

Ratner's Theorems on Unipotent Flows

Dave Witte Morris

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**Elisabetta Colombo, Barbara
Fantechi, Paola Frediani, Donatella
Iacono, Rita Pardini**



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Ratner's Theorems on Unipotent Flows Dave Witte Morris, 2005-08-15 The theorems of Berkeley mathematician Marina Ratner have guided key advances in the understanding of dynamical systems Unipotent flows are well behaved dynamical systems and Ratner has shown that the closure of every orbit for such a flow is of a simple algebraic or geometric form In *Ratner's Theorems on Unipotent Flows* Dave Witte Morris provides both an elementary introduction to these theorems and an account of the proof of Ratner's measure classification theorem A collection of lecture notes aimed at graduate students the first four chapters of *Ratner's Theorems on Unipotent Flows* can be read independently The first chapter intended for a fairly general audience provides an introduction with examples that illustrate the theorems some of their applications and the main ideas involved in the proof In the following chapters Morris introduces entropy ergodic theory and the theory of algebraic groups The book concludes with a proof of the measure theoretic version of Ratner's Theorem With new material that has never before been published in book form *Ratner's Theorems on Unipotent Flows* helps bring these important theorems to a broader mathematical readership

Ratner's Theorems on Unipotent Flows Dave Witte Morris, 2005-08-15 The theorems of Berkeley mathematician Marina Ratner have guided key advances in the understanding of dynamical systems Unipotent flows are well behaved dynamical systems and Ratner has shown that the closure of every orbit for such a flow is of a simple algebraic or geometric form In *Ratner's Theorems on Unipotent Flows* Dave Witte Morris provides both an elementary introduction to these theorems and an account of the proof of Ratner's measure classification theorem A collection of lecture notes aimed at graduate students the first four chapters of *Ratner's Theorems on Unipotent Flows* can be read independently The first chapter intended for a fairly general audience provides an introduction with examples that illustrate the theorems some of their applications and the main ideas involved in the proof In the following chapters Morris introduces entropy ergodic theory and the theory of algebraic groups The book concludes with a proof of the measure theoretic version of Ratner's Theorem With new material that has never before been published in book form *Ratner's Theorems on Unipotent Flows* helps bring these important theorems to a broader mathematical readership

Proceedings Of The International Congress Of Mathematicians 2010 (Icm 2010) (In 4 Volumes) - Vol. I: Plenary Lectures And Ceremonies, Vols. II-IV: Invited Lectures Rajendra Bhatia, Arup Pal, G Rangarajan, V Srinivas, M Vanninathan, 2011-06-06 ICM 2010 proceedings comprises a four volume set containing articles based on plenary lectures and invited section lectures the Abel and Noether lectures as well as contributions based on lectures delivered by the recipients of the Fields Medal the Nevanlinna and Chern Prizes The first volume will also contain the speeches at the opening and closing ceremonies and other highlights of the Congress

Handbook of Dynamical Systems B. Hasselblatt, A. Katok, 2002-08-20 Volumes 1A and 1B These volumes give a comprehensive survey of dynamics written by specialists in the various subfields of dynamical systems The presentation attains coherence through a major introductory survey by the

editors that organizes the entire subject and by ample cross references between individual surveys The volumes are a valuable resource for dynamicists seeking to acquaint themselves with other specialties in the field and to mathematicians active in other branches of mathematics who wish to learn about contemporary ideas and results dynamics Assuming only general mathematical knowledge the surveys lead the reader towards the current state of research in dynamics Volume 1B will appear 2005

Ergodic Theory and Its Connection with Harmonic Analysis Karl Endel Petersen, 1995 Tutorial survey papers on important areas of ergodic theory with related research papers *Equidistribution in Number Theory, An Introduction* Andrew Granville, Zeév Rudnick, 2007-04-08 From July 11th to July 22nd 2005 a NATO advanced study institute as part of the series Seminaire de mathematiques superieures was held at the U versite de Montreal on the subject Equidistribution in the theory of numbers There were about one hundred participants from sixteen countries around the world This volume presents details of the lecture series that were given at the school Across the broad panorama of topics that constitute modern number t ory one nds shifts of attention and focus as more is understood and better questions are formulated Over the last decade or so we have noticed incre ing interest being paid to distribution problems whether of rational points of zeros of zeta functions of eigenvalues etc Although these problems have been motivated from very di erent perspectives one nds that there is much in common and presumably it is healthy to try to view such questions as part of a bigger subject It is for this reason we decided to hold a school on Equidistribution in number theory to introduce junior researchers to these beautiful questions and to determine whether di erent approaches can in uence one another There are far more good problems than we had time for in our schedule We thus decided to focus on topics that are clearly inter related or do not require a lot of background to understand

Rationality of Varieties Gavril Farkas, Gerard van der Geer, Mingmin Shen, Lenny Taelman, 2021-10-19 This book provides an overview of the latest progress on rationality questions in algebraic geometry It discusses new developments such as universal triviality of the Chow group of zero cycles various aspects of stable birationality cubic and Fano fourfolds rationality of moduli spaces and birational invariants of group actions on varieties contributed by the foremost experts in their fields The question of whether an algebraic variety can be parametrized by rational functions of as many variables as its dimension has a long history and played an important role in the history of algebraic geometry Recent developments in algebraic geometry have made this question again a focal point of research and formed the impetus to organize a conference in the series of conferences on the island of Schiermonnikoog The book follows in the tradition of earlier volumes which originated from conferences on the islands Texel and Schiermonnikoog

Group Actions in Ergodic Theory, Geometry, and Topology Robert J. Zimmer, 2019-12-23 Robert J Zimmer is best known in mathematics for the highly influential conjectures and program that bear his name Group Actions in Ergodic Theory Geometry and Topology Selected Papers brings together some of the most significant writings by Zimmer which lay out his program and contextualize his work over the course of his career Zimmer s body of work is remarkable in that it involves

methods from a variety of mathematical disciplines such as Lie theory differential geometry ergodic theory and dynamical systems arithmetic groups and topology and at the same time offers a unifying perspective After arriving at the University of Chicago in 1977 Zimmer extended his earlier research on ergodic group actions to prove his cocycle superrigidity theorem which proved to be a pivotal point in articulating and developing his program Zimmer's ideas opened the door to many others and they continue to be actively employed in many domains related to group actions in ergodic theory geometry and topology In addition to the selected papers themselves this volume opens with a foreword by David Fisher Alexander Lubotzky and Gregory Margulis as well as a substantial introductory essay by Zimmer recounting the course of his career in mathematics The volume closes with an afterword by Fisher on the most recent developments around the Zimmer program

Mathematics of Complexity and Dynamical Systems Robert A. Meyers, 2011-10-05 Mathematics of Complexity and Dynamical Systems is an authoritative reference to the basic tools and concepts of complexity systems theory and dynamical systems from the perspective of pure and applied mathematics Complex systems are systems that comprise many interacting parts with the ability to generate a new quality of collective behavior through self organization e g the spontaneous formation of temporal spatial or functional structures These systems are often characterized by extreme sensitivity to initial conditions as well as emergent behavior that are not readily predictable or even completely deterministic The more than 100 entries in this wide ranging single source work provide a comprehensive explication of the theory and applications of mathematical complexity covering ergodic theory fractals and multifractals dynamical systems perturbation theory solitons systems and control theory and related topics Mathematics of Complexity and Dynamical Systems is an essential reference for all those interested in mathematical complexity from undergraduate and graduate students up through professional researchers

Birational Geometry and Moduli Spaces Elisabetta Colombo, Barbara Fantechi, Paola Frediani, Donatella Iacono, Rita Pardini, 2020-02-25 This volume collects contributions from speakers at the INdAM Workshop Birational Geometry and Moduli Spaces which was held in Rome on 11-15 June 2018 The workshop was devoted to the interplay between birational geometry and moduli spaces and the contributions of the volume reflect the same idea focusing on both these areas and their interaction In particular the book includes both surveys and original papers on irreducible holomorphic symplectic manifolds Severi varieties degenerations of Calabi-Yau varieties uniruled threefolds toric Fano threefolds mirror symmetry canonical bundle formula the Lefschetz principle birational transformations and deformations of diagrams of algebras The intention is to disseminate the knowledge of advanced results and key techniques used to solve open problems The book is intended for all advanced graduate students and researchers interested in the new research frontiers of birational geometry and moduli spaces

Dynamics and Randomness II Alejandro Maass, Servet Martínez, Jaime San Martín, 2004-04-30 This book contains the lectures given at the Second Conference on Dynamics and Randomness held at the Centro de Modelamiento Matemático of the Universidad de Chile from December 9-13 2003 This meeting brought together mathematicians theoretical physicists

theoretical computer scientists and graduate students interested in fields related to probability theory ergodic theory symbolic and topological dynamics The courses were on Some Aspects of Random Fragmentations in Continuous Times Metastability of Ageing in Stochastic Dynamics Algebraic Systems of Generating Functions and Return Probabilities for Random Walks Recurrent Measures and Measure Rigidity Stochastic Particle Approximations for Two Dimensional Navier Stokes Equations and Random and Universal Metric Spaces The intended audience for this book is Ph D students on Probability and Ergodic Theory as well as researchers in these areas The particular interest of this book is the broad areas of problems that it covers We have chosen six main topics and asked six experts to give an introductory course on the subject touching the latest advances on each problem

Dynamics and Analytic Number Theory Dzmitry Badziahin,Alexander Gorodnik,Norbert Peyerimhoff,2016-11-10 Presents current research in various topics including homogeneous dynamics Diophantine approximation and combinatorics

Elements of Dynamical Systems Anima Nagar,Riddhi Shah,Shrihari Sridharan,2022-11-11 This book stems from lectures that were delivered at the three week Advanced Instructional School on Ergodic Theory and Dynamical Systems held at the Indian Institute of Technology Delhi from 4-23 December 2017 with the support of the National Centre for Mathematics National Board for Higher Mathematics Department of Atomic Energy Government of India The book discusses various aspects of dynamical systems Each chapter of this book specializes in one aspect of dynamical systems and thus begins at an elementary level and goes on to cover fairly advanced material The book helps researchers be familiar with and navigate through different parts of ergodic theory and dynamical systems

Translation Surfaces Jayadev S. Athreya,Howard Masur,2024-04-17 This textbook offers an accessible introduction to translation surfaces Building on modest prerequisites the authors focus on the fundamentals behind big ideas in the field ergodic properties of translation flows counting problems for saddle connections and associated renormalization techniques Proofs that go beyond the introductory nature of the book are deftly omitted allowing readers to develop essential tools and motivation before delving into the literature Beginning with the fundamental example of the flat torus the book goes on to establish the three equivalent definitions of translation surface An introduction to the moduli space of translation surfaces follows leading into a study of the dynamics and ergodic theory associated to a translation surface Counting problems and group actions come to the fore in the latter chapters giving a broad overview of progress in the 40 years since the ergodicity of the Teichmüller geodesic flow was proven Exercises are included throughout inviting readers to actively explore and extend the theory along the way Translation Surfaces invites readers into this exciting area providing an accessible entry point from the perspectives of dynamics ergodicity and measure theory Suitable for a one or two semester graduate course it assumes a background in complex analysis measure theory and manifolds while some familiarity with Riemann surfaces and ergodic theory would be beneficial

Dynamics, Geometry, Number Theory David Fisher,Dmitry Kleinbock,Gregory Soifer,2022-02-07 This definitive synthesis of mathematician Gregory Margulis's research brings together leading experts to

cover the breadth and diversity of disciplines Margulis's work touches upon. This edited collection highlights the foundations and evolution of research by widely influential Fields Medalist Gregory Margulis. Margulis is unusual in the degree to which his solutions to particular problems have opened new vistas of mathematics; his ideas were central, for example, to developments that led to the recent Fields Medals of Elon Lindenstrauss and Maryam Mirzakhani. **Dynamics, Geometry, Number Theory** introduces these areas, their development, their use in current research, and the connections between them. Divided into four broad sections: Arithmeticity, Superrigidity, Normal Subgroups, Discrete Subgroups, Expanders, Representations, Spectral Theory, and Homogeneous Dynamics, the chapters have all been written by the foremost experts on each topic, with a view to making them accessible both to graduate students and to experts in other parts of mathematics. This was no simple feat: Margulis's work stands out in part because of its depth, but also because it brings together ideas from different areas of mathematics. Few can be experts in all of these fields, and this diversity of ideas can make it challenging to enter Margulis's area of research. **Dynamics, Geometry, Number Theory** provides one remedy to that challenge. **Geometric Methods in Physics** Piotr Kielanowski, Pierre Bieliavsky, Anatol Odziejewicz, Martin Schlichenmaier, Theodore Voronov, 2015-09-21. This book presents a selection of papers based on the XXXIII Biaowie a Workshop on Geometric Methods in Physics 2014. The Biaowie a Workshops are among the most important meetings in the field and attract researchers from both mathematics and physics. The articles gathered here are mathematically rigorous and have important physical implications, addressing the application of geometry in classical and quantum physics. Despite their long tradition, the workshops remain at the cutting edge of ongoing research. For the last several years, each Biaowie a Workshop has been followed by a School on Geometry and Physics, where advanced lectures for graduate students and young researchers are presented; some of the lectures are reproduced here. The unique atmosphere of the workshop and school is enhanced by its venue, framed by the natural beauty of the Biaowie a forest in eastern Poland. The volume will be of interest to researchers and graduate students in mathematical physics, theoretical physics, and mathematics. **Ergodic Theory** Manfred Einsiedler, Thomas Ward, 2010-09-11. This text is a rigorous introduction to ergodic theory, developing the machinery of conditional measures and expectations, mixing, and recurrence. Beginning by developing the basics of ergodic theory and progressing to describe some recent applications to number theory, this book goes beyond the standard texts in this topic. Applications include Weyl's polynomial equidistribution theorem, the ergodic proof of Szemerédi's theorem, the connection between the continued fraction map and the modular surface, and a proof of the equidistribution of horocycle orbits. **Ergodic Theory with a View Towards Number Theory** will appeal to mathematicians with some standard background in measure theory and functional analysis. No background in ergodic theory or Lie theory is assumed, and a number of exercises and hints to problems are included, making this the perfect companion for graduate students and researchers in ergodic theory, homogeneous dynamics, or number theory. *An Introduction to Probabilistic Number Theory* Emmanuel

Kowalski, 2021-05-06 This introductory textbook for graduate students presents modern developments in probabilistic number theory many for the first time

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

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