

Recent Breakthrough on Zimmer's conjecture and group actions

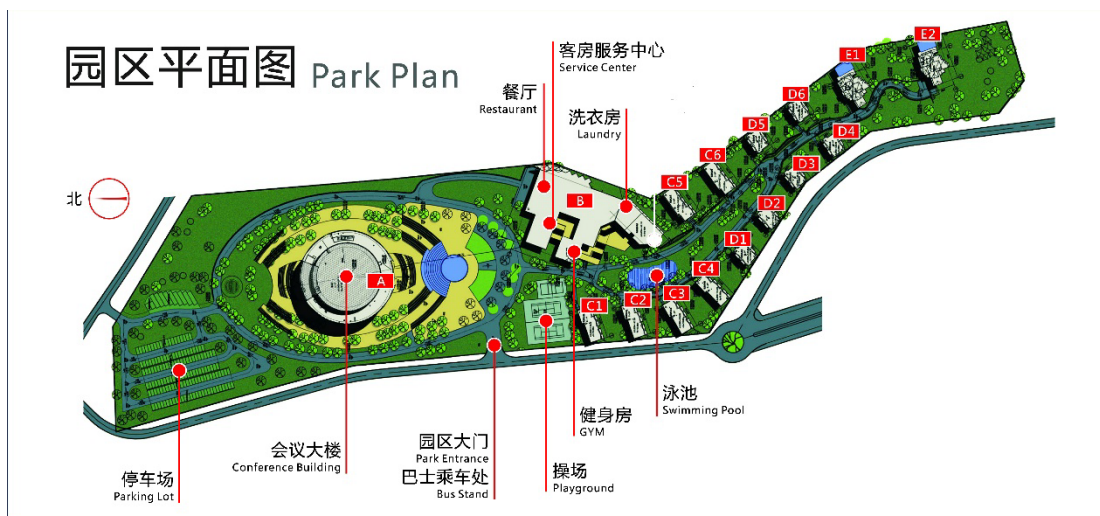
March 31-April 2, 2018

**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.

## About Facilities

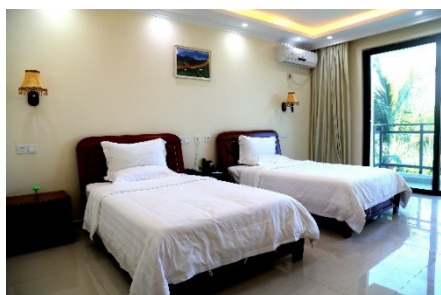


## Registration

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.

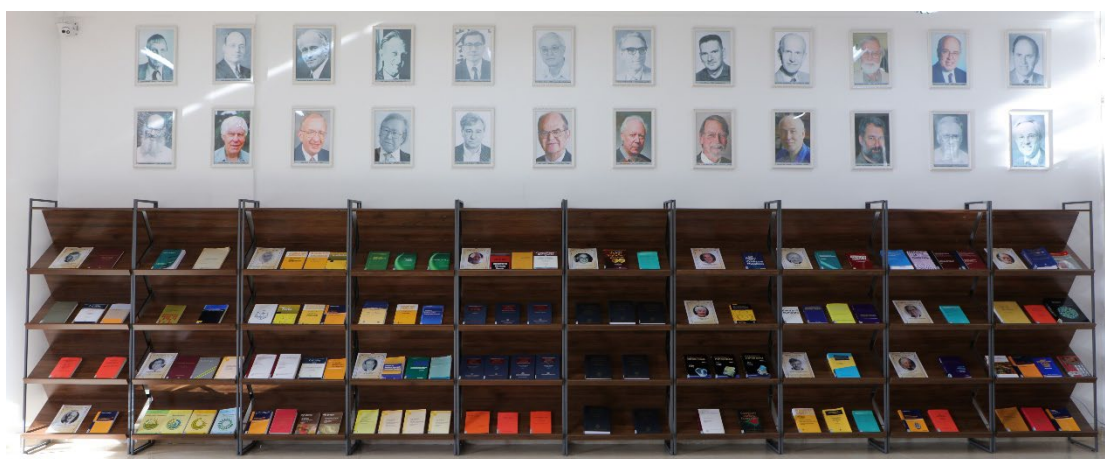


## Library



**Opening Hours: 09:00am-22:00pm**

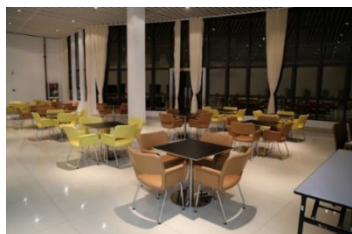
TSIMF library is available during the conference and can be accessed by using your room card. There is no need to sign out books but we ask that you kindly return any borrowed books to the book cart in library before your departure.



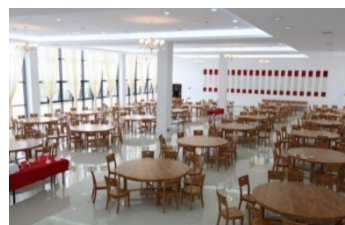
In order to give readers a better understanding of the contributions made by the Fields Medalists, the library of Tsinghua Sanya International Mathematics Forum (TSIMF) instituted the Special Collection of Fields Medalists as permanent collection of the library to serve the mathematical researchers and readers.

So far, there are 210 books from 43 authors in the Special Collection of Fields Medalists of TSIMF library. They are on display in room A220. The participants are welcome to visit.

## Restaurant



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



<b>Breakfast</b>	<b>07:30-08:30</b>
<b>Lunch</b>	<b>12:00-13:30</b>
<b>Dinner</b>	<b>17:30-19:00</b>





## Laundry

**Opening Hours: 24 hours**

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

## Gym

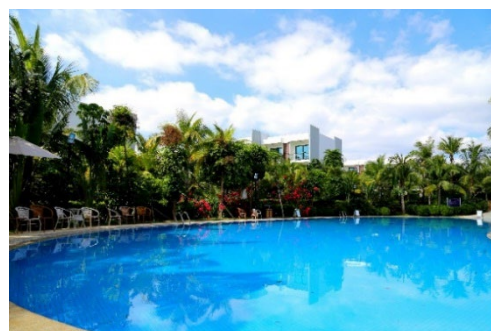
The gym is located in the Building 1 (B1), opposite to the reception hall. The gym provides various fitness equipment, as well as pool tables, tennis tables and etc.

## 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 Haihong Square (海虹广场) 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.



## Contact Information of Administration Staffs

**Location of Conference Affair Office:** Room 104, Building A

Tel: 0086-898-38263896

Technical Support: Shouxi, He 何守喜

Tel: 0086-186-8980-2225

E-mail: hesx@tsimf.cn

Administrator: Ms. Xianying, Wu 吴显英

Tel:0086-186-8962-3393

E-mail: wuxy@tsimf.cn

**Location of Accommodation Affair Office: Room 200, Building B1**

Tel: 0086-898-38882828

Accommodation Manager: Ms. Li Ye 叶莉

Tel: 0086-139-7679-8300

E-mail: yeli@tsimf.cn

**Director of TSIMF:**

Prof.Xuan Gao 高瑄

E-mail: gaoxuan@tsinghua.edu.cn

Recent Breakthrough on Zimmer's conjecture and group actions , March31-April2 2018			
Date	31-Mar	1-Apr	2-Apr
7:30-8:30	Breakfast		
9:00-9:45	Jinpeng An	Wen Huang	Yi Shi
9:45-10:15	Coffee break 茶歇		
10:15-11:00	Aaron Brown	Aaron Brown	Aaron Brown
11:05-11 : 50	Aaron Brown	Aaron Brown	Aaron Brown
12:00-2:00	Lunch		
2:00-2:45	Lei Yang	Huichi Huang	
2:50-3:35	Enhui Shi	Guohua Zhang	
3:35-4:05	Coffee break 茶歇		
4:05-4:50	Ronggang Shi	Dou Dou	
4:55-5:40	Shengkui Ye	Yun Zhao	
6:00	<b>Banquet</b>	Dinner	

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## Title and abstracts

### 1 Jinpeng An (Peking U)

Title: Bounded orbits of homogeneous dynamics

Abstract: Homogeneous dynamics is a special kind of dynamical systems given by Lie groups. For certain important cases, the systems are ergodic and hence the points with bounded orbits form a set of measure zero if the space is noncompact. However, the behavior of bounded orbits reveals the complexity of the system and is related to problems in Diophantine approximation. In this talk, we will discuss some recent progresses of investigations in bounded orbits of homogeneous dynamics and their relations with Diophantine problems.

### 2 Minicourse by Aaron Brown (University of Chicago)

Title: Around the Zimmer Program

Abstract: The Zimmer Program concerns a number of questions and conjectures about smooth (sometimes volume-preserving) actions of lattice in higher-rank Lie groups (such as  $SL(n, \mathbb{Z})$  when  $n \geq 3$ ) on manifolds. I will give an overview of the program, motivation for various conjectures, and outline some recent results due to myself and coauthors. A tentative outline is the following:

1. Lattices in Lie groups, examples of standard actions, non-standard actions
2. Superrigidity and conjectures in the Zimmer program: existence, local rigidity, and global rigidity of actions
3. Zimmer's conjecture part 1
4. Smooth ergodic theory for abelian actions
5. Zimmer's conjecture part 2
6. global rigidity of actions on tori

### 3 Dou Dou (Nanjing U)

Title: Variational principles for amenable metric mean dimensions

Abstract: Mean dimension is a meaningful quantity to measure infinite entropy. In this talk, for countable discrete amenable group actions, we show that there exist variational principles between metric mean dimension and rate distortion function in information theory. This extends recent results by Lindenstrauss and Tsukamoto.



#### 4 Huichi Huang (Chongqing U)

Title: Problems related to Furstenberg's  $\times p, \times q$  conjecture

Abstract: We discuss several problems related to Furstenberg's  $\times p, \times q$  conjecture, namely, irreducible representations of a semi-direct product group, Fourier coefficients of Borel probability measures on the unit circle, equidistributions of a double sequence in the unit circle and a semigroup action on the Banach space  $C[0, 1]$ .

#### 5 Wen Huang (USTC)

Title: Measure complexity and Mobius disjointness

Abstract: We will review some progress about Sarnak's Mobius disjointness conjecture by the measure complexity. Some examples including (Quasi)-discrete spectrum systems and skew product maps on torus over a rotation of the circle will be discussed.

#### 6 Enhui Shi (Suda)

Title: Topological transitivity and wandering intervals for group actions on the line  $\mathbb{R}$

Abstract: For every group  $G$ , we show that either  $G$  has a topologically transitive action on the line  $\mathbb{R}$  by orientation-preserving homeomorphisms, or every orientation-preserving action of  $G$  on  $\mathbb{R}$  has a wandering interval. According to this result, all groups are divided into two types: transitive type and wandering type, and the types of several groups are determined. We also show that every finitely generated orderable group of wandering type is indicible. As a corollary, we show that if a higher rank lattice  $\Gamma$  is orderable, then  $\Gamma$  is of transitive type. This is a slight progress of the 1-dimensional Zimmer's rigidity conjecture.

#### 7 Ronggang Shi (Fudan U)

Title: Multiple ergodic theorem on homogeneous spaces

Abstract: We prove a multiple ergodic theorem for one parameter diagonal group actions on homogeneous spaces. The convergence rate is also obtained. The proof uses effective  $k$ -step correlations. These effective results are based on the existence of the spectral gap and quantitative nonescape of mass estimates.

#### 8 Yi Shi (Peking U)

Title:  $C^r$ -Closing lemma for conservative partially hyperbolic diffeomorphisms on 3-manifolds

Abstract. The  $C^r$  closing lemma is one well-known problem in the theory of dynamical systems. The problem is to perturb the original dynamical system so as to obtain a  $C^r$ -close system that has a periodic orbit passing through a given point. Smale listed this problem as one of the mathematical problems in this century. In this talk, we will prove the  $C^r$  ( $r=1,2,3,\dots,\infty$ ) closing lemma for conservative partially hyperbolic diffeomorphisms on 3-manifolds. This shows that  $C^r$ -generic conservative partially hyperbolic diffeomorphisms on 3-manifolds have dense periodic points. If time permits, we will also discuss this problem for partially hyperbolic diffeomorphisms with one-dimensional center. This is a joint work with Shaobo Gan.

## 9 Lei Yang (Sichuan U)

Title: badly approximable points on manifolds and unipotent orbits in homogeneous spaces

Abstract: We will study  $n$ -dimensional badly approximable points on manifolds. Given an smooth non-degenerate submanifold in  $R^n$ , we will show that any countable intersection of the sets of weighted badly approximable points on the manifold has full Hausdorff dimension. This strengthens a previous result of Beresnevich by removing the condition on weights and weakening the analytic condition on manifolds to smooth condition. Compared with the work of Beresnevich, we study the problem through homogeneous dynamics. It turns out that the problem is closely related to the study of distribution of long pieces of unipotent orbits in homogeneous spaces.

## 10 Shengkui Ye (Xi'an Jiaotong Liverpool)

Title: Topological Zimmer's conjecture and Euler characteristics

Abstract: Let  $M$  be an orientable (may not be compact) manifold. When the Euler characteristic of  $M$  is not divisible by 6, any group action of  $SL(n, \mathbb{Z})$  ( $n > \dim M + 1$ ) on  $M$  by homeomorphisms is trivial. This proves a topological version of the Zimmer's conjecture for these manifolds.

## 11 Guohua Zhang (Fudan U)

Title: Comparison property for group actions

Abstract: Let a countable amenable group  $G$  act on a zero-dimensional compact metric space  $X$ . We say that the action admits comparison if for any clopen sets  $A$  and  $B$ , the condition, that for every  $G$ -invariant measure  $m$  on  $X$  we have the sharp inequality  $m(A) < m(B)$ , implies that  $A$  is subequivalent to  $B$ , that is, there exists a finite clopen partition  $A_1, \dots, A_k$  for  $A$ , and elements  $g_1, \dots, g_k$  in  $G$  such that  $g_1(A_1), \dots, g_k(A_k)$  are disjoint clopen subsets of  $B$ . We prove this property for actions of groups whose every finitely generated subgroup has subexponential growth. This is a joint work with Professor Tomasz Downarowicz.

## 12 Yun Zhao (Suda)

Title: Measure Theoretic Pressure for Amenable Group Actions

Abstract: In this talk, we will define measure theoretic pressure for an amenable group action by using the spanning sets, and shows that the measure theoretic pressure of ergodic measures can be described in terms of metric entropy and an integral of the observable associated with the ergodic measure. Using the theory of Caratheodory structure, we give an equivalent definition of measure theoretic pressure for amenable group actions, and obtain an inverse variational principle, i.e., the topological pressure on a certain set is exactly the measure theoretic pressure of an ergodic measure.