New Publications Offered by the AMS

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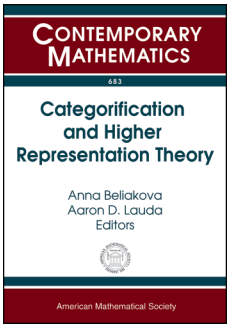
Algebra and Algebraic Geometry



Categorification and Higher Representation Theory

Anna Beliakova, *Universität Zürich, Switzerland*, and **Aaron D. Lauda**, *University of Southern California, Los Angeles, CA*, Editors

The emergent mathematical philosophy of categorification is reshaping our view of modern mathematics by uncovering a hidden layer of structure in mathematics, revealing richer and more robust structures capable of describing more complex phenomena. Categorified representation theory, or higher representation theory, aims to understand a new level of structure present in representation theory. Rather than studying actions of algebras on vector spaces where algebra elements act by linear endomorphisms of the vector space, higher representation theory describes the structure present when algebras act on categories, with algebra elements acting by functors. The new level of structure in higher representation theory arises by studying the natural transformations between functors. This enhanced perspective brings into play a powerful new set of tools that deepens our understanding of traditional representation theory.

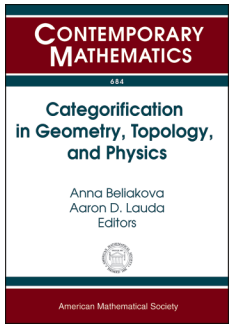
This volume exhibits some of the current trends in higher representation theory and the diverse techniques that are being employed in this field with the aim of showcasing the many applications of higher representation theory.

The companion volume (Contemporary Mathematics, Volume 684) is devoted to categorification in geometry, topology, and physics.

Contents: **I. Losev**, Rational Cherednik algebras and categorification; **O. Dudas**, **M. Varagnolo**, and **E. Vasserot**, Categorical actions on unipotent representations of finite classical groups; **J. Brundan** and **N. Davidson**, Categorical actions and crystals; **A. M. Licata**, On the 2-linearity of the free group; **M. Ehrig**, **C. Stroppel**, and **D. Tubbenhauer**, The Blanchet-Khovanov algebras; **G. Lusztig**, Generic character sheaves on groups over $k[\epsilon]/(\epsilon^r)$; **D. Berdeja Suárez**, Integral presentations of quantum lattice Heisenberg algebras; **Y. Qi** and **J. Sussan**, Categorification at prime roots of unity and hopfological finiteness; **B. Elias**, Folding with Soergel bimodules; **L. T. Jensen** and **G. Williamson**, The p-canonical basis for Hecke algebras.

Contemporary Mathematics, Volume 683

March 2017, approximately 363 pages, Softcover, ISBN: 978-1-4704-2460-2, 2010 *Mathematics Subject Classification:* 81R50, 17B10, 20C08, 14F05, 18D10, 17B50, 17B55, 17B67, **AMS members US$88.80**, List US$111, Order code CONM/683



Categorification in Geometry, Topology, and Physics

Anna Beliakova, *Universität Zürich, Switzerland*, and **Aaron D. Lauda**, *University of Southern California, Los Angeles, CA*, Editors

The emergent mathematical philosophy of categorification is reshaping our view of modern mathematics by uncovering a hidden layer of structure in mathematics, revealing richer and more robust structures capable of describing more complex phenomena. Categorification is a powerful tool for relating various branches of mathematics and exploiting the commonalities between fields. It provides a language emphasizing essential features and allowing precise relationships between vastly different fields.

This volume focuses on the role categorification plays in geometry, topology, and physics. These articles illustrate many important trends for the field including geometric representation theory, homotopical methods in link homology, interactions between higher representation theory and gauge theory, and double affine Hecke algebra approaches to link homology.

The companion volume (Contemporary Mathematics, Volume 683) is devoted to categorification and higher representation theory.

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

Contents: **B. Webster**, Geometry and categorification; **Y. Li**, A geometric realization of modified quantum algebras; **T. Lawson**, **R. Lipshitz**, and **S. Sarkar**, The cube and the Burnside category; **S. Chun**, **S. Gukov**, and **D. Roggenkamp**, Junctions of surface

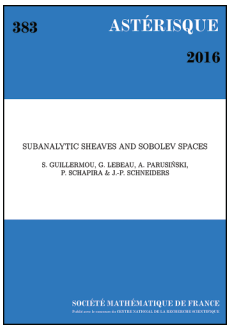
operators and categorification of quantum groups; **R. Rouquier**, Khovanov-Rozansky homology and 2-braid groups; **I. Cherednik** and **I. Danilenko**, DAHA approach to iterated torus links.

Contemporary Mathematics, Volume 684

March 2017, approximately 268 pages, Softcover, ISBN: 978-1-4704-2821-1, 2010 *Mathematics Subject Classification:* 81R50, 57M25, 14F05, 18D10, 58J28, 17B81, 20C08, 17B55, 17B67, **AMS members US$88.80**, List US$111, Order code CONM/684

New AMS-Distributed Publications

Algebra and Algebraic Geometry



Subanalytic Sheaves and Sobolev Spaces

Stéphane Guillermou, *Université de Grenoble I, Saint-Martin d'Hères*, **Gilles Lebeau**, *Université Nice Sophia Antipolis, France*, **Adam Parusiński**, *Université Nice Sophia Antipolis, France*, **Pierre Schapira**, *Université Paris 6, Jussieu, France*, and **Jean-Pierre Schneiders**, *Université de Liège, Belgique*

Sheaves on manifolds are perfectly suited to treat local problems, but many spaces that one naturally encounter, especially in analysis, are not of a local nature. The subanalytic topology (in the sense of Grothendieck) on real analytic manifolds allows the authors to partially overcome this difficulty and to define, for example, sheaves of functions or distributions with temperate growth but not to make the growth precise.

In this volume, the authors introduce the linear subanalytic topology, a refinement of the preceding one, and construct various objects of the derived category of sheaves on the subanalytic site with the help of the Brown representability theorem. In particular, they construct the Sobolev sheaves. These objects have the nice property that the complexes of their sections on open subsets with Lipschitz boundaries are concentrated in degree zero and coincide with the classical Sobolev spaces.

Another application of this topology is that it allows the authors to functorially endow regular holonomic D-modules with filtrations (in the derived sense).

In the course of the text, the authors also obtain some results on subanalytic geometry and make a detailed study of the derived category of filtered objects in symmetric monoidal categories.

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.

Astérisque, Number 383

October 2016, 120 pages, Softcover, ISBN: 978-2-85629-844-2, 2010 *Mathematics Subject Classification:* 16E35, 16W70, 18A25, 18D10, 18D35, 18F20, 32B20, 32C05, 32C38, 32S60, 46E35, 58A03, **AMS members US$41.60**, List US$52, Order code AST/383

Representation Theory—Current Trends and Perspectives

Henning Krause, *University of Bielefeld, Germany*, **Peter Littelmann**, *University of Cologne, Germany*, **Gunter Malle**, *University of Kaiserlautern, Germany*, **Karl-Hermann Neeb**, *University of Erlangen-Nuernberg, Germany*, and **Christoph Schweigert**, *University of Hamburg, Germany*, Editors

From April 2009 until March 2016, the German Science Foundation generously supported the Priority Program SPP 1388 in Representation Theory. The core principles of the projects realized in the framework of the priority program have been categorification and geometrization, which are also reflected in the contributions to this volume.

Apart from the articles by former postdocs supported by the priority program, the volume contains a number of invited research and survey articles. This volume covers current research topics from the representation theory of finite groups, of algebraic groups, of Lie superalgebras, of finite dimensional algebras, and of infinite dimensional Lie groups.

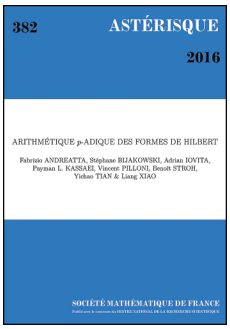
Graduate students and researchers in mathematics interested in representation theory will find this volume inspiring. It contains many stimulating contributions to the development of this broad and extremely diverse subject.

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

EMS Series of Congress Reports, Volume 11

January 2017, 773 pages, Hardcover, ISBN: 978-3-03719-171-2, 2010 *Mathematics Subject Classification:* 14Mxx, 16Gxx, 17Bxx, 18Exx, 20Gxx, 22Exx; 58Cxx, 81Txx, **AMS members US$94.40**, List US$118, Order code EMSSCR/11

Analysis



Arithmétique *p*-adique des Formes de Hilbert

Fabrizio Andreatta, *Universita di Milano, Italy*, **Stéphane Bijakowski**, *Université Paris 13, Villetaneuse, France*, **Adrian Iovita**, *Concordia University, Montreal, Canada*, **Payman L. Kassaei**, *McGill University, Montreal, Canada*, **Vincent Pilloni**, *École Normale Supérieure de Lyon, France*, **Benoît Stroh**, *Université Paris 13, Villetaneuse, France*, **Yichao Tian**, *Chinese Academy of Sciences, Beijing, China*, and **Liang Xiao**, *University of Connecticut, Storrs, CT*

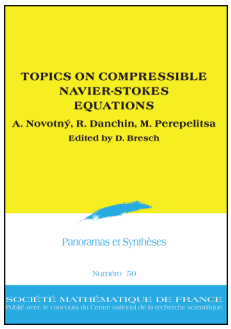
This volume is devoted to the study of Hilbert *p*-adic modular forms. It contains classicality theorems for overconvergent forms which generalize on the first hand Coleman criterion, which can be applied in big weights, and on the second hand Buzzard-Taylor criterion, which can be applied in weight one. The authors deduce applications to the Artin and Fontaine-Mazur conjectures. They conclude by constructing Hecke varieties for Hilbert modular forms.

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

Astérisque, Number 382

October 2016, 266 pages, Softcover, ISBN: 978-2-85629-843-5, 2010 *Mathematics Subject Classification:* 37A20, 37D25, 37D30, 37A50, 37C40, **AMS members US$65.60**, List US$82, Order code AST/382

Differential Equations



Topics on Compressible Navier-Stokes Equations

Didier Bresch, *Université de Savoie LAMA, Le Bourget-du-Lac, France*, Editor; **Antonin Novotný**, *Université du Sud Toulon-Var, La Garde, France*, **Raphaël Danchin**, *Université Paris-est, France*, and **Misha Perepelitsa**, *University of Houston, Texas*

This issue includes contributions from the session États de la Recherche: Topics on Compressible Navier-Stokes Equations that was held from May 21–25, 2012 at the Laboratoire de Mathématiques in Le Bourget du Lac, France.

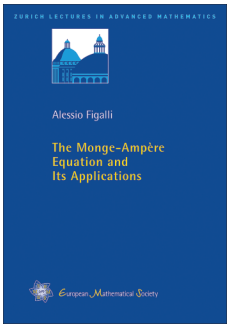
This national training session provided the opportunity to gather four internationally renowned specialists (D. Bresch, A. Novotný, R. Danchin, and M. Perepetlisa) and allow them to present the major actual mathematical developments related to the well-posedness character problem for the compressible Navier-Stokes equations to non-subject specialists.

For the sake of unity, this special issue includes only the contributions dedicated to the non-degenerate viscosities case, aiming to present a self-contained contribution on the subject: global weak-solutions à la Leray, intermediate solutions à la Hoff and strong solutions in critical spaces à la Fujita-Kato.

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.

Panoramas et Synthèses, Number 50

November 2016, 135 pages, Softcover, ISBN: 978-2-85629-847-3, 2010 *Mathematics Subject Classification:* 35Q30, 76N10, 35Q35, **AMS members US$48**, List US$60, Order code PASY/50



The Monge-Ampère Equation and Its Applications

Alessio Figalli, *ETH Zürich, Switzerland*

The Monge-Ampère equation is one of the most important partial differential equations, appearing in many problems in analysis and geometry. This monograph is a comprehensive introduction to the existence and regularity theory of the Monge-Ampère equation and some selected applications; the main goal is to provide the reader with a wealth of results and techniques he or she can draw from to understand current research related to this beautiful equation.

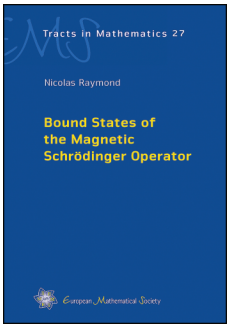
The presentation is essentially self-contained, with an appendix that contains precise statements of all the results used from different areas (linear algebra, convex geometry, measure theory, nonlinear analysis, and PDEs).

This book is intended for graduate students and researchers interested in nonlinear PDEs: explanatory figures, detailed proofs, and heuristic arguments make this book suitable for self-study and also as a reference.

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

Zurich Lectures in Advanced Mathematics, Volume 22

January 2017, 210 pages, Softcover, ISBN: 978-3-03719-170-5, 2010 *Mathematics Subject Classification:* 35J96; 35B65, 35J60, 35J66, 35B45, 35B50, 35D05, 35D10, 35J65, 53A15, 53C45, **AMS members US$33.60**, List US$42, Order code EMSZLEC/22



Bound States of the Magnetic Schrödinger Operator

Nicolas Raymond, *Université de Rennes, France*

This book is a synthesis of recent advances in the spectral theory of the magnetic Schrödinger operator. It can be considered a catalog of concrete examples of magnetic spectral asymptotics.

Since the presentation involves many notions of spectral theory and semiclassical analysis, it begins with a concise account of concepts and methods used in the book and is illustrated by many elementary examples. Assuming various points of view (power series expansions, Feshbach–Grushin reductions, WKB constructions, coherent states decompositions, normal forms) a theory of magnetic harmonic approximation is then established which allows, in particular, accurate descriptions of the magnetic eigenvalues and eigenfunctions.

Some parts of this theory, such as those related to spectral reductions or waveguides, are still accessible to advanced students while others (e.g., the discussion of the Birkhoff normal form and its spectral consequences or the results related to boundary magnetic wells in dimension three) are intended for seasoned researchers.

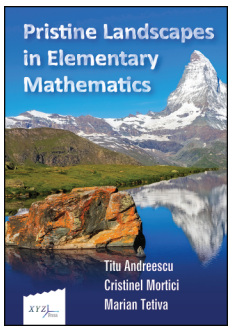
This item will also be of interest to those working in analysis.

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

EMS Tracts in Mathematics, Volume 27

January 2017, 394 pages, Hardcover, ISBN: 978-3-03719-169-9, 2010 *Mathematics Subject Classification:* 35P15, 35P20, 49R05, 81Q10, 81Q20, **AMS members US$62.40**, List US$78, Order code EMSTM/27

General Interest



Pristine Landscapes in Elementary Mathematics

Titu Andreescu, *University of Texas at Dallas*, **Cristabel Mortici**, *Valahia University, Targoviste, Romania*, and **Marian Tetiva**, *Gh. Rosca Codreanu National College, Barlad, Romania*

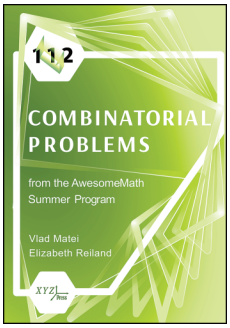
This book takes familiar ideas and extends them to a rich variety of problems. The intended audience is the ambitious high school or college student. The topics covered span algebra, geometry, number theory, and even a few elements of mathematical analysis. Each chapter explores specific themes and ideas that underlie the aforementioned subject areas. The "landscapes" presented provide a "view" into areas that are not typically encountered in great depth in standard coursework but nonetheless have profound implications.

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

A publication of XYZ Press. Distributed in North America by the American Mathematical Society.

XYZ Series, Volume 22

December 2016, 280 pages, Hardcover, ISBN: 978-0-9968745-7-1, 2010 *Mathematics Subject Classification:* 00A05, 00A07, 97U40, 97D50, **AMS members US$47.96**, List US$59.95, Order code XYZ/22



112 Combinatorial Problems from the AwesomeMath Summer Program

Vlad Matei, *University of Wisconsin, Madison*, and **Elizabeth Reiland**, *Johns Hopkins University, Baltimore, MD*

This book aims to give students a chance to begin exploring some introductory to intermediate topics in combinatorics, a fascinating and accessible branch of mathematics centered around (among other things) counting various objects and sets.

The book includes chapters featuring tools for solving counting problems, proof techniques, and more to give students a broad foundation to build on. The only prerequisites are a solid background in arithmetic, some basic algebra, and a love for learning mathematics.

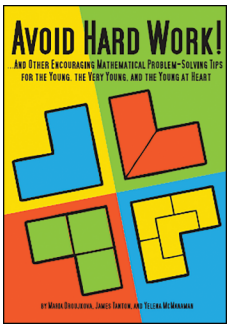
This item will also be of interest to those working in math education.

A publication of XYZ Press. Distributed in North America by the American Mathematical Society.

XYZ Series, Volume 21

December 2016, 196 pages, Hardcover, ISBN: 978-0-9968745-2-6, 2010 *Mathematics Subject Classification:* 00A05, 00A07, 97U40, 97D50, **AMS members US$47.96**, List US$59.95, Order code XYZ/21

Math Education



Avoid Hard Work!

... And Other Encouraging Mathematical Problem-Solving Tips for the Young, the Very Young, and the Young at Heart

Maria Droujkova, **James Tanton**, and **Yelena McManaman**

Avoid Hard Work gives a playful view on ten powerful problem-solving techniques. These techniques were first published by the Mathematical Association of America to help high school students with advanced math courses. These techniques and sample problems have been adapted for much younger children.

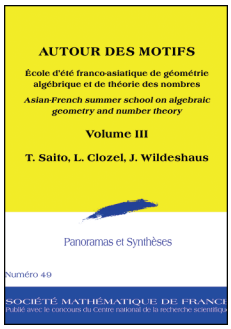
This item will also be of interest to those working in general interest.

A publication of Delta Stream Media, an imprint of Natural Math. Distributed in North America by the American Mathematical Society.

Natural Math Series, Volume 6

December 2016, 96 pages, Softcover, ISBN: 978-1-945899-01-0, **AMS members US$12**, List US$15, Order code NMATH/6

Number Theory



Autour des Motifs

Asian–French Summer School on Algebraic Geometry and Number Theory: Volume III

Takeshi Saito, *University of Tokyo, Japan*, **Laurent Clozel**, *Université Paris-Sud 11, Orsay, France*, and **Jörg Wildeshaus**, *Université Paris 13, Villetaneuse, France*

This volume contains the third part of the lecture notes of the Asian–French Summer School on Algebraic Geometry and Number Theory, which was held at the Institut des Hautes Études Scientifiques (Bures-sur-Yvette) and the Université Paris-Sud XI (Orsay) in July 2006. This summer school was devoted to the theory of motives and its recent developments and to related topics, notably Shimura varieties and automorphic representations.

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

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Panoramas et Synthèses, Number 49

November 2016, 131 pages, Softcover, ISBN: 978-2-85629-846-6, 2010 *Mathematics Subject Classification:* 14F42, 14C35, 14D10, 19E15, 19F27, **AMS members US$41.60**, List US$52, Order code PASY/49