Spectral Theory of Automorphic Functions-A B Venkov 1990-10-31
Spectral Methods of Automorphic Forms-Henryk Iwaniec 1995 Automorphic forms are one of the central topics of analytic number theory. In fact, they sit at the confluence of analysis, algebra, geometry, and number theory. In this book, Henryk Iwaniec once again displays his penetrating insight, powerful analytic techniques, and lucid writing style. The first edition of this book was an underground classic, both as a textbook and as a respected source for results, ideas, and references. Iwaniec treats the spectral theory of automorphic forms as the study of the space of $L^2$ functions on the upper half plane modulo a discrete subgroup. Key topics include Eisenstein series, estimates of Fourier coefficients, Kloosterman sums, the Selberg trace formula and the theory of small eigenvalues. Henryk Iwaniec was awarded the 2002 Cole Prize for his fundamental contributions to number theory.

Spectral Theory of the Riemann Zeta-Function-Yoichi Motohashi 1997-09-11 The Riemann zeta function is one of the most studied objects in mathematics, and is of fundamental importance. In this book, based on his own research, Professor Motohashi shows that the function is closely bound with automorphic forms and that many results from there can be woven with techniques and ideas from analytic number theory to yield new insights into, and views of, the zeta function itself. The story starts with an elementary but unabridged treatment of the spectral resolution of the non-Euclidean Laplacian and the trace formulas. This is achieved by the use of standard tools from analysis rather than any heavy machinery, forging a substantial aid for beginners in spectral theory as well. These ideas are then utilized to unveil an image of the zeta-function, first perceived by the author, revealing it to be the main gem of a necklace composed of all automorphic L-functions. In this book, readers will find a detailed account of one of the most fascinating stories in the development of number theory, namely the fusion of two main fields in mathematics that were previously studied separately.

Scattering Theory for Automorphic Functions-Peter D. Lax 1976 The application by Fadeev and Pavlov of the Lax-Phillips scattering theory to the automorphic wave equation led Professors Lax and Phillips to reexamine this development within the framework of their theory. This volume sets forth the results of that work in the form of new or more straightforward treatments of the spectral theory of the Laplace-Beltrami operator over fundamental domains of finite area; the meromorphic character over the whole complex plane of the Eisenstein series; and the Selberg trace formula. CONTENTS: 1. Introduction. 2. An abstract scattering theory. 3. A modified theory for second order equations with an indefinite energy form. 4. The Laplace-Beltrami operator for the modular group. 5. The automorphic wave equation. 6. Incoming and outgoing subspaces for the automorphic wave equations. 7. The scattering matrix for the automorphic wave equation. 8. The general case. 9. The Selberg trace formula.
Scattering Theory for Automorphic Functions. (AM-87), Volume 87-Peter D. Lax 2016-03-02 The application by Fadeev and Pavlov of the Lax-Phillips scattering theory to the automorphic wave equation led Professors Lax and Phillips to reexamine this development within the framework of their theory. This volume sets forth the results of that work in the form of new or more straightforward treatments of the spectral theory of the Laplace-Beltrami operator over fundamental domains of finite area; the meromorphic character over the whole complex plane of the Eisenstein series; and the Selberg trace formula. CONTENTS: 1. Introduction. 2. An abstract scattering theory. 3. A modified theory for second order equations with an
indefinite energy form. 4. The Laplace-Beltrami operator for the modular group. 5. The automorphic wave equation. 6. Incoming and outgoing subspaces for the automorphic wave equations. 7. The scattering matrix for the automorphic wave equation. 8. The general case. 9. The Selberg trace formula.

Spectral Theory for Bounded Functions and Applications to Evolution Equations-Gaston Mandata NGuerekata 2017 One of the central questions in the qualitative theory of difference and differential equations is to find the conditions of existence and asymptotic behavior of bounded solutions. For equations with almost periodic coefficients, the problem concerns Favard and Perron. A remarkable theory has been developed in harmonic analysis with outstanding contributions by Loomis, Arendt, Batty, Lyubic, Phong, Naito, Minh and many others, when the Carleman spectrum of the functions is countable. Uniform continuity in this case plays a key role. In the absence of this condition, the theory does not apply. This led to the introduction over the last decade of new types of spectrum functions which helped solve the problem, especially in the case of almost automorphic functions by using the theory of commutating operators. This monograph presents a unique and unified manner of recent developments in the theory of bounded continuous functions, including the space of (Bohr) almost periodic functions and some of their generalisations, and the spaces of (Bochner) almost automorphic functions and almost automorphic sequences. Classical concepts from harmonic analysis such as the Bohr spectrum, Beurling spectrum and Carleman spectrum are also presented with some examples. Special attention is devoted to the recently introduced concepts of uniform spectrum and circular spectrum of bounded functions derived from the study of linear differential equation solutions, whose forcing terms are not necessarily uniformly continuous. Connections between these various types of spectra are also investigated. The book provides a semigroup-free study of the existence and asymptotic behavior of mild solutions concerning evolution equations of the first and second order as well as difference equations. Bibliographical and historical notes complete the major chapters. An appendix reviewing basic results on the theory of commutating operators is given. The content is presented in a way that is easily accessible to readers who are working in differential equations, but are not familiar with harmonic analysis and advanced functional analysis. Its our hope that this first monograph ever on this topic will attract more researchers.

Pseudodifferential Analysis, Automorphic Distributions in the Plane and Modular Forms-André Unterberger 2011-08-06 Pseudodifferential analysis, introduced in this book in a way adapted to the needs of number theorists, relates automorphic function theory in the hyperbolic half-plane Π to automorphic distribution theory in the plane. Spectral-theoretic questions are discussed in one or the other environment: in the latter one, the problem of decomposing automorphic functions in Π according to the spectral decomposition of the modular Laplacian gives way to the simpler one of decomposing automorphic distributions in R2 into homogeneous components. The Poincaré summation process, which consists in building automorphic distributions as series of g-transforms, for g E SL(2;Z), of some initial function, say in S(R2), is analyzed in detail. On Π, a large class of new automorphic functions or measures is built in the same way: one of its features lies in an interpretation, as a spectral density, of the restriction of the zeta function to any line within the critical strip. The book is addressed to a wide audience of advanced graduate students and researchers working in analytic number theory or pseudo-differential analysis.

Spectral Decomposition and Eisenstein Series-C. Moeglin 1995-11-02 A self-contained introduction to automorphic forms, and Eisenstein series and pseudo-series, proving some of Langlands' work at the intersection of number theory and group theory.
Automorphic Forms and Applications-Peter Sarnak 2007 The theory of automorphic forms has seen dramatic developments in recent years. In particular, important instances of Langlands functoriality have been established. This volume presents three weeks of lectures from the IAS/Park City Mathematics Institute Summer School on automorphic forms and their applications. It addresses some of the general aspects of automorphic forms, as well as certain recent advances in the field. The book starts with the lectures of Borel on the basic theory of automorphic forms, which lay the foundation for the lectures by Cogdell and Shahidi on converse theorems and the Langlands-Shahidi method, as well as those by Clozel and Li on the Ramanujan conjectures and graphs. The analytic theory of GL(2)-forms and $L$-functions are the subject of Michel's lectures, while Terras covers arithmetic quantum chaos. The volume also includes a chapter by Vogan on isolated unitary representations, which is related to the lectures by Clozel. This volume is recommended for independent study or an advanced topics course. It is suitable for graduate students and researchers interested in automorphic forms and number theory. the Institute for Advanced Study/Park City Mathematics Institute. Members of the Mathematical Association of America (MAA) and the National Council of Teachers of Mathematics (NCTM) receive a 20% discount from list price.

Scattering Theory for Automorphic Functions and Its Relation to L-functions-Ioannis N. Petridis 1992

Eisenstein Series and Applications-Wee Teck Gan 2007-12-22 Eisenstein series are an essential ingredient in the spectral theory of automorphic forms and an important tool in the theory of L-functions. They have also been exploited extensively by number theorists for many arithmetic purposes. Bringing together contributions from areas which do not usually interact with each other, this volume introduces diverse users of Eisenstein series to a variety of important applications. With this juxtaposition of perspectives, the reader obtains deeper insights into the arithmetic of Eisenstein series. The central theme of the exposition focuses on the common structural properties of Eisenstein series occurring in many related applications.

Introduction to the Spectral Theory of Automorphic Forms-Henryk Iwaniec 1995

Families of Automorphic Forms-Roelof W. Bruggeman 2009-11-23 Automorphic forms on the upper half plane have been studied for a long time. Most attention has gone to the holomorphic automorphic forms, with numerous applications to number theory. Maass, [34], started a systematic study of real analytic automorphic forms. He extended Hecke's relation between automorphic forms and Dirichlet series to real analytic automorphic forms. The names Selberg and Roelcke are connected to the spectral theory of real analytic automorphic forms, see, e. g. , [50], [51]. This culminates in the trace formula of Selberg, see, e. g. , Hejhal, [21]. Automorphicformsarefunctionsontheupperhalfplanewithspecialtransformation behavior under a discontinuous group of real analytic automorphic forms. One may ask how automorphic forms change if one perturbs this group of motions. This question is discussed by, e. g. , Hejhal, [22], and Phillips and Sarnak, [46]. Hejhal also discusses the effect of variation of the multiplier system (a function on the discontinuous group that occurs in the description of the transformation behavior of automorphic forms). In [5]-[7] I considered variation of automorphic forms for the full modular group under perturbation of the multiplier system. A method based on ideas of Colin de Verdi`ere, [11], [12], gave the meromorphic continuation of Eisenstein and Poincaré series as functions of the eigenvalue and the multiplier system jointly. The present study arose from a plan to extend these results to much more general groups (discrete co?nite subgroups of SL (R)).

Topics in Classical Automorphic Forms-Henryk Iwaniec 1997 The main purpose of the book is to present the reader with various perspectives of the theory of automorphic forms. In addition to detailed and often nonstandard exposition of familiar topics of the theory, with a particular emphasis on analytic aspects, special attention is paid to such subjects as theta-functions and representations of integers by quadratic forms.

Scattering Theory, Revised Edition-Peter D. Lax 1990-02-22 This revised edition of a classic book, which established scattering theory as an important and fruitful area of research, reflects the wealth of new results discovered in the intervening years. This new, revised edition should
continue to inspire researchers to expand the application of the original ideas proposed by the authors.

An Introduction to the Langlands Program-Joseph Bernstein 2013-12-11 This book presents a broad, user-friendly introduction to the Langlands program, that is, the theory of automorphic forms and its connection with the theory of L-functions and other fields of mathematics. Each of the twelve chapters focuses on a particular topic devoted to special cases of the program. The book is suitable for graduate students and researchers.

Cohomological Theory of Dynamical Zeta Functions-Andreas Juhl 2012-12-06 Dynamical zeta functions are associated to dynamical systems with a countable set of periodic orbits. The dynamical zeta functions of the geodesic flow of locally symmetric spaces of rank one are known also as the generalized Selberg zeta functions. The present book is concerned with these zeta functions from a cohomological point of view. Originally, the Selberg zeta function appeared in the spectral theory of automorphic forms and were suggested by an analogy between Weil’s explicit formula for the Riemann zeta function and Selberg’s trace formula ([261]). The purpose of the cohomological theory is to understand the analytical properties of the zeta functions on the basis of suitable analogs of the Lefschetz fixed point formula in which periodic orbits of the geodesic flow take the place of fixed points. This approach is parallel to Weil’s idea to analyze the zeta functions of projective algebraic varieties over finite fields on the basis of suitable versions of the Lefschetz fixed point formula. The Lefschetz formula formalism shows that the divisors of the rational Hasse-Weil zeta functions are determined by the spectra of Frobenius operators on l-adic cohomology.

Spectral Theory-David Borthwick 2020-03-12 This textbook offers a concise introduction to spectral theory, designed for newcomers to functional analysis. Curating the content carefully, the author builds to a proof of the spectral theorem in the early part of the book. Subsequent chapters illustrate a variety of application areas, exploring key examples in detail. Readers looking to delve further into specialized topics will find ample references to classic and recent literature. Beginning with a brief introduction to functional analysis, the text focuses on unbounded operators and separable Hilbert spaces as the essential tools needed for the subsequent theory. A thorough discussion of the concepts of spectrum and resolvent follows, leading to a complete proof of the spectral theorem for unbounded self-adjoint operators. Applications of spectral theory to differential operators comprise the remaining four chapters. These chapters introduce the Dirichlet Laplacian operator, Schrödinger operators, operators on graphs, and the spectral theory of Riemannian manifolds. Spectral Theory offers a uniquely accessible introduction to ideas that invite further study in any number of different directions. A background in real and complex analysis is assumed; the author presents the requisite tools from functional analysis within the text. This introductory treatment would suit a functional analysis course intended as a pathway to linear PDE theory. Independent later chapters allow for flexibility in selecting applications to suit specific interests within a one-semester course.

Spectral Theory of Infinite-Area Hyperbolic Surfaces-David Borthwick 2007-09-13 This book is a self-contained monograph on spectral theory for non-compact Riemann surfaces, focused on the infinite-volume case. By focusing on the scattering theory of hyperbolic surfaces, this work provides a compelling introductory example which will be accessible to a broad audience. The book opens with an introduction to the geometry of hyperbolic surfaces. Then a thorough development of the spectral theory of a geometrically finite hyperbolic surface of infinite volume is given. The final sections include recent developments for which no thorough account exists.

Mathematical Quantum Theory II-Joel S. Feldman The articles in this collection constitute the proceedings of the Canadian Mathematical Society Annual Seminar on Mathematical Quantum Theory, held in Vancouver in August 1993. The meeting was run as a research-level summer school concentrating on two related areas of contemporary mathematical physics. The first area, quantum field theory and many-body theory, is covered in volume 1 of these proceedings. The second area, treated in the present volume, is Schrödinger operators. The meeting featured a series of four-hour mini-courses, designed to introduce students to the state of the art in particular areas, and thirty hour-long expository lectures. With contributions
from some of the top experts in the field, this book is an important resource for those interested in activity at the frontiers of mathematical quantum theory.

Groups Acting on Hyperbolic Space-Juergen Elstrodt 2013-03-09 This book is concerned with discontinuous groups of motions of the unique connected and simply connected Riemannian 3-manifold of constant curvature -1, which is traditionally called hyperbolic 3-space. This space is the 3-dimensional instance of an analogous Riemannian manifold which exists uniquely in every dimension n (n > 2). The hyperbolic spaces appeared first in the work of Lobachevski in the first half of the 19th century. Very early in the last century the group of isometries of these spaces was studied by Steiner, when he looked at the group generated by the inversions in spheres. The geometries underlying the hyperbolic spaces were of fundamental importance since Lobachevski, Bolyai and Gauß had observed that they do not satisfy the axiom of parallels. Already in the classical works several concrete coordinate models of hyperbolic 3-space have appeared. They make explicit computations possible and also give identifications of the full group of motions or isometries with well-known matrix groups. One such model, due to H. Poincare, is the upper 3 half-space $\mathbb{H}$ in $\mathbb{R}^3$. The group of isometries is then identified with an extension of index 2 of the group $\text{PSL}(2,\mathbb{R})$. 

Analytic Number Theory, Mathematical Analysis and Their Applications-Nikolai Nikolaevich Bogoliubov 1984 This "Proceedings of the Steklov Institute of Mathematics" together with the volume preceding it (Volume 157), is a collection of papers dedicated to Academician I. M. Vinogradov on his ninetieth birthday. This volume contains original papers on various branches of mathematics: analytic number theory, algebra, partial differential equations, probability theory, and differential games.

The Arithmetic and Spectral Analysis of Poincaré Series-James W. Cogdell 2014-07-14 The Arithmetic and Spectral Analysis of Poincaré series deals with the spectral properties of Poincaré series and their relation to Kloosterman sums. In addition to Poincaré series for an arbitrary Fuchsian group of the first kind, the spectral expansion of the Kloosterman-Selberg zeta function is analyzed, along with the adelic theory of Poincaré series and Kloosterman sums over a global function field. This volume is divided into two parts and begins with a discussion on Poincaré series and Kloosterman sums for Fuchsian groups of the first kind. A conceptual proof of Kuznetsov's formula and its generalization are presented in terms of the spectral analysis of Poincaré series in the framework of representation theory. An analysis of the spectral expansion of the Kloosterman-Selberg zeta function is also included. The second part develops the adelic theory of Poincaré series and Kloosterman sums over a global function field. The main result here is to show that in this context the analogue of the Linnik conjecture can be derived from the Ramanujan conjecture over function fields. Whittaker models, Kirillov models, and Bessel functions are also considered, along with the Kloosterman-spectral formula, convergence, and continuation. This book will be a valuable resource for students of mathematics.

Dynamical, Spectral, and Arithmetic Zeta Functions-Spectral AMS Special Session on Dynamical 2001 The original zeta function was studied by Riemann as part of his investigation of the distribution of prime numbers. Other sorts of zeta functions were defined for number-theoretic purposes, such as the study of primes in arithmetic progressions. This led to the development of $L$-functions, which now have several guises. It eventually became clear that the basic construction used for number-theoretic zeta functions can also be used in other settings, such as dynamics, geometry, and spectral theory, with remarkable results. This volume grew out of the special session on dynamical, spectral, and arithmetic zeta functions held at the annual meeting of the American Mathematical Society in San Antonio, but also includes four articles that were invited to be part of the collection. The purpose of the meeting was to bring together leading researchers, to find links and analogies between their fields, and to explore new methods. The papers discuss dynamical systems, spectral geometry on hyperbolic manifolds, trace formulas in geometry and in arithmetic, as well as computational work on the Riemann zeta function. Each article employs techniques of zeta functions. The book unifies the application of these
techniques in spectral geometry, fractal geometry, and number theory. It is a comprehensive volume, offering up-to-date research. It should be useful to both graduate students and confirmed researchers.

The Spectral Theory of Geometrically Periodic Hyperbolic 3-Manifolds-Charles L. Epstein 1985

Contributions to the Theory of Zeta-Functions-Shigeru Kanemitsu 2015 This volume provides a systematic survey of almost all the equivalent assertions to the functional equations - zeta symmetry - which zeta-functions satisfy, thus streamlining previously published results on zeta-functions. The equivalent relations are given in the form of modular relations in Fox H-function series, which at present include all that have been considered as candidates for ingredients of a series. The results are presented in a clear and simple manner for readers to readily apply without much knowledge of zeta-functions. This volume aims to keep a record of the 150-year-old heritage starting from Riemann on zeta-functions, which are ubiquitous in all mathematical sciences, wherever there is a notion of the norm. It provides almost all possible equivalent relations to the zeta-functions without requiring a reader’s deep knowledge on their definitions. This can be an ideal reference book for those studying zeta-functions.

Pseudodifferential Operators with Automorphic Symbols-André Unterberger 2015-06-22 The main results of this book combine pseudo differential analysis with modular form theory. The methods rely for the most part on explicit spectral theory and the extended use of special functions. The starting point is a notion of modular distribution in the plane, which will be new to most readers and relates under the Radon transformation to the classical one of modular form of the non-holomorphic type. Modular forms of the holomorphic type are addressed too in a more concise way, within a general scheme dealing with quantization theory and elementary, but novel, representation-theoretic concepts.

Heads in Grammatical Theory-Greville G. Corbett 1993-06-24 A study of the idea of the 'head' or dominating element of a phrase.

L-Functions and Automorphic Forms-Jan Hendrik Bruinier 2018-02-22 This book presents a collection of carefully refereed research articles and lecture notes stemming from the Conference "Automorphic Forms and L-Functions", held at the University of Heidelberg in 2016. The theory of automorphic forms and their associated L-functions is one of the central research areas in modern number theory, linking number theory, arithmetic geometry, representation theory, and complex analysis in many profound ways. The 19 papers cover a wide range of topics within the scope of the conference, including automorphic L-functions and their special values, p-adic modular forms, Eisenstein series, Borcherds products, automorphic periods, and many more.

Automorphic Forms and L-Functions for the Group GL(n,R)-Dorian Goldfeld 2006-08-03 L-functions associated to automorphic forms encode all classical number theoretic information. They are akin to elementary particles in physics. This 2006 book provides an entirely self-contained introduction to the theory of L-functions in a style accessible to graduate students with a basic knowledge of classical analysis, complex variable theory, and algebra. Also within the volume are many new results not yet found in the literature. The exposition provides complete detailed proofs of results in an easy-to-read format using many examples and without the need to know and remember many complex definitions. The main themes of the book are first worked out for GL(2,R) and GL(3,R), and then for the general case of GL(n,R). In an appendix to the book, a set of Mathematica functions is presented, designed to allow the reader to explore the theory from a computational point of view.


Spectral Theory and Nonlinear Analysis with Applications to Spatial Ecology-An Approach to the Selberg Trace Formula via the Selberg Zeta-Function-Jürgen Fischer 2006-11-15 The Notes give a direct approach to the Selberg zeta-function for cofinite discrete subgroups of SL (2,#3) acting on the upper half-plane. The basic idea is to compute the trace of the iterated
resolvent kernel of the hyperbolic Laplacian in order to arrive at the logarithmic derivative of the Selberg zeta-function. Previous knowledge of the Selberg trace formula is not assumed. The theory is developed for arbitrary real weights and for arbitrary multiplier systems permitting an approach to known results on classical automorphic forms without the Riemann-Roch theorem. The author's discussion of the Selberg trace formula stresses the analogy with the Riemann zeta-function. For example, the canonical factorization theorem involves an analogue of the Euler constant. Finally the general Selberg trace formula is deduced easily from the properties of the Selberg zeta-function: this is similar to the procedure in analytic number theory where the explicit formulae are deduced from the properties of the Riemann zeta-function. Apart from the basic spectral theory of the Laplacian for cofinite groups the book is self-contained and will be useful as a quick approach to the Selberg zeta-function and the Selberg trace formula.

Spectral and Scattering Theory-M. Ikawa 2020-12-18 "This useful volume, based on the Taniguchi International Workshop held recently in Sanda, Hyogo, Japan, discusses current problems and offers the most up-to-date methods for research in spectral and scattering theory."

Number Theory, Analysis and Geometry-Dorian Goldfeld 2011-12-20 In honor of Serge Lang’s vast contribution to mathematics, this memorial volume presents articles by prominent mathematicians. Reflecting the breadth of Lang's own interests and accomplishments, these essays span the field of Number Theory, Analysis and Geometry.

Number Theory with an Emphasis on the Markoff Spectrum-Andrew Pollington 2017-10-05 Presenting the proceedings of a recently held conference in Provo, Utah, this reference provides original research articles in several different areas of number theory, highlighting the Markoff spectrum.;Detailing the integration of geometric, algebraic, analytic and arithmetic ideas, Number Theory with an Emphasis on the Markoff Spectrum contains refereed contributions on: general problems of diophantine approximation; quadratic forms and their connections with automorphic forms; the modular group and its subgroups; continued fractions; hyperbolic geometry; and the lower part of the Markoff spectrum.;Written by over 30 authorities in the field, this book should be a useful resource for research mathematicians in harmonic analysis, number theory algebra, geometry and probability and graduate students in these disciplines.

Number Theory-H. Kisilevsky This volume contains a collection of articles from the meeting of the Canadian Number Theory Association held at the Centre de Recherches Mathematiques (CRM) at the University of Montreal. The book represents a cross section of current research and new results in number theory. Topics covered include algebraic number theory, analytic number theory, arithmetic algebraic geometry, computational number theory, and Diophantine analysis and approximation. The volume contains both research and expository papers suitable for graduate students and researchers interested in number theory.

**Spectral Theory Of Automorphic Functions**

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