Representation Theory
organized by Toshiyuki Kobayashi

SPEAKER **Toshiyuki Kobayashi** (the University of Tokyo)

DATE November 7 (Thu), 2013, 13:30–14:20

TITLE Global Geometry and Analysis on Locally Pseudo-Riemannian Homogeneous Spaces

ABSTRACT The local to global study of geometries was a major trend of 20th century geometry, with remarkable developments achieved particularly in Riemannian geometry. In contrast, in areas such as Lorentz geometry, familiar to us as the space-time of relativity theory, and more generally in pseudo-Riemannian geometry of general signature, surprising little is known about global properties of the geometry even if we impose a locally homogeneous structure.

Taking anti-de Sitter manifolds, which are locally modelled on AdS^n as an example, I plan to explain two programs:

1. (global shape) Existence problem of compact locally homogeneous spaces, and deformation theory.
2. (spectral analysis) Construction of the spectrum of the Laplacian, and its stability under the deformation of the geometric structure.

SPEAKER **Vaibhav Vaish** (the Institute of Mathematical Sciences)

DATE November 7 (Thu), 2013, 14:30–15:20

TITLE Weightless cohomology of algebraic varieties

ABSTRACT Using Morel's weight truncations in categories of mixed sheaves, we attach to any variety defined over complex numbers, over finite fields or even over a number field, a series of groups called the weightless cohomology groups. These lie between the usual cohomology and the intersection cohomology, have a natural ring structure, satisfy Kunneth, and are functorial for certain morphisms.
The construction is motivic and naturally arises in the context of Shimura Varieties where they capture the cohomology of Reductive Borel Serre compactification. The construction also yields invariants of singularities associated with the combinatorics of the boundary divisors in any resolution.

SPEAKER **Yuichiro Tanaka** (the University of Tokyo)

DATE November 7 (Thu), 2013, 15:40–16:10

TITLE Visible actions on generalized flag varieties — Geometry of multiplicity-free representations of $SO(N)$

ABSTRACT The subject of study is tensor product representations of irreducible representations of the orthogonal group, which are multiplicity-free. Here we say a group representation is multiplicity-free if any irreducible representation occurs at most once in its irreducible decomposition.
The motivation is the theory of visible actions on complex manifolds, which was introduced by T. Kobayashi. In this theory, the main tool for proving the multiplicity-freeness property of group representations is the "propagation theorem of the multiplicity-freeness property". By using this theorem and Stembridge's classification result, we obtain the following: All the multiplicity-free tensor product representations of $SO(N)$ and $Spin(N)$ can be obtained from character, alternating tensor product and spin representations combined with visible actions on orthogonal generalized flag varieties.

SPEAKER **Pampa Paul** (Indian Statistical Institute, Kolkata)

DATE November 7 (Thu), 2013, 16:10–16:40

TITLE Holomorphic discrete series and Borel-de Siebenthal discrete series

ABSTRACT Let G_0 be a simply connected non-compact real simple Lie group with maximal compact subgroup K_0. Let $T_0 \subset K_0$ be a Cartan subgroup of K_0 as well as of G_0. So G_0 has discrete series representations. Denote by $\mathfrak{g}, \mathfrak{k}$, and $\mathfrak{t}$, the complexifications of the Lie algebras $\mathfrak{g}_0, \mathfrak{k}_0$ and $frakt_0$ of G_0, K_0 and T_0 respectively. There exists a positive root system Δ^+ of $\mathfrak{g}$ with respect to $\mathfrak{t}$, known as the Borel-de Siebenthal positive system for which there is exactly one non-compact simple root, denoted ν. Let μ denote the highest root. If G_0/K_0 is Hermitian symmetric, then ν has coefficient 1 in μ and one can define holomorphic discrete series representation of G_0 using Δ^+. If G_0/K_0 is not Hermitian symmetric, the coefficient of ν in the highest root μ is 2. In this case, Borel-de Siebenthal discrete series of G_0 is defined using Δ^+ in a manner analogous to the holomorphic discrete series.

Let ν^* be the fundamental weight corresponding to ν and L_0 be the centralizer in K_0 of the circle subgroup defined by $i\nu^*$. Note that $L_0 = K_0$, when G_0/K_0 is Hermitian symmetric. Otherwise, L_0 is a proper subgroup of K_0 and K_0/L_0 is an irreducible compact Hermitian symmetric space. Let G be the simply connected Lie group with Lie algebra $\mathfrak{g}$ and $K_0^* \subset G$ be the dual of K_0 with respect to L_0 (or, the image of L_0 in G). Then K_0^*/L_0 is an irreducible non-compact Hermitian symmetric space dual to K_0/L_0. In this talk, to each Borel-de Siebenthal discrete series of G_0, a holomorphic discrete series of K_0^* will be associated and occurrence of common L_0-types in both the series will be discussed.

SPEAKER **Dipendra Prasad** (Tata Institute of Fundamental Research)

DATE November 7 (Thu), 2013, 16:50–17:40

TITLE Branching laws and the local Langlands correspondence

ABSTRACT The decomposition of a representation of a group when restricted to a subgroup is an important problem well-studied for finite and compact Lie groups, and continues to be of much contemporary interest in the context of real and p-adic groups. We will survey some of the questions that have recently been considered drawing analogy with Compact Lie groups, and what it suggests in the context of real and p- adic groups via what is called the local Langlands correspondence.