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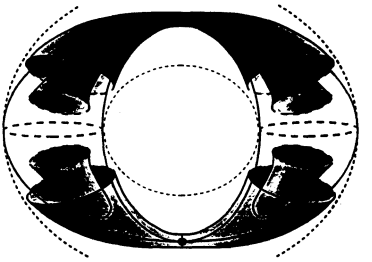
Harmonic Analysis on Reductive Groups



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PREFACE

A conference on Harmonic Analysis on Reductive Groups was held at Bowdoin College in Brunswick, Maine from July 31 to August 11, 1989. The stated goal of the conference was to explore recent advances in harmonic analysis on both real and p-adic groups. It was the first conference since the AMS Summer Symposium on Harmonic Analysis on Homogeneous Spaces, held at Williamstown, Massachusetts in 1972, to cover local harmonic analysis on reductive groups in such detail and to such an extent. While the Williamstown conference was longer (three weeks) and somewhat broader (nilpotent groups, solvable groups, as well as semisimple and reductive groups), the structure and timeliness of the two meetings was remarkably similar.

The program of the Bowdoin Conference consisted of two parts. First, there were six major lecture series, each consisting of several talks addressing those topics in harmonic analysis on real and p-adic groups which were the focus of intensive research during the previous decade. These lectures began at an introductory level and advanced to the current state of research. Second, there was a series of single lectures in which the speakers presented an overview of their latest research. The principal speakers and their topics for the lecture series were: James Arthur, *Some problems in local harmonic analysis*; Colin Bushnell, *The admissible dual of GL(n) via restriction to compact, open subgroups*; Laurent Clozel, *Invariant harmonic analysis on the Schwartz space of a reductive p-adic group*; Lawrence Corwin, *Constructing the supercuspidal representations of GL(n,F), F p-adic*; Wilfried Schmid, *Construction and classification of irreducible Harish-Chandra modules;* and David Vogan, *Associated varieties and unipotent representations.* The content of these lectures reflected accurately most of the major developments in the field of harmonic analysis on reductive groups since the Williamstown Conference. Those developments of importance which were not covered in the principal lecture series, such as harmonic analysis on semisimple symmetric spaces, were discussed in the individual lectures.

By design, the conference did not treat the extensive applications of local representation theory to the theory of automorphic forms. This is, without doubt, one of the most active and interesting areas of modern mathematics, and conferences on this topic have been held regularly over the past fifteen years. Two of the more comprehensive were held at Corvallis in 1977 (AMS Summer Symposium on Automorphic Forms, Representations, and L-functions, A. Borel and W. Casselman, eds.) and Ann Arbor in 1988 (Automorphic forms, Shimura varieties, and L-functions, L. Clozel and J. Milne, eds.). It should be mentioned, however, that much of the current research in local harmonic analysis, especially for p-adic groups, is motivated by considerations related to various aspects of the Langlands program. Moreover, it appears that some deep results in local

harmonic analysis are necessary to achieve further progress in some parts of this program.

Returning to the Williamstown Conference, we note that a number of participants at Williamstown also attended the Bowdoin conference, and, in fact, several people spoke at both conferences. On the other hand, most of the speakers at Bowdoin had not started their research in mathematics in 1972. These facts illustrate both the continuity and the enduring vitality of the research in harmonic analysis on reductive groups. At Williamstown, the principal lecture series related directly to reductive groups were given by Harish-Chandra (Harmonic analysis on reductive p-adic groups); S. Helgason (Functions on symmetric spaces); and V. S. Varadarajan (The theory of characters and the discrete series for semisimple Lie groups). A quick glance at the papers in this volume shows that these lecture series are still directly connected to present day research. For example, Helgason's lectures are related to the papers of Anker and Helgason I, Varadarajan's to the papers of Adams and Herb, and Harish-Chandra's to most of the p-adic papers. It is no surprise that the deep and penetrating work of Harish-Chandra on both real and p-adic groups is reflected in the majority of the papers appearing here. Furthermore, it was at the Williamstown Conference that Roger Howe stated his famous conjecture about the finite-dimensionality of certain spaces of invariant distributions on p-adic groups. Harish-Chandra regarded this conjecture as the key to the study of invariant distributions on these groups. The Howe conjecture was proved by Clozel in the mid-1980s, and many of the consequences are contained in his paper in this volume. At the same time, the papers presented at the Bowdoin Conference contained much mathematics that was developed entirely within the past twenty years. Instances of this are the work on unipotent representations in the unitary dual for real groups, applications of the local trace formula to harmonic analysis, the introduction of D-modules into the study of representation theory, along with many others.

This volume is intended to serve as a reference for both graduate students and researchers working in representation theory and harmonic analysis on reductive groups. While the papers included here represent to a large extent the material covered in the talks at the Conference, they actually contain much more. The principal speakers, and, to some degree, the individual speakers have made a serious effort to give a complete exposition of their topics. We expect that these proceedings will provide a valuable resource for many years.

Paul Sally, Jr.

ACKNOWLEDGMENTS

The Organizing Committee for the conference consisted of William Barker, Rebecca Herb, Paul Sally, and Joseph Wolf. Joseph Bernstein also served on the committee until illness forced him to withdraw. The editors of these proceedings wish to thank their fellow committee members for the time and effort they expended in making the conference a success.

The editors also wish to thank those colleagues who delivered lectures at the conference, and especially those who subsequently contributed manuscripts to the Proceedings. Our thanks further go to the reviewers of the papers—many valuable improvements resulted from their careful reading.

We gratefully acknowledge the support provided by the National Science Foundation in grant number DMS-8804695. Additional support—specifically designated to aid graduate students— was generously supplied by Bowdoin College. These grants permitted a large and diverse group of mathematicians to participate in the conference.

The editors wish to extend a special word of thank to the staff of Birkhäuser Boston for their support and patience during the preparation of this volume. The delays they had to endure may have made lesser persons change professions. We further thank Ann Kostant, also of Birkhäuser Boston, who did an excellent job of converting a number of the longer manuscripts into TEX.

During and prior to the conference, the Organizing Committee was fortunate to have the services of Pam Ohlman as Administrative Assistant. Pam ably coordinated all the daily functions of the conference, and displayed confidence and good humor even under the most trying of circumstances. Sue Theberge, the Academic Coordinator for the Bowdoin Mathematics Department, also helped with the administrative work; in addition, she played an important role in polishing and completing the TEXfiles for this volume.

Finally, we wish to thank Donald Knuth for inventing the marvelous computer typesetting system TEX, and the AMS for the development of the TEXmacro package AMS-TEX. All the papers in this volume were typeset by AMS-TEX, version 2.0, preprint style.

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