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**Modular Forms  
and Hecke Operators**

A. N. Andrianov  
V. G. Zhuravlev



American Mathematical Society

# Modular Forms And Hecke Operators

**Jayce Getz, Mark Goresky**



## **Modular Forms And Hecke Operators:**

Modular Forms and Hecke Operators A. N. Andrianov, V. G. Zhuravlev, 2016-01-29 The concept of Hecke operators was so simple and natural that soon after Hecke's work scholars made the attempt to develop a Hecke theory for modular forms such as Siegel modular forms. As this theory developed, the Hecke operators on spaces of modular forms in several variables were found to have arithmetic meaning. Specifically, the theory provided a framework for discovering certain multiplicative properties of the number of integer representations of quadratic forms by quadratic forms. Now that the theory has matured, the time is right for this detailed and systematic exposition of its fundamental methods and results. Features: The book starts with the basics and ends with the latest results explaining the current status of the theory of Hecke operators on spaces of holomorphic modular forms of integer and half-integer weight congruence subgroups of integral symplectic groups. Hecke operators are considered principally as an instrument for studying the multiplicative properties of the Fourier coefficients of modular forms. It is the authors' intent that *Modular Forms and Hecke Operators* help attract young researchers to this beautiful and mysterious realm of number theory.

*Modular Forms* Lloyd James Peter Kilford, 2008 This book presents a graduate student level introduction to the classical theory of modular forms and computations involving modular forms including modular functions and the theory of Hecke operators. It also includes applications of modular forms to such diverse subjects as the theory of quadratic forms, the proof of Fermat's last theorem, and the approximation of  $\pi$ . It provides a balanced overview of both the theoretical and computational sides of the subject, allowing a variety of courses to be taught from it.

Modular forms and Hecke operators A. N. Andrianov, V. G. Zhuravlev, 1995-08-28 The concept of Hecke operators was so simple and natural that soon after Hecke's work scholars made the attempt to develop a Hecke theory for modular forms such as Siegel modular forms. As this theory developed, the Hecke operators on spaces of modular forms in several variables were found to have arithmetic meaning. Specifically, the theory provided a framework for discovering certain multiplicative properties of the number of integer representations of quadratic forms by quadratic forms. Now that the theory has matured, the time is right for this detailed and systematic exposition of its fundamental methods and results. Features: The book starts with the basics and ends with the latest results explaining the current status of the theory of Hecke operators on spaces of holomorphic modular forms of integer and half-integer weight congruence subgroups of integral symplectic groups. Hecke operators are considered principally as an instrument for studying the multiplicative properties of the Fourier coefficients of modular forms. It is the authors' intent that *Modular Forms and Hecke Operators* help attract young researchers to this beautiful and mysterious realm of number theory.

**Modular Forms and Hecke Operators** Anatolii Nikolaevich Andrianov, 1995 The concept of Hecke operators was so simple and natural that soon after Hecke's work scholars made the attempt to develop a Hecke theory for modular forms such as Siegel modular forms. As this theory developed, the Hecke operators on spaces of modular forms in several variables were found to have arithmetic meaning. Specifically, the

theory provided a framework for discovering certain multiplicative properties of the number of integer representations of quadratic forms by quadratic forms Now that the theory has matured the time is right for this detailed and systematic exposition of its

**Modular Forms and Hecke Operators** Robert Alexander Rankin, 1999\* *Modular Forms* Toshitsune Miyake, 2006-02-17 For the most part this book is the translation from Japanese of the earlier book written jointly by Koji Doi and the author who revised it substantially for the English edition It sets out to provide the reader with the basic knowledge of elliptic modular forms necessary to understand the recent developments in number theory The first part gives the general theory of modular groups modular forms and Hecke operators with emphasis on the Hecke Weil theory of the relation between modular forms and Dirichlet series The second part is on the unit groups of quaternion algebras which are seldom dealt with in books The so called Eichler Selberg trace formula of Hecke operators follows next and the explicit computable formula is given In the last chapter written for the English edition Eisenstein series with parameter are discussed following the recent work of Shimura Eisenstein series are likely to play a very important role in the future progress of number theory and this chapter provides a good introduction to the topic

**Quadratic Forms and Hecke Operators** Anatolij N. Andrianov, 1987 The numerous explicit formulae of the classical theory of quadratic forms revealed remarkable multiplicative properties of the numbers of integral representations of integers by positive definite integral quadratic forms These properties were explained by the original theory of Hecke operators As regards the integral representations of quadratic forms in more than one variable by quadratic forms no multiplicative properties were known at that time and so there was nothing to explain However the idea of Hecke operators was so natural and attractive that soon attempts were made to cultivate it in the neighbouring field of modular forms of several variables The approach has proved to be fruitful in particular a number of multiplicative properties of integral representations of quadratic forms by quadratic forms were eventually discovered By now the theory has reached a certain maturity and the time has come to give an up to date report in a concise form in order to provide a solid ground for further development The purpose of this book is to present in the form of a self contained text book the contemporary state of the theory of Hecke operators on the spaces of holomorphic modular forms of integral weight the Siegel modular forms for congruence subgroups of integral symplectic groups The book can also be used for an initial study of modular forms of one or several variables and theta series of positive definite integral quadratic forms

**Traces of Hecke Operators** Andrew Knightly, Charles Li, 2006 The Fourier coefficients of modular forms are of widespread interest as an important source of arithmetic information In many cases these coefficients can be recovered from explicit knowledge of the traces of Hecke operators The original trace formula for Hecke operators was given by Selberg in 1956 Many improvements were made in subsequent years notably by Eichler and Hijikata This book provides a comprehensive modern treatment of the Eichler Selberg Hijikata trace formula for the traces of Hecke operators on spaces of holomorphic cusp forms of weight  $k \geq 2$  for congruence subgroups of  $SL(2, \mathbb{Z})$  The first half of the

text brings together the background from number theory and representation theory required for the computation. This includes detailed discussions of modular forms, Hecke operators, adèles and ideles, structure theory for operatorname GL 2  $\mathbf{A}$ , strong approximation, integration on locally compact groups, the Poisson summation formula, adelic zeta functions, basic representation theory for locally compact groups, the unitary representations of operatorname GL 2  $\mathbf{R}$ , and the connection between classical cusp forms and their adelic counterparts on operatorname GL 2  $\mathbf{A}$ . The second half begins with a full development of the geometric side of the Arthur-Selberg trace formula for the group operatorname GL 2  $\mathbf{A}$ . This leads to an expression for the trace of a Hecke operator which is then computed explicitly. The exposition is virtually self-contained with complete references for the occasional use of auxiliary results. The book concludes with several applications of the final formula. *Quadratic Forms and Hecke Operators* Anatoliĭ Nikolaevich Andrianov, 1987

**Arithmetic of p-adic Modular Forms** Fernando Q. Gouvea, 2006-11-14 The central topic of this research monograph is the relation between p-adic modular forms and p-adic Galois representations and in particular the theory of deformations of Galois representations recently introduced by Mazur. The classical theory of modular forms is assumed known to the reader but the p-adic theory is reviewed in detail with ample intuitive and heuristic discussion so that the book will serve as a convenient point of entry to research in that area. The results on the U operator and on Galois representations are new and will be of interest even to the experts. A list of further problems in the field is included to guide the beginner in his research. The book will thus be of interest to number theorists who wish to learn about p-adic modular forms leading them rapidly to interesting research and also to the specialists in the subject. *Hecke Operators on Modular Forms and Integrals* Reine Younis Al-Housseini, American University of Beirut. Faculty of Arts and Sciences. Department of Mathematics, 2009 We define modular forms of nonnegative weight  $k$  on the full modular group  $\Gamma$  and give some of their properties. We proceed to show the behavior of Hecke operators on modular forms. Then we discuss the multiplicative property of Hecke operators. We notice that differentiating a modular form of negative weight  $k$ ,  $k \geq 1$  times turns out to be a modular form of weight  $k - 2$ . However integrating a modular form of weight  $k - 2$  does not give a modular form but it gives what we call an Eichler integral. So we study Eichler integrals of negative weight and see the action of Hecke operators on them. Finally we introduce entire modular integrals and study the behavior of Hecke operators when they act on them. **The Basis Problem for Modular Forms on  $\Gamma_0(N)$**  Hiroaki Hijikata, Arnold K. Pizer, Thomas R. Shemanske, 1989 The basis problem for modular forms of degree one is to find a basis for a space of modular forms with elements whose Fourier coefficients can be computed explicitly. The authors give a general treatment for all cases. The main idea in the solution is to consider two kinds of forms: theta series associated with special order and bases of primitive nebent space. *Operads and Hecke Operators on Modular Forms* Chongli Wang, 2011 **Hilbert Modular Forms with Coefficients in Intersection Homology and Quadratic Base Change** Jayce Getz, Mark Goresky, 2012-03-28 In the 1970s Hirzebruch and Zagier produced elliptic modular forms

with coefficients in the homology of a Hilbert modular surface They then computed the Fourier coefficients of these forms in terms of period integrals and L functions In this book the authors take an alternate approach to these theorems and generalize them to the setting of Hilbert modular varieties of arbitrary dimension The approach is conceptual and uses tools that were not available to Hirzebruch and Zagier including intersection homology theory properties of modular cycles and base change Automorphic vector bundles Hecke operators and Fourier coefficients of modular forms are presented both in the classical and ad lic settings The book should provide a foundation for approaching similar questions for other locally symmetric spaces

**Lectures on Modular Forms** Robert C. Gunning, 2016-03-02 New interest in modular forms of one complex variable has been caused chiefly by the work of Selberg and of Eichler But there has been no introductory work covering the background of these developments H C Gunning s book surveys techniques and problems only the simpler cases are treated modular forms of even weights without multipliers the principal congruence subgroups and the Hecke operators for the full modular group alone

**Hecke Operators for Algebraic Modular Forms** Sebastian Schönnebeck, 2016

**HECKE OPERATORS FOR MODULAR FORMS OF GENUS R.** ERIK ALEXANDER LIPPA, 1971 *P-adic Aspects Of Modular Forms* Baskar Balasubramanyam, A Raghuram, Jacques Tilouine, Haruzo Hida, 2016-06-14 The aim of this book is to give a systematic exposition of results in some important cases where p adic families and p adic L functions are studied We first look at p adic families in the following cases general linear groups symplectic groups and definite unitary groups We also look at applications of this theory to modularity lifting problems We finally consider p adic L functions for GL 2 the p adic adjoint L functions and some cases of higher GL n

*Hecke Operators on Quotients of the Ring of Modular Forms of Level 1* Rachel Catherine Field, University of Manchester. Department of Mathematics, Pure and Applied, 1991 Explicit Action of Hecke Operators on Hilbert-Siegel Modular Forms Suzanne Caulk, 2002

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