

*ASARC-Conference on
Transformation Group Theory
dedicated to Professor K. H. Dovermann
on his 60th birthday*

Speakers

K. H. Dovermann (U. of Hawaii)

Y. Kamishima (Tokyo Metropolitan U.)

M. Masuda (Osaka City U.)

M. Mimura (Okayama U. & KAIST)

J. Shin (Chungnam U.)

J. H. Cho (U. of Suwon)

Y. Cho (KAIST)

M. J. Choi (Yonsei U.)

S. Choi (KAIST)

Time *9:30 ~ 17:50*

August 29 (Friday) 2008

Place *Seminar Room 1409*

Building E6-1 KAIST



Contact

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*Algebraic Structures and its Applications Research Center
Department of Mathematical Sciences
Korea Advanced Institute of Science and Technology*

ASARC-Conference on Transformation Group Theory

dedicated to Professor Karl Heinz Dovermann on his 60th birthday

TIME	9:30 AM ~ 5:50 PM August 29 (Friday), 2008
PLACE	Seminar Room 1409, Building E6-1 Department of Mathematical Sciences Korea Adv. Institute of Sci. and Tech.

PARTICIPANTS

Karl Heinz Dovermann	(Univ. of Hawaii)
Mamoru Mimura	(Okayama Univ.)
Yoshinobu Kamishima	(Tokyo Metropolitan Univ.)
Mikiya Masuda	(Osaka City Univ.)
Joonkook Shin	(Chungnam Univ.)
Sung Sook Kim	(Paichai Univ.)
Dong Youp Suh	(KAIST)
Dae Heui Park	(Cheonnam National Univ.)
Jin-Hwan	Cho (Univ. of Suwon)
Myung-Jun Choi	(Yonsei Univ. & ASARC-KAIST)
Hee Sook Park	(ASARC-KAIST)
Suyoung Choi	(KAIST)
Yunhyung Cho	(KAIST)
Seonjeong Park	(KAIST)

- The conference is organized by Algebraic Structures and its Application Research Center (ASARC) and BK21 KAIST.
- After the conference there will be a conference Banquet
- Any question concerning the conference can be asked to dysuh@math.kaist.ac.kr.

Time-Table

9:00—9:30	Registration
9:30--10:20	Mimura <i>Stiefel-Whitney classes and representations for the exceptional Lie groups</i>
10:35 --11: 35	Dovermann <i>Algebraic realization of manifolds and vector bundles with group actions</i>
11:50:00--12:20	Masuda <i>Cohomology of real projective bundles over a real projective space</i>
12:20--12:30	Photo session
12:30--2:00	Lunch
2:00--2:50	Kamishima <i>Noncompact conformal group actions on compact Lorent manifolds</i>
3:00--3:30	Shin <i>Twisted quaternionic heisenberg group</i>
3:30—4:10	Coffee Break
4:10--4:30	J. Cho <i>Topological entropy of pseudo-Anosov diffeomorphisms of genus two surfaces</i>
4:30--4:50	M. Choi <i>A remark on the deformation quantization</i>
5:10--5:30	Y. Cho <i>Circle actions on symplectic manifolds</i>
5:30--5:50	S. Choi <i>Properties of Bott towers</i>
6:30--8:30	Conference Banquet (Riviera Hotel Buffet)

Lecture Titles and Abstracts

- Mamoru Mimura (Okayama University & KAIST)

"Stiefel-Whitney classes and representations for the exceptional Lie groups"

(abstract)

"In this talk, we study the Stiefel-Whitney classes of some representation of the simply connected exceptional Lie groups (see for example [Adams, Chapter 5.8])

$\rho_2 : G_2 \rightarrow SO(7);$

$\rho_4 : F_4 \rightarrow SO(26);$

$\rho_6 : E_6 \rightarrow SU(27) \rightarrow SO(54);$

$\rho_7 : E_7 \rightarrow SU(56) \rightarrow SO(112);$

$\rho_8 : E_8 \rightarrow SO(248);$

where $SU(n) \rightarrow SO(2n)$ is a natural inclusion."

- Heiner Doerrmann (University of Hawaii at Manoa)

"Algebraic realization of manifolds and vector bundles with group actions"

- Mikiya Masuda (Osaka City University)

"Cohomology of real projective bundles over a real projective space"

- Yoshinobu Kamishima (Tokyo Metropolitan University)

"Noncompact conformal group actions on compact Lorentz manifolds"

(short abstract)

The vague conjecture by D'ambra and Gromov states that if there exists a global geometric flow on a compact geometric manifold, then it is rigid, ie isomorphic to the standard model with flat G -structure. A supporting example is the celebrated Obata-Ferrand's theorem. We study an analogue of the Obata-Ferrand's theorem to compact conformal Lorentz manifolds.

- Jun Kook Shin (Chungnam National University)

“Twisted quaternionic heisenberg group”

(short abstract)

We shall study the special Lie group which is called the twisted quaternionic Heisenberg group. In this talk, we shall study the 7-dimensional infra-nilmanifolds modeled on the twisted quaternionic Heisenberg group and investigate the maximal order of their holonomy group.

- Jin Hwan Cho (The University of Suwon)

“Topological entropy of pseudo-Anosov diffeomorphisms of genus two surfaces”

- Myung Jun Choi (Yonsei University)

“A remark on the deformation quantization”

(abstract)

I will give a remark on Kotsevich's work of “deformation of Poisson manifold

- Yunhyung Cho (KAIST)

“Circle actions on symplectic manifolds”

(abstract)

We focus to the 6-dimensional symplectic manifold M admitting circle action with non-empty fixed set. Here, we prove two problems; the one is, if the fixed set is the union of 2-spheres with a certain condition, then the action is Hamiltonian. The second thing is, if the action is semifree and the fixed set consists of points and spheres, then it is Hamiltonian.

- Suyoung Choi (KAIST)

“Properties of Bott towers”

(abstract)

A \emph{Bott tower} is a sequence of projective bundles of the Whitney sum of \mathbb{C} -line bundles starting with a point. A \emph{Bott manifold} is the last stage of tower and the sequence is called \emph{Bott tower structure}. We first define \emph{twist number} and \emph{cohomological complexity} of Bott tower which are topological and algebraic invariants, respectively. We prove that twist number is equal to cohomological complexity. A quasitoric manifold is a $2n$ -dimensional smooth closed manifold with an effective locally standard action of $(S^1)^n$ whose orbit space is combinatorially an n -dimensional simple convex polytope. One of the interesting examples of quasitoric manifolds is a \emph{Bott manifold}. We shall show that a quasitoric manifold M is a Bott manifold if $H^*(M) = H^*(B)$ for some Bott manifold B .

NONCOMPACT CONFORMAL GROUP ACTIONS ON COMPACT LORENTZ MANIFOLDS

The vague conjecture by D'ambra and Gromov states that if there exists a global geometric flow on a compact geometric manifold, then it is rigid, ie isomorphic to the standard model with flat G -structure. A supporting example is the celebrated Obata-Ferrand's theorem that if a closed group \mathbf{R} acts conformally on a compact Riemannian manifold, then it is conformal to the standard sphere S^n . We study an analogue of the Obata-Ferrand's theorem to compact conformal Lorentz manifolds. The n -dimensional conformally flat Lorentz model $S^{n-1,1}$ is the quotient of the product $S^{n-1} \times S^1$ by \mathbf{Z}_2 equipped with conformal transitive group $\text{PO}(n, 2)$. Of course we know that it is not true only by the existence of a noncompact conformal closed subgroup \mathbf{R} . For example, a compact 3-dimensional $\text{SL}(2, \mathbf{R})/\Gamma$ where Γ is a discrete uniform subgroup. It is the Lorentz space form of constant negative curvature which admits a noncompact closed subgroup of likelike isometries or spacelike isometries.

Which conditions on the closed noncompact connected Lie groups acting conformally on a compact Lorentz manifold M assure that M is conformal to $S^{n-1,1}$. We prove this problem affirmatively by considering *causal almost complex conformal transformations*.

Theorem. Suppose that a compact almost complex Lorentz manifold M of dimension $2n + 2$ admits a closed subgroup \mathbf{C}^ consisting of almost complex lightlike conformal transformations. Then the universal covering \tilde{M} is conformally isomorphic to the universal covering $\tilde{S}^{2n+1,1}$ of the standard model $S^{2n+1,1}$. Moreover, M is the quotient of $\tilde{S}^{2n+1,1}$ by an infinite cyclic subgroup \mathbf{Z} .*

TWISTED QUATERNIONIC HEISENBERG GROUP

Joonkook Shin (with DaeHwan Goo)

Chungnam National University, Korea

We shall study the special Lie group which is called the twisted quaternionic Heisenberg group.

Note that for $p = x_1 + ix_2 + jx_3 + kx_4$, $q = y_1 + iy_2 + jy_3 + ky_4 \in \mathbb{H}$,

$$\begin{aligned} p\bar{q} &= (x_1y_1 + x_2y_2 + x_3y_3 + x_4y_4) + i(-x_1y_2 + x_2y_1 - x_3y_4 + x_4y_3) \\ &\quad + j(-x_1y_3 + x_2y_4 + x_3y_1 - x_4y_2) + k(-x_1y_4 - x_2y_3 + x_3y_2 + x_4y_1), \\ \bar{p}q &= (x_1y_1 + x_2y_2 + x_3y_3 + x_4y_4) + i(x_1y_2 - x_2y_1 - x_3y_4 + x_4y_3) \\ &\quad + j(x_1y_3 + x_2y_4 - x_3y_1 - x_4y_2) + k(x_1y_4 - x_2y_3 + x_3y_2 - x_4y_1). \end{aligned}$$

For $p = x_1 + ix_2 + jx_3 + kx_4 \in \mathbb{H}$, write

$$p^{(1)} = x_1, \quad p^{(i)} = x_2, \quad p^{(j)} = x_3, \quad p^{(k)} = x_4.$$

For $p, q \in \mathbb{H}$, we define $p \circ q$ as follows:

$$p \circ q = (\bar{p}q)^{(1)} + (\bar{p}q)^{(i)}i + (\bar{p}q)^{(j)}j + (\bar{p}q)^{(k)}k \in \mathbb{H}.$$

With this operation, $\mathbb{R}^3 \tilde{\times} \mathbb{H}$ gets a group structure given by

$$(s, p)(t, q) = (s + t + 2\text{Im}\{p \circ q\}, p + q),$$

where $\text{Im}\{p \circ q\}$ is imaginary part of the quaternion number $p \circ q$ seen as an element of \mathbb{R}^3 . This group is denoted by

$$\mathcal{H}_7(\mathbb{H}) = \mathbb{R}^3 \tilde{\times} \mathbb{H}.$$

Then $\mathcal{H}_7(\mathbb{H})$ is a simply connected 2-step nilpotent Lie group with the center $\mathcal{Z}(\mathcal{H}_7(\mathbb{H})) = \mathbb{R}^3$. We call $\mathcal{H}_7(\mathbb{H})$ the twisted quaternionic Heisenberg group.

In this talk, we shall study the 7-dimensional infra-nilmanifolds modeled on the twisted quaternionic Heisenberg group and investigate the maximal order of their holonomy group.