Tsinghua Sanya International Mathematics Forum

（清华三亚国际数学论坛）

Algebraic Topology, Geometry and Combinatorics of Manifolds
流形的代数拓扑、几何及组合研讨会

December 5 - 9, 2017

No.100 Tsinghua Rd.，Tianya District, Sanya, Hainan.

（海南省三亚市天涯区清华路100号）

Welcome to TSIMF

The facilities of TSIMF are built on a 23-acre land surrounded by pristine environment at Phoenix Hill of Phoenix Township. The total square footage of all the facilities is over 29,000 square meter that includes state-of-the-art conference facilities (over 10,000 square meter) to hold many international workshops simultaneously, two libraries, a guest house (over 10,000 square meter) and the associated catering facilities, a large swimming pool, gym and sports court and other recreational facilities.

Mathematical Sciences Center (MSC) of Tsinghua University, assisted by TSIMF's International Advisory Committee and Scientific Committee, will take charge of the academic and administrative operation of TSIMF. The mission of TSIMF is to become a base for scientific innovations, and for nurturing of innovative human resource; through the interaction between leading mathematicians and core research groups in pure mathematics, applied mathematics, statistics, theoretical physics, applied physics, theoretical biology and other relating disciplines, TSIMF will provide a platform for exploring new directions, developing new methods, nurturing mathematical talents, and working to raise the level of mathematical research in China.
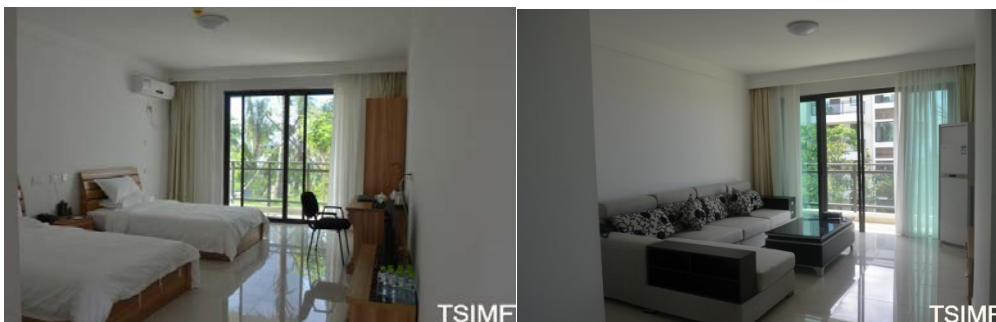
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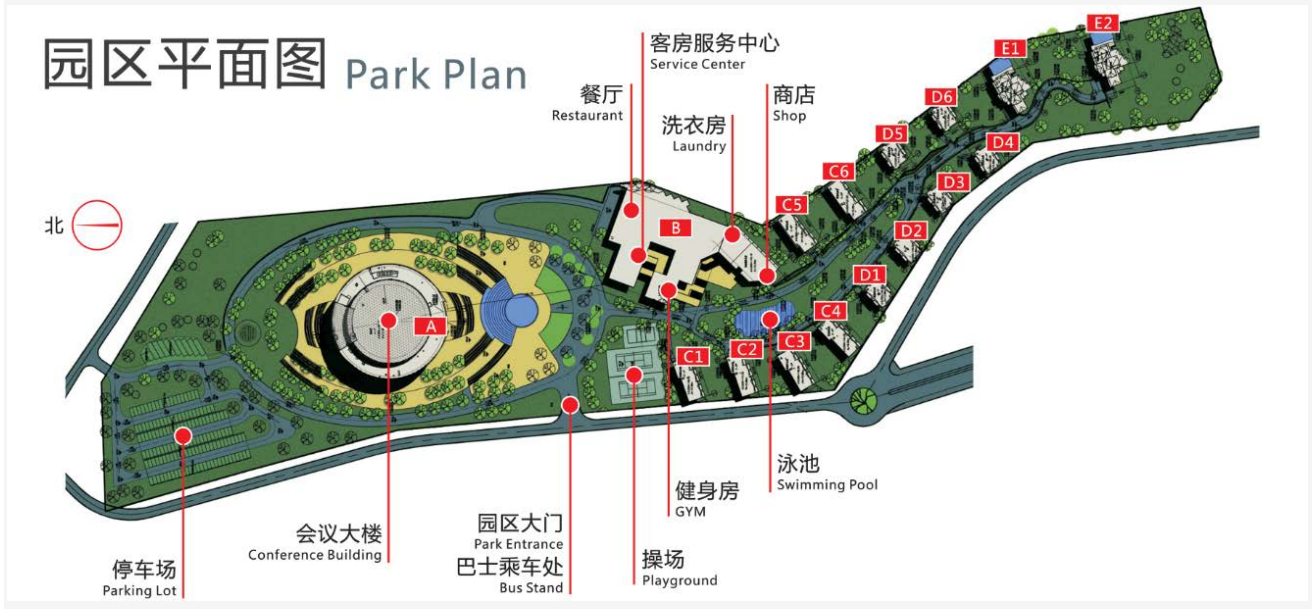
Registration

Conference booklets, room keys and name badges for all participants will be distributed at the Registry. Please take good care of your name badge. It is also your meal card and entrance ticket for all events.

Guest Room

Conference Center can receive about 378 people having both single and double rooms, and 42 family rooms.

All the rooms are equipped with: free Wi-Fi, TV, air conditioning and other utilities.

Family rooms are also equipped with kitchen and refrigerator.

Library

Opening Hours: 08:00am-22:00pm

TSIMF library is available during the conference and can be accessed by using your room card. There is no need to sign out books but we ask that you kindly return any borrowed books to the book cart in library before your departure.

Restaurant

All the meals are provided in the Chinese Restaurant (Building B1) according to the time schedule.

Breakfast	07:30-08:30
Lunch	12:00-13:30
Dinner	18:00-19:30

Laundry

Opening Hours: 24 hours

The self-service laundry room is located in the Building 1 (B1), next to the shop.

Gym

The gym is located in the Building 1 (B1), opposite to the reception hall. The gym provides various fitness equipment, as well as pool tables, tennis tables and etc.

Playground

Playground is located on the east of the central gate. There you can play basketball, tennis and badminton. Meanwhile, you can borrow table tennis, basketball, tennis balls and badminton at the reception desk.

Swimming Pool

Please note that there are no lifeguards. We will not be responsible for any accidents or injuries. In case of any injury or any other emergency, please call the reception hall at +86-898-38882828.

Outside Shuttle Service:

We have shuttle bus to take participants to the airport for your departure service. Also, we would provide transportation at the Haipo Square （海坡广场） of Howard Johnson for the participants who will stay outside TSIMF.If you have any questions about transportation arrangement, please feel free to contact Ms. Li Ye (叶莉), her cell phone number is (0086)139-7679-8300.

Free Shuttle Bus Service at TSIMF:

We provide free shuttle bus for participants and you are always welcome to take our shuttle bus, all you need to do is wave your hands to stop the bus.
Destinations: Conference Building, Reception Room, Restaurant, Swimming Pool, Hotel etc.

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TSIMF
清华三亚国际数学论坛

Schedule for the International Open Chinese-Russian Conference, December 5-9, 2017(ROOM 121)

Time&Date	Tuesday (Dec 5)	Wednesday (Dec 6)	Thursday (Dec 7)	Friday (Dec 8)	Saturday (Dec 9)
7:30-8:30	Breakfast				
Chair	Fuquan Fang	——	——	——	——
8:20-8:40	Opening Ceremony & Group Photo	——	——	——	——
Chair	Fuquan Fang	Weiping Li	Taras Panov	Haibao Duan	Zhi Lü
8:40-9:25	Victor Buchstaber	Kee Yuen Lam	Haibao Duan	Mikiya Masuda	Nigel Ray
9:35-10:20	Alexey Ustinov	Shengkui Ye	Yang Su	Alexander Gaifullin	Ping Li
10:20-10:35	Tea Break				
Chair	Jianzhong Pan	Sergei Ivanov	Xiangjun Wang	Hongzhu Gao	Vladimir Grujic
10:35-11:20	Donald Stanley	Guozhen Wang	Matthias Franz	Jiming Ma	Li Yu
11:30-12:00	Feifei Fan	Ivan Limonchenko	Anton Ayzenberg	Hailiang Hu	Alastair Darby
12:00-13:30	Lunch				
Chair	Mikiya Masuda	Victor Buchstaber	——	Nigel Ray	——
14:00-14:45	Weiping Li	Min Yan		Oleg Musin	
14:55-15:40	Seonjeong Park	Wilderich Tuschmann	Free Discussion	Soumen Sarkar	Departure
15:40-15:55	Tea Break			Tea Break	
Chair	Guoping Tang	Fei Han		Alexey Ustinov	
15:55-16:40	Hui Li	Yanying Wang		Sergei Ivanov	
16:50-17:20	Nikolay Erokhovets	Yakov Veryovkin		Chen He	
17:30-18:00	Natalia Prudnikova	Fangting Zheng		Jongbaek Song	
18:00-19:30	Dinner			Dinner	

Titles and Abstracts

1. Alastair Darby, Xian Jiaotong−Liverpool University, China

Title: The equivariant cohomology of torus orbifolds

Abstract: In this joint work with Shintaro Kuroki and Jongbaek Song we discuss how we can extend the notion of GKM-graphs, which are combinatorial structures associated to manifolds with nice torus actions, to orbifolds. We then use these objects to compute the equivariant cohomology of torus orbifolds−a wide class of orbifolds with torus actions.

2. Alexander Gaifullin, Moscow State University, Russian

Title: Invariants of polyhedra that remain constant during their flexions

Abstract: Flexible polyhedra are polyhedral surfaces with rigid faces and hinges at edges that admit non-trivial deformations, that is, deformations not induced by ambient isometries of the space. An interesting problem consists in finding metric invariants of polyhedra that remain constant during flexions. Two classical invariants of such kind are the total mean curvature and the volume. We shall show that the Dehn invariant of any flexible polyhedron also remains constant during any its flexion.

This implies that every three− or four−dimensional flexible polyhedron remains scissors congruent to itself during the flexion.

The talk is based on a recent joint work with Leonid Ignashchenko.

3. Alexey Ustinov, Pacific National University, Russia (Institute of Applied Mathematics Russian Academy of Sciences)

Title: An elementary approach to Somos-4 sequences

Abstract: A sequence Somos-4 is defined by initial data s_0, s_1, s_2, s_3 and fourth-order recurrence

$$s_{n+2}s_{n-2} = \alpha s_{n+1}s_{n-1} + \beta s_n^2.$$

Usually properties of this sequence are studied by means of elliptic functions. The talk will be devoted to the new elementary approach to Somos-4 sequences. Hopefully it will be suitable for higher-rank Somos sequences corresponding to curves of higher genus.

4. Anton Ayzenberg, Steklov Mathematical Institute, Russian

Title: Algebras of multi-fans and combinatorics of pseudomanifolds

Abstract: A complete simplicial multi-fan is a collection of simplicial cones with prescribed weights which satisfy some natural properties. Each complete simplicial multi-fan is encoded by two objects. First is a simplicial cycle which is typically a fundamental cycle of a manifold or even a pseudomanifold. Second is a so called characteristic function, which contains information on directions of one-dimensional cones. Multi-fans are a powerful tool to study torus manifolds.

In a joint work with Mikiya Masuda we constructed certain Poincare duality algebras associated with multi-fans, which are related to cohomology of torus manifolds. If the underlying cycle of a multi-fan is a manifold, our multi-fan algebra coincides with the Novik-Swartz algebra, which appeared in combinatorial commutative algebra from a completely different approach. The dimensions of algebra's graded components in this case are the h"-numbers of a manifold. These numbers depend only on f-numbers and Betti numbers of a manifold, and do not depend on a characteristic function. We conjectured that dimensions of multi-fan algebras are independent of characteristic function even in non-manifold case.

Recent computer experiments disproved this conjecture and revealed interesting relations between multi-fan algebras, 3-dimensional pseudomanifolds and knot theory. This will be the subject of my talk.

5. Donald Stanley, University of Regina, Canada

Title: CLATs and Integral Sullivan Models

Abstract: A CLAT is a CDGA over the rationals together with an integral lattice of maximal rank inside its cohomology. We can get a CLAT in two ways: from a CDGA, A over the integers, and from a space X. If this gives rise to an isomorphic CLAT then we say that A is an integral Sullivan model for X. Any finite dimensional CLAT comes from an integral CDGA, but this is not true for all CLATs. We are also interested in which CLATs come from spaces.

We conjecture that if a space has no torsion in its cohomology, then it has an integral Sullivan model whose cohomology has no torsion, and can prove this in some special cases.

This is joint with work Jonathan Xiyuan Wang.

6. Feifei Fan, Sun Yat-Sen University, China

Title: Cohomological rigidity of two classes of manifolds in toric topology

Abstract: First, we consider a class of 2-dimensional simplicial spheres satisfying the "no $\triangle$ and $\square$ condition". We prove that the moment-angle manifolds in this class is cohomological rigid. Moreover, for every 6-dimensional toric manifold M in this class, we prove that the equivariant diffeomorphism class of M is determined by its ordinary cohomology ring, i.e., if M' is any other toric manifold and $H^*(M') \cong H^*(M)$, then M' is equivariantly diffeomorphic to M. The cohomological rigidity of toric manifolds in this case is also obtained by Buchstaber, Erochovets, Masuda, Panov and Park.

Second, we get a generalization of this result for higher dimensional moment-angle manifolds and toric manifolds along this line of reasoning. More specifically, for any simplicial n-sphere ($n \geq 3$) K (resp. simple n-polytope P) which is flag and satisfies the "separable circuit condition" (a combinatorial analog of the "no $\square$ condition" in the 3-dim case), the moment-angle manifold $\mathcal{Z}_K$ (resp. the toric manifold M_P) defined on it is cohomological rigid. This is a joint work with Jun Ma and Xiangjun Wang.

7. Guozhen Wang, Fudan University, China

Title: Computations of stable homotopy groups of spheres

Abstract: In the past years, new methods are discovered for the computations of stable homotopy groups. These include Wang and Xu's RP method computing the 60 and 61 stems, which implies that the 61 dimensional sphere has unique differential structure, solving the question of uniqueness of homotopy spheres for odd dimensions. Also, Gheorghe, Isaksen, Wang and Xu developed the motivic C-tau method, which enabled the last three people to compute approximately thirty new stable homotopy groups, in dimensions $62 - 93$. Our methodology uses motivic techniques to leverage computer calculations of both the Adams and Adams-Novikov E2-pages. I will give an account of these methods and show the phenomenons discovered in the new range.

8. Haibao Duan, Chinese Academy of Sciences, China

Title: The cohomology of projective Unitary groups

Abstract: Let $c : U(n) \to PU(n) := U(n)/S^1$ be the quotient map of the unitary group $U(n)$ by its center S^1. Based on a Gysin type exact sequence relating the cohomologies of $U(n)$ and $PU(n)$, we determine the integral cohomology ring $H^*(PU(n))$ using explicitly constructed generators.

9. Hailiang Hu, Hong Kong University of Science and Technology, China

Title: The isovariant structure set of cyclic permutation on cartesian product

Abstract: One analogue of structure set in the G-realm is the isovariant structure set $S^{G-iso}(M)$, where the elements are equivalent classes of $G - isovariant$ homotopy equivalences

$$[f : N \to M]$$

This group is involved in many works of transformations group theory. To name a few, the (*weak*) fixed point set replacement problem asks if a homotopy M^G could be realized as the fixed point set of some isovariant $G - actions$ on a homotopy M. This is tantamount to understanding the image of the restriction map

$$S^{G-iso}(M) \xrightarrow{Res} S(M^G)$$

There is also the forgetful map to the ordinary structure set of the underlying manifold

$$S^{G-iso}(M) \xrightarrow{F} S(M)$$

and the kernel elements (if any) could be arising from interesting actions on M itself.
   In this talk, we will study the isovariant structure set of cyclic permutation on cartesian product by using its identification with the stratified structure set of the orbit space. Some well known techniques in ordinary surgery theory are employed to understand the geometry of the representatives.

10. Hui Li, Suzhou University, China

Title: The fundamental group of contact toric manifolds

Abstract: It is well known that compact symplectic toric manifolds are simply connected. In this talk, we discuss the fundamental group of compact contact toric

manifolds. Compact contact toric manifolds are divided into two types, Reeb type and non-Reeb type. We will give the results on fundamental groups for both cases, in particular, we show that those of Reeb type have fundamental group a finite cyclic group, and we will give an explicit formula on the order of the cyclic group in terms of data on the moment cone.

11. Ivan Limonchenko, School of Mathematical Sciences, Fudan University, Shanghai, 200433, P.R. China

Title: SU-bordism ring and Calabi–Yau manifolds

Abstract: To find nice geometric representatives of bordism classes and bordism ring generators for various bordism theories has been a classical problem in algebraic and differential topology since 1960s. From that time till nowadays much was done regarding this problem, starting with the influential works by Conner, Floyd, Milnor, Novikov, Stong and others. For example, it was proved in 1960s that Milnor hypersurfaces generate the unitary bordism ring over the integers, and similar generators also exist for unoriented and oriented bordism rings.

By an SU-manifold one means a stably complex (or complex) manifold with vanishing first Chern class. In 2014 Lü and Panov constructed a family of quasitoric manifolds which contains polynomial generators of the special unitary bordism ring (with 2 reversed) in all dimensions greater than 8. We refer to a Kähler SU-manifold as a Calabi–Yau manifold. By a classical theorem of Yau it has a Ricci flat metric and can be defined in several equivalent ways, possessing many other deep and interesting properties that were proved in a number of recent works in geometry motivated by modern physics.

In 1993 Batyrev constructed a family of Calabi–Yau manifolds obtained as hypersurfaces dual to the first Chern class in Fano toric varieties. Using this construction, in this talk we introduce a family of Calabi–Yau manifolds, such that their SU-bordism classes $y_i, i \geq 2$ generate the special unitary bordism ring $\Omega^{SU} \otimes \mathbb{Z}[\frac{1}{2}] = \mathbb{Z}[\frac{1}{2}][y_i : i \geq 2]$, i.e, we allow to change orientations and perform sums. Then we discuss Calabi–Yau manifolds in dimensions 6 and 8 as candidates to represent the multiplicative generators y_3 and y_4.

This is a joint work with Zhi Lü (Fudan University) and Taras Panov (Moscow State University).

12. Jiming Ma, Fudan University, China

Title: 3-manifolds subgroups of the Coxeter group over the 120-cells

Abstract: For any positive x large enough, it is well-known there are infinitely many hyperbolic 3-manifolds with bounded above by x. We show that for a hyperbolic group G, there are only finitely many 3-manifolds subgroups in G with volume bounded above, and in the case G is the Coxeter group over the famous 120-cells, we also give a lower bound.

13. Jongbaek Song, Korean Advanced Institute of Science and Technology, Korean

Title: Infinite family of equivariant formal toric orbifolds

Abstract: Given a compact Lie group G acting smoothly and almost freely on a smooth manifold M, one can equip the quotient space M/G with an orbifold structure. In toric topology, a simple polytope defines infinite family of polyhedral products $(D^{2n}, S^{2n-1})^{\partial P^*}$, and a characteristic function λ on P defines a compact torus acting smoothly and (almost) freely on the polyhedral product. For the case when (P, λ) satisfies the $non-singularity$ condition, it is well-known that there are many similarities among toric manifolds of this family, in particular their cohomology rings. In this talk, we consider the case when (P, λ) defines orbifolds, and discuss their cohomology rings. This is a joint work with A.Bahri and S.Sarkar.

14. Kee Yuen Lam, University of British Columbia, Canada

Title: Proving Yuzvinskys Conjecturer on intercalate coloring of matrices: recent progress

Abstract: The Yuzvinsky Conjecture is concerned with a matrix coloring problem that arises from the study of sums of squares identities, where one seeks to express the polynomial

$$P = (x_1^2 + ... + x_t^2)(y_1^2 + ... + y_s^2)$$

as a sum of squares of n polynomials with integer coefficients. Each expression of this kind leads to a coloring of an $r \times s$ matrix M using n colors, for which certain intercalate conditions would hold. Yuzvinsky in 1981 conjectured that the chromatic number of such intercalate colorings of M ought to be given by a certain function of r and s that already appears, implicitly, in some topological papers by Stiefel and Hopf.

In this talk I shall outline a purely combinatorial proof of Yuzvinskys Conjecture for many values of r and s. I shall then provide some additional evidence that the answer to this conjecture ought to be fully affirmative.

15. Matthias Franz, University of Western Ontario, Canada

Title: A quotient criterion for syzygies in equivariant cohomology

Abstract: Syzygies interpolate between torsion-free and free modules. In this talk we start by reviewing the theory syzygies in equivariant cohomology, developed jointly with Chris Allday and Volker Puppe. Then we present a criterion that allows to determine the order of syzygy from a natural filtration of the orbit space of a T-manifold. The criterion unifies and generalizes results of many authors about the freeness and torsion-freeness of equivariant cohomology for various classes of T-manifolds including torus manifolds and toric varieties. In order to apply the criterion, the fixed point set of the action must be 'sufficiently large'. We explain how this can always be achieved by certain blow-ups without changing the syzygy order.

16. Mikiya Masuda, Osaka City University, Japanese

Title: Volumes of regular semisimple Hessenberg varieties and faces of Gelfand-Zetlin polytopes

Abstract: If X is a nonsingular projective variety of complex dimension d together with an embedding $X \hookrightarrow \mathbb{P}^N$, then the volume of the embedding is defined by

$$\mathrm{vol}(X \hookrightarrow \mathbb{P}^N) := \frac{1}{d!} \deg(X \hookrightarrow \mathbb{P}^N) = \frac{1}{d!} \int_X c_1(L)^d$$

where L is the very ample line bundle on X associated to the embedding. If X is a flag variety $\mathrm{Flags}(\mathbb{C}^n)$ together with a Plücker embedding, then its volume is known to agree with the volume of the associated Gelfand-Zetlin polytope.

Regular semisimple Hessenberg varieties are nonsingular subvarieties of $\mathrm{Flags}(\mathbb{C}^n)$, so the Plücker embedding of $\mathrm{Flags}(\mathbb{C}^n)$ induces their embeddings to $\mathbb{P}^N$. In this talk, we discuss how to represent their volumes in terms of faces of the Gelfand-Zetlin polytope.

This is joint work with Megumi Harada, Tatsuya Horiguchi, and Seonjeong Park.

REFERENCES

[1] H. Abe, L. Dedieu, F. Galetto, and M. Harada, *Geometry of Hessenberg varieties with applications to Newton-Okounkov bodies*, Selecta Math. (to appear); arXiv:1612.08831.

[2] T. Abe, T. Horiguchi, M. Masuda, S. Murai, and T. Sato, *Hessenberg varieties and hyperplane arrangements*, arXiv:1611.00269.

[3] V. Kiritchenko, E. Smirnov, and V. Timorin, *Schubert calculus and Gelfand-Zetlin polytopes*, Russian Math. Surveys, 2012, 67 (4) 685-719; arXiv:1101.0278.

17. Min Yan, Hong Kong University of Science and Technology, China

Title: Periodicity, Stratified Space, and Multiaxial Manifolds

Abstract: This is an expository talk on the fundamental role played by the periodicity in the surgery theory of topological manifolds and stratified spaces. I will first explain the homological view of the surgery exact sequence for topological manifolds. Then I will explain how this leads to the surgery theory of homotopically stratified spaces. Finally, I will explain the stratified interpretation of the periodicity and the application of the interpretation to the study of multiaxial manifolds.

18. Nigel Ray(joint with Yumi Boote), University of Manchaster, UK

Title: Compactifications of configuration spaces, and their cohomology rings

Abstract: Over many decades, configuration spaces of finite subsets of a Riemannian manifold M have arisen naturally during attempts to solve classic problems, such as the construction of embeddings of M in Euclidean spaces of low codimension. The space $C_2(M)$ of $2 - element$ subsets is the simplest example, and is the orbit space of the canonical involution on $M \times M$ with its diagonal removed. In fact $C_2(M)$ is never compact, and its compactifications have become important objects of study in their own right. Taken together they form a partially ordered set, and each compactification determines different (but related) rules for allowing points of M to collide.

In this talk I plan to illustrate the general situation by focusing on the example $M = \mathbb{O}P^2$, the $16-$dimensional octonionic projective plane. This manifold has particularly beautiful geometrical properties that may be expressed in terms of the octonions, and lead us to descriptions of $C_2(\mathbb{O}P^2)$ and three of its most natural compactifications, namely the Axelrod-Singer compactification, the symmetric square of

$\mathbb{O}P^2$, and the one-point compactification. These descriptions are sufficiently explicit that they may used to compute the corresponding integral cohomology rings, and to identify interesting and fruitful connections with the compact Lie group $Pin^-(8)$.

I shall try to provide an overview, rather than full technical details.

19. Nikolai Erokhovets, Lomonosov Moscow State University, Moscow, Russia

Title: Toric topology and combinatorics of fullerenes and Pogorelov polytopes

Abstract: A *(mathematical) fullerene* is a simple convex 3-polytope with all facets 5- and 6-gons. A *k-belt* of a simple 3-polytope is a cyclic sequence of facets with empty common intersection such that facets intersect if and only if they follow each other. It is known that fullerenes has no 3- and 4-belts. Results by A.V. Pogorelov and E.M. Andreev imply that this condition is the criterion for a simple 3-polytope different from a simplex to be realized in Lobachevky (hyperbolic) space as a bounded polytope with right angles. Such polytopes we call Pogorelov polytopes. It follows from results by F. Fan, J. Ma and X. Wang [1] that two Pogorelov polytopes P and Q are combinatorially equivalent, if the graded cohomology rings $H^*(\mathcal{Z}_P)$ and $H^*(\mathcal{Z}_Q)$ of moment-angle manifolds are isomorphic. We will discuss recent result by V.M. Buchstaber, N.Yu. Erokhovets, M. Masuda, T.E. Panov and S. Park [2] that for Pogorelov polytopes characteristic pairs (P_1, Λ_1) and (P_2, Λ_2) are equivalent, if the graded cohomology rings $H^*(M(P_1, \Lambda_1))$ and $H^*(M(P_2, \Lambda_2))$ of quasitoric manifolds are isomorphic. The example of a Pogorelov polytope is given by a *k - barrel* – a polytope with surface glued from two patches, each consisting of a k-gon surrounded by a k-belt of 5-gons. Results by T. Inoue [3] imply that any Pogorelov polytope can be combinatorially obtained from k-barrels by a sequence of (s, k)-truncations (cutting off s subsequent edges of a k-gon by a single plane), $2 \le s \le k-4$, and connected sums along k-gonal faces (combinatorial analog of gluing two polytopes along k-gons perpendicular to adjacent facets). We prove that any Pogorelov polytope except for k-barrels can be obtained from the 5- or the 6-barrel by a sequence of $(2, k)$-truncations, $k \ge 6$, and connected sums with 5-barrels along 5-gons. In the case of fullerenes we prove a stronger result. Let $(2, k; m_1, m_2)$-truncation be a $(2, k)$-truncation that cuts off two edges intersecting an m_1-gon and an m_2-gon by vertices different from the common vertex. There is an infinite family of connected sums of 5-barrels along 5-gons surrounded by 5-gons called $(5, 0)$-nanotubes. We prove that any fullerene except for the 5-barrel and the $(5, 0)$-nanotubes can be obtained from the 6-barrel by a sequence of $(2, 6; 5, 5)$-, $(2, 6; 5, 6)$-, $(2, 7; 5, 6)$-, $(2, 7; 5, 5)$-truncations such that all intermediate polytopes are either fullerenes or Pogorelov polytopes with facets 5-, 6- and one 7-gon with the 7-gon adjacent to some 5-gon. These results are obtained in joint work with V.M. Buchstaber [4].

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[1] F. Fan, J. Ma, X. Wang, *B-Rigidity of flag 2-spheres without 4-belt*, arXiv:1511.03624.
[2] V.M. Buchstaber, N.Yu. Erokhovets, M. Masuda, T.E. Panov, S. Park, *Cohomological rigidity of manifolds defined by right-angled 3-dimensional polytopes*, Russian Math. Surveys, **72**:2 (2017), arXiv:1610.07575v3.

[3] T. Inoue, *Organizing volumes of right-angled hyperbolic polyhedra*, Algebraic &Geometric Topology, **8** (2008), 1523–1565.

[4] V.M. Buchstaber, N.Yu. Erokhovets, *Construction of families of three-dimensional polytopes, characteristic patches of fullerenes and Pogorelov polytopes*, Izvestiya: Mathematics, **81**:5 (2017).

20. Ping Li, Tongji University, China

Title: Alexandrov-Fenchel type inequalities, revisited

Abstract: Various Alexandrov-Fenchel type inequalities have appeared and played important roles in convex geometry, matrix theory and complex algebraic geometry. It has been noticed for some time that they share some striking analogies and have intimate relationships. In this talk we will shed new light on this by comparatively investigating them in several aspects. This talk is based on my preprint, which is available on the arXiv:1710.00520.

21. Oleg Musin, IITP Moscow and University of Texas, USA

  TBA

22. Chen He, YMSC, China

Title: Localization of certain torus actions on odd-dimensional manifolds

Abstract: Let torus T act on a compact smooth manifold M, if the equivariant cohomology $H_T^*(M)$ is a free module of $H_T^*(pt)$, then according to the Chang-Skjelbred Lemma, $H_T^*(M)$ can be localized to the 1-skeleton M_1 consisting of fixed points and 1-dimensional orbits. Goresky, Kottwitz and MacPherson considered the even-dimensional case where M is an algebraic manifold and M_1 is 2-dimensional, and introduced a graphic description of its equivariant cohomology. In this talk, we will deal with the odd-dimensional case.

23. Seonjeong Park, National Institute for Mathematical Sciences, South Korea

Title: Real toric manifolds arising from a graph

Abstract: Given a simple graph G, there is a Delzant polytope PG, known as a graph associahedron, whose facets correspond to the proper connected induced subgraphs of G. Graph associahedra have been studied widely and are found in a broad range of subjects. S. Choi and H. Park introduced a new graph invariant, called a-number, and then compute the rational Betti numbers of the real toric variety corresponding to the graph associahedron PG by using a-numbers. In this talk, we will introduce three kinds of Delzant polytopes arising from a simple graph which are different from PG, and then compute the rational Betti numbers of the real toric variety corresponding to each of our Delzant polytopes. We also discuss the relationship between our results and the known results. This talk is based on joint work with B. Park and H. Park.

24. Natalia Prudnikova, Lomonosov Moscow State University, Russia

  TBA

25. Sergei Ivanov, St. Petersburg State University, Russia

Title: Homology of R-completions of groups and finite R-bad spaces.

Abstract: In the talk I will remind the Bousfield-Kan theory of R-completions and R-homological localizations of spaces and its connection with the theory of R-completions and HR-localizations of groups. Then I will present our new results in this theory (with R. Mikhailov). In particular, we prove that the second mod-p homology group of a free pro-p-group (considered as a discrete group) $H_2(\widehat{F}_p, Z/p)$ is uncountable and the second rational homology group of the rational completion of a free group (considered as a discrete group) $H_2(\widehat{F}_Q, Q)$ is uncountable. Using this we prove that the wedge of two circles is a Q-bad space which is the first example of a finite Q-bad space.

26. Shengkui Ye, Xi'an Jiaotong Liverpool University, China

Title: Euler characteristics and matrix group actions

Abstract: Let M^r be a manifold with non-vanishing Euler characteristics modulo 6. Then any topological action of the special linear group $SL(n, Z)$ on M is trivial when $r < n - 1$. This confirms the general Zimmer conjecture for these manifolds.

27. Soumen Sarkar, Indian Institute of Technology Madras, Indian

Title: On integral homology of orbifolds.

Abstract: Orbifolds are the natural generalization of manifolds and several topological invariants of orbifolds are computed with rational coefficients. In this talk, I will introduce some machinery which help to determine the integral (co)homology of orbifolds. This is a joint work with A. Bahri, D. Notbohm and J. Song.

28. Victor Buchstaber, Steklov Mathematical Institute RAS, Russia

Title: Toric topology of complex Grassmann manifolds.

Abstract: The complex Grassmann manifold $G(n, k)$ of all k-dimensional complex linear subspaces in the complex vector space $\mathbb{C}^n$ plays the fundamental role in algebraic topology, algebraic geometry, and other areas of mathematics. The manifolds $G(n, 1)$ and $G(n, n - 1)$ can be identified with the complex projective space $CP^{(n-1)}$. The coordinate-wise action of the compact torus T^n on $\mathbb{C}^n$ induces its canonical action on the manifolds $G(n, k)$. The orbit space $CP^{(n-1)}/T^n$ can be identified with the $(n-1)-$dimensional simplex. The description of the combinatorial structure and algebraic topology of the orbit space $G(n, k)/T^n$, where k is not 1 or $(n - 1)$, is a well-known topical problem, which is far from being solved. The talk is devoted to the results in this direction which were recently obtained by methods of toric topology jointly with Svjetlana Terzic.

The talk is aimed at a broad audience. All necessary definitions and constructions will be given during the lecture.

29. Weiping Li, Southwest Jiaotong University, China

Title: Massey Product and Twisted Cohomology of A-infinity Algebras

Abstract: We study the twisted cohomology groups of A_∞-algebras defined by twisting elements and their behavior under morphisms and homotopies using the bar construction.

We define higher Massey products on the cohomology groups of general A_∞-algebras and establish the naturality under morphisms and their dependency on defining systems. The above constructions are also considered for C_∞-algebras.

We construct a spectral sequence converging to the twisted cohomology groups and show that the higher differentials are given by the A_∞-algebraic Massey products. This is a joint work with Siye Wu.

30. Yakov Veryovkin, Moscow State University, Russian

Title: Polyhedral products and commutator subgroups of right-angled Artin and Coxeter groups

Abstract: We construct and study polyhedral product models for classifying spaces of right-angled Artin and Coxeter groups, general graph product groups and their commutator subgroups. By way of application, we give a criterion of freeness for the commutator subgroup of a graph product group, and provide an explicit minimal set of generators for the commutator subgroup of a right-angled Coxeter group.

This is a joint work with Taras Evgenievich Panov.

31. Yang Su, Chinese Academy of Sciences, China

Title: On the mapping class group of complex 3-dimensional complete intersections

Abstract: In a recent joint work with M.Kreck, we computed the mapping class group of certain simply-connected 6-manifolds, which include complex 3-dimensional complete intersections, especially the Calabi-Yau 3-folds. In this talk I will introduce the result and compare it with the mapping class group of surfaces.

32. Wilderich Tuschmann, Karlsruhe Institut of Technology, Germany

Title: MODULI SPACES OF NON-NEGATIVELY CURVED RIEMANNIAN METRICS

Abstract: We study spaces and moduli spaces of Riemannian metrics with non-negative Ricci or non-negative sectional curvature on closed and open manifolds and construct, in particular, first and large classes of manifolds for which these spaces have non-trivial homotopy groups. This is recent joint work with Michael Wiemeler.

33. Yanying Wang, Hebei Normal University, China

Title: Small covers and some subgroups of the unoriented cobordism group

Abstract: In the unoriented cobordism group MO_n, let $J_{n,k}^{l_1,l_2,\cdots,l_m}$ denote the subgroup of unoriented cobordism classes containing a representative M^n that admits a $(\mathbb{Z}_2)^k$-action with the fixed point set of closed $(n - l_i)$-dimensional submanifolds of

M^n. By constructing small covers and generalized Dold manifolds as generators of the unoriented cobordism ring MO_*, some subgroups $J_{n,k}^{l_1,l_2,\cdots,l_m}$ are determined.

34. Li Yu, Nanjing University, China

Title: On the fundamental groups of small covers

Abstract: We study the topology of small covers from their fundamental groups. We find a way to obtain explicit presentations of the fundamental group of a small cover. Then we use these presentations to study the relations between the fandamental groups of a small cover and its facial submanifolds. In particular, we can determine exactly when a facial submanifold of a small cover is π_1-injective in terms of some purely combinatorial condition on the underlying simple polytope. In addition, our study reveals some connections between several topological notions for 3-dimensional small covers. This allows us to determine when a 3-dimensional small cover and its regular $(\mathbb{Z}_2)^k$-covering spaces are Haken manifolds.

35. Fangting Zheng, Fudan University, China

Title: Hyperbolic 4-manifolds over the 120-cell

Abstract: Since there is no hyperbolic Dehn filling theorem in higher dimension, it is difficult to construct concrete hyperbolic manifolds in dimension at least four. We will talk about eight-colorable small covers over the 120-cell, which give us a set of closed hyperbolic 4-manifolds. This is a joint work with Jiming Ma.