

# ABSTRACT

February 1 (Friday)

9:30- Open and Tea

10:00-10:30 Imsoon Jeong, Carlos J.G. Machado, Juan de Dios Perez and Young Jin Suh (Kyungpook National University, Korea)

“ $\mathfrak{D}$ -parallelism of normal and structure Jacobi operators for hypersurfaces in complex two-plane Grassmannians”

ABSTRACT: In this talk, we introduce notions of normal Jacobi operator and structure Jacobi operator related to the curvature tensor for hypersurfaces in complex two-plane Grassmannians  $G_2(\mathbb{C}^{m+2})$  which consists of all complex two dimensional linear subspaces in  $\mathbb{C}^{m+2}$ , respectively. And we give non-existence theorems for Hopf hypersurfaces in  $G_2(\mathbb{C}^{m+2})$  with  $\mathfrak{D}$ -parallel normal Jacobi operator and  $\mathfrak{D}$ -parallel structure Jacobi operator, respectively.

10:40-11:10 Young Suk Choi, Hyunjin Lee and Changhwa Woo (Kyungpook National University, Korea)

“Classification of real hypersurfaces with Reeb parallel shape operator in complex two-plane Grassmannians”

ABSTRACT: In this paper we consider a new notion of Reeb parallel shape operator for real hypersurface  $M$  in complex two-plane Grassmannian  $G_2(\mathbb{C}^{m+2})$ . When  $M$  has the Reeb parallel shape operator and non-vanishing geodesic Reeb flow, it becomes a real hypersurface of Type (A) with exactly four distinct constant principal curvatures.

11:20-11:50 Misa Ohashi (Meijo University & OCAMI, Japan)

“On  $G_2$  moduli of curves in purely imaginary octonions ”

ABSTRACT: In this talk, first we explain the  $G_2$ -congruence theorem and give the interesting example of curves in purely imaginary octonions. Usually, the  $SO(7)$ -invariants of the curves in  $\mathbf{R}^7$  are obtained by a standard Frenet Serret formula. Note that the  $G_2$ -invariants are  $SO(7)$ -invariants but the converse is not true. We explain this phenomenon. Also we give the candidate of  $G_2$  moduli of curves in purely imaginary octonions.

- 13:30-14:00 Mijung Kim, Hyunjin Lee and Young Jin Suh (Kyungpook National University, Korea)  
 “A Real hypersurface in complex two-plane Grassmannians with g-Tanaka-Webster recurrent shape operator ”  
 ABSTRACT: It is known that submanifolds in Kaehler manifolds have many kinds of connections. Among them, we introduce a new connection named generalized Tanaka-Webster (in short, g-Tanaka-Webster) connection for real hypersurfaces in complex two-plane Grassmannians  $G_2(\mathbb{C}^{m+2})$ . In this talk, we consider a new notion of recurrent hypersurfaces in  $G_2(\mathbb{C}^{m+2})$  for g-Tanaka-Webster connection and give a non-existence theorem for a Hopf hypersurface in  $G_2(\mathbb{C}^{m+2})$  with g-Tanaka-Webster recurrent shape operator.
- 14:10-14:40 Imsoon Jeong, Eunmi Pak and Young Jin Suh (Kyungpook National University, Korea)  
 “Parallelism of various generalized Tanaka-Webster invariant shape operators for real hypersurfaces in complex two-plane Grassmannians ”  
 ABSTRACT: In this talk, we introduce new notions of Lie invariant shape operator for a real hypersurface in complex two-plane Grassmannian  $G_2(\mathbb{C}^{m+2})$ , and give classifications for Hopf hypersurfaces in  $G_2(\mathbb{C}^{m+2})$  with Lie invariant shape operators in the generalized Tanaka-Webster connection.
- 15:00-15:30 Akira Kubo (Hiroshima University, Japan)  
 “Homogeneous Ricci soliton hypersurfaces in the complex hyperbolic spaces ”  
 ABSTRACT: A Lie hypersurface in the complex hyperbolic space is a homogeneous real hypersurface without focal submanifolds. In this talk, I will present classification results of Ricci soliton Lie hypersurfaces in the complex hyperbolic space. This is a joint work with Takahiro Hashinaga and Hiroshi Tamaru.
- 15:40-16:10 Takahiro Hashinaga (Hiroshima University, Japan)  
 “Low-dimensional solvsolitons and the minimality of the corresponding submanifolds”  
 ABSTRACT: The notion of the corresponding submanifolds to left-invariant Riemannian metrics on Lie groups is defined through the study on the space of left-invariant Riemannian metrics on a Lie group. Our interest is to characterize a geometric property of left-invariant Riemannian metrics in terms of the corresponding submanifolds. In this talk, we introduce the relationship between the existence of solvsolitons on low-dimensional solvable Lie groups and the minimality of the corresponding submanifolds.

## February 2 (Saturday)

- 9:45-10:45 Claudio Gorodski (University of Sao Paulo, Brasil)  
“Isoparametric submanifolds in Hilbert space”  
ABSTRACT: A proper Fredholm submanifold  $M$  in a separable Hilbert space is called “isoparametric” if (a) its normal bundle is flat; and (b) the shape operators along any parallel normal vector field are conjugate. Standard (homogeneous) examples of such submanifolds arise essentially as principal orbits of isotropy representations of affine Kac-Moody symmetric spaces (Terng). In fact, in codimension different from one Heintze and Liu proved that  $M$  must be homogeneous, but little is known about the structure of the group which acts transitively on it. In this talk, we will explain our contribution to the conjecture that in codimension different from one  $M$  must be one of the standard examples. Namely, we introduce a “homogeneous structure” on  $M$  and use it to prove a rigidity theorem asserting that  $M$  is completely determined by the second fundamental form and its covariant derivative at one point, thereby making such submanifolds accessible to classification. Joint work with Ernst Heintze (Augsburg).
- 11:00-12:00 Naoyuki Koike (Tokyo University of Science, Japan)  
“Certain kind of isoparametric submanifolds in symmetric spaces of non-compact type and Hermann actions ”  
ABSTRACT: In this talk, we state that full irreducible curvature-adapted isoparametric real analytic submanifolds of codimension greater than one in a symmetric space  $G/K$  of non-compact type are principal orbits of Hermann actions on  $G/K$  under certain condition. In the proof, it is key to show the homogeneity of the lift of the complexification of the original submanifold to an infinite dimensional anti-Kaehler space through an anti-Kaehler submersion.
- 14:00-15:00 Laura Geatti (University of Rome II Tor Vergata, Italy)  
“Invariant envelopes of holomorphy in the complexification of a Hermitian symmetric space”  
ABSTRACT: Let  $G/K$  be a noncompact symmetric space and let  $G^c/K^c$  be its Lie group complexification. Then  $G^c/K^c$  is a Stein manifold where the Lie group  $G$  acts by holomorphic transformations. Basic questions in the study of  $G^c/K^c$  are the classification of invariant Stein subdomains and the determination of the envelopes of holomorphy of arbitrary invariant subdomains. In general, such questions have a complete answer only inside a distinguished  $G$ -invariant domain containing  $G/K$ , namely the complex crown  $\Xi \subset G^c/K^c$ . We present some new results in this direction which hold in the Hermitian case. We also show how the Cauchy-Riemann structure of the  $G$ -orbits plays a role in this context.
- 15:30-16:20 Byung Hak Kim (Kyung Hee University, Korea)  
“On conformal transformations and conformally flat spaces ”  
ABSTRACT: The conformal transformation on Riemannian manifolds is characterized by Riemannian metrics, which does not change the angle between two vectors at a point. In this talk, we are survey to the various conformal transformations and their properties. Moreover we consider the conformal transformations between complete product Riemannian manifolds, and conformally flatness in the warped product space or more general space

16:30-17:20

Tohru Morimoto (Emeritus Professor of Nara Women University, Japan)

“A Klein-Cartan programme for differential equations and extrinsic geometries in flag manifolds”

ABSTRACT: In 1872 Klein declared the Erlangen programme to understand various geometries in a unified manner via transformation groups as homogeneous spaces, then in 1920's Cartan invented the notion of *espace généralisé* (principal bundle with Cartan connection in modern terminology) to treat still group theoretically not only the homogeneous spaces but also inhomogeneous spaces such as Riemannian geometries, conformal or projective differential geometries. With modern approaches to general equivalence problems of geometric structures we have now a general transparent view to intrinsic geometries. In this talk we propose a Klein Cartan programme for differential equations in the framework of nilpotent geometry and analysis. In particular, we show a categorical correspondence between integrable overdetermined systems of linear partial differential equations and submanifolds in flag manifolds. We then have a general method to find the invariants of a submanifold in a flag manifold, based on an algebraic harmonic theory and the moving frame method, in the case when the relevant Lie algebra is semi-simple.

## February 3 (Sunday)

- 9:45-10:35 Makiko Sumi Tanaka (Tokyo University of Science, Japan)  
“Isometries of Hermitian symmetric spaces”  
ABSTRACT: This is my joint work with Jost-Hinrich Eschenburg and Peter Quast. We consider the following problem. Let  $P$  be a Riemannian symmetric space and  $G$  its symmetry group, that is, the subgroup of the full isometry group which is generated by all geodesic symmetries. Let  $\iota : p \rightarrow V$  be an isometric  $G$ -equivariant embedding into some Euclidian space  $V$ . Hence any  $g \in G$  extends to a linear isometry of  $V$ . But what happens to those isometries of  $P$  which are not contained in  $G$ ? Do they also extend to linear isometries of the ambient space? We obtained the affirmative answer to the problem when  $P$  is a semisimple Hermitian symmetric space. In this talk I will explain our result and refer to some related topics.
- 10:45-11:35 Osamu Ikawa (Kyoto Institute of Technology, Japan)  
“The geometry of orbits of Hermann actions”  
ABSTRACT: The isotropy actions of compact symmetric spaces are typical examples of Hermann actions. Hermann actions have nice properties. For example these are hyperpolar actions and also variational complete actions. We study the orbits of Hermann actions. In order to do this, we introduce a notion of a symmetric triad, which is a generalization of an irreducible root system.
- 13:15-14:05 Hiroyuki Tasaki (University of Tsukuba, Japan)  
“Antipodal sets in compact Riemannian symmetric spaces ”  
ABSTRACT: There is a symmetry at each point in a Riemannian symmetric space. An antipodal set is a subset where the restriction of the symmetry at each point is the identity, which was introduced by Chen and Nagano. A set of two antipodal points (in a usual sense) in a sphere is a typical example of antipodal sets. A maximal antipodal set is a kind of frame of a compact Riemannian symmetric space. In this talk I mainly explain antipodal sets in symmetric R-spaces and oriented real Grassmann manifolds.
- 14:15-15:05 Takashi Sakai (Tokyo Metropolitan University & OCAMI, Japan)  
“Special Lagrangian submanifolds in the complex sphere and the complex cones”  
ABSTRACT: In 1993 Stenzel constructed Calabi-Yau metrics on the cotangent bundles of compact rank one symmetric spaces. As the limit of the Stenzel metric on the cotangent bundle of the sphere, where we call it the complex sphere, we can obtain a (singular) Calabi-Yau metric on the complex cone. In this talk, I would like to demonstrate two methods to construct special Lagrangian submanifolds in the complex sphere and the complex cone. One is the conormal bundle construction, and the other is the moment map technique.
- 15:15-16:05 Hiroshi Tamaru (Hiroshima University, Japan)  
“On the moduli space of left-invariant metrics on a Lie group ”  
ABSTRACT: We introduce the space of left-invariant metrics on a Lie group up to isometry and scaling, the moduli space. This moduli space derives a Milnor-type theorem, a generalization of the Milnor frame for three-dimensional unimodular Lie groups. Our Milnor-type theorem is useful to examine the existence and the nonexistence of a distinguished left-invariant metric, such as Einstein and Ricci soliton. In this talk, we explain the above mentioned framework of our study by describing some explicit examples. We will also mention a pseudo-Riemannian version.