

Hyperbolic Manifolds and Discrete Groups

Michael Kapovich

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John G. Ratcliffe



Hyperbolic Manifolds And Discrete Groups:

Hyperbolic Manifolds and Discrete Groups Michael Kapovich, 2001 *Hyperbolic Manifolds and Discrete Groups* is at the crossroads of several branches of mathematics hyperbolic geometry discrete groups 3 dimensional topology geometric group theory and complex analysis The main focus throughout the text is on the Big Monster i e on Thurston s hyperbolization theorem which has not only completely changes the landscape of 3 dimensional topology and Kleinian group theory but is one of the central results of 3 dimensional topology The book is fairly self contained replete with beautiful illustrations a rich set of examples of key concepts numerous exercises and an extensive bibliography and index It should serve as an ideal graduate course seminar text or as a comprehensive reference

Foundations of Hyperbolic Manifolds John G. Ratcliffe, 1994 This book is an exposition of the theoretical foundations of hyperbolic manifolds It is intended to be used both as a textbook and as a reference The reader is assumed to have a basic knowledge of algebra and topology at the first year graduate level of an American university The book is divided into three parts The first part Chapters 1-7 is concerned with hyperbolic geometry and discrete groups The second part Chapters 8-12 is devoted to the theory of hyperbolic manifolds The third part Chapter 13 integrates the first two parts in a development of the theory of hyperbolic orbifolds There are over 500 exercises in this book and more than 180 illustrations

The Arithmetic of Hyperbolic 3-Manifolds Colin Maclachlan, Alan W. Reid, 2003 Recently there has been considerable interest in developing techniques based on number theory to attack problems of 3 manifolds Contains many examples and lots of problems Brings together much of the existing literature of Kleinian groups in a clear and concise way At present no such text exists

Foundations of Hyperbolic Manifolds John Ratcliffe, 2010-11-23 This heavily class tested book is an exposition of the theoretical foundations of hyperbolic manifolds It is both a textbook and a reference A basic knowledge of algebra and topology at the first year graduate level of an American university is assumed The first part is concerned with hyperbolic geometry and discrete groups The second part is devoted to the theory of hyperbolic manifolds The third part integrates the first two parts in a development of the theory of hyperbolic orbifolds Each chapter contains exercises and a section of historical remarks A solutions manual is available separately

Discrete Groups Ken'ichi Ōshika, Ken'ichi Ōshika, 2002 Ohshika provides a concise introduction to the study of infinite groups as geometric objects The main topics addressed are the theory of hyperbolic groups in the sense of Gromov Epstein s automatic group theory and Kleinian group theory Coverage extends to the interactions between these theories and their relations to low dimensional topology Ohshika developed the text while teaching graduate courses at three Japanese universities The text has been translated from the Japanese by the author c Book News Inc

Conformal Geometry of Discrete Groups and Manifolds Boris Nikolaevich Apanasov, 2000 The aim of the Expositions is to present new and important developments in pure and applied mathematics Well established in the community over more than two decades the series offers a large library of mathematical works including several important classics The volumes supply thorough and detailed expositions of the

methods and ideas essential to the topics in question In addition they convey their relationships to other parts of mathematics The series is addressed to advanced readers interested in a thorough study of the subject Editorial Board Lev Birbrair Universidade Federal do Cear Fortaleza Brasil Walter D Neumann Columbia University New York USA Markus J Pflaum University of Colorado Boulder USA Dierk Schleicher Jacobs University Bremen Germany Katrin Wendland University of Freiburg Germany Honorary Editor Victor P Maslov Russian Academy of Sciences Moscow Russia Titles in planning include Yuri A Bahturin Identical Relations in Lie Algebras 2019 Yakov G Berkovich Lev G Kazarin and Emmanuel M Zhmud Characters of Finite Groups Volume 2 2019 Jorge Herbert Soares de Lira Variational Problems for Hypersurfaces in Riemannian Manifolds 2019 Volker Mayer Mariusz Urba ski and Anna Zdunik Random and Conformal Dynamical Systems 2021 Ioannis Diamantis Bostjan Gabrovsek Sofia Lambropoulou and Maciej Mroczkowski Knot Theory of Lens Spaces 2021

Foundations of Hyperbolic Manifolds John Ratcliffe, 2008-11-01 This heavily class tested book is an exposition of the theoretical foundations of hyperbolic manifolds It is both a textbook and a reference A basic knowledge of algebra and topology at the first year graduate level of an American university is assumed The first part is concerned with hyperbolic geometry and discrete groups The second part is devoted to the theory of hyperbolic manifolds The third part integrates the first two parts in a development of the theory of hyperbolic orbifolds Each chapter contains exercises and a section of historical remarks A solutions manual is available separately **Hyperbolic Manifolds and Kleinian Groups** Katsuhiko Matsuzaki, Masahiko Taniguchi, 1998-04-30 A Kleinian group is a discrete subgroup of the isometry group of hyperbolic 3 space which is also regarded as a subgroup of Möbius transformations in the complex plane The present book is a comprehensive guide to theories of Kleinian groups from the viewpoints of hyperbolic geometry and complex analysis After 1960 Ahlfors and Bers were the leading researchers of Kleinian groups and helped it to become an active area of complex analysis as a branch of Teichmüller theory Later Thurston brought a revolution to this area with his profound investigation of hyperbolic manifolds and at the same time complex dynamical approach was strongly developed by Sullivan This book provides fundamental results and important theorems which are needed for access to the frontiers of the theory from a modern viewpoint **Geometry and Dynamics of Groups and Spaces** Mikhail Kapranov, Sergii Kolyada, Yu. I.

Manin, Pieter Moree, Leonid Potyagailo, 2008-03-05 Alexander Reznikov 1960-2003 was a brilliant and highly original mathematician This book presents 18 articles by prominent mathematicians and is dedicated to his memory In addition it contains an influential so far unpublished manuscript by Reznikov of book length The book further provides an extensive survey on Kleinian groups in higher dimensions and some articles centering on Reznikov as a person **Arithmetic Groups and Their Generalizations** Lizhen Ji, 2008 In one guise or another many mathematicians are familiar with certain arithmetic groups such as \mathbf{Z} or $\mathrm{SL}(n, \mathbf{Z})$ Yet many applications of arithmetic groups and many connections to other subjects within mathematics are less well known Indeed arithmetic groups admit many natural and important generalizations

The purpose of this expository book is to explain through some brief and informal comments and extensive references what arithmetic groups and their generalizations are why they are important to study and how they can be understood and applied to many fields such as analysis geometry topology number theory representation theory and algebraic geometry It is hoped that such an overview will shed a light on the important role played by arithmetic groups in modern mathematics Titles in this series are co published with International Press Cambridge MA Table of Contents Introduction General comments on references Examples of basic arithmetic groups General arithmetic subgroups and locally symmetric spaces Discrete subgroups of Lie groups and arithmeticity of lattices in Lie groups Different completions of \mathbb{Q} and \mathbb{S} arithmetic groups over number fields Global fields and \mathbb{S} arithmetic groups over function fields Finiteness properties of arithmetic and \mathbb{S} arithmetic groups Symmetric spaces Bruhat Tits buildings and their arithmetic quotients Compactifications of locally symmetric spaces Rigidity of locally symmetric spaces Automorphic forms and automorphic representations for general arithmetic groups Cohomology of arithmetic groups K groups of rings of integers and K groups of group rings Locally homogeneous manifolds and period domains Non cofinite discrete groups geometrically finite groups Large scale geometry of discrete groups Tree lattices Hyperbolic groups Mapping class groups and outer automorphism groups of free groups Outer automorphism group of free groups and the outer spaces References Index Review from Mathematical Reviews the author deserves credit for having done the tremendous job of encompassing every aspect of arithmetic groups visible in today's mathematics in a systematic manner the book should be an important guide for some time to come AMSIP 43

Geometry, Spectral Theory, Groups, and Dynamics Robert Brooks, Michael Entov, Yehuda Pinchover, Michah Sageev, 2005 This volume contains articles based on talks given at the Robert Brooks Memorial Conference on Geometry and Spectral Theory and the Workshop on Groups Geometry and Dynamics held at Technion the Israel Institute of Technology Haifa Robert Brooks 1952 2002 broad range of mathematical interests is represented in the volume which is devoted to various aspects of global analysis spectral theory the theory of Riemann surfaces Riemannian and discrete geometry and number theory A survey of Brooks work has been written by his close colleague Peter Buser Also included in the volume are articles on analytic topics such as Szegő's theorem and on geometric topics such as isoperimetric inequalities and symmetries of manifolds The book is suitable for graduate students and researchers interested in various aspects of geometry and global analysis

In the Tradition of Thurston II Ken'ichi Ohshika, Athanase Papadopoulos, 2022-08-02 The purpose of this volume and of the other volumes in the same series is to provide a collection of surveys that allows the reader to learn the important aspects of William Thurston's heritage Thurston's ideas have altered the course of twentieth century mathematics and they continue to have a significant influence on succeeding generations of mathematicians The topics covered in the present volume include complex hyperbolic Kleinian groups Mbius structures hyperbolic ends cone 3 manifolds Thurston's norm surgeries in representation varieties triangulations spaces of polygonal decompositions and of singular flat structures

on surfaces combination theorems in the theories of Kleinian groups hyperbolic groups and holomorphic dynamics the dynamics and iteration of rational maps automatic groups and the combinatorics of right angled Artin groups Geometry, Groups and Dynamics C. S. Aravinda, William M. Goldman, Krishnendu Gongopadhyay, Alexander Lubotzky, Mahan Mj, Anthony Weaver, 2015-05-01 This volume contains the proceedings of the ICTS Program Groups Geometry and Dynamics held December 3 16 2012 at CEMS Almora India The activity was an academic tribute to Ravi S Kulkarni on his turning seventy Articles included in this volume both introductory and advanced surveys represent the broad area of geometry that encompasses a large portion of group theory finite or otherwise and dynamics in its proximity These areas have been influenced by Kulkarni's ideas and are closely related to his work and contribution **Handbook of Teichmüller Theory** Athanase Papadopoulos, 2007 The subject of this handbook is Teichmüller theory in a wide sense namely the theory of geometric structures on surfaces and their moduli spaces This includes the study of vector bundles on these moduli spaces the study of mapping class groups the relation with 3 manifolds the relation with symmetric spaces and arithmetic groups the representation theory of fundamental groups and applications to physics Thus the handbook is a place where several fields of mathematics interact Riemann surfaces hyperbolic geometry partial differential equations several complex variables algebraic geometry algebraic topology combinatorial topology low dimensional topology theoretical physics and others This confluence of ideas toward a unique subject is a manifestation of the unity and harmony of mathematics This volume contains surveys on the fundamental theory as well as surveys on applications to and relations with the fields mentioned above It is written by leading experts in these fields Some of the surveys contain classical material while others present the latest developments of the theory as well as open problems This volume is divided into the following four sections The metric and the analytic theory The group theory The algebraic topology of mapping class groups and moduli spaces Teichmüller theory and mathematical physics This handbook is addressed to graduate students and researchers in all the fields mentioned

Combinatorial and Geometric Group Theory Sean Cleary, 2002 This volume grew out of two AMS conferences held at Columbia University New York NY and the Stevens Institute of Technology Hoboken NJ and presents articles on a wide variety of topics in group theory Readers will find a variety of contributions including a collection of over 170 open problems in combinatorial group theory three excellent survey papers on boundaries of hyperbolic groups on fixed points of free group automorphisms and on groups of automorphisms of compact Riemann surfaces and several original research papers that represent the diversity of current trends in combinatorial and geometric group theory The book is an excellent reference source for graduate students and research mathematicians interested in various aspects of group theory *The Geometry of Discrete Groups* Alan F. Beardon, 2012-12-06 This text is intended to serve as an introduction to the geometry of the action of discrete groups of Möbius transformations The subject matter has now been studied with changing points of emphasis for over a hundred years the most recent developments being connected with the theory of 3 manifolds see for example the

papers of Poincaré 77 and Thurston 101 About 1940 the now well known but virtually unobtainable Fenchel Nielsen manuscript appeared Sadly the manuscript never appeared in print and this more modest text attempts to display at least some of the beautiful geometrical ideas to be found in that manuscript as well as some more recent material The text has been written with the conviction that geometrical explanations are essential for a full understanding of the material and that however simple a matrix proof might seem a geometric proof is almost certainly more profitable Further wherever possible results should be stated in a form that is invariant under conjugation thus making the intrinsic nature of the result more apparent Despite the fact that the subject matter is concerned with groups of isometries of hyperbolic geometry many publications rely on Euclidean estimates and geometry However the recent developments have again emphasized the need for hyperbolic geometry and I have included a comprehensive chapter on analytical not axiomatic hyperbolic geometry It is hoped that this chapter will serve as a dictionary of formulae in plane hyperbolic geometry and as such will be of interest and use in its own right

Lectures on Kähler Groups Pierre Py, 2025-03-25 An introduction to the state of the art in the study of Kähler groups This book gives an authoritative and up to date introduction to the study of fundamental groups of compact Kähler manifolds known as Kähler groups Approaching the subject from the perspective of a geometric group theorist Pierre Py equips readers with the necessary background in both geometric group theory and Kähler geometry covering topics such as the actions of Kähler groups on spaces of nonpositive curvature the large scale geometry of infinite covering spaces of compact Kähler manifolds and the topology of level sets of pluriharmonic functions Presenting the most important results from the past three decades the book provides graduate students and researchers with detailed original proofs of several central theorems including Gromov and Schoen's description of Kähler group actions on trees the study of solvable quotients of Kähler groups following the works of Arapura Beauville Campana Delzant and Nori and Napier and Ramachandran's work characterizing covering spaces of compact Kähler manifolds having many ends It also describes without proof many of the recent breakthroughs in the field *Lectures on Kähler Groups* also gives in eight appendixes detailed introductions to such topics as the study of ends of groups and spaces groups acting on trees and Hilbert spaces potential theory and L^2 cohomology on Riemannian manifolds

Crystallographic Groups and Their Generalizations Paul Igodt, 2000 This volume contains articles written by the invited speakers and workshop participants from the conference on Crystallographic Groups and Their Generalizations held at Katholieke Universiteit Leuven Kortrijk Belgium Presented are recent developments and open problems Topics include the theory of affine structures and polynomial structures affine Schottky groups and crooked tilings theory and problems on the geometry of finitely generated solvable groups flat Lorentz 3 manifolds and Fuchsian groups filiform Lie algebras hyperbolic automorphisms and Anosov diffeomorphisms on infranilmanifolds localization theory of virtually nilpotent groups and aspherical spaces projective varieties and results on affine apartment systems Participants delivered high level research mathematics and a discussion was held forum for new

researchers The survey results and original papers contained in this volume offer a comprehensive view of current developments in the field

Geometry, Rigidity, and Group Actions Robert J. Zimmer, Benson Farb, David Fisher, 2011-04-15 The study of group actions is more than 100 years old but remains a widely studied topic in a variety of mathematic fields A central development in the last 50 years is the phenomenon of rigidity whereby one can classify actions of certain groups This book looks at rigidity

In the Tradition of Ahlfors-Bers, V Mario Bonk, 2010 The Ahlfors Bers Colloquia commemorate the mathematical legacy of Lars Ahlfors and Lipman Bers The core of this legacy lies in the fields of geometric function theory Teichmüller theory hyperbolic geometry and partial differential equations However the work of Ahlfors and Bers has impacted and created interactions with many other fields of mathematics such as algebraic geometry dynamical systems topology geometric group theory mathematical physics and number theory Recent years have seen a flowering of this legacy with an increased interest in their work This current volume contains articles on a wide variety of subjects that are central to this legacy These include papers in Kleinian groups classical Riemann surface theory translation surfaces algebraic geometry and dynamics The majority of the papers present new research but there are survey articles as well

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