimates and the Willmore functional; H. Baum and F. Leitner, The geometric structure of Lorentzian manifolds with twistor spinors in low dimension; F. El Chami, Geometric spectrum of isospectral spherical space forms; A. El Kacimi, Towards a basic index theory; N. Ginoux, Reilly-type spinorial inequalities; S. Montiel, Dirac operators and hypersurfaces; A. Moroianu, From Kirchberg's inequality to the Goldberg conjecture; Bibliography.

## International Press

April 2005, 320 pages, Hardcover, ISBN 1-57146-175-2, 2000 Mathematics Subject Classification: 53C27, 53C29, 53C35, 53C40, 53C50, 53C55, 53C12, 58C40, 58J20, 58J32, 58J50, 58J53, 58J60, 83C60, 83E50, 47B25, 22E45, 22E46, 22E60, All AMS members US\$64, List US\$80, Order code INPR/63

## General and Interdisciplinary

## Contributions to the History of Indian Mathematics

G. G. Emch, University of Florida, Gainesville, FL, R. Sridharan, Chennai Mathematical Institute, India, and M. D. Srinivas, Centre for Policy Studies, Chennai, India, Editors

This volume resulted from the first Joint India-AMS Meeting in Mathematics held in Bangalore. One of its themes was the "History of Indian Mathematics". The refereed articles in the book were written by invited speakers and cover a wide spectrum of topics ranging from Vedic Prosody and ancient Buddhist logic to the contributions of Srinivasa Ramanujan and Indian contributions to quantum statistics.
The first section, which deals with the ancient period, has two articles, one on Vedic Prosody and the work of Pingala and the other on Buddhist Logic.
The next section, which discusses the mathematics of the classical and medieval periods, begins with two articles, one on the work of Brahmagupta on Bhavana and its applications, another on the contributions of Bhaskara II to the mathematics of Karani or surds. The next article is on the use of power series techniques by the medieval Kerala School of Mathematics. The next two articles focus on the nature of algorithms in Indian Mathematics and Astronomy. The final article of this section is on the notion of proofs in Indian Mathematics and the tradition of Upapattis in Mathematics and Astronomy of India.
The third section is devoted to the modern period. The first article points to some surprising contributions of Srinivasa Ramanujan on partial fractions while the second surveys the history of some of the contributions of Indian mathematicians to Quantum Statistics.
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Contents: Introductory Overview: R. Sridharan, Mathematics in ancient and medieval India; Ancient Period: R. Sridharan, Sanskrit prosody, pingala sutras and binary arithmetic; F. E. J. Linton, Shedding some localic and linguistic light on the tetralemma conundrums; Classical and Medieval Period: A. K. Dattta, Brahmagupta's bhavana: Some reflections; F. Patte, The Karani: How to use integers to make accurate calculations on square roots; K. Plofker, Relations between approximations to the sine in kerala mathematics;
M. S. Sriram, Algorithms in Indian mathematics;
K. Ramasubramanian, Algorithms in Indian astronomy;
M. D. Srinivas, Proofs in Indian mathematics; Modern Period:
G. E. Andrews, Ramanujan and partial fractions; G. G. Emch, Contributions of Indian mathematicians to quantum statistics.

## Hindustan Book Agency

October 2005, 300 pages, Hardcover, ISBN 81-85931-58-5, 2000 Mathematics Subject Classification: 01A32, All AMS members US\$45, List US\$56, Order code HIN/27

Geometry and Topology

## Surveys in Differential Geometry <br> Eigenvalues of Laplacians and Other Geometric Operators

Alexander Grigor'yan, Imperial College of Science and Technology, London, England, and S.-T. Yau, Harvard University, Cambridge, MA, Editors

This volume is a collection of surveys of diverse topics in geometry related to the eigenvalues of the Laplacian and other geometric operators. A good understanding of the spectral properties of differential operators has deep consequences in geometry, physics, number theory, probability theory, etc. Analytic methods have penetrated also into discrete mathematics, where the study of the spectral properties of difference operators leads to a deeper understanding of the combinatorial question on graphs. The present collection represents a substantial part of the subject, and it will be beneficial to geometers and experts from the adjacent area.
This item will also be of interest to those working in differential equations.
A publication of International Press. Distributed worldwide by the American Mathematical Society.
Contents: M. T. Barlow, Anomalous diffusion and stability of Harnack inequalities; G. Besson, From isoperimetric inequalities to heat kernels via symmetrisation; F. Chung, Discrete isoperimetric inequalities; T. H. Colding and W. P. Minicozzi II, An excursion into geometric analysis; A. Grigor'yan, Y. Netrusov, and S.-T. Yau, Eigenvalues of elliptic operators and geometric applications; M. Ledoux, Spectral gap, logarithmic Sobolev constant, and geometric bounds; L. Lovász, Discrete analytic functions: An exposition; W. H. Meeks III and J. Pérez, Confromal properties in classical minimal surface theory; R. Neel and D. Stroock, Analysis of the cut locus via the heat kernel; L. Saloff-Coste, Analysis on Riemannian co-compact covers; F. Shahidi, Functoriality and small eigenvalues of Laplacian on Riemann survaces;
S. Zelditch, The inverse spectral problem.

International Press
April 2004, 467 pages, Hardcover, ISBN 1-57146-115-9, All AMS members US\$52, List US\$65, Order code INPR/64

## Polarizable Twistor $\mathcal{D}$-modules

Claude Sabbah, École Polytechnique, Palaiseau, France

In this book, the author proves a decomposition theorem for the direct image of an irreducible local system on a smooth complex projective variety under a morphism with values in another smooth complex projective variety. For this purpose, he constructs a category of polarized twistor $\mathcal{D}$-modules and shows a decomposition theorem in this category.
The book is suitable for graduate students and research mathematicians interested in geometry and topology.

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Contents: Introduction; Preliminaries; Coherent and holonomic $\mathcal{R}_{\chi}$-modules; Smooth twistor structures; Specializable $\mathcal{R} \chi^{-}$ modules; Polarizable twistor $\mathcal{D}$-modules; Polarizable regular twistor $\mathcal{D}$-modules on curves; The decomposition theorem for polarizable regular twistor $\mathcal{D}$-modules; Integrability; Appendix. Monodromy at infinity and partial Fourier Laplace transform; Bibliography; Notation.
Astérisque, Number 300
September 2005, 208 pages, Softcover, ISBN 2-85629-174-0, 2000 Mathematics Subject Classification: 32S40, Individual member US\$59, List US\$66, Order code AST/300

## Mathematical Physics

## Mathematical Foundations of Quantum Mechanics

K. R. Parthasarathy, Indian Statistical Institute, New Delhi, India

This is a brief introduction to the mathematical foundations of quantum mechanics based on lectures given by the author to Ph.D. students at the Delhi Centre of the Indian Statistical Institute in order to initiate active research in the emerging field of quantum probability. In addition to quantum probability, an understanding of the role of group representations in the development of quantum mechanics is always a fascinating theme for mathematicians.

The first chapter deals with the definitions of states, observables and automorphisms of a quantum system through Gleason's theorem, Hahn-Hellinger theorem, and Wigner's theorem. Mackey's imprimitivity theorem and the theorem of inducing representations of groups in stages are proved directly for projective unitary antiunitary representations in the second chapter. Based on a discussion of multipliers on locally compact groups in the third chapter all the well-known observables of classical quantum theory like linear momenta, orbital and spin angular momenta, kinetic and potential energies, gauge operators etc., are derived solely from Galilean covariance in the last chapter. A very short account of observables concerning a relativistic free particle is included.
In conclusion, the spectral theory of Schrodinger operators of one and two electron atoms is discussed in some detail.

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    Contents: Probability theory on the lattice of projections in a Hilbert space; Systems with a configuration under a group action; Multipliers on locally compact groups; The basic observables of a quantum mechanical system; Bibliography.

    ## Hindustan Book Agency

    October 2005, 184 pages, Hardcover, ISBN 81-85931-59-3, 2000 Mathematics Subject Classification: 81-02, 81R05, All AMS members US\$27, List US\$34, Order code HIN/26

