THE FIELDS INSTITUTE
FOR RESEARCH IN MATHEMATICAL SCIENCES

ABSTRACTS 1.2

JOSEPH BERNSTEIN
Tel Aviv University

Subconvexity estimates and representation theory

Important role in number theory play estimates of the following type.

We have a function $f(t)$ of real variable t and we would like to find upper bound estimates for $|f(t)|$ for large t.

The function f is usually normalized in such a way that we expect it to satisfy $|f(t)| << t^{\epsilon}$.

Usually one gives an average bound of the type

$$\int_I |f(t)|^2 dt << l(I)T^{\epsilon}$$

where I is some interval around T and $l(I)$ denotes its length.

Bounds of such type when $l(I)$ is of order T are colled "convexity bounds".

Bounds of such type over the intervals much shorter than T are called "subconvexity bounds".

In my talk I would like to explain how using representation theory one can prove some subconvexity bounds for triple periods of automorphic forms of the group $G = SL(2, \mathbb{R})$ with respect to a discrete subgroup $\Gamma \subset G$. These estimates essentially give subconvexity bounds for the corresponding triple L-function (of degree 8).

The main new feature of our proof is that we do not use any arithmetic information about the group Γ, only very explicit knowledge of representations of the group G.

BILL CASSELMAN
University of British Columbia

Truncation and buildings

This talk will (I hope) explain how results about reduction theory and Arthur's truncation operator can be simplified by using the rational Tits building.

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LAURENT CLOZEL
Paris-South

Arthur's conjectures, restriction principle, and mysterious functorialities

Arthur has formulated striking conjectures describing the representations of a real or p-adic group that can occur in spaces of automorphic forms. On the other hand, for a pair of reductive groups, Burger, Li and Sarnak have shown that the usual representation-theoretic operations of induction and restriction preserve these representations. Because of Arthur's parametrization, this implies new manifestations of Langlands functoriality, not predicted by the standard dogma. This raises interesting combinatorial, representation-theoretic, and perhaps geometric problems.

STEPHEN DEBACKER
University of Michigan

Murnaghan-Kirillov theory for depth zero supercuspidal representations

It has now been established by J.-L. Kim, F. Murnaghan, and others that the character of a positive depth supercuspidal representation can be expressed (on a certain domain) in terms of the Fourier transforms of certain regular semisimple orbital integrals. In this talk, we shall discuss, among other things, (1) how this result can be extended to depth zero supercuspidal representations (for split groups) and (2) why this extension is useful for studying certain stability questions.

THOMAS HAINES
University of Maryland

Shimura varieties with parahoric level structure

For certain "simple" Shimura varieties with parahoric level structure at p, it is possible to express the semi-simple local Hasse-Weil zeta function explicitly in terms of semi-simple local L-functions. This generalizes work of Kottwitz in the hyperspecial case. A key ingredient is a fundamental lemma for base-change between centers of parahoric Hecke algebras.

DAVID KAZHDAN
Hebrew University

On endoscopic decomposition of certain weight zero representations

We construct an endoscopic decomposition for local L-packets assocoated to irreducible cuspidal Deligne-Lusztig representations.

HENRY H. KIM
University of Toronto

Functoriality for unitary groups

We will explain the stable base change lift of globally generic cuspidal representations of quasi-split unitary groups to general linear groups using Langlands-Shahidi method and converse theorem of Cogdell and Piatetski-Shapiro.

ROBERT KOTTWITZ
University of Chicago

Arthur's work on the trace formula

no abstract

JEAN-PIERRE LABESSE
Institut Mathmatique de Luminy

Norm map for twisted endoscopy

The stabilization of the twisted trace formula is still a work in progress. A first step is to understand the stabilization of elliptic terms. This has been done by Kottwitz and Shelstad for stronly regular elements; the case of arbitrary elliptic element is now available. We shall try to explain the state of art, and in particular we would like to describe the so-called "norm map" that connects conjugacy classes in the twisted group with conjugacy classes in the endoscopic groups.

ROBERT LANGLANDS
Institute for Advanced Study

The trace formula and the theory of numbers

After briefly reviewing the suggestions of the paper "Beyond Endoscopy", I will comment on the problems in the analytic theory of numbers and in algebraic geometry that arise when attempting to put them into practice.

EREZ LAPID
Hebrew University

Explicit trace identities

I'll try to link (certain versions of) the trace formula with explicit constructions as well as with special values of L-functions

GERARD LAUMON
CNRS and Universite Paris-Sud

The Fundamental Lemma for Unitary Groups (I)

We will present a proof of the Langlands-Shelstad Fundamental Lemma for unitary groups U(n) over a local field of characteristic p¿n. Our main tool is the Hichin fibration for a global unitary group. We first obtain a global formula using equivariant cohomology. Then we get the Fundamental Lemma by a standard global to local reduction.

WERNER MULLER
University of Bonn

The trace formula and spectral theory of automorphic forms

The trace formula is an important tool to study spectral problems in the theory of automorphic forms. We will discuss some applications of the trace formula in the spectral theory of automorphic forms and we will also comment on analytic problems that arrise in this context.

BAO CHAU NGO
Universite Paris-Sud

The Fundamental Lemma for Unitary Groups (II)

We will present a proof of the Langlands-Shelstad Fundamental Lemma for unitary groups U(n) over a local field of characteristic p¿n. Our main tool is the Hichin fibration for a global unitary group. We first obtain a global formula using equivariant cohomology. Then we get the Fundamental Lemma by a standard global to local reduction.

MICHAEL RAPOPORT
Universitat Bonn

Local models of Shimura varieties

Local models of Shimura varieties are projective varieties over p-adic integer rings which model etale locally the singularities of Shimura varieties with parahoric level structure. I will report on recent progress in the area.

PETER SARNAK
Princeton University and Courant Institute

Some analytic applications of the trace and related formulae

From the beginning the trace formula has been a natural tool for spectral and conjugacy class counting problems or for studying the size of eigenfunctions. However other trace and pretrace like formulae have often proved to be more effective. We will discuss various examples applications and philosophies.

FREYDOON SHAHIDI
Purdue University

Infinite dimensional groups and automorphic L-functions

After a discussion of the Ramanujan and Selberg conjectures for $GL(2)$ and relating them to functoriality, we will discuss whether any new automorphic L-functions are obtained by studying Eisenstein series on infinite dimensional groups. Time permitting we will discuss the conjecture for other groups.

DAVID VOGAN
MIT

Arthur packets and unitary representations

Near the heart of Langlands' notion of functoriality is a classification of irreducible representations of a reductive group G over a local field. This classification was proven by Langlands for archimedean fields, but remains conjectural for non-archimedean fields. Among the Langlands parameters (homomorphisms of a Weil group into an L-group) one can naturally single out those with precompact image; these should correspond to the tempered representations, which are the simplest and most important unitary representations of G. It is natural to ask for a larger class of Langlands parameters that corresponds to more general unitary representations, but this is a surprisingly difficult problem.

More than twenty years ago, Arthur found such a class, suggested by his work on understanding the residual spectrum for automorphic forms. His work suggests a somewhat different way of thinking about the Langlands classification. I will recall Arthur's definitions (emphasizing the archimedean case) and say a little about the (very slow) progress on proving that the corresponding representations are indeed unitary.

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J.-L. WALDSPURGER
Institut de mathematiques de Jussieu, CNRS

Identites de caracteres entre representations de SO(2n+1) et de GL(2n) tordu

Le corps de base est local, non archimedien de caracteristique nulle. On suppose verifie le lemme fondamental concernant le groupe GL(2n) "tordu" et son groupe endoscopique SO(2n+1). On etablit une identite de caracteres entre L-paquets de representations temperees et de reduction unipotente de SO(2n+1) et caracteres de representations analogues de GL(2n) tordu. Dans certains cas, on peut supprimer l'hypothese "temperee". On doit alors remplacer les L-paquets par des paquets plus generaux. L'existence de ces paquets a ete conjecturee par J. Arthur. Dans les cas que l'on considere, une construction explicite en a ete recemment proposee par C. Moeglin.