



丘成桐数学科学中心
YAU MATHEMATICAL SCIENCES CENTER



“沼泽地猜想”国际会议

The Lotus and Swampland School/workshop

February 10-13, 2025

Room A-103, TSIMF

组织者 ORGANIZERS

Babak Haghighat, YMSC & BIMSA

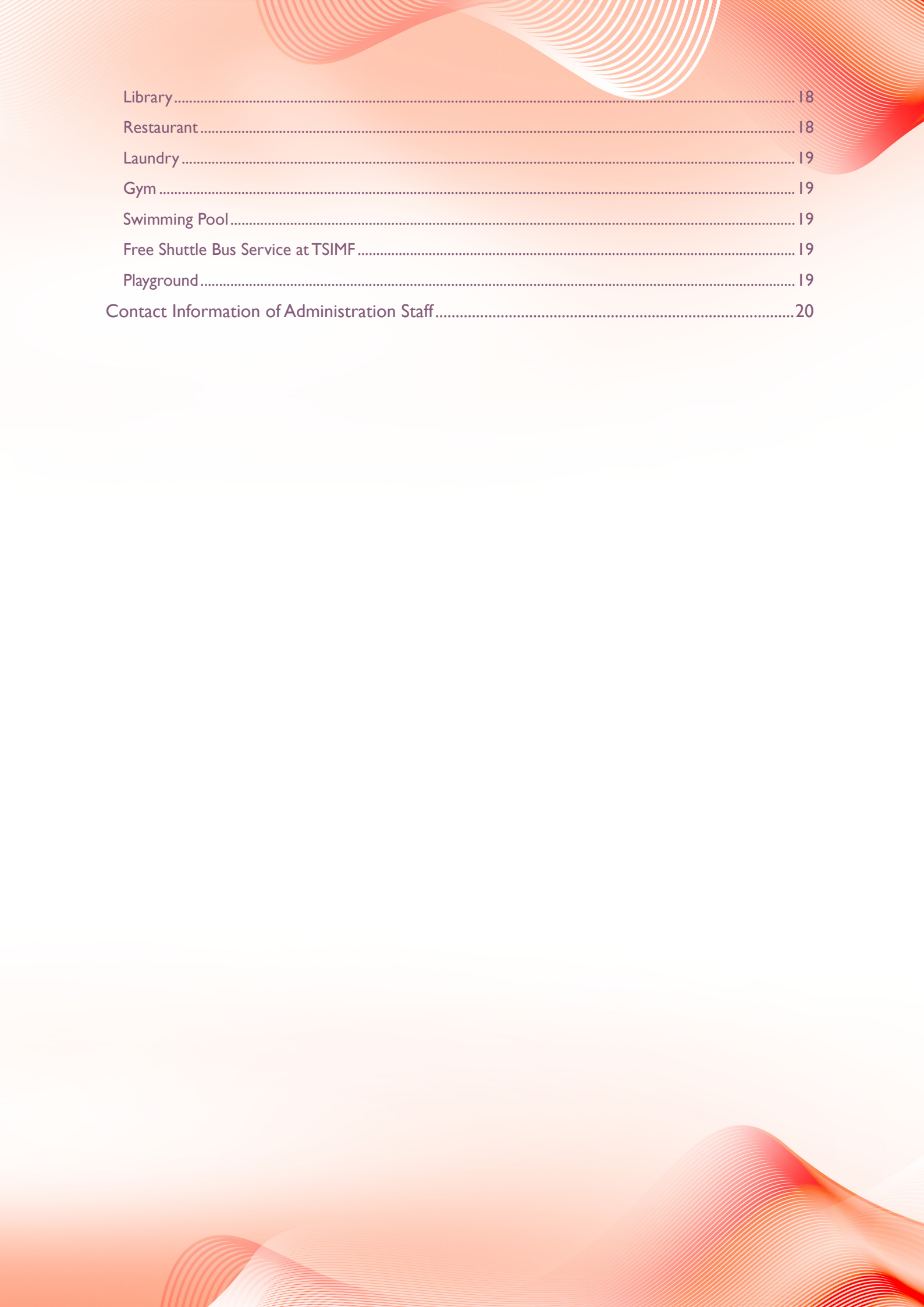
Fengjun Xu(徐峰军), BIMSA

Shing-Tung Yau(丘成桐), Tsinghua University&BIMSA

Cumrun Vafa, Harvard University

Contents

About the conference.....	1
Schedule	3
February 10, 2025, Monday.....	4
February 11, 2025, Tuesday	5
February 12, 2025, Wednesday.....	6
February 13, 2025, Thursday.....	7
Titles and Abstracts	8
School	
Cumrun Vafa	9
Jacob McNamara	9
Hector Parra de Freitas	9
Severin Luest	9
Timm Wrase	10
Houri Tarazi	10
Gary Shiu	10
Georges Obied	10
Kai Xu	10
Workshop	
Jacob McNamara	11
David Wu	11
Hector Parra de Freitas.....	11
Severin Luest	11
Timm Wrase	11
Houri Tarazi.....	12
Gary Shiu.....	12
Georges Obied	12
Kai Xu	12
Welcome to TSIMF.....	15
About Facilities.....	17
Registration.....	17
Guest Room	17



Library	18
Restaurant	18
Laundry	19
Gym	19
Swimming Pool	19
Free Shuttle Bus Service at TSIMF	19
Playground	19
Contact Information of Administration Staff	20



About the conference

Date

February 10-13, 2025

Venue

Room A-103, TSIMF

Organizers

Babak Haghighat, YMSC & BIMSA
Fengjun Xu(徐峰军), BIMSA
Shing-Tung Yau(丘成桐), Tsinghua University&BIMSA
Cumrun Vafa, Harvard University

Abstract

We are delighted to announce the “The Lotus and the Swampland” School and conference, to be held in TSIMF, Sanya, China, from Feb. 10 to Feb. 13, 2025, hosted by the BIMSA (Beijing Institute of Mathematical Sciences and Applications). This event is proposed by Prof. Cumrun Vafa, who will also be attending it.

This unique event will consist of a two-day School, followed by a two-day conference. It brings together experts in the Swampland program and its application to the universe. Each distinguished speaker is expected to deliver a lecture during the School and present a talk in the conference, providing participants with a comprehensive learning experience.

The School aims to summarize lessons we have learned from string theory about quantum gravity with a focus on the Swampland program equipping attendees with new insights and practical tools.

Event Details

School: [Feb. 10-11, 2025] (two days)

Workshop: [Feb. 12-13, 2025] (two days)

Special Guest

Cumrun Vafa (Harvard University)

Speakers

Hector Parra de Freitas (Harvard University)

Severin Lust (U. Montpellier)

Jacob McNamara (Caltech)

Georges Obied (Oxford)

Gary Shiu (University of Wisconsin-Madison)

Houri Tarazi (Chicago University)

Cumrun Vafa (Harvard University)

Timm Wrase (Lehigh University)

David Wu (Harvard University)

Kai Xu (Harvard CMSA)



Schedule

February 10, 2025, Monday

School

Time(日期)	Name(报告人)	Title(报告题目)
7:30~8:30	Breakfast	
9:00~9:15	Opening Remark	
9:15-10:30	Cumrun Vafa	Introduction to the Swampland Program
10:30~10:45	Tea Break	
10:45~12:00	Jacob McNamara	The Kinematic Swampland Conjectures
12:00~13:30	Lunch	
13:45-15:00	Hector Parra de Freitas	The Landscape with High Supersymmetry (an overview)
15:00~15:15	Tea Break	
15:15-16:30	Severin Luest	The landscape of less supersymmetric vacua
16:30~16:45	Break	
16:45-18:00	Timm Wrase	State of the art in moduli stabilization
18:00~19:00	Dinner	

February 11, 2025, Tuesday

Time(日期)	Name(报告人)	Title(报告题目)
7:30~8:30	Breakfast	
9:15-10:30	Houri Tarazi	A journey through the non-geometric string landscape
10:30~10:45	Tea Break	
10:45~12:00	Gary Shiu	Early Universe: Inflation and Quantum Gravity
12:00~13:30	Lunch	
13:45-15:00	Georges Obied	The dark dimension and cosmology in the late universe
15:00~15:15	Tea Break	
15:15-16:30	Kai Xu	Swampland and Geometry
16:30~16:45	Break	
16:45-18:00	Performance*	
18:00~19:00	Dinner	

* 17:00-17:30 Performance of Chinese Traditional Music (Qin and Xiao) Played by Li Fengyun and Wang Jianxin

February 12, 2025, Wednesday

Workshop

Time(日期)	Name(报告人)	Title(报告题目)
7:30~8:30	Breakfast	
8:30-9:30	Jacob McNamara	Quantum Cobordism and Higher Factorization
9:30~9:45	Break	
9:45-10:45	David Wu	The black hole scale in quantum gravity
10:45~11:00	Tea Break	
11:00-12:00	Hector Parra de Freitas	Overarching structures underlies the Landscape with 16 supercharges
12:00~13:30	Lunch	
14:00-15:00		
15:00~15:15		
15:15-16:15		
16:15~16:30		
16:30~17:30		
17:30~19:00	Dinner	

February 13, 2025, Thursday

Time(日期)	Name(报告人)	Title(报告题目)
7:30~8:30	Breakfast	
8:30-9:30	Severin Luest	Holography and KKLT
9:30~9:45	Break	
9:45-10:45	Timm Wrase	Stabilizing all moduli in a Landau-Ginzburg model
10:45~11:00	Tea Break	
11:00-12:00	Houri Tarazi	Exploring exotic corners of the susy and non-susy string landscape
12:00~13:30	Lunch	
14:00-15:00	Gary Shiu	The Weak Gravity Conjecture
15:00~15:15	Tea Break	
15:15-16:15	Georges Obied	De Sitter space constraint on brane tension and couplings.
16:15~16:30	Break	
16:30~17:30	Kai Xu	Finite Landscape of 6d $\mathcal{N}=(1,0)$ Supergravity
17:30~19:00	Dinner	



Titles and Abstracts

Introduction to the Swampland Program

Cumrun Vafa
Harvard University

TBA

The Kinematic Swampland Conjectures

Jacob McNamara
Caltech

TBA

The Landscape with High Supersymmetry (an overview)

Hector Parra de Freitas
Harvard University

In the first talk I will give an overview of the state of our knowledge regarding the landscape of string vacua with 32 and 16 supercharges, both from the top down and bottom up. I will present various open questions and puzzles.

In the second talk I will introduce various concepts and tools that are useful for characterizing the spectrum of these theories in a systematic way. These methods are based on manipulations of indefinite lattices which play the role of lattices of electric charges and underlie many critical aspects of the nonperturbative structure governing this branch of the Landscape. They can be used as well in many other setups with broken supersymmetry.

The landscape of less supersymmetric vacua

Severin Luest
U. Montpellier

This lecture will cover less supersymmetric vacua in the string theory landscape, in particular those with eight and four real supercharges. We will first review compactifications of type II string theory on Calabi-Yau three-folds, and the resulting effective description in terms of four-dimensional $N=2$ supergravity. We will then discuss supersymmetry breaking via orientifolding and $N=1$ supersymmetric flux vacua. Time permitting, I will also outline their relationship to F-theory and heterotic compactifications.

State of the art in moduli stabilization

Timm Wrase
Lehigh University

Moduli stabilization is one of the most interesting and important goals in string phenomenology. After lots of new constructions and ideas in the early 2000's we have entered a phase of careful checks and scrutiny. This led to swampland conjectures that call into question the existence of dS vacua as well as scale-separated AdS vacua in string theory. I will review the current status of well-known string compactification scenarios like KKLT, LVS and DGKT as well as other ideas to stabilize moduli in string compactifications. References or Resources: 2310.20559 Chapters 1-5 and 9

A journey through the non-geometric string landscape

Houri Tarazi
Chicago University

TBA

Early Universe: Inflation and Quantum Gravity

Gary Shiu
University of Wisconsin-Madison

TBA

The dark dimension and cosmology in the late universe

Georges Obied
Oxford
TBA

Swampland and Geometry

Kai Xu
Harvard CMSA

TBA

Quantum Cobordism and Higher Factorization

Jacob McNamara
Caltech
TBA

The black hole scale in quantum gravity

David Wu
Harvard University

In this talk, I will introduce a new scale called the black hole scale which marks the inverse length (or the temperature) of the smallest Schwarzschild black hole where the EFT of quantum gravity gives a correct description of its free energy. This new scale is motivated from Swampland principles and is hard to detect from the viewpoint of the EFT. In particular, the black hole scale gets related to the Gregory-Laflamme transition in the decompactification limit and to the Horowitz-Polchinski solutions in the light perturbative string limits. Then, motivated by the identification of the black hole scale in quantum gravity, I will discuss recent progress in finding higher-dimensional analogues of the Horowitz-Polchinski solutions.

Overarching structures underlies the Landscape with 16 supercharges

Hector Parra de Freitas
Harvard University

TBA

Holography and KKLT

Severin Lust
U. Montpellier

In this talk I discuss holographic constraints on scale separated, supersymmetric AdS vacua of IIB string theory and M-theory. Their dual CFTs should have very large central charges and rather unusual properties. I first describe brane configurations that source these would-be AdS flux compactifications. Subsequently, I identify certain UV AdS geometries in the near horizon limit of these branes. Lastly, I explain how to obtain bounds on the absolute values of the cosmological constants of the AdS vacua from the central charges of the dual CFTs.

Stabilizing all moduli in a Landau-Ginzburg model

Timm Wrase
Lehigh University

I will discuss non-geometric flux compactifications of string theory on Landau-Ginzburg models that are dual to rigid Calabi-Yau manifolds. Minkowski vacua can be analyzed even at strong

coupling, providing a rare window in this corner of the string theory landscape. We focus on the number of stabilized moduli to test the tadpole conjecture in this context. While the conjecture is confirmed, a refined version is violated and needs to be modified. We furthermore discuss the existence of Minkowski vacua in which all scalar fields are stabilized. For some of these vacua all scalars fields are massive, while others have also some massless but stabilized scalar fields.

Exploring exotic corners of the susy and non-susy string landscape

Houri Tarazi
Chicago University

In this talk I will discuss concrete examples of string theory compactifications that are non-geometric. From the susy perspective such examples provide us with a more complete understanding of the string theory landscape that does not come from geometry. I will also discuss the importance of such examples in connection to the Swampland program in an effort to avoid the geometric lamppost. Additionally, from the non-susy perspective moduli stabilization is an important problem. I will show that non-geometric models can provide non-susy tachyon-free examples with a single neutral scalar field, which are a source of instability.

The Weak Gravity Conjecture

Gary Shiu
University of Wisconsin-Madison

The Weak Gravity Conjecture was motivated by black hole physics, i.e., black holes, even if extremal, must decay unless there is a symmetry that warrants its stability. The conjecture has since been formulated in different forms. In this talk, I will present arguments for the Weak Gravity Conjecture and its various strong forms. I will further discuss recent computations of decay rate of extremal black holes in diverse spacetimes that may distinguish different formulations of the conjecture.

De Sitter space constraint on brane tension and couplings.

Georges Obied
Oxford

Extended objects are ubiquitous in string theory where they have special properties. Outside of string theory, there are relatively few insights into the nature of extended objects that are allowed by quantum gravity. In this talk, using the Festina Lente conjecture, I will argue for new universal bounds on the tension of branes coupled to gauge fields in de Sitter space. This bound is implied by cosmic censorship and can be derived by studying the evolution of large charged black holes in de Sitter space. Since this is a bottom-up argument, it should be obeyed by any de Sitter quantum gravity including stringy constructions. Finally, I will provide a heuristic check of these bounds against the properties of (wrapped) D-branes in Type II string theory in the weak coupling limit and show that they satisfy all these constraints.

Finite Landscape of 6d $\mathcal{N}=(1,0)$ Supergravity

Kai Xu
Harvard CMSA

We present a bottom-up argument showing that the number of massless fields in six-dimensional quantum gravitational theories with eight supercharges is uniformly bounded.

Specifically, we show that the number of tensor multiplets is bounded by $T \leq 193$, and the rank of the gauge group is restricted to $r(V) \leq 480$. Given that F-theory compactifications on elliptic CY 3-folds are a subset, this provides a bound on the Hodge numbers of elliptic CY 3-folds: $h^{1,1}(\text{CY}_3) \leq 491$, $h^{1,1}(\text{Base}) \leq 194$ which are saturated by special elliptic CY 3-folds. This establishes that our bounds are sharp and also provides further evidence for the string lamppost principle. These results are derived by a comprehensive examination of the boundaries of the tensor moduli branch, showing that any consistent supergravity theory with $T \neq 0$ must include a BPS string in its spectrum corresponding to a "little string theory" (LST) or a critical heterotic string. From this tensor branch analysis, we establish a containment relationship between SCFTs and LSTs embedded within a gravitational theory. Combined with the classification of 6d SCFTs and LSTs, this then leads to the above bounds.

Together with previous works, this establishes the finiteness of the supergravity landscape for $d \geq 6$.

This is joint work with Hee-Cheol Kim and Cumrun Vafa.



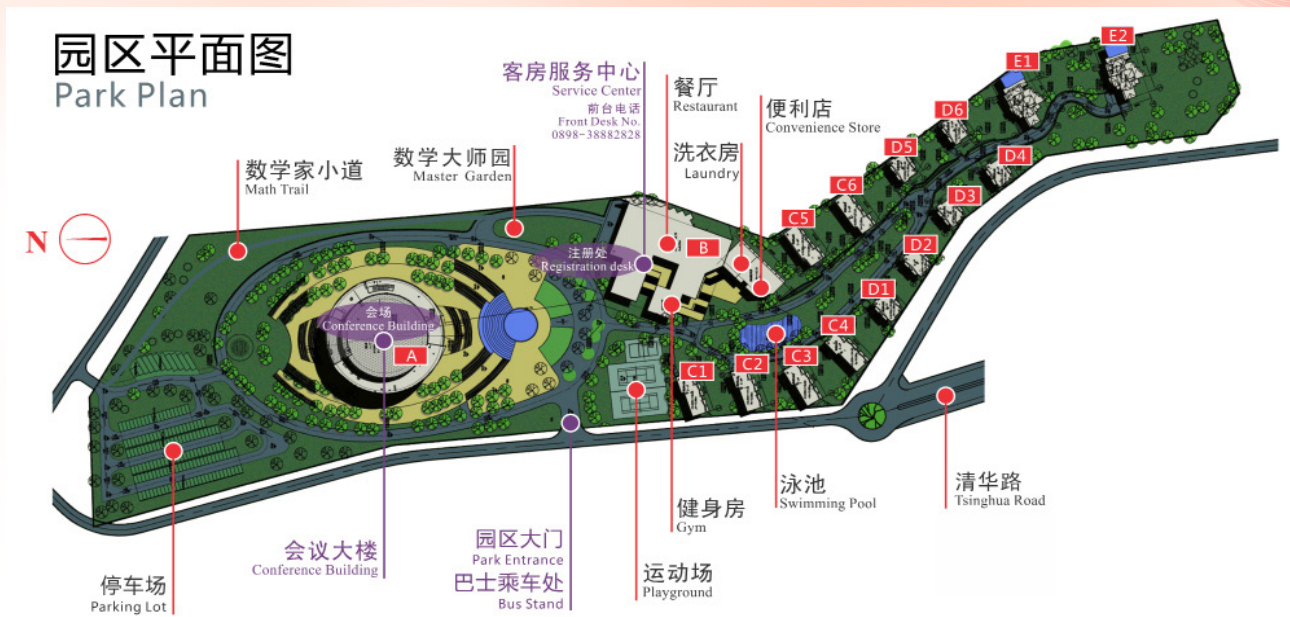
Welcome to TSIMF



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 reading rooms of library, 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.

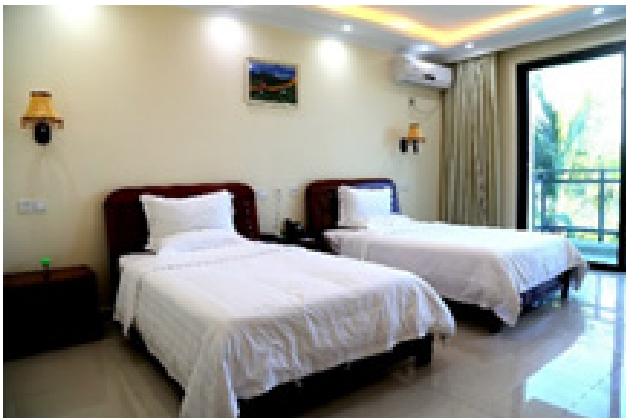
Management Center of Tsinghua Sanya International Forum is responsible for the construction, operation, management and service of TSIMF. The mission of TSIMF is to become a base for scientific innovations, and for nurturing of innovative human resource; through the interaction between leading mathematicians 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 front desk. Please take good care of your name badge. It is also your meal card and entrance ticket for all events.



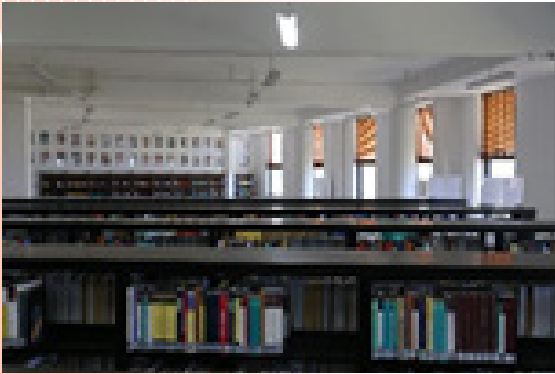
Guest Room

All the rooms are equipped with: free Wi-Fi (Password:tsimf123), TV, air conditioning and other utilities.

Family rooms are also equipped with kitchen and refrigerator.



Library



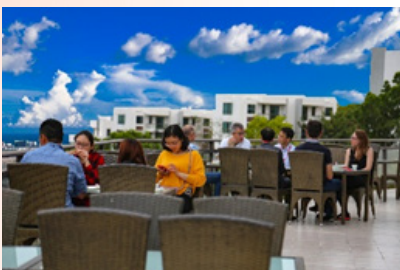
Opening Hours: 09:00am-22:00pm

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 271 books from 49 authors in the Special Collection of Fields Medalists of TSIMF library. They are on display in room A220. The participants are welcome to visit.



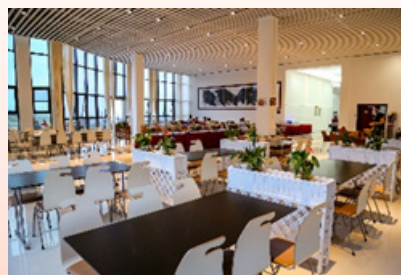
Restaurant

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

Breakfast 07:30-08:30

Lunch 12:00-13:30

Dinner 17:30-19:00



Laundry

Opening Hours: 24 hours

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



Gym

Opening Hours: 24 hours

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 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 enter the pool during the open hours, swimming attire and swim caps are required, if you feel unwell while swimming, please stop swimming immediately and get out of the pool. The depth of the pool is 1.2M-1.8M.

Opening Hours: 13:00-14:00 18:00-21:00



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 Staff

Location of Conference Affairs Office: Room 104, Building A

Tel: 0086-898-38263896

Conference Affairs Manager: Shouxi He 何守喜

Tel:0086-186-8980-2225

Email: heshouxi@tsinghua.edu.cn

Location of Accommodation Affairs Office: Room 200, Building B1

Tel: 0086-898-38882828

Accommodation Manager: Ms. Li YE 叶莉

Tel: 0086-139-7679-8300

Email: yel@tsinghua.edu.cn

IT

Yuanhang Zhou 周远航

Tel: 0086-133-6898-0169

Email: 13368980169@163.com

*Reception duty hours: 7:00-23:00, chamber service please call: 0086-38882828 (exterior line) 80000 (internal line)

*Room maintainer night duty hours: 23:00-7:00, if you need maintenance services, please call: 0086-38263909 (exterior line) 30162 (internal line)

Director Assistant of TSIMF

Kai CUI 崔凯

Tel/Wechat: 0086- 136-1120-7077

Email :cuik@tsinghua.edu.cn

Director of TSIMF

Prof.Xuan GAO 高瑄

Tel: 0086-186-0893-0631

Email: gaoxuan@tsinghua.edu.cn

清华大学三亚国际论坛管理中心 | 三亚清华数学论坛管理中心
Tsinghua Sanya International Mathematics Forum (TSIMF)



0086-898-38882828

0086-898-38883896



0086-898-38883895



tsimf@tsinghua.edu.cn



572000



<https://www.tsimf.cn>



海南省三亚市天涯区清华路 100 号, 清华三亚国际数学论坛

No.100, Tsinghua Road, Tianya District, Sanya, Hainan, P. R. China.

