



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



彭桓武高能基础理论研究中心
Peng Huanwu Center for Fundamental Theory



北京大学

高能物理研究中心
Center for High Energy Physics, PKU



国家自然科学基金委员会
National Natural Science Foundation of China



清华大学 高等研究院
Institute for Advanced Study, Tsinghua University

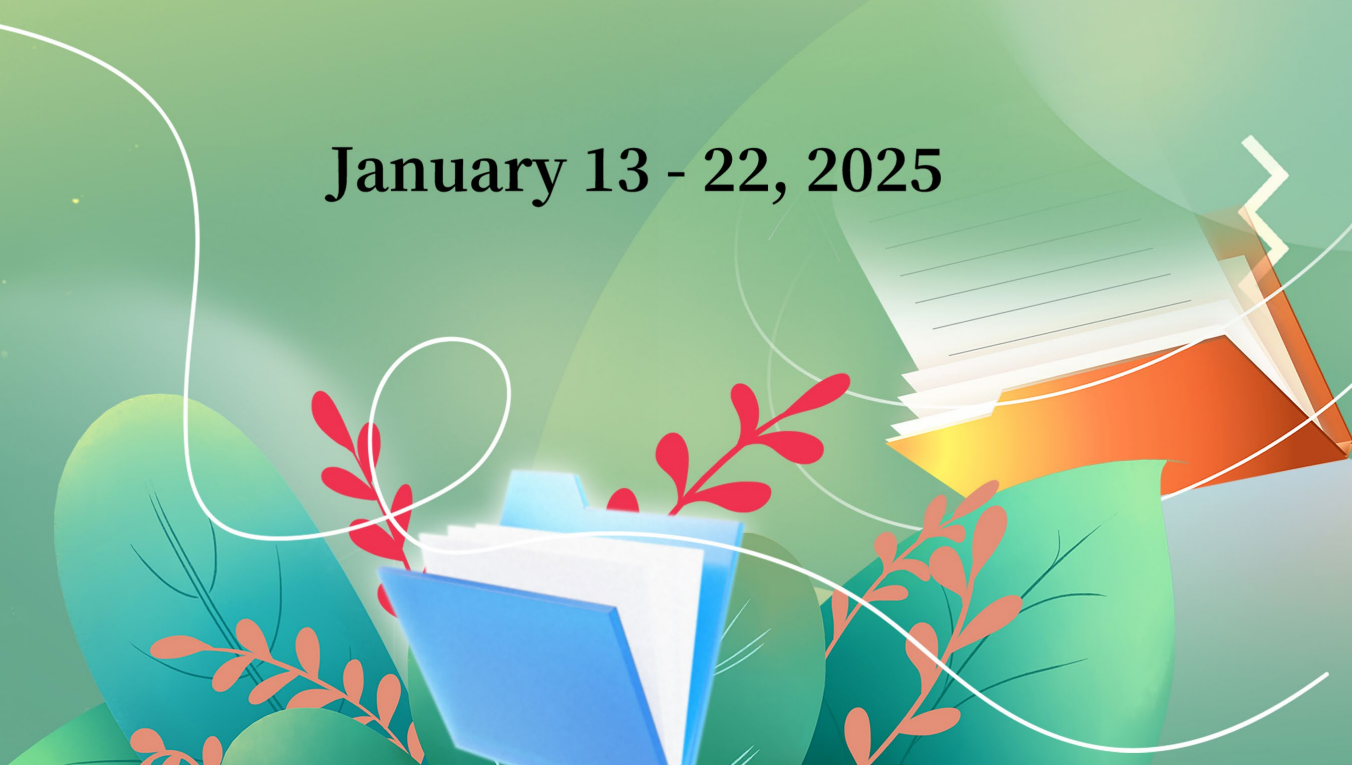


International and Inter-Institution Network
for Accelerator Science to Next Generation



The 19th Asian winter school on strings, particle physics and cosmology

January 13 - 22, 2025



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About AWS2025



The 19th Asian winter school on strings, particle physics and cosmology
第 19 届弦理论、粒子和宇宙学亚洲冬季学校

Date

January 13-22, 2025

Venue

Room A-211, TSIMF

Local Organization Committee

Bin Chen(陈斌), Peking University
Ling-Yan Hung(孔令欣), Tsinghua University
Jian-Xin Lu(卢建新), University of Science and Technology of China
Wei Song(宋伟), Tsinghua University
Yi-Nan Wang(王一男), Peking University
Zhen-Bin Yang(杨镇斌), Tsinghua University

Introduction

The Asian Winter School (AWS) on Strings, Particles and Cosmology is a pan-Asian collaborative effort of high energy theorists from China, India, Japan and Korea to give young researchers in Asia an opportunity to come together and learn about the latest developments in high energy theory from leading experts on the subject.

This school is aimed towards advanced graduate students, postdoctoral fellows and active researchers in the field. This is the 19th in a series of Asian Winter Schools that have been organized on a rotating basis among China, Japan, India and Korea. We welcome students from all of these participating countries as well as students from outside.

The previous Asian Winter Schools in this series have provided young researchers with opportunities for discussions with leading experts in different areas and also for initiating collaboration with other young researchers belonging to the different participating countries. We hope the 2025 School will continue this tradition.

Invited Speakers

Jonathan J. Heckman (University of Pennsylvania): Top Down Approach to Symmetries in Quantum Field Theory and Gravity

Jonathan Sorce (Massachusetts Institute of Technology): Operators in quantum field theory

Sameer Murthy (King's College London): Black holes and their microstates in string theory

Micha Berkooz (Weizmann Institute of Science):

Victor A. Rodriguez (Princeton University): 2d String Theories and Applications

Washington Taylor (Massachusetts Institute of Technology):

Miguel Montero (Institute of Theoretical Physics in Madrid): An Introduction to the Swampland Program

Sabrina Pasterski (Perimeter Institute):

Vladimir Kazakov (École normale supérieure): Integrability of AdS₅/CFT₄, Quantum Spectral Curve and Fishnet CFT

Steering Committee

Agnese Bissi (ICTP, Italy)

Bin Chen (Peking, China)

Atish Dabholkar (ICTP, Italy)

Rajesh Gopakumar (ICTS, India)

Koji Hashimoto (Kyoto, Japan)

Seok Kim (SNU, Korea)

Kimyeong Lee (KIAS, Korea)

Miao Li (ITP, CAS & Sun Yat-Sen, China)

Jian-Xin Lu (USTC, China)

Jun Nishimura (KEK, Japan)

Hiroshi Ooguri (Caltech, USA & Kavli IPMU, Japan)

Ashoke Sen (ICTS, India)

Sang-Jin Sin (Hanyang, Korea)
 Wei Song (Yau MSC, Tsinghua, China)
 Tadashi Takayanagi (Yukawa ITP, Japan)
 Spenta R. Wadia (ICTS, India)
 Piljin Yi (KIAS, Korea)

Course Organizers

David Gross (Kavli Institute for Theoretical Physics)
 Andrew Strominger (Harvard University)
 Hirotaka Sugawara (OIST)
 Shing-Tung Yau (Harvard University)

Course Organizers

Nabamita Banerjee (Indian Institute of Science Education and Research)
 Seung-Joo Lee (IBS Center for Theoretical Physics of the Universe)
 Honda Masazumi (RIKEN • Advanced Science Institute)
 Onkar Parrikar (Tata institute of fundamental research)
 Yinan Wang (Peking University)
 Junggi Yoon (Asia Pacific Center for Theoretical Physics)
 Masahito Yamazaki (Kavli Institute for the Physics and Mathematics of the Universe)
 Zhenbin Yang (Tsinghua University)

Steering Committee



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 Institute for Advanced Study, Tsinghua University



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Supporting Organizations





Yau Mathematical Sciences Center(YMSC)

In December 2009, Tsinghua University established Mathematical Sciences Center, with internationally renowned mathematics master Professor Shing-Tung Yau appointed as the Director of the center. As a major strategic measure to support development in mathematics at Tsinghua University, the Ministry of Education officially approved the establishment of Yau Mathematical Sciences Center managed by Tsinghua University at the end of 2014. Under the leadership of Professor Shing-Tung Yau, YMSC has made substantial development in top talents recruitment, outstanding mathematical talents cultivation, cutting-edge scientific research and mathematical discipline construction, making it a world-class research center of significant international influence. YMSC treats faculty development and students cultivation as its fundamental tasks. In the past years, YMSC has attracted 86 full-time faculty members with strong support from Tsinghua University, including 28 professors, 14 associate professors and 44 assistant professors. Currently, YMSC has 75 postdoctoral researchers.

Around faculty development and student cultivation, YMSC keeps exploring and innovating the modes of mathematical talents selection and cultivation. It has established a series of talent selection and communication platforms including "S. T. Yau High School Science Award", "S.-T. Yau College student Mathematics Contests", "ICCM Medal of Mathematics", "Distinguished Lectures", "Master Forums", "International Chinese Mathematical Union" and "International Congress of Chinese Mathematicians". In addition, it has signed Memoranda of Understanding with relevant departments of nearly 30 world top universities and research institutes, such as Harvard University, Stanford University and Oxford University. More than 300 mathematicians as well as experts and scholars in related areas visit YMSC each year for exchange and communication. It has also hosted many important international academic conferences at Tsinghua University or Tsinghua Sanya International Mathematical Forum. A large number of academicians in various countries as well as winners of the Nobel Prize, the Fields Medal and Wolf Prize have visited YMSC for communication and speech delivery.



Peng Huanwu Center for Fundamental Theory

Fundamental theories and mathematical methods in physics have always been important parts of physics. They play an essential role in guiding and in promoting the development of physics and even natural science. The recent progresses in quantum field theory and quantum gravity have changed some of our general comprehensions and views towards them, highlighting the importance of basic theoretical research. To solve some of the fundamental issues in physics, such as dark matter, dark energy and quantum gravity, we must first have a profound and deep understanding of them. This will serve as a basis for further development and advance in physics and in science in general.

After years of efforts, China has accumulated and made considerable progress in the fundamental theories of high energy physics and other related fields. But at the same time, we need to realize that the achievements in originality and with international influence are quite slim. If we want to have a place in the area of theoretical high energy physics with a worldwide recognition, it is necessary for us to cultivate and to build a competitive group of talented people, especially the young ones, in this area, and to encourage them to carry out a first-rate research emphasizing primarily on the depth and originality, in an atmosphere that puts the academic research first.

The establishment of "Peng Huanwu Center for Fundamental Theory" (PCFT) is an important concrete step to achieve this. The 7-th scientific committee for the special fund of the National Natural Science Foundation of China decided in its second annual meeting in 2019 that the University of Science and Technology of China along with the Northwest University, given their respective establishments in the formal aspects of high energy theories and in quantum integrable systems, to build jointly the PCFT in High Energy Physics. The focus of this center is on areas such as the general mathematical structure of quantum field theory, quantum gravity including String/M theory and the related mathematical physics along with the associated high quality academic activities.

With the joint and accumulated efforts of the members of this center along with others, we hope that certain breakthroughs can be made on some of the key issues mentioned above, enhancing our understanding of fundamental laws of physics, in the foreseeable future.



Center for High Energy Physics, PKU

In order to continuously develop and innovate high-energy physics in China and in the world, to attract cutting-edge talents at home and abroad, and also to speed up the pace of Peking University becoming a world-class university, Center for High Energy Physics was set up in Peking University on November 25th, 2006, as Prof. Tsung-Dao Lee was appointed as the director of the center. The core missions of the center are to promote exchanges and cooperation between scientists at home and abroad, to train a group of outstanding young scholars among some of the important High-energy physics areas so that they can be directly involved in scientific research frontiers. To achieve this mission, CHEP, PKU adhere to opening up at home and abroad, with the responsibility of serving the country while facing the world, will focus on high-energy physics, nuclear physics, astrophysics, cosmology physics and related cutting-edge researches. At the same time, CHEP actively promotes international exchanges and cooperation, aims to develop into a high-level academic research institution and become a world-renowned base in the high-energy physics research areas.



Schedule



Sunday(Jan 12)	Time&Date	Monday (Jan 13)	Tuesday (Jan 14)
Arrival	7:30-8:20	Breakfast (50 minutes)	Breakfast (60 minutes)
	8:20-8:30	Opening remark	
	8:30-10:00	Sabrina Pasterski	Sabrina Pasterski
	10:00-10:30	Group photo and Break	Coffee Break (30 minutes)
	10:30-12:00	Jonathan J. Heckman	Jonathan J. Heckman
	12:00-13:30	Lunch (90 minutes)	
	13:30-15:00	Micha Berkooz	Micha Berkooz
	15:00-15:30	Coffee Break(30 minutes)	
	15:30-17:00	Jonathan J. Heckman	Jonathan J. Heckman
	17:30-18:30	Dinner(60 minutes)	Dinner(90 minutes) 17: 30-19: 00
	18:30-20:00	The AWS 2025 Poster Exhibition	
Time&Date	Wednesday (Jan 15)	Thursday (Jan 16)	Friday (Jan 17)
7:30-8:30	Breakfast (60 minutes)		
8:30-10:00	Sabrina Pasterski	Sabrina Pasterski	Jonathan Sorce
10:00-10:30	Coffee Break (30 minutes)		
10:30-12:00	Miguel Montero	Vladimir Kazakov	Vladimir Kazakov
12:00-13:30	Lunch (90 minutes)		
13:30-15:00	Micha Berkooz	Micha Berkooz	Miguel Montero
15:00-15:30	Coffee Break(30 minutes)		
15:30-17:00	Jonathan Sorce	Jonathan Sorce	Jonathan Sorce
17:30-19:00	Dinner(90 minutes)		

Time&Date	Saturday (Jan 18)	Sunday (Jan 19)	Monday (Jan 20)
7:30-8:30	Breakfast (60 minutes)		
8:30-10:00	Miguel Montero	Miguel Montero	Washington Taylor
10:00-10:30	Coffee Break (30 minutes)		
10:30-12:00	Vladimir Kazakov	Vladimir Kazakov	Victor A. Rodriguez
12:00-13:30	Lunch (90 minutes)		
13:30-15:00	Free discussion	Sameer Murthy	Sameer Murthy
15:00-15:30		Coffee Break(30 minutes)	
15:30-17:00		Victor A. Rodriguez	Victor A. Rodriguez
17:30-19:00	Dinner(90 minutes)		
Time&Date	Tuesday (Jan 21)	Wednesday (Jan 22)	Thursday(Jan 23)
7:30-8:30	Breakfast (60 minutes)		
8:30-10:00	Washington Taylor	Washington Taylor	Departure
10:00-10:30	Coffee Break (30 minutes)		
10:30-12:00	Sameer Murthy	Sameer Murthy	
12:00-13:30	Lunch (90 minutes)		
13:30-15:00	Washington Taylor	Free discussion	
15:00-15:30	Coffee Break(30 minutes)		
15:30-17:00	Victor A. Rodriguez		
17:30-19:00	Dinner(90 minutes)		



About Speakers





Jonathan J. Heckman

Associate Professor

Department of Physics and Astronomy at the University of Pennsylvania;
Department of Mathematics at the University of Pennsylvania.

Jonathan J. Heckman is an associate professor in the Department of Physics and Astronomy at the University of Pennsylvania with a secondary appointment in the Department of Mathematics. He received his AB in 2004 from Princeton University and his PhD in 2009 from Harvard University. He was then a member at the IAS at Princeton and a postdoc at Harvard, before starting as an assistant professor at UNC Chapel Hill in 2014. Since 2017 he has been on the faculty at the University of Pennsylvania.

Currently, his efforts are concentrated in three directions:

- 1) The study of quantum field theory using the extra dimensions of string theory.
- 2) The study of formal and phenomenological aspects of string compactification, and in particular F-theory.
- 3) Conceptual questions connected with the embedding of field theoretic UV cutoffs in string theory.

Top Down Approach to Symmetries in Quantum Field Theory and Gravity

Jonathan J. Heckman

Department of Physics and Astronomy at the University of Pennsylvania;
Department of Mathematics at the University of Pennsylvania.

We give an overview of recent advances in understanding generalized symmetries in the context of quantum field theory and quantum gravity. The overarching theme is to use a top down approach based on the UV complete framework of string theory to construct and study novel examples of such structures, especially at strong coupling, and especially in systems that are eventually coupled to gravity.

A rough outline for the lectures is as follows:

- 1) Overall motivation / introduction to engineering QFTs via extra-dimensional geometry
- 2) Top down approach to topological symmetry operators and heavy defects
- 3) Symmetry Topological Field Theories and their top down generalizations
- 4) On the fate of global symmetries in quantum gravity

Bonus Lecture (part of 4, time permitting):
How to Falsify String Theory at a Collider



Jonathan Sorce

Postdoctoral

Massachusetts Institute of Technology(MIT)

Jonathan Sorce is a postdoctoral fellow in theoretical physics at the Massachusetts Institute of Technology. In 2022, he completed his PhD at Stanford University under the supervision of Patrick Hayden. Jonathan's research broadly lies in the "It From Qubit" field, using ideas from quantum information theory to understand problems in quantum gravity and in quantum field theory. He is particularly interested in using modular theory to understand the thermodynamic properties of far-from-equilibrium states.

Jonathan's physics publications can be found on arXiv or iNSPIRE (though one paper, a pure-math article, is listed only on arXiv). In late 2021, he started maintaining a physics blog at sorcenotes.blogspot.com, where he compile research-level notes on topics in mathematical physics.

Operators in quantum field theory

Jonathan Sorce

Massachusetts Institute of Technology(MIT)

These lectures will provide an introduction to the “algebraic approach” to quantum field theory. In this approach, one focuses on the way fields act on Hilbert space as operators, and studies the physics of quantum field theory using mathematical tools from functional analysis. I will present on the general mathematical structure, some concrete settings in which explicit calculations can be performed, and connections to an exciting modern topic of research in which operator algebras are used to study black hole entropy.

Lecture 1: Smearing fields and unbounded operators

Lecture 2: von Neumann algebras and modular theory

Lecture 3: Operators in free field theory

Lecture 4: (Bonus, depending on time) Types, traces, and renormalization



Sameer Murthy

Professor of Theoretical and Mathematical Physics
King's College London

Sameer Murthy graduated from the Indian Institute of Technology Bombay, and got his PhD at Princeton University. He subsequently held a research position at the Abdus Salam ICTP Trieste, a Marie Curie fellowship at the University of Paris, and a senior post-doctoral research position at Nikhef Amsterdam where he was awarded the NWO VIDI research grant by the Dutch organisation for scientific research. In 2015 he was awarded the ERC consolidator grant to lead a research team working on a research project involving quantum gravity, black holes, and modular forms. He moved to King's College London as a Lecturer in Theoretical Physics in September 2013, where he now is a Professor of Theoretical and Mathematical Physics. He was the J. Robert Oppenheimer Visiting Professor 2023/24 at the Institute for Advanced Study in Princeton. Sameer's research interests lie broadly in the fields of string theory, quantum field theory, and quantum gravity, and their interactions with mathematics. He is particularly interested in quantum aspects of black holes and exact (finite- N) holography, and their relation to modular and automorphic forms.

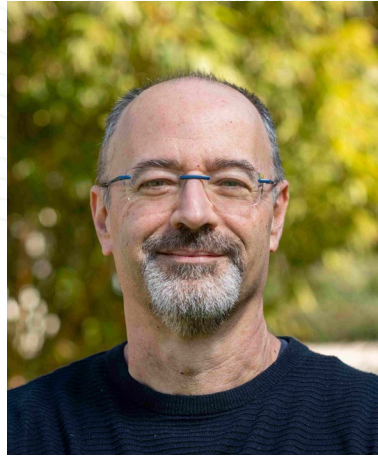
Black holes and their microstates in string theory

Sameer Murthy

Theoretical and Mathematical Physics
King's College London

The broad goal of this lecture series is to describe the idea of the counting of supersymmetric black hole microstates in string theory. I will describe the main ideas that underlie this subject, from the original breakthroughs of Strominger-Vafa and Sen in the 1990s to more recent developments involving large quantum effects in near-extremal black holes.





Micha Berkooz

Professor

Weizmann Institute of Science

I did my Ph.D. at Rutgers University during the heydays of the field theory and String theory revolutions which introduced the concepts of field theory dualities in a large class of field theories, and the ubiquity of String theory dualities. Then went on to a post-doctoral position at the IAS in Princeton and at Princeton University, before joining the Weizmann Institute of Science in Israel. Over this time period, we have gained considerable control over field theories and String theories. As is often the case in physics, the progress has been extremely impressive in question where there are rigid (in a loose sense) algebraic structures such as anomalies or supersymmetry, i.e., protected quantities. At the same time, many questions about dynamical, and less protected, processes remain unanswered.

My current research deals with quantum chaos and its relation to quantum gravity black holes - perhaps the least understood of all dynamical processes. Frustrated chaotic quantum systems have been studied for a very long time but we still have a poor understanding of their structure beyond the strong chaos/long time/random matrix theory aspects. My research focuses on solvable models and their new algebraic structure and universality classes, beyond the limit mentioned above, and their quantum gravity duals.

A cordial approach to the SYK model

Micha Berkooz

Weizmann Institute of Science

I will review recent progress regarding the double scaled Sachdev-Ye-Kitaev model and other p -local quantum mechanical random Hamiltonians. These models exhibit an expansion using chord diagrams, which can be solved by combinatorial methods. I will describe exact results in these models, including their spectrum, correlation functions, and Lyapunov exponent. In a certain limit, these techniques manifest the relation to the Schwarzian quantum mechanics, a theory of quantum gravity in AdS2. More generally, the theory is controlled by a rigid algebraic structure of a quantum group, suggesting a theory of quantum gravity on non-commutative q -deformed AdS2. I will conclude with a discussion of related universality classes, and survey some of the current research directions.



Victor Alonso Rodriguez

Postdoctoral Scholar

University of California, Santa Barbara

Victor earned a PhD in theoretical physics from Harvard University in 2021. He then held a postdoctoral fellowship at Princeton University until 2024. He is currently a postdoctoral scholar at UC Santa Barbara.

His research focuses on string theory and theoretical high-energy physics. Victor's interests include the foundational aspects of string perturbation theory, conformal field theory, holographic duality, and their applications to quantum gravity and quantum cosmology.

A broad theme of his research is the investigation of holographic dualities between two-dimensional string theories and matrix models as a possible window into a non-perturbative description of string theory.

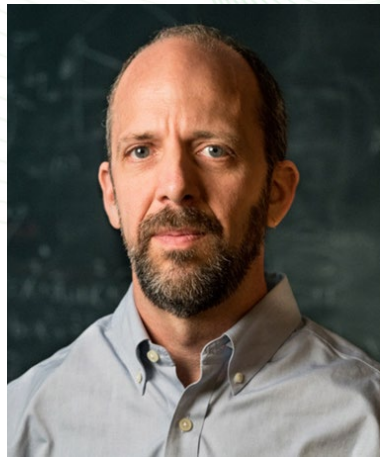
2d String Theories and Applications

Victor Alonso Rodriguez

University of California, Santa Barbara

In these lectures, I will review several distinct 2d string theories (broadly defined) and discuss how they serve as valuable theoretical laboratories for exploring fundamental aspects of string theory and quantum gravity. In particular, I will cover classic models such as the $c=1$ and type 0B string theories, as well as more recent developments, including the Virasoro minimal string and the complex Liouville string.





Washington Taylor

Professor

Director, Center for Theoretical Physics
Massachusetts Institute of Technology(MIT)

Washington Taylor is a Professor of Physics in the MIT Center for Theoretical Physics (CTP) from 2016-2018 and 2024-present. Taylor received his BA in mathematics from Stanford, and his PhD in physics from UC-Berkeley in 1993. He came to MIT as a postdoc in the CTP in 1993. Taylor joined the faculty at Princeton University in 1995, and returned to MIT in 1998, where he became a full professor in 2002. Taylor served as the Director of MIT's Center for Theoretical Physics from 2016-2018.

Professor Taylor's primary research interests are centered on basic theoretical questions related to quantum physics and gravity. Some of Taylor's principal research contributions have been in fundamental aspects of string theory, including the physics of D-branes, string field theory, the matrix model formulation of M-theory, string compactifications, and the geometry and physics of F-theory. Taylor's work combines mathematical, computational, and physics approaches, and has led to progress on mathematical problems as well as in physics. Taylor's recent research has focused on exploring the large number of apparent solutions to string theory and connections between these solutions and observable particle physics and cosmology. Taylor has also recently begun to engage in research on mathematical and computational models of ecology and evolution.

String theory compactifications in various dimensions

Washington Taylor

Director, Center for Theoretical Physics
Massachusetts Institute of Technology(MIT)

This series of lectures will describe supergravity and supersymmetric string theory vacua in various dimensions. Lecture 1: Supergravity in 10 and 11 dimensions and various tools from geometry and string theory. Lecture 2: Supergravity and string compactifications to 7 and 8 dimensions, introduction to F-theory. Lecture 3: supergravity and $N = 1$ string vacua in 6 dimensions. Lecture 4: Fluxes, $N = 1$ string compactifications in 4 dimensions.



Miguel Montero

Professor of IFT madrid

Miguel Montero is a Ramon y Cajal researcher at the theoretical physics institute IFT UAM-CSIC in Madrid, Spain. His research focuses on string compactification and the Swampland Program, which aims to uncover the general features that any low-energy effective field theory which can be consistently coupled to quantum theory of gravity must satisfy.

An Introduction to the Swampland Program

Miguel Montero

IFT madrid

At first sight, it might seem that any quantum field theory, regarded as a low-energy effective field theory (EFT), can be coupled to Einsteinian gravity. Over the past few years, a large body of work has challenged this view, arguing that not every EFT arises as the IR of a consistent theory of quantum gravity. EFT's that do not descend from quantum gravity are said to be in the "Swampland". This lectures will provide a bird's eye view over some of the recent efforts in delineating the boundaries of the Swampland, collectively known as the "Swampland Program". We first give an introduction to the oldest Swampland Conjecture, the absence of global symmetries, but from a modern point of view of topological symmetry operators and its generalization to non-invertible symmetries. We then introduce a certain extension of the absence of global symmetries, known as the Cobordism Conjecture, and discuss its applications to constrain the Landscape of minimal supergravity in more than six dimensions. Finally, we will discuss other conjectured properties of quantum gravity which we cover in this chapter, including Weak Gravity Conjecture, its phenomenological implications, and the Distance Conjecture, ranging from recent connections to EFT strings to the Emergent String Conjecture and implications for potentials.



Sabrina Paterski

Research Faculty

Perimeter Institute for Theoretical Physics

Sabrina is part of the Quantum Fields and Strings group as well as founder and Principal Investigator of the Celestial Holography Initiative (CHI) at the Perimeter Institute for Theoretical Physics. She received her PhD in physics from Harvard University in 2013. She has been a postdoctoral fellow at Princeton University for 2 years before joining Perimeter Institute. She was the Lead Coordinator for Strings 2023 and is a Deputy Director of the newly formed Simons Collaboration on Celestial Holography.

Awards

- Simons Collaboration on Celestial Holography, Simons Foundation, 2023
- Deputy Director, Simons Collaboration on Celestial Holography, Simons Foundation, 2023
- IMSA Alumni Distinguished Leadership Award, Illinois Mathematics and Science Academy, 2019
- InStyle - Badass Woman, TIME Inc., 2018
- 2017 Forbes 30 Under 30 (All Star), Forbes, 2017
- Physics 'Rising Star' Award, MIT, 2016
- 30 under 30 (Science), Forbes, 2015
- 2013 European Physical Society High Energy and Particle Physics Prize, MIT-CMS, 2013
- The Joel Matthew Orloff Award (highest graduating GPA), MIT Physics, 2013
- 2011 MIT Freshman Entrepreneurship Award, MIT, 2011

Celestial Holography

Sabrina Paterski

Perimeter Institute for Theoretical Physics

The Celestial Holography program encompasses recent efforts to understand the flat space hologram in terms of a CFT living on the celestial sphere. A key development instigating these efforts came from understanding how soft limits of scattering encode infinite dimensional symmetry enhancements corresponding to the asymptotic symmetry group of the bulk spacetime. Historically, the construction of the bulk-boundary dual pair has followed bottom up approach matching symmetries on both sides. Recently, however, there has been exciting progress in formulating top down descriptions using insights from twisted holography. These lectures will review salient aspects of the celestial construction, the status of the dictionary, and active research directions.

Lifting Swing Surfaces to AdS

Sabrina Paterski

Perimeter Institute for Theoretical Physics

In this talk we will explore some fun questions that arise when we try to reconcile holographic entanglement entropy proposals in flat space with their AdS uplifts.



Vladimir Kazakov

Professor

Ecole Normale Supérieure and Sorbonne University
Senior member of the Institut Universitaire de France

Vladimir Kazakov is a full professor at Ecole Normale Supérieure and Sorbonne University in Paris. He got his Ph.D. degree from Landau Institute of Theoretical Physics (Moscow) in 1981. Since 1989, he has taught at the Ecole Normale Supérieure and Sorbonne University in Paris, France. His research work was focused on diverse topics in quantum field theory, string theory, statistical mechanics. He is one of the world's leading experts in matrix models, 2d gravity, $N=4$ super-Yang-Mills theory and quantum integrability.

Awards

- Landau-Weizmann Award of the Weizmann Institute (Israel, 1990).
- Senior Member of Institut Universitaire de France (2003-2013)
- Servant Award of French Academy of Sciences (2007)
- Humboldt-GayLussac Award (Germany, France, 2007)
- Programme "Kosmos" of Humboldt University at Berlin, invited professor (2016)
- European Research Council Advanced Grant (principal investigator) (2012)

Integrability of AdS5/CFT4, Quantum Spectral Curve and Fishnet CFT

Vladimir Kazakov

Ecole Normale Supérieure and Sorbonne University
Senior member of the Institut Universitaire de France

The lectures are aimed at the description and some practical applications of integrability of the spectrum of conformal operators in $N=4$ super-Yang Mills theory in the 't Hooft limit. After an introduction into the basics of the subject: AdS/CFT correspondence, Large N limit, (super) conformal symmetry, definition of conformal operators, I will present the one-loop computation of the dilatation operator and explain how to diagonalize it and thus extract the spectrum of anomalous dimensions, using the algebraic Bethe ansatz. Then I will define the system of Baxter Q -functions, their analyticity properties and the so called QQ -relations among these functions, encoded into the Hasse diagram. This will allow to introduce the AdS5/CFT4 Q -system solving the problem of spectrum of conformal dimensions of a-priori any conformal operator in the planar limit. Example of operators in $SL(2)$ sector of the theory will be considered. If the time permits, I will present the so-called fishnet limit of gamma-twisted version of $N=4$ SYM, combining the double scaling limit of large twist and the weak coupling. Integrability of the resulting fishnet CFT and its generalizations allows computations of a large class of multi-loop Feynman graphs.



About Students



**ALI, ARSHAD**

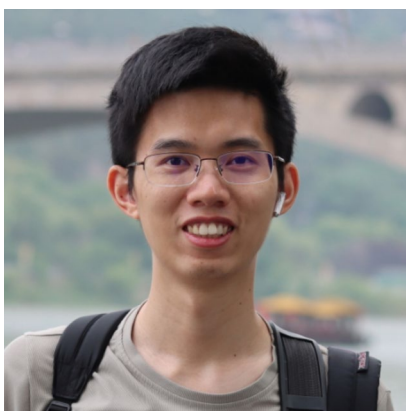
Soochow University, China

**ALI, MOHD**Indian Institute of Science Education
and Research Pune**ARENAS HENRIQUEZ,
GABRIEL DARIO**

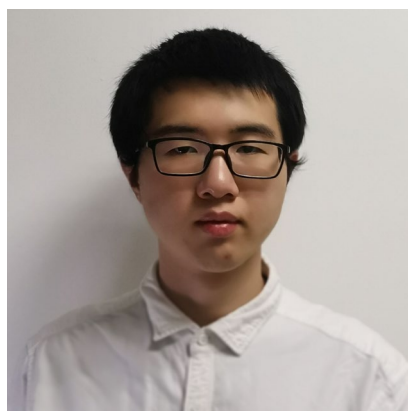
Tsinghua university

**BAISHYA, BANASHREE**Indian Institute of Technology
Guwahati**BISWAS, SAIKAT**Indian Institute Of Technology
Kanpur**CAO, QU (曹趣)**

Zhejiang University

**CHEN, LIANGYU (陈良玉)**

Tsinghua University

**CHEN, KEREN (陈可人)**

Peking University

**DEY, ANKUR**Indian Institute Of Technology
Kanpur



DU, BAONING(杜宝宁)

Max Planck Institute For
Mathematics



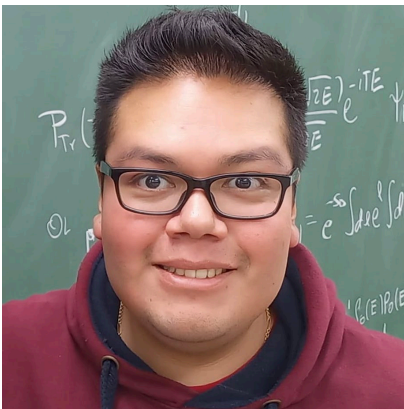
DUAN, ZHIHAO(段治豪)

Queen Mary University of London



DUARY, SARTHAK

Yau Mathematical Sciences Center
(YMSC), Tsinghua University



**ESPINDOLA ROMERO,
RICARDO**

Tsinghua University



FENG, LI(冯黎)

Northeastern University



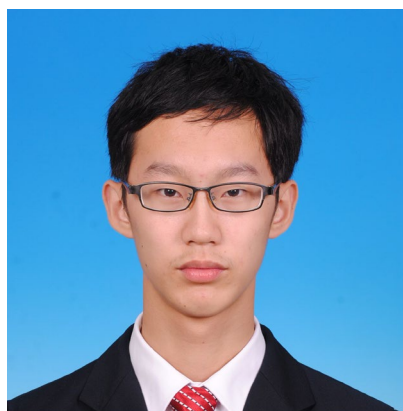
GILL, ANKIT

Indian Institute of Technology
Kanpur



GROVER, SACHIN

Indian Institute of Technology
Kanpur



GU, ZHENBANG(顾振邦)

Peking University



GUO, YUANHONG(郭圆宏)

Institute of Theoretical Physics,
Chinese Academy of Sciences

**GUPTA, NISHANT**National Institute of Science
Education and Research**HAO, YU (郝雨)**

Southeast University

**HU, ZEZHOU (胡泽州)**

Peking University

**HUANG, XINHAN (黄新瀚)**University of Science and Technology
of China**KANDA, HIROKI (神田大树)**

Kyoto University

**KANG, HEE SU**

Seoul National University

**KHO, MINSUNG**Ulsan National Institute of Science
and Technology**KIM, SEUNGGYU (金承圭)**Korea Advanced Institute of Science
and Technology**LAI, WENXIN (赖文昕)**University of Chinese Academy of
Sciences



LE, DUC TRUYEN (黎德傳)

National Tsinghua University



LEE, JEHYUN

Seoul National University



LI, JINYANG (李金阳)

KEK/Sokendai



LI, ZEYU (李泽宇)

Institute of Theoretical Physics,
Chinese Academy of Sciences



LI, CHUNHAO (李淳浩)

Imperial College London



LIU, KANGNING (刘康宁)

Tsinghua University



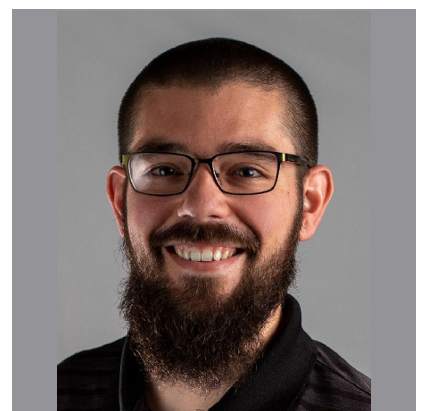
LIU, YIHUA (刘逸华)

Tsinghua University



LIU, WENBIN (刘文斌)

Huazhong University of Science and
Technology



LOGES, GREGORY JOSEPH

High Energy Accelerator Research
Organization (KEK)



LOU, QINJIAN (娄琴剑)

Peking University



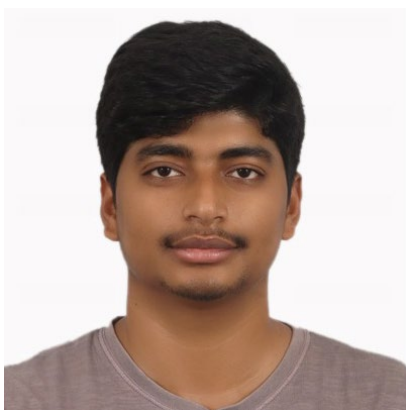
LU, JINGRU (路京儒)

Tsinghua university



MANSHA, ADEEL

Shenzhen University



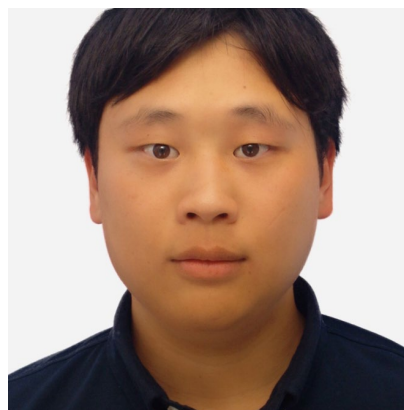
MISHRA, AMIYA

Shing-Tung Yau Center And School
Of Physics, Southeast University



NANDY, PRATIK

Interdisciplinary Theoretical and
Mathematical Sciences Program
(iTHEMS), RIKEN



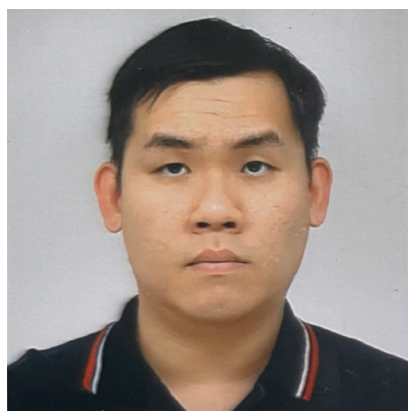
OHATA, HIROKI (大畑宏樹)

High Energy Accelerator Research
Organization



OU, MANQIAN (欧满谦)

Tsinghua University



PIENSUK, MR. WORAPAT

The Graduate University for
Advanced Studies, SOKENDAI



RAJ, VINAYAK

Huzhou Normal University



REN, JIE (任杰)

University of Science and Technology
of China



SABIR, MUDASSAR

University of Electronic Science and
Technology China



SHUAI, SIRUI (帅思睿)

Tsinghua University



SIVAKUMAR, AKHIL

Asia Pacific Center for Theoretical
Physics, Pohang



SU, YANMING (苏彦铭)

University of Tokyo



TANG, YICHAO (唐一朝)

Institute of Theoretical Physics,
Chinese Academy of Sciences



WANG, XIAOSHUAI (王晓帅)

Institute of Theoretical Physics,
Chinese Academy of Sciences



WANG, ZHUOHUI (王卓辉)

University of Science and Technology
of China



WANG, YUANTAI (王元泰)

University of Science and Technology
of China



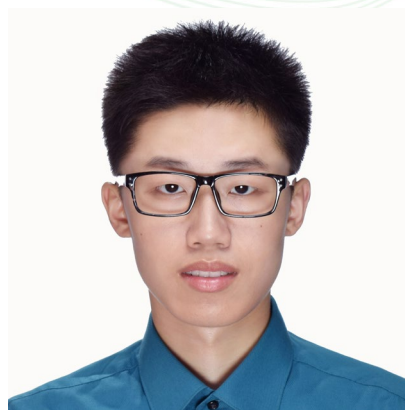
WANG, JUNQI (汪隽琪)

The Hong Kong University of
Science and Technology



WANG, YUCHEN (王雨晨)

Harvard University



WEN, YUTING (温煜琰)

Peking university



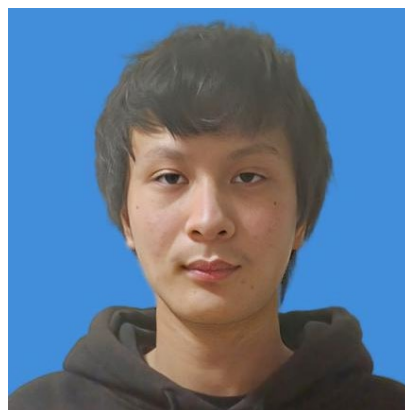
XIAO, HONGYANG (肖弘洋)

Huazhong University of Science and
Technology



XIE, CHONGSI (谢崇思)

Wuhan University



ZENG, BAIJUN (曾柏钧)

Tianjin University



ZHANG, XUAO (张绪敖)

University of Chinese Academy of
Sciences



ZHANG, HAO (张昊)

University of Tokyo



ZHAO, WEICHENG (赵伟程)

Tianjin University



ZHENG, WENNI (郑文旎)

International Centre for Theoretical
Physical Asia-Pacific, University of
Chinese Academy of Sciences



ZHENG, YUFAN (郑宇凡)

BIMSA



ZHONG, HAOCHENG (钟浩成)

Southeast University



ZHONG, ZHENGHAO (钟正皓)

University of Oxford



ZHOU, BOCHEN (周柏辰)

Tianjin University





Welcome to TSIMF



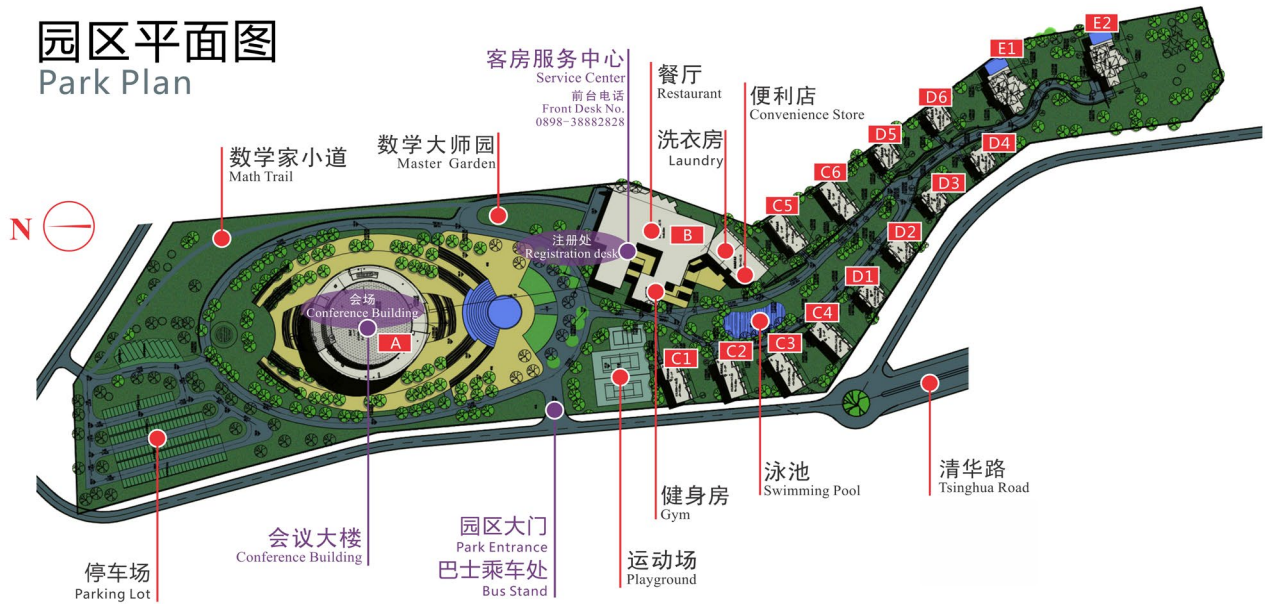


Welcome to TSIMF

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.



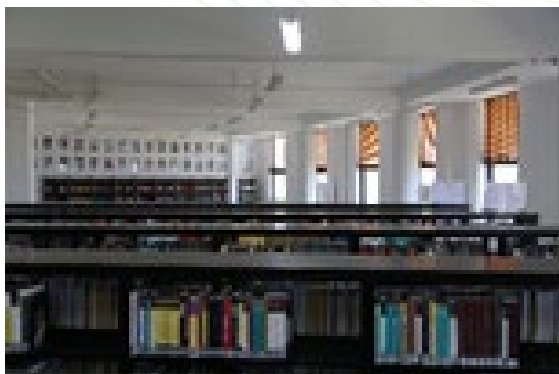
Guest Room

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.



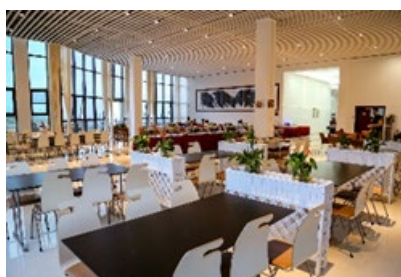
In order to give readers a better understanding of the contributions made by the Fields Medalists, the library of Tsinghua Sanya International Mathematics Forum (TSIMF) instituted the Special Collection of Fields Medalists as permanent collection of the library to serve the mathematical researchers and 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 07:30-08:45

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: 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.

