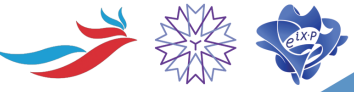
Conference on

Algebraic Geometry

2025 Dec 27 to Dec 31

Caucher Birkar & Santai Qu



Description

This conference is a lasting pilgrimage for the international mathematics community. Each year, we gather to map the changing landscape of algebraic geometry, share groundbreaking discoveries that expand the frontiers of our field, and build collaborations that will shape its future. From the deepest theoretical foundations to the most unexpected intersections with other areas, this gathering acts as the heartbeat of discovery and discussion.

We meet each year not only to present but also to engage in the ongoing collective advancement of knowledge. Join us at the Tsinghua Sanya International Mathematics Forum as we once again come together to explore, question, and be inspired.

Date

December 27-31, 2025

Venue

Room A-110, TSIMF

Zoom ID: 262 865 5007

Passcode: YMSC

Contents

Schedule

Time&Date	Saturday (December 27)	Sunday (December 28)	Monday (December 29)	Tuesday (December 30)	Wednesday (December 31)
7:30-8:30	Breakfast (60 minutes)				
9:00-10:00	Shinobu Hosono	Yuri Prokhorov	Masayuki Kawakita	Meng Chen 陈猛	Zhizhong Huang 黄治中
10:00-10:30	Tea Break (30 minutes)				
10:30-11:30	Yongnam Lee	Shin-ichi Matsumura	Chen Jiang 江辰	Jun-Yong Park	Pham Hoang Hiep (online)
12:00-13:30	Lunch (90 minutes)				
13:30-14:30	Zhiwei Zheng 郑志伟	Mao Sheng 盛茂	Artan Sheshmani	Seung-Joo Lee	Jia Jia 贾甲
14:30-15:00	Tea Break (30 minutes)				
15:00-16:00	Wenhao Ou 欧文浩	Junchao Shentu 申屠钧超	Yu Zou 邹瑜	Junpeng Jiao 焦骏鹏	Priyankur Chaudhuri
16:00-16:30	Tea Break (30 minutes)				
16:30-17:30	Minzhe Zhu 朱民哲	Jihao Liu 刘济豪		Heer Zhao 赵和耳	
17:30-20:00	Dinner (90 minutes)				

Titles and Abstracts

December 27, 2025 - Saturday

Families of Calabi-Yau manifolds and mirror symmetry

Shinobu Hosono
Gakushuin University

I will survey mirror symmetry arising from families of Calabi-Yau manifolds. As an example, I will describe in detail mirror symmetry of Calabi-Yau manifolds fibered by abelian surfaces, and observe that quasi-modular forms appear as the generating functions of Gromov-Witten invariants. This talk is based on my recent survey article arXiv:2502.10970.

Positivity of the (co)tangent bundle of smooth projective varieties

Yongnam Lee
IBS

The positivity of (co)tangent bundle has profound implications for its geometry, as various conditions like ampleness, bigness, semi-ampleness, nefness, or pseudo-effectivity restrict its structure. In this talk, I will discuss some geometric restrictions and applications on smooth projective manifolds due to the positivity of the (co)tangent bundle, and present various related examples.

Commensurability among Deligne--Mostow Monodromy Groups, and Transformation Relations among Hypergeometric Functions

Zhiwei Zheng 郑志伟
Tsinghua University

This talk is based on joint works with Chenglong Yu. We give the commensurability classification of Deligne--Mostow ball quotients and show that the 104 Deligne--Mostow lattices form 38 commensurability classes. Firstly, we find commensurability relations among Deligne--Mostow monodromy groups, which are not necessarily discrete. This generalizes previous work by Sauter and Deligne--Mostow in dimension two. In this part, we consider certain projective surfaces with two fibrations over the projective line, which induce two sets of Deligne--Mostow data. The correspondences of moduli spaces provide the geometric realization of commensurability relations. Secondly, we obtain commensurability invariants from conformal classes of Hermitian forms and toroidal boundary divisors. This completes the commensurability classification of Deligne--Mostow lattices and also provides an alternative approach to the results of Kappes–Möllerr and McMullen's on non-arithmetic Deligne--Mostow lattices. Inspired by this work and as an ongoing project, we find new proofs for certain transformation formulas among hypergeometric functions, in the flavour of Fubini theorem.

Unitary flat vector bundles on compact Kaehler varieties

Wenhao Ou 欧文浩
AMSS

In this talk, we will present a recent joint work with Xin Fu. We prove that a stable reflexive coherent sheaf, on a compact Kaehler variety with klt singularities, is a unitary flat vector bundle up to quasi-etale cover, if and only if its first and second orbifold Chern classes are both zero.

Boundedness of polarized log Calabi-Yau fibrations with bounded bases

Minzhe Zhu 朱民哲
KIAS

A Calabi-Yau fibration is a fibration of projective varieties $X \to Z$ such that the canonical bundle K_X is numerically trivial over Z. The central question is: under what conditions does the total space of such a fibration belong to a bounded family? Motivated by this, we investigate fibrations whose bases and general fibers are themselves bounded. We show that, after fixing natural invariants, the total spaces are bounded in codimension one. Furthermore, when the general fibers have vanishing irregularity, the total spaces are in fact bounded. These results have further applications to the study of stable minimal models and fibered Calabi–Yau varieties. This is based on the joint work with Xiaowei Jiang and Junpeng Jiao.

December 28, 2025 - Sunday

Birational geometry of conic bundles

Yuri Prokhorov
Steklov, RAS

I am going to discuss applications of Sarkisov program to the rationality problem of three-dimensional algebraic varieties having conic bundle structures.

I will give a survey of the problem and present a few new results.

The talk is based on the work in progress joint with V. Shokurov.

The Nonvanishing Problem for Varieties with Nef Anticanonical Bundle

Shin-ichi Matsumura
Tohoku University

In this talk, I discuss the nonvanishing problem in the framework of the "generalized" Minimal Model Program. I first introduce some structure theorems for projective varieties with "non-negative curvature" in various senses, including pseudo-effective tangent bundles, semi-positive holomorphic sectional curvature, and nef anti-canonical divisor. I then show that the structure theorem of this type reduces the nonvanishing problem for nef anticanonical divisors to the case of rationally connected varieties, and that the nef anticanonical bundle of a projective threefold is numerically represented by an effective divisor. The first part of this talk is joint work with Juanyong Wang (Chinese Academy of Sciences), and the latter part is joint work with Thomas Peternell, Vladimir Lazic, Nikolaos Tsakanikas, and Zhixin Xie.

Nonlinear Hodge theory

Mao Sheng 盛茂
Tsinghua University

I shall report our recent progress on nonlinear Hodge theory. In the talk, I shall discuss a nonlinear generalization of a classical theorem of A. Weil on the existence of flat structures on holomorphic vector bundles over compact Riemann surfaces, introduce the notion of nonlinear harmonic bundles and construct holomorphic nonlinear Higgs bundles from reductive representations of topological fundamental groups of compact Kaehler manifolds. This is a joint work with Nianzi Li.

Stratified Hyperbolicity of the Moduli Stack of Stable Minimal Models

Junchao Shentu 申屠钧超
USTC

Hyperbolicity constitutes a fundamental global property of moduli spaces associated with various algebraic varieties of non-negative Kodaira dimension. In this talk, I will present a natural stratification of the moduli stack of stable minimal models—originally introduced by Professor Birkar—that encompasses the moduli stack of KSBA pairs. Over each stratum, the universal family exhibits equisingularity in the context of birational geometry. I will then analyze the hyperbolicity properties of these strata. Specifically, I will establish several forms of hyperbolicity for both the open locus $M_{g,n}$ and the boundary strata corresponding to the boundary divisor $\partial\overline{M}_{g,n}$.

Boundedness of Fano algebraically integrable Foliations

Jihao Liu 刘济豪
Peking University

I will discuss works on the boundedness of Fano foliations, particularly the algebraically integrable ones.

December 29, 2025 - Monday

Minimal log discrepancies on threefold singularities

Masayuki Kawakita
Kyoto University

The minimal log discrepancy is an invariant of singularities. The ACC for minimal log discrepancies, together with the lower semi-continuity, will imply the termination of flips. However, the ACC is still unknown in dimension three, and it is one of the most important remaining problems in the birational geometry of threefolds. I shall discuss this problem and present a proof of the ACC on a fixed threefold.

Fano indices of canonical Fano 3-folds

Chen Jiang 江辰
Fudan University

We show that the Q-Fano index of a canonical weak Fano 3-fold is at most 66. This upper bound is optimal and gives an affirmative answer to a conjecture of Chengxi Wang in dimension 3. During the proof, we establish a new Riemmann--Roch formula for canonical 3-folds and provide a detailed study of non-isolated singularities on canonical Fano 3-folds, concerning both their local and global properties. Our proof also involves a Kawamata--Miyaoka type inequality and geometry of foliations of rank 2 on canonical Fano 3-folds.

D-Geometric Hilbert and Quot DG-Schemes (derived Hilbert scheme of solutions to nonlinear PDE)

Artan Sheshmani
BIMSA

We report on recent series of joint works with Jacob Kryczka and Shing-Tung Yau on construction

of derived moduli spaces of solutions to nonlinear PDE. We construct a parameterizing space of ideal sheaves of involutive and formally integrable non-linear partial differential equations in the algebraic-geometric setting. We elaborate on the construction of a D-geometric analog of Grothendieck's Quot (resp. Hilbert) functor and prove that its is represented by a D-scheme which is suitably of finite type. A natural derived enhancement of the so-called D-Quot (resp. D-Hilbert) moduli functor is constructed and its representability by a differentially graded D-manifold with corresponding finiteness properties is studied. If time permits, we further elaborate on construction of universal variational tri-complexes over these derived D-hilbert schemes and their induced BV structure.

The degree of canonical Fano 3-folds

Yu Zou 邹瑜
Chongqing University

We prove that the degree of a canonical weak Fano 3-fold is at most 72, and this upper bound is sharp. This result confirms Prokhorov's conjecture. I will present the proof idea derived from a previous joint work with Chen Jiang. And then I will elaborate on the strategy developed to establish this sharp upper bound (joint work with Chen Jiang and Tianqi Zhang).

December 30, 2025 - Tuesday

On varieties of general type with many global holomorphic forms

Meng Chen 陈猛
Fudan University

By considering the birational geometry induced from global k-forms, we prove the existence of Noether type inequalities between the canonical volume Vol and the Hodge number $h^{k,0}$ for all n -folds of general type and for $1 \leq k \leq n$. As applications, we first introduce the advance in studying minimal volume conjecture in dimension 3. Then we disclose a new type of lifting principle for the sequence of canonical stability indices.

Height moduli spaces and exact Shafarevich counts for elliptic curves over function fields

Jun-Yong Park
University of Sydney

Motivated by Shafarevich–type questions for abelian varieties over global function fields, I will explain how to construct moduli stacks of elliptic surfaces as height moduli and how this yields a

generalization of the classical Tate's algorithm for maps into any moduli space that is isomorphic to a weighted projective stack. We show how to use motivic classes in the Grothendieck ring of stacks to obtain an exact counting formula for elliptic curves over K = Fq(t) of a given height, in all characteristics. Each lower–order term in the formula has a precise geometric origin: it is contributed by certain rational points with extra automorphism groups on Mbar_{1,1} over K, detected via weighted point count of inertia stack of height moduli. This is joint work with Dori Bejleri (Maryland) and Matthew Satriano (Waterloo).

Addressing explicit bounds - dialogues between physics and geometry

Seung-Joo Lee
Yonsei University

String theory leads to a huge number of supersymmetric effective theories, at least as many as the number of topologically distinct Calabi-Yau varieties, forming a vast "landscape" of string theory. Despite the vastness of the latter, interestingly and perhaps surprisingly, one can address universal constraints applying to the string landscape in its entirety. Such constraints sometimes lead to explicit, uniform bounds on concrete physical quantities of effective theories, which may be interpreted as those on the corresponding concrete topological quantities of Calabi-Yau varieties. In this talk, focusing on (real) 6-dimensional F-theory models, or equivalently, on genus-one fibered Calabi-Yau varieties of dimension 3, we will exemplify such dialogues between physics and geometry. For physicists, what we aim to constrain are particle spectra and discrete symmetries of supergravity theories, and for geometers, the base Picard number and (multi-)sections of the genus-one fibrations.

On the Volume of Divisors: Semicontinuity in Families and Discreteness for Calabi-Yau Pairs

Junpeng Jiao 焦骏鹏
Tsinghua University

The volume of a divisor, a fundamental numerical invariant in algebraic geometry, measures its asymptotic rate of growth. In this talk, I will present two recent results that explore the behavior of this invariant in different settings.

The first part concerns the variation of volumes in an algebraic family. We prove that the volume function is upper semicontinuous for a family of divisors in Zariski topology. In the second part, we study the volumes of divisors on Calabi--Yau type varieties. We show that given a klt Calabi--Yau pair (X, B) and an integral divisor A on X, the volume of A is in a discrete set depending only on the dimension and singularities of (X, B). As an application, we prove a boundedness result of polarized log Calabi--Yau pairs which was conjectured by Birkar.

Tame covers and Kummer log flat torsors (joint with J. Gillibert)

Heer Zhao 赵和耳
HIT

Let X be a regular scheme, D a normal crossing divisor on X, and U the complement of D. We endow X with the canonical log structure associated to D. Let G be a finite flat group scheme over X. We discuss the relations among tame G-covers of X relative to D, fppf G-torsors over U, and Kummer log flat G-torsors over X.

December 31, 2025 - Wednesday

Hilbert property for Kummer varieties and K3 surfaces

Zhizhong Huang 黄治中
AMSS

A conjecture of Corvaja--Zannier predicts that a smooth projective simply connected variety Xover a number field k with a Zariski dense set of rational points $X(k)$ should satisfy the Hilbert property. Roughly speaking, given any finite surjective morphism $f : Y \to X$ over k of degree >1, rational points on X lying outside $f(Y(k))$ are still Zariski dense. We report recent progress (joint with D. Gvirtz-Chen, Z. Ji and J. Xie) confirming this conjecture for all Kummer varieties associated to the Jacobian of a hyperelliptic curve, and proving a potential version of this conjecture for loxodromic K3 surfaces.

Singularity Invariants of Plurisubharmonic Functions and Complex Spaces

Pham Hoang Hiep (online)
VAST

This talk introduces several notions of singularity invariants for plurisubharmonic functions. These invariants are then used to define new singularity invariants for complex spaces. We combine tools from pluripotential theory and commutative algebra to study the singularity invariants of plurisubharmonic functions. In addition, we establish several relationships between the singularity invariants of plurisubharmonic functions and those of holomorphic functions.

Sheaf stable pairs on projective surfaces

Jia Jia 贾甲
Tsinghua University

We study the moduli space of higherrank marginally stable pairs (E,s), where E is a torsionfree coherent sheaf of rank r on a smooth projective surface and s = (s_1, …, s_r) is a collection of r sections of E. Fixing the Chern character of E, the moduli space is realised as a subscheme of an appropriate Quot–scheme that parametrises quotient sheaves with the corresponding Hilbert polynomial. We establish a precise link between these moduli spaces and the stable minimal models determined by E and its sections, together with the (relative) log canonical model of the base surface. Using the birational geometry of such minimal models, we analyse in detail the components of the Hilbert–Chow morphism from the moduli space to the Hilbert scheme of effective Cartier divisors on the surface. This is a work in progress.

On the log canonical minimal model program for corank one foliations on threefolds

Priyankur Chaudhuri
Tsinghua University

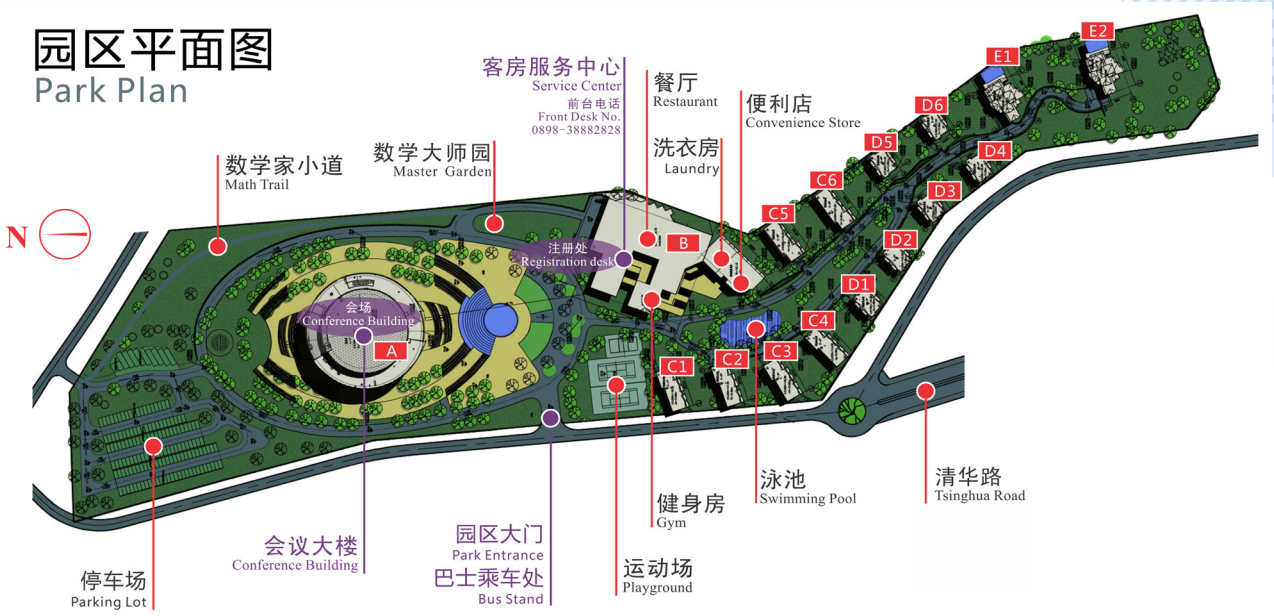
Building on the pioneering work of Cano who proved the existence of foliated log resolution for corank one foliations in dimension three, the minimal model program (MMP) for such foliations with mild (non dicritical) singularities was established in a series of papers by Cascini, Spicer and Svaldi. When the foliation has strictly log canonical (dicritical) singularities, one requires to use other techniques. Considering such foliations becomes essential for studying the birational geometry of Fano foliations and for studying moduli theory of corank one foliations. I will report on a joint work with Roktim Mascharak where we have established the full log canonical MMP for corank one foliations. Time permitting, I will briefly indicate how these results can be extended to the setting of generalized foliated quadruples (i.e. generalized pairs in the foliated setting) and mention applications to indicate why such an extension is necessary even for the classical foliated MMP.

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.

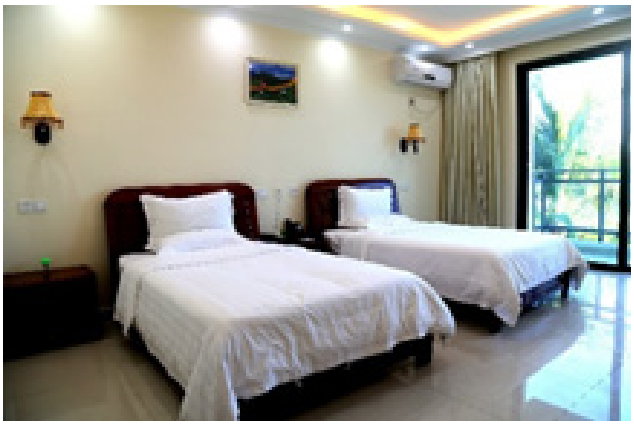
Management Center of Tsinghua Sanya International Forum is responsible for the construction, operation, management and service of TSIMF. The mission of TSIMF is to become a base for scientific innovations, and for nurturing of innovative human resource; through the interaction between leading mathematicians 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.

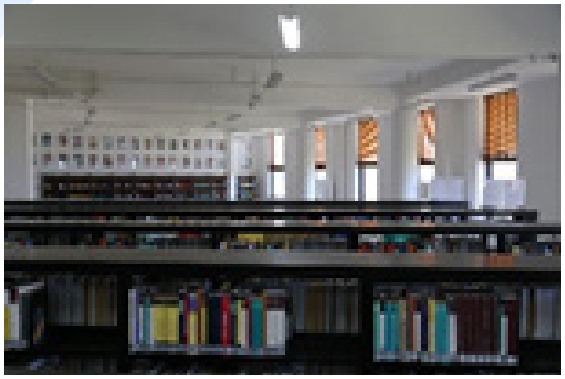


Guest Room

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 :

Sarah 陈媛姗

Tel/Wechat:0086-130-2983-0780

Email: tsimf@tsinghua.edu.cn

Shouxi He 何守喜

Tel/Wechat: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/Wechat: 0086-139-7679-8300

Email: yel@tsinghua.edu.cn

*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)

IT

Yuanhang Zhou 周远航

Tel/Wechat: 0086-133-6898-0169

Email: 13368980169@163.com

Director Assistant of TSIMF

Kai CUI 崔凯

Tel/Wechat: 0086- 136-1120-7077

Email :cuik@tsinghua.edu.cn

Director of TSIMF

Junpeng Zhu 朱俊鹏

Tel: 0086-136-1113-2615

Email: zjp@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
FAX 0086-898-38883895
tsimf@tsinghua.edu.cn
572000
https:/tsimf.tsinghua.edu.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.