

北京雁栖湖  
应用数学研究院  
Beijing Institute  
of Mathematical  
Sciences and Applications



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



TSIMF  
清华三亚国际数学论坛

# 2026三亚波国际前沿论坛

Sanya Waves 2026

February 2-6, 2026

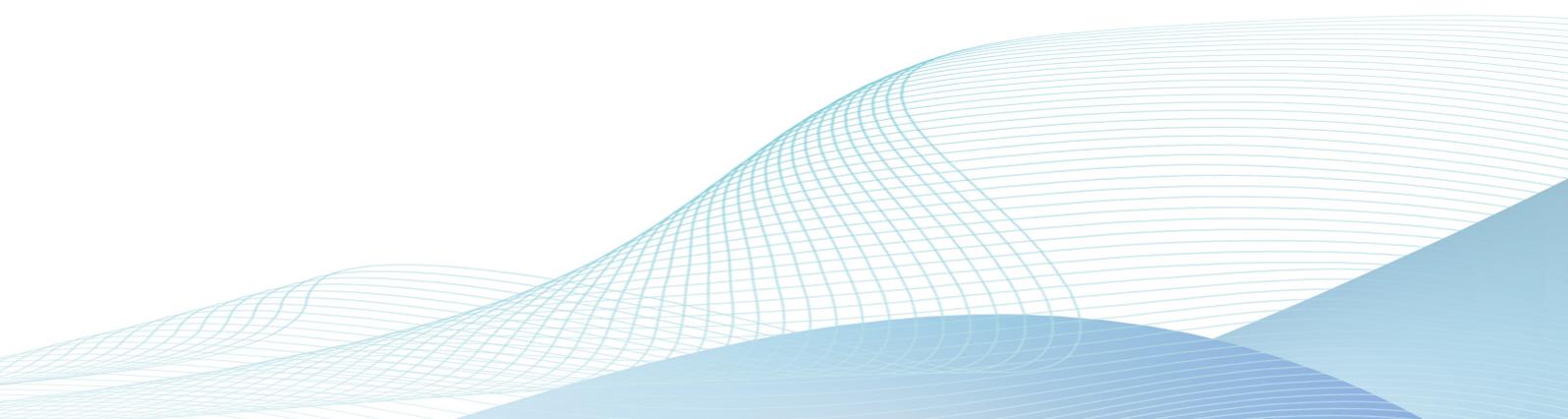
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Piotr T. Chruściel, BIMSA/Polish Academy of Sciences  
Sergiu Klainerman, Princeton University  
Pieter Blue, The University of Edinburgh  
Pengyu Le(乐鹏宇), BIMSA

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***About the conference***

## 2026 三亚波国际前沿论坛

### Sanya Waves 2026

#### Date

February 2-6, 2026

#### Venue

Room A-121, TSIMF

Zoom ID: 689 216 8449

Passcode: TSIMF

#### Organizers

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

Sergiu Klainerman, Princeton University

Piotr T. Chruściel, BIMSA/Polish Academy of Sciences

Pieter Blue, The University of Edinburgh

Pengyu Le( 乐鹏宇 ), BIMSA

#### Abstract

The conference will bring together leading experts and researchers working in General Relativity, Non-Linear Waves, Geometric Analysis, Fluids, and related fields. It aims to foster collaboration and highlight recent advances across these interconnected areas.

#### Description of the aim

Recent decades have shown that interaction among researchers in Nonlinear Wave Equations, Geometric Analysis, and General Relativity greatly benefits progress in each field. While significant advances have been made in general relativity, many important challenges remain. This conference will provide a platform for experts to share new results, discuss open problems, and explore future directions in a collaborative setting.

#### Confirmed Participants

Spyros Alexakis, University of Toronto

Zhongshan An( 安中山 ), Institute of Geometry and Physics (IGP) of USTC

Lv Cai( 蔡律 ), Shanghai University

Xuantao Chen( 陈炫涛 ), Centre national de la recherche scientifique (CNRS)

Wan Cong( 丛弯 ), University of Vienna

Wenjie Deng( 邓文杰 ), Tsinghua University

Qianhui Fan( 范干慧 ), Academy of Mathematics and Systems Science CAS  
Dejan Gajic, Leipzig University  
Xiaokai He( 何孝凯 ), Hunan First Normal University  
Haonan Hu( 胡昊南 ), Academy of Mathematics and Systems Science CAS  
Allen Juntao Fang( 方君陶 ), Munster University  
XiangKai Ke ( 柯翔凯 ), Tsinghua University  
Ningan Lai( 赖宁安 ), Zhejiang Normal University  
Chuxiao Liu( 刘楚萧 ), Guangxi University  
Eric Ling, University of Copenhagen  
Junbin Li( 黎俊彬 ), Sun Yat-sen University  
Jianli Liu( 刘见礼 ), Shanghai University  
Jue Liu( 刘珏 ), South China Normal University  
Jiongyue Li( 李同玥 ), Sun Yat-sen University  
Warren Hua-Lun Li, Stanford University  
Zhaohui Li( 李昭辉 ), Academy of Mathematics and Systems Science, CAS  
Tianwen Luo( 罗天文 ), South China Normal University  
Yue Ma( 马跃 ), Xi'an Jiaotong University  
Maximilian Ofner, University of Vienna  
Todd Oliynyk, Monash University  
Claudio Paganini, University of Regensburg  
Volker Schlue, University of Melbourne  
Kerun Shao ( 邵科润 ), Tsinghua University  
Hongyi Sheng( 盛弘毅 ), Westlake University  
Yuguang Shi( 史宇光 ), Peking University  
Maxime Van de Moortel, Rutgers University  
Chengbo Wang( 王成波 ), Zhejiang Normal University  
Jingbo Wan( 万静波 ), Sorbonne Université  
Jinhua Wang( 王金花 ), Xiamen University  
Xiaoning Wu( 吴小宁 ), Chinese Academy of Sciences  
Guixiang Xu( 徐桂香 ), Beijing Normal University  
Hossein Yavartanoo, BIMSA  
Xueyi Yu ( 余学一 ), Peking University  
Yunlong Zang( 臧云龙 ), Yangzhou University  
Fan Zheng( 郑凡 ), Instituto de Ciencias Matematicas  
Peng Zhao( 赵鹏 ), Beijing Normal University  
Yi Zhou( 周忆 ), Fudan University  
Yiyue Zhang( 张一岳 ), BIMSA  
Yi Zhu( 朱昇 ), East China University of Science and Technology



# ***Schedule***

Time&Date	Monday ( February 2 )	Tuesday ( February 3 )	Wednesday ( February 4 )	Thursday ( February 5 )	Friday ( February 6 )
7:30-8:30	Breakfast (60 minutes)				
8:30-9:00	Group Photo				
9:00-9:50	Todd Oliynyk	Dejan Gajic	Tianwen Luo 罗天文	Junbin Li 黎俊彬	Spyros Alexakis
9:50-10:20	Coffee Break (within 30 minutes)				
10:20-11:10	Jinhua Wang 王金花	Volker Schlue	Fan Zheng 郑凡	Maxime Van de Moortel (Virtual)	Hongyi Sheng 盛弘毅
11:10-12:00	Zhongshan An 安中山	Allen Juntao Fang 方君陶	Maximilian Ofner	Xuantao Chen 陈炫涛	
12:00-13:30	Lunch (90 minutes)				
14:00-14:50	Yi Zhou 周忆	Yuguang Shi 史宇光	Free Discussion 13:30-17:00	Jingbo Wan 万静波	
14:50-15:20	Coffee Break (within 30 minutes)			Coffee Break	
15:20-16:10	Warren Li	Yiyue Zhang 张一岳		Wan Cong 丛穹	
16:10-17:00		Eric Ling (Virtual)			
17:30 - 19:00	Dinner (90 minutes)		Banquet 18:00-20:00	Dinner (90 minutes)	

**February 2, 2026 - Monday**

Time	Name	Title
7:30-8:30	Breakfast (60 minutes)	
8:30-9:00	Group Photo	
9:00-9:50	Todd Oliynyk	Big bang stability: the ekpyrotic regime
9:50-10:20	Coffee Break (within 30 minutes)	
10:20-11:10	Jinhua Wang 王金花	Extension principles for the Einstein Yang--Mills system
11:10-12:00	Zhongshan An 安中山	Geometric boundary conditions for the initial boundary value problem of Einstein equations
12:00-13:30	Lunch (90 minutes)	
14:00-14:50	Yi Zhou 周忆	Recent advances on bilinear estimate method
14:50-15:20	Coffee Break (within 30 minutes)	
15:20-16:10	Warren Li	On ODE blow-up surfaces for the focusing power nonlinearity wave equation
16:10-17:00		
17:30 - 19:00	Dinner (90 minutes)	

**February 3, 2026 - Tuesday**

<b>Time</b>	<b>Name</b>	<b>Title</b>
7:30-8:30	Breakfast (60 minutes)	
9:00-9:50	Dejan Gajic	Late-time tails and stability of extremal black holes
9:50-10:20	Coffee Break (within 30 minutes)	
10:20-11:10	Volker Schlue	Expanding black hole cosmologies: On the non-linear stability of Kerr de Sitter spacetimes
11:10-12:00	Allen Juntao Fang 方君陶	Teukolsky in the vanishing cosmological constant limit
12:00-13:30	Lunch (90 minutes)	
14:00-14:50	Yuguang Shi 史宇光	Positive mass theorems on singular spaces and some applications
14:50-15:20	Coffee Break (within 30 minutes)	
15:20-16:10	Yiyue Zhang 张一岳	Spinorial slicings and causal character of imaginary Killing spinors
16:10-17:00	Eric Ling (Virtual)	On energy and its positivity in spacetimes with an expanding flat de Sitter background
17:30 - 19:00	Dinner (90 minutes)	

**February 4, 2026 - Wednesday**

<b>Time</b>	<b>Name</b>	<b>Title</b>
7:30-8:30	Breakfast (60 minutes)	
9:00-9:50	Tianwen Luo 罗天文	On multi-dimensional rarefaction waves
9:50-10:20	Coffee Break (within 30 minutes)	
10:20-11:10	Fan Zheng 郑凡	Finite-time singularity formation in the forced hypodissipative Navier-Stokes equations
11:10-12:00	Maximilian Ofner	The dichotomy of shocks and stability in the context of expanding cosmological fluids
12:00-13:30	Lunch (90 minutes)	
13:30-14:00	Free Discussion	
14:00-14:50		
14:50-15:20		
15:20-16:10		
16:10-17:00		
18:00 - 20:00	Banquet (120 minutes)	

**February 5, 2026 - Thursday**

<b>Time</b>	<b>Name</b>	<b>Title</b>
7:30-8:30	Breakfast (60 minutes)	
9:00-9:50	Junbin Li 黎俊彬	Instability of naked singularities: Exterior & Interior
9:50-10:20	Coffee Break (within 30 minutes)	
10:20-11:10	Maxime Van de Moortel (Virtual)	The interior of dynamical black holes in spherical symmetry
11:10-12:00	Xuantao Chen 陈炫涛	Solving the constraint equation for general free data
12:00-13:30	Lunch (90 minutes)	
14:00-14:50	Jingbo Wan 万静波	Formation of multiple black holes from Cauchy data
14:50-15:20	Coffee Break (within 30 minutes)	
15:20-16:10	Wan Cong 丛弯	Characteristic gluing in D-dimensional spacetimes with cosmological constant
16:10-17:00		
17:30 - 19:00	Dinner (90 minutes)	

### February 6, 2026 - Friday

Time	Name	Title
7:30-8:30	Breakfast (60 minutes)	
9:00-9:50	Spyros Alexakis	Squeezing a fixed amount of gravitational mass to arbitrarily small scales
9:50-10:20	Coffee Break (within 30 minutes)	
10:20-11:10	Hongyi Sheng 盛弘毅	Localized deformations of curvatures and rigidity on manifolds with boundary
11:10-12:00		
12:00-13:30	Lunch (90 minutes)	
14:00-14:50		
14:50-15:20		
15:20-16:10		
16:10-17:00		
17:30 - 19:00	Dinner (90 minutes)	



# ***Titles and Abstracts***

February 2, 2026 - Monday

## Big bang stability: the ekpyrotic regime

Todd Oliynyk  
Monash University

In  $n$ -spacetime dimensions, the Einstein--scalar field equations with an exponential potential are given by

$$R_{ij} = 2\nabla_i\phi\nabla_j\phi + \frac{4}{n-2}V(\phi)g_{ij},$$

$$\square_g\phi = V'(\phi),$$

where

$$V(\phi) = V_0e^{-s\phi},$$

$V_0 \in \{-1, 0, 1\}$  and  $s \in \mathbb{R}$ . The Kasner--scalar field spacetimes are a distinguished family of solutions to the Einstein-scalar field equations that are past geodesically incomplete. In these solutions, past-directed timelike geodesics terminate at a spacelike big bang singularity characterised by curvature blow-up. Remarkable progress has been made recently on establishing the past stability of these solutions and their big bang singularities. The first major breakthrough was achieved by Fournodavlos-Rodnianski-Speck, who proved stability over the full sub-critical range of Kasner exponents in the case of a vanishing potential, i.e.  $V_0 = 0$ . Subsequently, Oude Groeniger-Petersen-Ringström established past stability for the Kasner-scalar field spacetimes with non-vanishing potentials,  $|V_0| \neq 0$ , under the condition  $s < \sqrt{\frac{8(n-1)}{n-2}}$ . In both settings, perturbations of these spacetimes terminate in the past at quiescent, generically anisotropic big bang singularities that are characterised by curvature blow-up.

For the parameter choices  $V_0 = -1$  and  $s > \sqrt{\frac{8(n-1)}{n-2}}$ , the Einstein-scalar field equations admit a distinct family of isotropic solutions with big bang singularities, known as *ekpyrotic FLRW spacetimes*. In this talk, I will present a new proof of big bang stability for this family. A remarkable feature of perturbations of these solutions is that, unlike perturbations of the Kasner-scalar field family, anisotropies are dynamically suppressed, and the spacetimes isotropise as they approach quiescent, spacelike big bang singularities characterised by curvature blow-up.

## Extension principles for the Einstein Yang--Mills system

Jinhua Wang(王金花)  
Xiamen University

We prove the local existence theorem and establish an extension principle for the spherically symmetric Einstein Yang--Mills system (SSEYM) with  $H^1$  data, which further implies Cauchy stability for the system. Based on this result, we further prove an extension theorem for developments of weighted  $H^1$  data. The weighted  $H^1$  space allows Hölder continuous data.

In contrast to a massless scalar field, the purely magnetic Yang--Mills field in spherical symmetry

satisfies a wave-type equation with a singular potential. As a consequence, the proof of Christodoulou, based on an  $L^\infty - L^\infty$  estimate, fails in the Yang--Mills context. Instead, we employ an  $L^2$ -based method, which is valid for both massless and massive scalar matter fields as well. These are based on joint works with Junbin Li.

## **Geometric boundary conditions for the initial boundary value problem of Einstein equations**

**Zhongshan An(安中山)**

Institute of Geometry and Physics (IGP) of USTC

In general relativity it is of great interest to construct spacetimes satisfying the vacuum Einstein equations. While the Cauchy problem for vacuum Einstein equations has been well studied since the work of Choquet-Bruhat, the initial boundary value problem (IBVP) remains much less understood. To establish a well-posed IBVP, one needs to impose boundary conditions on the time-like boundary which give rise to both energy estimate and geometric uniqueness. Due to complexity of the problem, so far there has not been a canonical choice of boundary conditions. In this talk I will discuss properties of various choices of geometric boundary conditions for the IBVP based on a series of works joint with Michael Anderson.

## **Recent advances on bilinear estimate method**

**Yi Zhou(周忆)**

Fudan University

I will briefly review various results obtained by our bilinear space time methods and focus on our recent work of global well posedness of skew mean curvature flow in critical Besov space and global well posedness of Ishimori equation in critical Sobolev spaces.

## **On ODE blow-up surfaces for the focusing power nonlinearity wave equation**

**Warren Li**

Stanford University

In this talk, we discuss “ODE-type” singularity formation for the focusing power nonlinearity wave  $\square\Phi = -\Phi^p$ , for any power and any spacetime dimension. We show that, for any smooth spacelike hypersurface, one can find a smooth solution that blows up precisely at that hypersurface, and moreover the location of this blow up surface is stable to perturbations of data away from the singularity. Based on joint work with Istvan Kadar (ETH Zurich).

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**February 3, 2026 - Tuesday**

## **Late-time tails and stability of extremal black holes**

**Dejan Gajic**  
Leipzig University

The question of dynamical stability of extremal Kerr black holes poses interesting challenges, stemming from their critical position within black hole families and the breakdown of key stability mechanisms in the sub-extremal regime. As a result, even linear stability remains an open problem. In this talk, I will present upcoming work on charged scalar fields propagating on extremal Reissner–Nordström black hole backgrounds. This setting captures many of the essential analytical difficulties encountered in extremal Kerr, while offering a more tractable pathway towards understanding the nonlinear effects associated with extremality. I will emphasize how a precise quantitative understanding of late-time tails is crucial for resolving qualitative questions, such as energy boundedness or energy growth.

## **Expanding black hole cosmologies: On the non-linear stability of Kerr de Sitter spacetimes**

**Volker Schlue**  
University of Melbourne

The Kerr de Sitter geometry models a rotating black hole in an expanding universe. I will review its stability properties in the context of the Einstein vacuum equations with positive cosmological constant, and present a recent resolution of the non-linear stability problem for the cosmological region. The talk is based on joint work with G Fournodavlos, and describes among others contributions by H Friedrich, P Hintz and A Vasy.

## **Teukolsky in the vanishing cosmological constant limit**

**Allen Juntao Fang (方君陶)**  
University of Münster

The Teukolsky equations are a wave-type system that has played a crucial role in proofs of black hole stability in recent years. While waves on both Kerr and Kerr-de Sitter decay, waves on Kerr-de Sitter exhibit exponential decay while waves on Kerr only exhibit polynomial decay. In this talk, I will speak about wave behavior that is uniform in the cosmological constant by considering solutions to the Teukolsky equations in Kerr(-de Sitter). The main point is a careful handling of the region of the spacetime far from the black hole. This provides a first step into understanding the vanishing cosmological constant stability of black hole spacetimes. This is joint work with Jérémie Szeftel and Arthur Touati.

## Positive mass theorems on singular spaces and some applications

Yuguang Shi( 史宇光 )  
Peking University

In this talk, I will discuss some positive mass theorems for certain singular spaces inspired by the dimension reduction techniques employed in the study of the geometry of manifolds with positive scalar curvature,

In these results, we assume only that the scalar curvature is non-negative in a strong spectral sense, which aligns well with the stability condition of a minimal hypersurface in an ambient manifold with non-negative scalar curvature. As an application, we provide a characterization of asymptotically flat (AF) manifolds with arbitrary ends, non-negative scalar curvature, and dimension less than or equal to 8. This also leads to positive mass theorems for AF manifolds with arbitrary ends and dimension less than or equal to 8 without using N.Smale's regularity theorem for minimal hypersurfaces in a compact 8-dimensional manifold with generic metrics. The talk is based on my recent joint work with He Shihang and Yu Haobin.

## Spinorial slicings and causal character of imaginary Killing spinors

Yiyue Zhang( 张一岳 )  
BIMSA

We characterize spin initial data sets that saturate the BPS bound in asymptotically AdS spacetimes. Our results show that (1) null imaginary Killing spinors give rise to codimension-2 foliations corresponding to Siklos waves, and (2) any imaginary Killing spinor of mixed causal type can be reduced to a strictly timelike or null spinor. This is joint work with Sven Hirsch.

## On energy and its positivity in spacetimes with an expanding flat de Sitter background

Eric Ling (Virtual)  
University of Copenhagen

The positive energy theorems are a fundamental pillar in mathematical general relativity. Originally proved by Schoen-Yau and later Witten, these theorems were established for asymptotically flat manifolds where the metric tends to the standard Euclidean metric and whose second fundamental form decays to zero at infinity. This ansatz on the metric and second fundamental form is motivated by the desire to model an isolated gravitational system with a Minkowski space background for the spacetime. However, actual astrophysical massive objects are not truly isolated but rather exist within an expanding cosmological universe, where the second fundamental form is umbilic. With this in mind, we seek a notion of energy for initial data sets with an umbilic second fundamental form. In this talk, I present a definition of energy in such an expanding cosmological setting. Instead of Minkowski space, we take de Sitter space as the background spacetime, which, when written

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in flat-expanding coordinates, is foliated by umbilic hypersurfaces each isometric to Euclidean 3-space. This cosmological setting necessitates a quasi-local energy definition, as the presence of a cosmological horizon in de Sitter space obstructs a global one. We define energy in this quasi-local setting by adapting the Liu-Yau energy to our framework and establish positivity of this energy for certain bounded values of the cosmological constant. This is joint work with Annachiara Piubello and Rodrigo Avalos.

February 4, 2026 - Wednesday

## On multi-dimensional rarefaction waves

**Tianwen Luo**(罗天文)  
South China Normal University

We study the two-dimensional acoustical rarefaction waves under the irrotational assumptions. We provide a new energy estimates without loss of derivatives. We also give a detailed geometric description of the rarefaction wave fronts. As an application, we show that the Riemann problem is structurally stable in the regime of two families of rarefaction waves. This is a joint work with Prof. Pin Yu in Tsinghua University.

## Finite-time singularity formation in the forced hypodissipative Navier-Stokes equations

**Fan Zheng**(郑凡)  
Instituto de Ciencias Matematicas

The question of singularity formation in fluid dynamics remains one of the most challenging open problems in mathematical physics. In this talk, we present new results showing that solutions to 3D hypodissipative Navier-Stokes equations with smooth initial data and an external forcing that is integrable in  $C^{1+\epsilon}$  can break down in finite time. The dissipation in the equation amounts to 0.1 orders of derivative, or  $(-\Delta)^{0.05}$ . Time permitting, I will discuss extensions that allow for more dissipation and rougher forcing.

## The dichotomy of shocks and stability in the context of expanding cosmological fluids

**Maximilian Ofner**  
University of Vienna

The dynamics of inviscid, compressible fluids, whether relativistic or classical, are described by hyperbolic systems. If nonlinear, these systems are prone to singularity formation, meaning that even small data with high regularity can launch solutions that blow up in finite time. As it turns out, such behavior is generic for conservation laws in low dimension. However, with an appropriate damping source, the formation of singularities like shocks is suppressed for sufficiently small data. In this talk we will discuss how expanding spacetimes, as found in cosmology, can create such a damping effect and explore the dynamics of these competing mechanisms in various settings.

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**February 5, 2026 - Thursday**

## **Instability of naked singularities: Exterior & Interior**

**Junbin Li**( 黎俊彬 )  
Sun Yat-sen University

We will first review some exterior results in the instability of naked singularities. Then we present a new approach to proving instability under interior perturbations, and its implications in the weak cosmic censorship conjecture, one of the most fundamental questions in general relativity.

## **The interior of dynamical black holes in spherical symmetry**

**Maxime Van de Moortel** (Virtual)  
Rutgers University

A major objective in proving the Strong Cosmic Censorship Conjecture is to characterize the nature of singularities inside generic black holes in the context of gravitational collapse (one-ended asymptotically flat initial data free of trapped surfaces).

I will present new results on the interiors of spherically symmetric, dynamical black holes, which reveal the existence of two distinct types of singular boundaries: a weakly singular Cauchy horizon and a strongly singular spacelike singularity. This analysis yields the first construction of a gravitational collapse spacetime exhibiting this feature, providing a new model for black hole interiors which is conjecturally similar to the non-spherical case.

## **Solving the constraint equation for general free data**

**Xuantao Chen**( 陈炫涛 )  
Centre national de la recherche scientifique (CNRS)

We revisit the problem of solving the Einstein constraint equations in vacuum by a new method, which allows us to prescribe four scalar quantities, representing the full dynamical degrees of freedom of the constraint system. We show that once appropriate gauge conditions have been chosen and four scalars freely specified (modulo  $\ell \leq 1$  modes), we can rewrite the constraint equations as a well-posed system of coupled transport and elliptic equations on 2-spheres, which we solve by an iteration procedure. Our results provide a large class of exterior solutions of the constraint equations that can be matched to given interior solutions, according to the existing gluing techniques. In particular, our result can be applied to provide a large class of initial Cauchy data sets evolving to black holes, generalizing the well-known result of the formation of trapped surfaces due to Li–Yu.

## Formation of multiple black holes from Cauchy data

**Jingbo Wan( 万静波 )**  
Sorbonne Université

We construct asymptotically flat vacuum initial data without trapped surfaces whose Einstein evolution leads to the formation of several disjoint trapped regions in finite time. The construction combines Christodoulou's short pulse method with a localized gluing procedure for the Einstein constraint equations, in which neighborhoods of the poles of a Brill-Lindquist manifold are replaced by constant-time slices of suitable dynamical spacetimes, while the data remain exactly Brill-Lindquist outside. We will also discuss some follow-up works. This is based on joint work with Elena Giorgi and Dawei Shen (Columbia University).

## Characteristic gluing in D-dimensional spacetimes with cosmological constant

**Wan Cong( 丛弯 )**  
University of Vienna

It is well known that the Einstein's equations admit a well-posed initial value formulation. However, the initial data is subjected to a set of constraint equations making it a non-trivial task to come up with permissible initial data. An interesting question is: given two sets of initial data, can one find a third which "glues" the two data together. The spacelike problem has been answered in the affirmative by Corvino and Schoen, specifically for the gluing of asymptotically flat data to Kerr data at large distances. In a series of recent papers, Aretakis, Czimek and Rodnianski considered the analogous problem for characteristic Cauchy data. I will discuss how characteristic gluing can be extended to higher spacetime dimensions and to spacetimes with non-zero cosmological constants.

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**February 6, 2026 - Friday****Squeezing a fixed amount of gravitational mass to arbitrarily small scales**

**Spyros Alexakis**  
University of Toronto

We discuss joint work with N. Carruth, where we construct solutions to the Einstein vacuum equations on a domain of fixed size, whose past boundary is a bifurcate null surface emanating from a sphere. The solutions form a 1-parameter family, whose incoming gravitational energy (mass) near the sphere is of fixed size, yet the its support can be squeezed to an arbitrary degree around the equator of the sphere, without affecting the size of the domain in which we obtain existence. Interpreting the space-times as bursts of incoming gravitational waves, which are allowed to diffuse on a region of space-times of uniform size, these are the largest amplitude such waves (relative to the size of their support) that have been obtained. We will place this work in the context of dynamical formation of black holes, results on the Burnett conjecture, as well as the hoop conjecture.

**Localized deformations of curvatures and rigidity on manifolds with boundary**

**Hongyi Sheng( 盛弘毅 )**  
Westlake University

Localized deformations and gluing constructions for initial data sets are fundamental tools in general relativity. For interior domains, this field was pioneered by Corvino, who established the local surjectivity of the scalar curvature operator. This work was later extended to the full constraint map by Corvino-Schoen, and developed into a systematic theory using weighted spaces by Chruściel-Delay, Carlotto-Schoen, Corvino-Huang, and others.

In this talk, I will discuss how these results can be generalized to the boundary setting under generic conditions, highlighting the unique analytical challenges that arise in this context. We will also examine the non-generic case, where various geometric constraints emerge, and discuss the resulting rigidity theorems and their connections to the positive mass theorem.



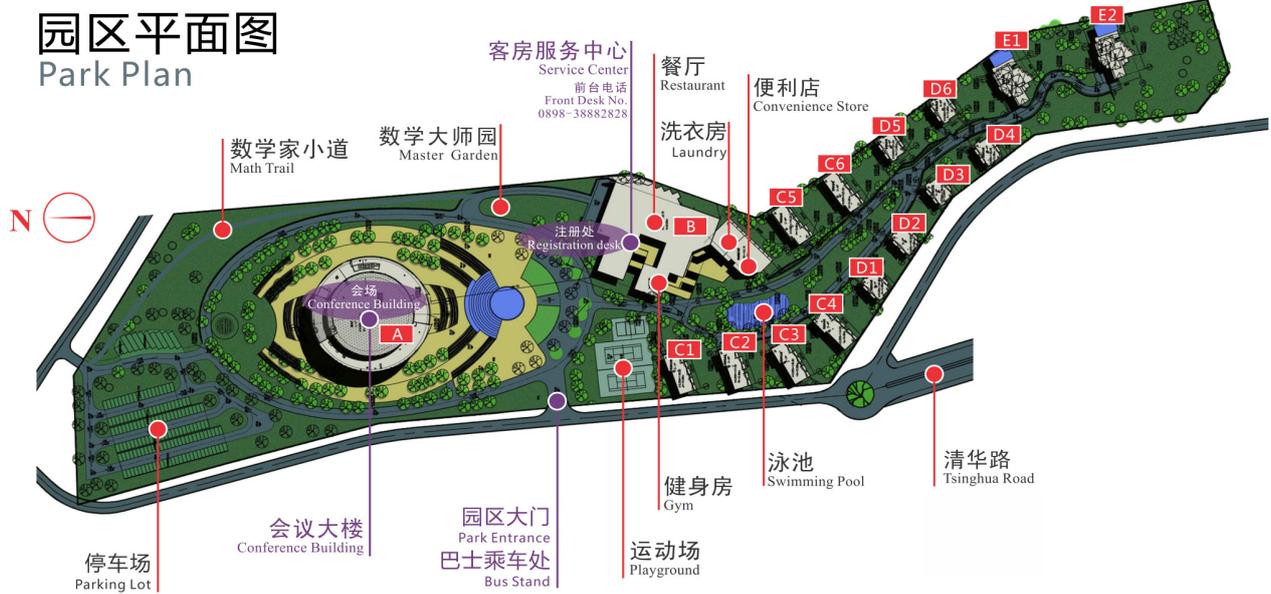
***Welcome to TSIMF***



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, TV, air conditioning and other utilities.

SSID:TSIMF-WiFi

Password:tsimf123

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

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### Director Assistant of TSIMF

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