

PREFACE

Roger E. Howe, member of the National Academy of Sciences, USA and fellow of the American Academy of Arts and Sciences, and Professor of Mathematics at Yale University, is a scholar of distinction.

Howe's major research interest is in applications of symmetry, particularly harmonic analysis, group representations, automorphic forms and invariant theory. To honor Howe's exceptional achievements both as a scholar and a teacher, an International Conference on Harmonic Analysis, Group Representations, Automorphic Forms and Invariant Theory was held at the National University of Singapore (NUS) from January 9 - 11, 2006, on the occasion of his 60th birthday.

The fact that the conference was held in Singapore and had many attendees from the Asia-Pacific region is clearly fitting due to Howe's extensive contact with and significant influence within the region. He has on many occasions visited universities in Australia, Israel, Japan, Singapore, Hong Kong and China. In particular, he was a fellow of the Institute for Advanced Studies at Hebrew University in Jerusalem in 1988, a fellow of the Japan Society for the Advancement of Science in 1993 and is currently chair of the Scientific Advisory Board of the Institute for Mathematical Sciences (IMS) in NUS.

The speakers of the conference are Michael Cowling (University of New South Wales, Australia), Stephen Gelbart (Weizmann Institute, Israel), Michael Harris (Université Paris VII, France), Masaki Kashiwara and Toshiyuki Kobayashi (both of RIMS, Kyoto University, Japan), Hanspeter Kraft (Universität Basel, Switzerland), Colette Moeglin (Université Paris VII, France), Allen Moy (Hong Kong University of Science and Technology, Hong Kong), Toshio Oshima (University of Tokyo, Japan), Wilfried Schmid (Harvard University, USA), David Vogan (MIT, USA), Gregg Zuckerman (Yale University, USA).

The eleven articles of this volume are for the most part expanded from the invited lectures of the Conference and are all reviewed. In the following,

we give a brief indication of the ranges of topics represented in this volume.

The first article is by Jeffrey Adams, on the theta correspondence over the reals (this has circulated informally for many years). One can hardly fail to notice Howe's influence. A favorite subject of Howe, the Heisenberg group (in relation to rigidity) appears in the next article by Michael Cowling *et al.* The article by Evans and Wallach delights with another classical subject (the Pfaffian) and its applications in integer games. Stephen Gelbart's survey article discusses three kinds of methods for proving that an L -function is non-zero in a part of its critical strip, which will be welcomed by the L -function community. Next Michael Harris presents his fourth in a series of articles devoted to the study of special values of L -functions of automorphic forms contributing to the cohomology of Shimura varieties attached to unitary groups. Here as Harris mentions in the article, the influence of Howe's approach to theta functions as a means for relating automorphic forms on different groups is evident. The article by Kobayashi and Mano examines holomorphic extension of the minimal representation of the conformal group, which is a strong analog of Howe's oscillator semigroup and it represents an excellent contribution of explicit representation theory to classical analysis, and vice versa.

As is well-known, another area where Howe made path-breaking contributions is in representation theory of p -adic groups. The articles by Moeglin and by Moy and Tadić, address two of the central questions on p -adic groups, namely the classification of discrete series, and how to attach invariants (algebra of distributions and the Bernstein center) to p -adic group representations. The final three articles are on real Lie groups and Lie algebras, and are contributed by some of the "real" masters of Lie theory. Specifically Oshima constructs a generator system of the annihilator of certain generalized Verma modules and the quantized minimal polynomials; Vogan addresses the fundamental question of branching of a standard representation to a maximal compact subgroup; Willenbring and Zuckerman introduces a novel notion of a small algebra of a semisimple Lie algebra.

Contributed by some of the leading members of the Lie theory community and with the range and diversity of the topics, we hope that the current volume pays a fitting tribute to the originality, depth and influence of Howe's mathematical work.

We would like to take the opportunity to thank the IMS and the Faculty of Science, of NUS for sponsoring this conference. The expertise and

dedication of all IMS staff, especially its director Louis Chen, contributed essentially to the success of this memorable event, which all four of us enjoyed much to organize.

May 2007

Jian-Shu Li
Hong Kong University of Science and Technology,
Hong Kong

Eng-Chye Tan
National University of Singapore,
Singapore

Nolan Wallach
University of California,
San Diego, USA

Chen-Bo Zhu
National University of Singapore,
Singapore