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KEY=CHARACTERISTIC - PAOLA ORR

Connections, Curvature, and Cohomology: Cohomology of principal bundles and homogeneous spaces

Academic Press *This monograph developed out of the Abendseminar of 1958-1959 at the University of Zürich. The purpose of this monograph is to develop the de Rham cohomology theory, and to apply it to obtain topological invariants of smooth manifolds and fibre bundles. It also addresses the purely algebraic theory of the operation of a Lie algebra in a graded differential algebra.*

What is a Mathematical Concept?

Cambridge University Press *Leading thinkers in mathematics, philosophy and education offer new insights into the fundamental question: what is a mathematical concept?*

Differential Forms in Algebraic Topology

Springer Science & Business Media *Developed from a first-year graduate course in algebraic topology, this text is an informal introduction to some of the main ideas of contemporary homotopy and cohomology theory. The materials are structured around four core areas: de Rham theory, the Cech-de Rham complex, spectral sequences, and characteristic classes. By using the de Rham theory of differential forms as a prototype of cohomology, the machineries of algebraic topology are made easier to assimilate. With its stress on concreteness, motivation, and readability, this book is equally suitable for self-study and as a one-semester course in topology.*

Geometry of Characteristic Classes

American Mathematical Soc. *This is an inexpensive paper volume that will appeal to upper level students. Professor Morita is a world-class authority on this topic.*

Mathematical Reviews

Automorphic Forms, Shimura Varieties, and L-functions

Proceedings of a Conference Held at the University of Michigan, Ann Arbor, July 6-16, 1988

Differential Geometry and Its Applications

World Scientific *The proceedings consists of lectures and selected original research papers presented at the conference. The contents is divided into 3 parts: I. Geometric structures, II. the calculus of variations on manifolds, III. Geometric methods in physics. The volume also covers interdisciplinary areas between differential geometry and mathematical physics like field theory, relativity, classical and quantum mechanics. Contents:On the Chern-Griffiths Formulas for an Upper Bound for the Rank of a Web (V V Goldberg)Natural and Gauge-Natural Operators on*

the Space of Linear Connections on a Vector Bundle (J Janyska)General Natural Bundles and Operators (I Kolár)Classes Caracteristiques Residuelles (D Lehmann)Remarks on Globalization of the Langrangian Formalism (A Borowiec)A Fresh Approach to the Poincaré-Cartan Form for a Linear PDE and a Map Between Cohomologies (T Harding & F J Bloore)Variational Sequences on Finite Order Jet Spaces (D Krupka)Equivalence of Degenerate Lagrangians of Higher Order (M de León & P R Rodrigues)Quantum SU(2) Group of Woronowicz and Poisson Structures (J Grabowski)Nonholonomic Intermediate Integrals of Partial Differential Equations (V V Lychagin & Yu R Romanovsky)The Metric in the Superspace of Riemannian Metrics and Its Relation to Gravity (H J Schmidt)Spherically Symmetric Vacuum Spacetimes: Global Approach (R Siegl)and others Readership: Mathematicians and mathematical physicists.

Lecture Notes on Motivic Cohomology

American Mathematical Soc. *The notion of a motive is an elusive one, like its namesake "the motif" of Cezanne's impressionist method of painting. Its existence was first suggested by Grothendieck in 1964 as the underlying structure behind the myriad cohomology theories in Algebraic Geometry. We now know that there is a triangulated theory of motives, discovered by Vladimir Voevodsky, which suffices for the development of a satisfactory Motivic Cohomology theory. However, the existence of motives themselves remains conjectural. This book provides an account of the triangulated theory of motives. Its purpose is to introduce Motivic Cohomology, to develop its main properties, and finally to relate it to other known invariants of algebraic varieties and rings such as Milnor K-theory, etale cohomology, and Chow groups. The book is divided into lectures, grouped in six parts. The first part presents the definition of Motivic Cohomology, based upon the notion of presheaves with transfers. Some elementary comparison theorems are given in this part. The theory of (etale, Nisnevich, and Zariski) sheaves with transfers is developed in parts two, three, and six, respectively. The theoretical core of the book is the fourth part, presenting the triangulated category of motives. Finally, the comparison with higher Chow groups is developed in part five. The lecture notes format is designed for the book to be read by an advanced graduate student or an expert in a related field. The lectures roughly correspond to one-hour lectures given by Voevodsky during the course he gave at the Institute for Advanced Study in Princeton on this subject in 1999-2000. In addition, many of the original proofs have been simplified and improved so that this book will also be a useful tool for research mathematicians. Information for our distributors: Titles in this series are copublished with the Clay Mathematics Institute (Cambridge, MA).*

Geometric and Topological Methods for Quantum Field Theory

Summer School on Geometric and Topological Methods for Quantum Field Theory, July 11-29, 2005, Villa de Leyva, Colombia

American Mathematical Soc. *This volume, based on lectures and short communications at a summer school in Villa de Leyva, Colombia (July 2005), offers an introduction to some recent developments in several active topics at the interface between geometry, topology and quantum field theory. It is aimed at graduate students in physics or mathematics who might want insight in the following topics (covered in five survey lectures): Anomalies and noncommutative geometry, Deformation quantisation and Poisson algebras, Topological quantum field theory and orbifolds. These lectures are followed by nine articles on various topics at the borderline of mathematics and physics ranging from quasicrystals to invariant instantons through black holes, and involving a number of mathematical tools borrowed from geometry, algebra and analysis.*

Algebraic K-Theory and Its Applications

Springer Science & Business Media *Algebraic K-Theory is crucial in many areas of modern mathematics, especially algebraic topology, number theory, algebraic geometry, and operator theory. This text is designed to help graduate students in other areas learn the basics of K-Theory and get a feel for its many applications. Topics include algebraic topology, homological algebra, algebraic number theory, and an introduction to cyclic homology and its interrelationship with K-Theory.*

Annales scientifiques de l'École normale supérieure

Revue Roumaine de Mathématiques Pures Et Appliquées

The Monodromy Group

Springer Science & Business Media *In singularity theory and algebraic geometry, the monodromy group is embodied in the Picard-Lefschetz formula and the Picard-Fuchs equations. It has applications in the weakened 16th Hilbert problem and in mixed Hodge structures. There is a deep connection of monodromy theory with Galois theory of differential equations and algebraic functions. In covering these and other topics, this book underlines the unifying role of the monogropy group.*

International Conference on Differential Geometry and Its Applications

Differential Geometry and Its Applications, Brno, Czechoslawakia, 27 August-2 September, 1989

World Scientific Publishing Company Incorporated

Computational Topology

An Introduction

American Mathematical Soc. *Combining concepts from topology and algorithms, this book delivers what its title promises: an introduction to the field of computational topology. Starting with motivating problems in both mathematics and computer science and building up from classic topics in geometric and algebraic topology, the third part of the text advances to persistent homology. This point of view is critically important in turning a mostly theoretical field of mathematics into one that is relevant to a multitude of disciplines in the sciences and engineering. The main approach is the discovery of topology through algorithms. The book is ideal for teaching a graduate or advanced undergraduate course in computational topology, as it develops all the background of both the mathematical and algorithmic aspects*

of the subject from first principles. Thus the text could serve equally well in a course taught in a mathematics department or computer science department.

Mathematical Reports

Topics in Differential Geometry

American Mathematical Soc.

Mod Two Homology and Cohomology

Springer *Cohomology and homology modulo 2 helps the reader grasp more readily the basics of a major tool in algebraic topology. Compared to a more general approach to (co)homology this refreshing approach has many pedagogical advantages: 1. It leads more quickly to the essentials of the subject, 2. An absence of signs and orientation considerations simplifies the theory, 3. Computations and advanced applications can be presented at an earlier stage, 4. Simple geometrical interpretations of (co)chains. Mod 2 (co)homology was developed in the first quarter of the twentieth century as an alternative to integral homology, before both became particular cases of (co)homology with arbitrary coefficients. The first chapters of this book may serve as a basis for a graduate-level introductory course to (co)homology. Simplicial and singular mod 2 (co)homology are introduced, with their products and Steenrod squares, as well as equivariant cohomology. Classical applications include Brouwer's fixed point theorem, Poincaré duality, Borsuk-Ulam theorem, Hopf invariant, Smith theory, Kervaire invariant, etc. The cohomology of flag manifolds is treated in detail (without spectral sequences), including the relationship between Stiefel-Whitney classes and Schubert calculus. More recent developments are also covered, including topological complexity, face spaces, equivariant Morse theory, conjugation spaces, polygon spaces, amongst others. Each chapter ends with exercises, with some hints and answers at the end of the book.*

The New Encyclop©Œdia Britannica

The New Encyclopædia Britannica

Peterson's Graduate Programs in the Physical Sciences, Mathematics,

Agricultural Sciences, the Environment and Natural Resources 2007

Book 4

Petersons *Offers information on entrance and degree requirements, expenses and financial aid, programs of study, and faculty research specialties.*

The New Encyclopaedia Britannica

Differential Geometric Methods in Theoretical Physics

Physics and Geometry

Springer Science & Business Media *After several decades of reduced contact, the interaction between physicists and mathematicians in the front-line research of both fields recently became deep and fruit ful again. Many of the leading specialists of both fields became involved in this devel opment. This process even led to the discovery of previously unsuspected connections between various subfields of physics and mathematics. In mathematics this concerns in particular knots von Neumann algebras, Kac-Moody algebras, integrable non-linear partial differential equations, and differential geometry in low dimensions, most im portantly in three and four dimensional spaces. In physics it concerns gravity, string theory, integrable classical and quantum field theories, solitons and the statistical me chanics of surfaces. New discoveries in these fields are made at a rapid pace. This conference brought together active researchers in these areas, reporting their results and discussing with other participants to further develop thoughts in future new directions. The conference was attended by SO participants from 15 nations. These proceedings document the program and the talks at the conference. This conference was preceded by a two-week summer school. Ten lecturers gave extended lectures on related topics. The proceedings of the school will also be published in the NATO-AS[volume by Plenum. The Editors vii ACKNOWLEDGMENTS We would like to thank the many people who have made the conference a success. Furthermore, ·we appreciate the excellent talks. The active participation of everyone present made the conference lively and stimulating. All of this made our efforts worth while.*

Periods and Nori Motives

Springer *This book casts the theory of periods of algebraic varieties in the natural setting of Madhav Nori's abelian category of mixed motives. It develops Nori's approach to mixed motives from scratch, thereby filling an important gap in the literature, and then explains the connection of mixed motives to periods, including a detailed account of the theory of period numbers in the sense of Kontsevich-Zagier and their structural properties. Period numbers are central to number theory and algebraic geometry, and also play an important role in other fields such as mathematical physics. There are long-standing conjectures about their transcendence properties, best understood in the language of cohomology of algebraic varieties or, more generally, motives. Readers of this book will discover that Nori's unconditional construction of an abelian category of motives (over fields embeddable into the complex numbers) is particularly well suited for this purpose. Notably, Kontsevich's formal period algebra represents a torsor under the motivic Galois group in Nori's sense, and the period conjecture of Kontsevich and Zagier can be recast in this setting. Periods and Nori Motives is highly informative and will appeal to graduate students interested in algebraic geometry and number theory as well as researchers working in related fields. Containing relevant background material on topics such as singular cohomology, algebraic de Rham cohomology, diagram categories and rigid tensor categories, as well as many interesting examples, the overall presentation of this book is self-contained.*

Algebraic Models in Geometry

Oxford University Press *In the past century, different branches of mathematics have become more widely separated. Yet, there is an essential unity to mathematics which still springs up in fascinating ways to solve interdisciplinary problems. This text provides a bridge between the subjects of algebraic topology, including differential topology, and geometry. It is a survey book dedicated to a large audience of researchers and graduate students in these areas. Containing a generalintroduction to the algebraic theory of rational homotopy and giving concrete applications of algebraic models to the study of geometrical problems, mathematicians in many areas will find subjects that are of interest to them in the book.*

Noncommutative Geometry, Quantum Fields and Motives

American Mathematical Soc. *The unifying theme of this book is the interplay among noncommutative geometry, physics, and number theory. The two main objects of investigation are spaces where both the noncommutative and the motivic aspects come to play a role: space-time, where the guiding principle is the problem of developing a quantum theory of gravity, and the space of primes, where one can*

regard the Riemann Hypothesis as a long-standing problem motivating the development of new geometric tools. The book stresses the relevance of noncommutative geometry in dealing with these two spaces. The first part of the book deals with quantum field theory and the geometric structure of renormalization as a Riemann-Hilbert correspondence. It also presents a model of elementary particle physics based on noncommutative geometry. The main result is a complete derivation of the full Standard Model Lagrangian from a very simple mathematical input. Other topics covered in the first part of the book are a noncommutative geometry model of dimensional regularization and its role in anomaly computations, and a brief introduction to motives and their conjectural relation to quantum field theory. The second part of the book gives an interpretation of the Weil explicit formula as a trace formula and a spectral realization of the zeros of the Riemann zeta function. This is based on the noncommutative geometry of the adèle class space, which is also described as the space of commensurability classes of Q-lattices, and is dual to a noncommutative motive (endomotive) whose cyclic homology provides a general setting for spectral realizations of zeros of L-functions. The quantum statistical mechanics of the space of Q-lattices, in one and two dimensions, exhibits spontaneous symmetry breaking. In the low-temperature regime, the equilibrium states of the corresponding systems are related to points of classical moduli spaces and the symmetries to the class field theory of the field of rational numbers and of imaginary quadratic fields, as well as to the automorphisms of the field of modular functions. The book ends with a set of analogies between the noncommutative geometries underlying the mathematical formulation of the Standard Model minimally coupled to gravity and the moduli spaces of Q-lattices used in the study of the zeta function.

British Books in Print

Dirichlet Branes and Mirror Symmetry

American Mathematical Soc. *Research in string theory over the last several decades has yielded a rich interaction with algebraic geometry. In 1985, the introduction of Calabi-Yau manifolds into physics as a way to compactify ten-dimensional space-time has led to exciting cross-fertilization between physics and mathematics, especially with the discovery of mirror symmetry in 1989. A new string revolution in the mid-1990s brought the notion of branes to the forefront. As foreseen by Kontsevich, these turned out to have mathematical counterparts in the derived category of coherent sheaves on an algebraic variety and the Fukaya category of a symplectic manifold. This has led to exciting new work, including the Strominger-Yau-Zaslow conjecture, which used the theory of branes to propose a geometric basis for mirror symmetry, the theory of stability conditions on triangulated categories, and a physical basis for the McKay correspondence. These developments have led to a great deal of new mathematical work. One difficulty in understanding*

all aspects of this work is that it requires being able to speak two different languages, the language of string theory and the language of algebraic geometry. The 2002 Clay School on Geometry and String Theory set out to bridge this gap, and this monograph builds on the expository lectures given there to provide an up-to-date discussion including subsequent developments. A natural sequel to the first Clay monograph on Mirror Symmetry, it presents the new ideas coming out of the interactions of string theory and algebraic geometry in a coherent logical context. We hope it will allow students and researchers who are familiar with the language of one of the two fields to gain acquaintance with the language of the other. The book first introduces the notion of Dirichlet brane in the context of topological quantum field theories, and then reviews the basics of string theory. After showing how notions of branes arose in string theory, it turns to an introduction to the algebraic geometry, sheaf theory, and homological algebra needed to define and work with derived categories. The physical existence conditions for branes are then discussed and compared in the context of mirror symmetry, culminating in Bridgeland's definition of stability structures, and its applications to the McKay correspondence and quantum geometry. The book continues with detailed treatments of the Strominger-Yau-Zaslow conjecture, Calabi-Yau metrics and homological mirror symmetry, and discusses more recent physical developments. This book is suitable for graduate students and researchers with either a physics or mathematics background, who are interested in the interface between string theory and algebraic geometry.

Reviews in Number Theory, 1984-96

As Printed in Mathematical Reviews

Topology and Geometry for Physicists

Courier Corporation *Written by physicists for physics students, this text assumes no detailed background in topology or geometry. Topics include differential forms, homotopy, homology, cohomology, fiber bundles, connection and covariant derivatives, and Morse theory. 1983 edition.*

Weil's Conjecture for Function

Fields

Volume I (AMS-199)

Princeton University Press *A central concern of number theory is the study of local-to-global principles, which describe the behavior of a global field K in terms of the behavior of various completions of K. This book looks at a specific example of a local-to-global principle: Weil's conjecture on the Tamagawa number of a semisimple algebraic group G over K. In the case where K is the function field of an algebraic curve X, this conjecture counts the number of G-bundles on X (global information) in terms of the reduction of G at the points of X (local information). The goal of this book is to give a conceptual proof of Weil's conjecture, based on the geometry of the moduli stack of G-bundles. Inspired by ideas from algebraic topology, it introduces a theory of factorization homology in the setting l-adic sheaves. Using this theory, Dennis Gaitsgory and Jacob Lurie articulate a different local-to-global principle: a product formula that expresses the cohomology of the moduli stack of G-bundles (a global object) as a tensor product of local factors. Using a version of the Grothendieck-Lefschetz trace formula, Gaitsgory and Lurie show that this product formula implies Weil's conjecture. The proof of the product formula will appear in a sequel volume.*

Factorization Algebras in Quantum Field Theory

Cambridge University Press *This first volume develops factorization algebras with a focus upon examples exhibiting their use in field theory, which will be useful for researchers and graduates.*

Geometric Models for Noncommutative Algebras

American Mathematical Soc. *The volume is based on a course, ``Geometric Models for Noncommutative Algebras'' taught by Professor Weinstein at Berkeley. Noncommutative geometry is the study of noncommutative algebras as if they were algebras of functions on spaces, for example, the commutative algebras associated to affine algebraic varieties, differentiable manifolds, topological spaces, and measure spaces. In this work, the authors discuss several types of geometric objects (in the usual sense of sets with structure) that are closely related to noncommutative algebras. Central to the discussion are symplectic and Poisson manifolds, which arise when noncommutative algebras are obtained by deforming commutative algebras. The authors also give a detailed study of groupoids (whose role in noncommutative geometry has been stressed by Connes) as well as of Lie algebroids, the infinitesimal*

approximations to differentiable groupoids. Featured are many interesting examples, applications, and exercises. The book starts with basic definitions and builds to (still) open questions. It is suitable for use as a graduate text. An extensive bibliography and index are included.

The New Encyclopaedia Britannica: Macropaedia

BMS Particles in Three Dimensions

Springer *This thesis presents the state of the art in the study of Bondi-Metzner-Sachs (BMS) symmetry and its applications in the simplified setting of three dimensions. It focuses on presenting all the background material in a pedagogical and self-contained manner to enable readers to fully appreciate the original results that have been obtained while learning a number of fundamental concepts in the field along the way. This makes it a highly rewarding read and a perfect starting point for anybody with a serious interest in the four-dimensional problem.*

Bordered Heegaard Floer Homology

American Mathematical Soc. *The authors construct Heegaard Floer theory for 3-manifolds with connected boundary. The theory associates to an oriented, parametrized two-manifold a differential graded algebra. For a three-manifold with parametrized boundary, the invariant comes in two different versions, one of which (type D) is a module over the algebra and the other of which (type A) is an A∞ module. Both are well-defined up to chain homotopy equivalence. For a decomposition of a 3-manifold into two pieces, the A∞ tensor product of the type D module of one piece and the type A module from the other piece is ^HF of the glued manifold. As a special case of the construction, the authors specialize to the case of three-manifolds with torus boundary. This case can be used to give another proof of the surgery exact triangle for ^HF. The authors relate the bordered Floer homology of a three-manifold with torus boundary with the knot Floer homology of a filling.*

An Invitation to Morse Theory

Springer Science & Business Media *This self-contained treatment of Morse theory focuses on applications and is intended for a graduate course on differential or algebraic topology, and will also be of interest to researchers. This is the first textbook to include topics such as Morse-Smale flows, Floer homology, min-max theory, moment maps and equivariant cohomology, and complex Morse theory. The reader is expected to have some familiarity with cohomology theory and differential and integral calculus on smooth manifolds. Some features of the second edition include added applications, such as Morse theory and the curvature of knots, the cohomology of the moduli space of planar polygons, and the Duistermaat-Heckman*

formula. The second edition also includes a new chapter on Morse-Smale flows and Whitney stratifications, many new exercises, and various corrections from the first edition.

Quasi-projective Moduli for Polarized Manifolds

Springer Science & Business Media *The concept of moduli goes back to B. Riemann, who shows in [68] that the isomorphism class of a Riemann surface of genus 9 ~ 2 depends on 3g - 3 parameters, which he proposes to name "moduli". A precise formulation of global moduli problems in algebraic geometry, the definition of moduli schemes or of algebraic moduli spaces for curves and for certain higher dimensional manifolds have only been given recently (A. Grothendieck, D. Mumford, see [59]), as well as solutions in some cases. It is the aim of this monograph to present methods which allow over a field of characteristic zero to construct certain moduli schemes together with an ample sheaf. Our main source of inspiration is D. Mumford's "Geometric In variant Theory". We will recall the necessary tools from his book [59] and prove the "Hilbert-Mumford Criterion" and some modified version for the stability of points under group actions. As in [78], a careful study of positivity proper ties of direct image sheaves allows to use this criterion to construct moduli as quasi-projective schemes for canonically polarized manifolds and for polarized manifolds with a semi-ample canonical sheaf.*

Scl 2009

Mathematical Society Of Japan Memoirs *This book is a comprehensive introduction to the theory of stable commutator length, an important subfield of quantitative topology, with substantial connections to 2-manifolds, dynamics, geometric group theory, bounded cohomology, symplectic topology, and many other subjects. We use constructive methods whenever possible, and focus on fundamental and explicit examples. We give a self-contained presentation of several foundational results in the theory, including Bavard's Duality Theorem, the Spectral Gap Theorem, the Rationality Theorem, and the Central Limit Theorem. The contents should be accessible to any mathematician interested in these subjects, and are presented with a minimal number of prerequisites, but with a view to applications in many areas of mathematics.Published by Mathematical Society of Japan and distributed by World Scientific Publishing Co. for all markets*

Variations on a Theorem of Tate

American Mathematical Soc. *Let F be a number field. These notes explore Galois-theoretic, automorphic, and motivic analogues and refinements of Tate's basic result that continuous projective representations Gal(F¯¯¯¯/F)→PGLn(C) lift to GLn(C). The author takes special interest in the interaction of this result with algebraicity (for automorphic representations) and geometricity (in the sense of Fontaine-Mazur). On*

the motivic side, the author studies refinements and generalizations of the classical Kuga-Satake construction. Some auxiliary results touch on: possible infinity-types of algebraic automorphic representations; comparison of the automorphic and Galois "Tannakian formalisms" monodromy (independence-of-ℓ) questions for abstract Galois representations.