Representation Theory and Group Actions

on the occasion of the award of Purple Ribbon to Professor Kobayashi

DATE July 12 (Sat), 2014, 9:30–17:00

PLACE Graduate School of Mathematical Sciences, The University of Tokyo (Komaba)

SPEAKER **Toshio Oshima** (Josai University) (9:30–10:30)

TITLE 超幾何系と Kac-Moody ルート系
Hypergeometric systems and Kac–Moody root systems

ABSTRACT 帯球関数やそれの一般化の Heckmann–Opdam の超幾何の解析のため，1 次元の特異集合への制限から常微分方程式の研究に興味を持った．Fuchs 型常微分方程式全体の空間に Euler 変換などを通じて Kac–Moody ルート系の Weyl 群が作用することが分かり，局所モノドロミーで決まらないモジュライ空間の次元を不変量として，群軌道の有限性が明らかになった．モジュライがない rigid な場合は自明な方程式に変換されるので具体的解析が可能になり，逆にモジュライのある場合は Painleve 方程式の構成と分類への応用がある．これらは分岐のない不確定特異点も許す場合に拡張されると共に，リジッドな場合は自然に多変数の超幾何への延長が定義され，その解析に役立つ．古典的な Appell の超幾何などは後者に含まれ，モノドロミーの可約性などがルート系の言葉で一般的に記述できる．これらの概説と共に，最近の結果や今後の問題ついて解説する．

SPEAKER **Godan Savin** (University of Utah) (10:45–11:45)

TITLE Representations of covering groups with multiplicity free K-types

ABSTRACT Let $\mathfrak{g}$ be a simple Lie algebra over complex numbers. McGovern has described an ideal J in the enveloping algebra U such that U/J, considered as a $\mathfrak{g}$-module under the adjoint action, is a sum of all self-dual representations of $\mathfrak{g}$ with multiplicity one. In a joint work with Loke, we prove that all $(\mathfrak{g}, K)$-modules annihilated by J have multiplicity free K-types, where K is defined by the Chevalley involution.

SPEAKER **Mikhail Kapranov** (Kavli IPMU) (13:20–14:20)

TITLE Perverse sheaves on hyperplane arrangements

ABSTRACT Given an arrangement of hyperplanes in $\mathbb{R}^n$, one has the complexified arrangement in $\mathbb{C}^n$ and the corresponding category of perverse sheaves (smooth along the strata of the natural stratification). The talk, based in a joint work with V. Schechtman, will present an explicit description of this category in terms of data associated to the face complex of the real arrangement. Such a description suggests a possibility of categorifying the concept of a oerverse sheaf in this and possibly in more general cases.

SPEAKER **Masaki Kashiwara** (RIMS) (14:40–15:40)

TITLE Upper global nasis, cluster algebra and simplicity of tensor products of simple modules

ABSTRACT One of the motivation of cluster algebras introduced by Fomin and Zelevinsky is multiplicative properties of upper global basis. In this talk, I explain their relations, related conjectures by Besrnard Leclerc and the recent progress by the speaker with Seok-Jin Kang, Myungho Kima and Sejin Oh.

SPEAKER **Toshiyuki Kobayashi** (the University of Tokyo, Kavli IMPU) (16:00–17:00)

TITLE Branching Problems of Representations of Real Reductive Groups

ABSTRACT Branching problems ask how irreducible representations π of groups G "decompose" when restricted to subgroups G'. For real reductive groups, branching problems include various important special cases, however, it is notorious that "infinite multiplicities" and "continuous spectra" may well happen in general even if (G, G') are natural pairs such as symmetric pairs.

By using analysis on (real) spherical varieties, we give a necessary and sufficient condition on the pair of reductive groups for the multiplicities to be always finite (and also to be of uniformly bounded). Further, we discuss "discretely decomposable restrictions" which allows us to apply algebraic tools in branching problems. Some classification results will be also presented.

If time permits, I will discuss some applications of branching laws of Zuckerman's derived functor modules to analysis on locally symmetric spaces with indefinite metric.