QIQG
2026

Quantum Information in Quantum Gravity 2026

2026年量子引力中的量子信息会议

会议手册
Handbook

清華大學 丘成桐数学科学中心
Yau Mathematical Sciences Center, Tsinghua University

清華大學 高等研究院
Institute for Advanced Study, Tsinghua University

中国科学院大学
University of Chinese Academy of Sciences

復旦大學
FUDAN UNIVERSITY

東南大學
SOUTHEAST UNIVERSITY

主办单位 Host

清华大学丘成桐数学科学中心

Yau Mathematical Sciences Center, Tsinghua University

合办单位 Co-organizers

清华大学高等研究院

Institute for Advanced Study, Tsinghua University

中国科学院大学量子学院

School of Quantum, University of Chinese Academy of Sciences

东南大学丘成桐中心

The Shing-Tung Yau Center of Southeast University (SEUYC)

复旦大学物理系

Department of Physics, Fudan University

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About YMSC

清华大学
丘成桐数学科学中心

数学科学中心成立于 2009 年 12 月，特聘国际著名数学大师丘成桐先生担任中心主任。作为支持清华大学发展数学学科的重大战略举措，教育部于 2014 年底同意依托清华大学成立“丘成桐数学科学中心”。笃行不怠、赓续前行，十七年来，数学中心在高端人才引进、杰出人才培养、高水平学术研究和数学学科建设等方面实现了跨越式发展，成为具有重要国际影响力的数学研究中心。

截至 2026 年 3 月，数学中心共有全日制在校教师和科研人员 190 人，其中教师 103 人（外籍 17 人），博士后 87 人（外籍 29 人）。中心已经建成以纯粹数学为核心的“五大领域”和“三个交叉研究方向”的综合性学科布局，共六大科研团队。代数与数论、数学物理以及动力系统与随机分析这三个科研团队，已达到世界顶尖水平。

中心国际一流学者云集，目前在职包括丘成桐、Caucher Birkar、Nicolai Reshetikhin、Akito Futaki、Vladimir Markovic、Kenji Fukaya 等国际知名教授，中心有 2 位菲尔兹奖获得者、2 位邵逸夫奖得主、5 位院士；中青年学者出类拔萃，多人入选国家级人才政策和科研基金支持项目。

集美清华，求真淬炼。清华大学丘成桐数学科学中心、数学科学系、求真书院，与北京雁栖湖应用数学研究院紧密合作，携手构筑高水平数学科学人才培养、学术研究的基地，为清华大学迈向世界一流大学前列和中国数学学科的繁荣发展贡献力量。

Yau Mathematical Sciences Center (YMSC)
Tsinghua University

In December 2009, Tsinghua University established the Mathematical Sciences Center, with internationally renowned mathematician Professor Shing-Tung Yau as the director. In late 2014, China’s Ministry of Education officially approved the establishment of the YMSC at Tsinghua University. Over 17 years of development, the YMSC has emerged as a world-class research institute. It has excelled in recruiting prestigious group of faculty members, nurturing a new generation of talented scholars, and spearheading cutting-edge research across various disciplines within the Mathematical Sciences.

As of March 2026, the YMSC has a total of 190 full-time faculty members and researchers, including 103 faculty members (17 international faculty) and 87 postdoctoral researchers (29 international postdoctoral researchers). Mathematical research at YMSC covers five major areas and three interdisciplinary research fields. Notably, of the six pillar research teams, the research teams in Algebra and Number Theory, Mathematical Physics, Dynamical Systems and Random Analysis have achieved remarkable original results that contribute significantly to their respective fields.

The YMSC boasts internationally renowned scholars, currently working at YMSC including Shing-Tung Yau, Caucher Birkar, Nicolai Reshetikhin, Vladimir Markovic, Kenji Fukaya and Akito Futaki. Among these esteemed members, there are two Fields Medalists, two Shaw Prize Winners and five Academicians. Many promising young mathematicians of YMSC have been recognized with various national funds and talent support programs.

The YMSC has collaborated with the Department of Mathematical Sciences, the Qiuzhen College of Tsinghua University, and the Yanqi Lake Beijing Institute of Mathematical Sciences and Applications, to build a top platform for mathematical education and research, contributing to Tsinghua University's goal of becoming one of the world-class universities, and promoting the growth and prosperity of the mathematical sciences in China.

中心主任
Director

丘成桐 Shing-Tung Yau

中心主任 YMSC Director
清华大学讲席教授，中国科学院外籍院士
美国国家科学院院士，美国人文与科学院院士

丘成桐教授开创了数学中极为重要的分支“几何分析”。他解决的卡拉比猜想在数学界和物理学界被称为卡拉比 - 丘空间，不单单是代数几何和数论中的主要工具，也成为高能物理中描述宇宙的主要模型。他先后获得菲尔兹奖 (Fields Medal)、克拉福德奖 (Crafoord Prize)、沃尔夫奖 (Wolf Prize)、马塞尔·格罗斯曼奖 (Marcel Grossmann Awards)、邵逸夫奖 (The Shaw Prize) 等国际科学大奖。

Shing-Tung Yau, a Member of the U.S. National Academy of Sciences, a Member of the American Academy of Arts and Sciences, and a Foreign Member of the Chinese Academy of Sciences. He is the Chair Professor of Tsinghua University, temeritus William Casper Graustein Professor of Mathematics and emeritus professor of physics at Harvard University. He has received the Fields Medal (1982), the Crafoord Prize (1994), the Wolf Prize (2010), the Marcel Grossmann Award (2018), and the Shaw Prize (2023).

合办方介绍
About the Co-organizers

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

清华大学高等研究院是清华大学面向基础科学和前沿交叉研究设立的重要科研机构，前身为清华大学高等研究中心，成立于 1997 年，2009 年更名为清华大学高等研究院。高研院借鉴国际高等研究机构的学术传统，致力于营造自由、深入、开放的学术环境，支持学者围绕自然科学中的根本问题和未来科技发展的关键方向开展原创性研究。

高研院的研究领域涵盖凝聚态物理、冷原子物理、量子引力、网络空间安全、数学、天体物理等方向，并重视不同学科之间的交叉融合。作为清华大学基础研究体系的重要组成部分，高等研究院汇聚了一批具有国际影响力的学者，通过学术访问、研讨交流和长期研究项目，推动高水平基础研究和跨学科创新，为清华大学建设世界一流大学和发展前沿科学贡献力量。

The Institute for Advanced Study, Tsinghua University is an important research institute dedicated to fundamental science and frontier interdisciplinary studies. Originally established in 1997 as the Center for Advanced Study, it was renamed the Institute for Advanced Study in 2009. Inspired by the academic tradition of leading institutes for advanced study worldwide, the Institute aims to provide a free, profound, and open intellectual environment in which scholars can pursue original research on fundamental questions in science and key directions shaping future technologies.

Its research spans condensed matter physics, cold atom physics, quantum gravity, cyberspace security, mathematics, astrophysics, and related interdisciplinary fields. As a vital part of Tsinghua University’s basic research ecosystem, the Institute brings together scholars with broad international influence and promotes academic exchange through visiting programs, seminars, and long-term research initiatives. It continues to contribute to Tsinghua’s mission of advancing world-class scholarship and pioneering scientific discovery.

中国科学院大学量子学院
School of Quantum, University of Chinese Academy of Sciences

中国科学院大学简称“国科大”，是一所以科教融合为办学模式、研究生教育为办学主体、精英化本科教育为办学特色的创新型大学。国科大的研究生教育，发端于中国科学院的人才培养。1950 年，中国科学院启动研究实习员的招考和培养工作。1964 年 9 月，中国科学院在北京试办“中国科学院研究生院”。2012 年 6 月，中国科学院研究生院更名为中国科学院大学，并于 2014 年开始招收本科生，形成了覆盖本、硕、博三个层次的高等教育体系。

量子学院是中国科学院大学于 2026 年创立的一所具有前瞻视野的教学科研机构，旨在推动量子科学与技术的前沿研究，开展具有国际水准的学术探索。学院汇聚了凝聚态物理、量子场论、弦理论、量子信息与量子计算等领域的优秀师资力量（卡弗里理论科学研究所已整体并入新成立的量子学院），在引领原始创新的同时，致力于培养卓越的青年人才，打造世界一流的研究重镇和国际化学术交流平台。

University of Chinese Academy of Sciences (UCAS) is an innovative university characterized by a model of integrating scientific research with education, with graduate education as its primary focus and elite undergraduate education as a distinctive feature. Graduate education at UCAS originated from the young researcher nurturing efforts of the Chinese Academy of Sciences (CAS). In 1950, CAS initiated the recruitment and training of research interns. In September 1964, CAS established the "Graduate School of the Chinese Academy of Sciences" on a trial basis in Beijing. In June 2012, the Graduate School of the Chinese Academy of Sciences was renamed the "University of Chinese Academy of Sciences", and in 2014, it began enrolling undergraduate students, thus forming a higher education system covering the three levels of bachelor's, master's, and doctoral degrees. The School of Quantum, established in 2026 by UCAS, is a forward-looking academic institution dedicated to advancing cutting-edge research in quantum science and technology and pursuing scholarly excellence of international caliber. It brings together distinguished faculty in condensed matter physics, quantum field theory, string theory, quantum information, and quantum computing (with the Kavli Institute for Theoretical Sciences entirely integrated into the newly founded School). Committed to fostering groundbreaking innovation and nurturing outstanding young talent, the School aspires to become a world-class research hub and a global platform for international academic exchange.

东南大学丘成桐中心
The Shing-Tung Yau Center Southeast University (SEUYC)

东南大学丘成桐中心（SEUYC）于 2017 年 7 月 7 日成立，是东南大学设立的新型科研机构，并于 2021 年 5 月 10 日转型为校内特殊学术特区。中心由国际著名数学家、菲尔兹奖、沃尔夫奖及邵逸夫奖得主丘成桐教授担任主任。

中心设有多个研究方向，涵盖数学、理论物理以及应用数学等基础研究领域。近年来，中心成员牵头承担了 40 余项科研项目。过去数年间，中心已在国际知名数学及交叉学科期刊（如《杜克数学杂志》、《数学进展》、《数学年鉴》、《克莱尔杂志》）以及顶级物理学期刊（如《物理评论快报》、《SciPost Physics》和《JHEP》）上发表学术论文 180 篇。目前，东南大学丘成桐中心已成为华南地区形式理论物理方向最大的研究团队之一。

The Shing-Tung Yau Center of Southeast University (SEUYC) was established on July 7, 2017, as a new type of research institution at Southeast University, and was upgraded to a special academic zone on May 10, 2021. The Center is directed by Prof. Shing-Tung Yau, a world-renowned mathematician and recipient of the Fields Medal, the Wolf Prize, and the Shaw Prize.

SEUYC conducts research across multiple disciplines, covering fundamental areas such as mathematics, theoretical physics, and applied mathematics. In recent years, its members have led more than 40 research projects. Over the past years, the Center has published 180 academic papers in prestigious international mathematics and interdisciplinary journals, including Duke Mathematical Journal, Advances in Mathematics, Mathematische Annalen, and Crelle's Journal, as well as in top-tier physics journals such as Physical Review Letters, SciPost Physics, and Journal of High Energy Physics. SEUYC now hosts one of the largest research groups in formal theoretical physics in southern China.

复旦大学物理系
Department of Physics Fudan University

复旦物理学系始建于 1952 年，是国家“双一流”建设学科、教育部第四轮学科评估 A 类学科。下设理论物理、凝聚态物理、光学三个二级国家重点学科，拥有应用表面物理全国重点实验室及两个教育部重点实验室，管理校级微纳加工平台。

作为国家基础学科人才培养基地，建有国家级实验教学示范中心和虚拟仿真实验教学中心，开设国家一流本科课程 2 门、国家级精品课程 5 门，多次荣获国家级教学成果奖，多部教材获国家奖项。 2015 年以来以第一完成单位在《Nature》《Science》及子刊发文 80 余篇，在《Phys. Rev. Lett.》发表第一作者论文 70 余篇。先后三次获国家自然科学奖二等奖（2012、2015、2019），在拓扑物态、低维量子材料、光场调控等前沿领域形成鲜明学术特色与国际影响力。

Established in 1952, the department is a National "Double First-Class" discipline and holds an A rating in the fourth national discipline evaluation. It encompasses three National Key Sub-disciplines—Theoretical Physics, Condensed Matter Physics, and Optics—and operates the State Key Laboratory of Surface Physics, two Ministry of Education Key Laboratories, and a university-level micro/nano-fabrication platform.

As a national base for foundational talent cultivation, it hosts a National Demonstration Center for Experimental Teaching and a National Virtual Simulation Experimental Teaching Center. It offers two National First-Class Undergraduate Courses and five National Quality Courses, has won multiple National Teaching Achievement Awards, and published several national award-winning textbooks.

Since 2015, the department has published over 80 papers as the primary affiliation in Nature, Science, and their sub-journals, alongside more than 70 first-author papers in Physical Review Letters. It has received the National Natural Science Award (Second Class) three times (2012, 2015, 2019), establishing distinctive academic strengths and significant international influence in topological states of matter, low-dimensional quantum materials, and light-field manipulation.

关于大会
About the conference

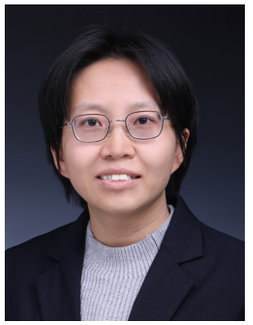
会议简介 / Conference Description

Quantum Information in Quantum Gravity (QIQG) 系列会议已有十余年历史，致力于促进量子信息理论与量子引力交叉领域的交流。QIQG 2026 将于 2026 年 6 月 29 日至 7 月 3 日在清华大学举行，汇聚量子引力、量子信息、数学物理与量子计算等方向的国际学者，交流相关领域的最新进展。

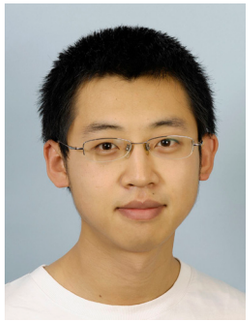
The Quantum Information in Quantum Gravity (QIQG) conference series has a history of more than a decade and is dedicated to promoting exchange at the interface of quantum information theory and quantum gravity. QIQG 2026 will be held at Tsinghua University from June 29 to July 3, 2026, bringing together international scholars in quantum gravity, quantum information, mathematical physics, and quantum computation to discuss recent developments in these closely connected fields.

组织者 / Organizers

Bartek Czech
Institute for Advanced Study, Tsinghua University



Ling-Yan Hung
孔令欣
Yau Mathematical Sciences Center, Tsinghua University



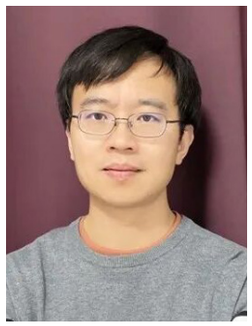
Cheng Peng
彭程
School of Quantum, UCAS

Wei Song
宋伟
Yau Mathematical Sciences Center, Tsinghua University

Huajia Wang
王华嘉
School of Quantum, UCAS

Qiang Wen
文强
The Shing-Tung Yau Center, Southeast University

Zhenbin Yang
杨镇斌
Institute for Advanced Study, Tsinghua University

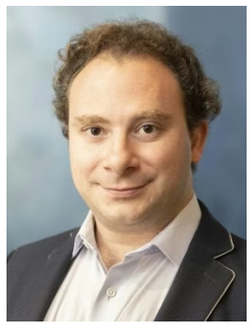


Yang Zhou
周洋
Fudan University

Abhijit Gadde
Tata Institute of Fundamental Research

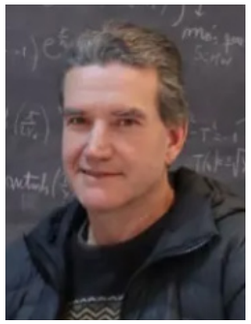
Ping Gao
高苹
UCAS

Matthew Headrick
Brandeis University



Daniel Jafferis
Harvard University

报告人 / Speakers



Horacio Casini
CONICET & Centro Atómico Bariloche

Chi-Ming Chang
张其明
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Ningbo University

Frank Ferrari
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Wei Li
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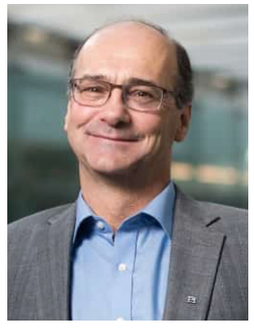

Robert Myers
Perimeter Institute for Theoretical Physics

Vladimir Narovlansky
Princeton University

Xiaoliang Qi 祁晓亮
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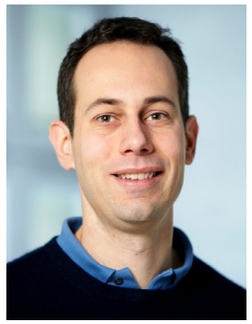

Renato Renner
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Peking University

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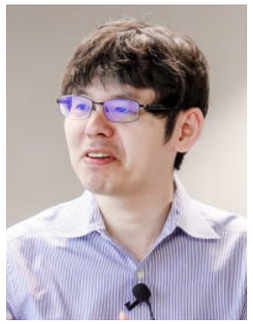

Tadashi Takayanagi
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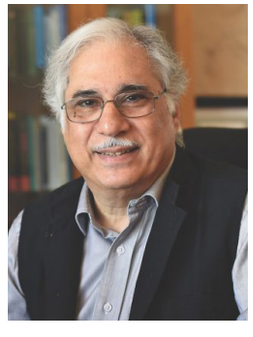
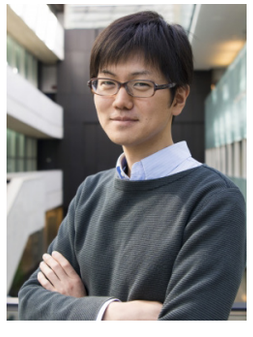
Herman Verlinde
Princeton University



Spenta Rustom Wadia
International Centre for Theoretical Sciences

Edward Witten
Institute for Advanced Study



Beni Yoshida
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Li You 尤力
Tsinghua University

Hui Zhai 翟荟
Tsinghua University

Ying Zhao 赵颖
MIT

Pengfei Zhang 张鹏飞
Fudan University

会议日程
Agenda

会议时间： 2026 年 6 月 29 日至 7 月 3 日

Time: June 29 - July 3, 2026

会议地点： 清华大学第三教室楼

Location: No. 3 Teaching Building, Tsinghua University

总体日程 / Schedule

June 29, Monday

Time	Room 2101, No. 3 Teaching Building, Tsinghua University
08:50-09:00	**Opening remarks** Speakers: Shing-Tung Yau 丘成桐 , Zhengyu Weng 翁征宇
	Session chair: Ling-Yan Hung 孔令欣
09:00-09:55	**Wormholes and Averaging over N** Speaker: Edward Witten
09:55-10:50	**An observer's quantization of 3d Kerr-de Sitter spacetime** Speaker: Herman Verlinde
10:50-11:05	**Break**
11:05-12:00	**JT gravity on finite-size geometries: from the path integral to the JT CFT** Speaker: Frank Ferrari
12:00-13:30	**Lunch**
	Session chair: Qiang Wen 文强
13:30-14:25	**The Hartle–Hawking state and quantum mechanics for de Sitter observers** Speaker: Ying Zhao 赵颖
14:25-15:20	**Reflected entropy in field theories and holography** Speaker: Bin Chen 陈斌
15:20-15:35	**Break**
15:35-16:30	**On accumulating saddles in gravitational transseries** Speaker: Ji Hoon Lee
16:30-17:25	**AdS3 Quantum Gravity via Finite-N Expansions** Speaker: Wei Li 李微

June 30, Tuesday

Time	Room 2101, No. 3 Teaching Building, Tsinghua University
	Session chair: Zhenbin Yang 杨镇斌
09:00-09:55	**Measuring the universe: perturbative aspects of inflationary scalar perturbations** Speaker: Juan Maldacena
09:55-10:50	**Bulk reconstruction and Hamiltonian dynamics across the horizon of an extended AdS black hole in the maximal slicing gauge** Speaker: Spenta Rustom Wadia
10:50-11:05	**Group Photo & Break**
11:05-12:00	**The Bulge Quantum Extremal Surface in the Gravity Path Integral** Speaker: Arvin Shahbazi-Moghaddam
12:00-13:30	**Lunch**
	Session chair: Wei Song 宋伟
13:30-14:25	**Seeing Quantum Many-body Chaos** Speaker: Hui Zhai 翟荟
14:25-15:20	**Probing D0 Black Holes with BMN Protected Sectors** Speaker: Chi-Ming Chang 张其明
15:20-15:35	**Break**
15:35-16:35	**Gongshow**
16:35-17:30	**Poster Session**

July 1, Wednesday

Time	Room 2101, No. 3 Teaching Building, Tsinghua University
	Session chair: Yang Zhou 周洋
09:00-09:55	**Can quantum theory handle multiple observers?** Speaker: Renato Renner
09:55-10:50	**Quantum computation and quantum simulation based on neutral atoms** Speaker: Li You 尤力
10:50-11:05	**Break**
11:05-12:00	**Beyond Page's theorem: aspects of tripartite Haar random states** Speaker: Beni Yoshida
12:00-12:55	**Haag duality violations, order parameters, and some classification results** Speaker: Horacio Casini
12:55-13:30	**Lunch**
13:30-17:30	**Free discussion**

July 2, Thursday

Time	Room 2101, No. 3 Teaching Building, Tsinghua University
	Session chair: Bartek Czech
09:00-09:55	**Blast Freezing a Black Hole** Speaker: Xiaoliang Qi 祁晓亮
09:55-10:50	**An AdS Window into de Sitter Spacetime** Speaker: Daniel Jafferis
10:50-11:05	**Break**
11:05-12:00	**Observable and computable entanglement in time** Speaker: Alexey Milekhin
12:00-13:30	**Lunch**
	Session chair: Cheng Peng 彭程
13:30-14:25	**Towards a microscopic description of de Sitter dynamics** Speaker: Vladimir Narovlansky
14:25-15:20	**Single-Sided Black Holes in Double-Scaled SYK Model and No Man's Island** Speaker: Ping Gao 高苹
15:20-15:35	**Break**
15:35-16:35	**Gongshow**
16:35-17:30	**Poster Session**

July 3, Friday

Time	Room 2101, No. 3 Teaching Building, Tsinghua University
	Session chair: Huajia Wang 王华嘉
09:00-09:55	**Holographic Dual of PT Symmetric BCFT** Speaker: Tadashi Takayanagi
09:55-10:50	**Entanglement and topology** Speaker: Abhijit Gadde
10:50-11:05	**Break**
11:05-12:00	**Smoothing the Bouncing-Geodesic Singularity in AdS/CFT** Speaker: Shanming Ruan 阮善明
12:00-13:30	**Lunch**
	Session chair: Daniel Harlow
13:30-14:25	**Are holographic entropy inequalities true in time-dependent states?** Speaker: Matthew Headrick
14:25-15:20	**Stabilizer Rényi Entropy in SYK-like Models** Speaker: Pengfei Zhang 张鹏飞
15:20-15:35	**Break**
15:35-16:30	**From Science-for-QC to QC-for-Science** Speaker: Chaoyang Lu 陆朝阳
16:30-17:25	**Flat Space Entanglement: A Coulomb Branch Perspective** Speaker: Robert Myers

学术报告 / Title and Abstract

June 29, 2026 (Monday)

Wormholes and Averaging over N

June 29 (Monday)
09:00-09:55

Edward Witten
Institute for Advanced Study

Abstract: The existence of spacetime wormholes appears to indicate that the gravitational path integral carries out some sort of averaging, but in models of holography there seems to be nothing to average over except, in some examples, a single integer N. Is "averaging over N" sufficient to account for wormhole physics? I will describe some optimistic hypotheses under which it might be. (Based on recent work with Jonah Kudler-Flam.)

An observer's quantization of 3d Kerr-de Sitter spacetime

June 29 (Monday)
09:55-10:50

Herman Verlinde
Princeton University

Abstract: In this talk I will describe a holographic calculation of the spectral density of the static patch in 3d Kerr-de Sitter spacetime. At the semi-classical level, the calculation involves a sum over an SL(2,Z) family of Euclidean no-boundary solutions sourced by a worldline with given energy E and spin J. I present a proposed exact quantum computation of this partition sum based on the holographic duality between 3D de Sitter gravity and the complex Liouville string (CLS). I comment on possible microscopic realizations of 3D Kerr-de Sitter spacetime in terms of SYK-like models with twisted boundary conditions.

JT gravity on finite-size geometries: from the path integral to the JT CFT

June 29 (Monday)
11:05-12:00

Frank Ferrari
Université libre de Bruxelles

Abstract: We present two UV-complete formulations of Euclidean JT gravity on finite-size geometries of fixed topology. One is based on discretization, reducing the problem, on the disk topology, to counting self-overlapping polygons. The other is a direct approach in the continuum, which reveals a deep and perhaps surprising relationship between JT quantum gravity and Liouville quantum gravity techniques. I explain the path integral, probabilistic, formulation of the problem, and also write down the associated JT CFT. This is a conformal field theory that plays the same role for JT gravity as Liouville CFT does for Liouville gravity. The three versions of JT, in negative, zero, or positive curvature, can be discussed in parallel, the three models having the same UV structure.

A fundamental conjecture is that the continuum description is equivalent to the scaling limit of the discrete model, paralleling the expected equivalence between triangulation-based and continuum formulations of Liouville quantum gravity. Another conjecture is that negative curvature JT on finite size geometries converges to the Schwarzian field theory in an appropriate large size limit. The Schwarzian theory is the leading term in a long wavelength, hydrodynamic-like approximation to the UV complete theory, in which a notion of smooth boundary emerges. Similarly, the usual canonical quantization à la Wheeler-DeWitt of JT gravity should be seen as a long-distance effective description of the full quantum gravity model. If established, the emergence of the Schwarzian theory at long distance provides a concrete mechanism for the emergence of time.

The Hartle–Hawking state and quantum mechanics for de Sitter observers

June 29 (Monday)
13:30-14:25

Ying Zhao 赵颖
MIT

Abstract: The one-state statement for closed universes has sparked considerable discussion. In this talk, we examine its physical meaning in the context of the Hartle–Hawking state and de Sitter space. We argue that the one-state property of closed universes is fully compatible with the finite-dimensional quantum mechanics experienced by observers inside de Sitter space, and that this compatibility requires neither mixing of α-sectors nor any modification of the rules of the gravitational path integral. The apparent tension is resolved by sharply distinguishing the baby-universe Hilbert space (the space of closed universes viewed from the outside) from the bulk Hilbert space that governs quantum mechanics for an observer inside a single de Sitter universe.

Reflected entropy in field theories and holography

June 29 (Monday)
14:25-15:20

Bin Chen 陈斌
Ningbo University

Abstract: Reflected entropy is a notion introduced recently to characterize the entanglement. In this talk, I would like to introduce its properties in field theories and implications in holography.

The talk is based on the works with Clement Berthiere, Hongjie Chen, Yuefeng Liu, Zhijun Yin and Boyang Yu.

On accumulating saddles in gravitational transseries

June 29 (Monday)
15:35-16:30

Ji Hoon Lee
ETH Zürich

Abstract: TBD

AdS3 Quantum Gravity via Finite-N Expansions

June 29 (Monday)
16:30-17:25

Wei Li 李微
ITP, CAS

Abstract: I will explain how to use a certain finite-N expansion to study AdS3 quantum gravity. Consider the duality between IIB string theory on AdS3×S3×M4 and Sym^N(M4), and focus on two protected sectors: the chiral-chiral partition function (1/2 BPS), and the polar part of the elliptic genus (1/4 BPS). The expansion allows one to rewrite the boundary counting as a sum over contributions from (AdS3xS3)/Z_k x M4 orbifolds. The sum reproduces the finite-N boundary data due to cancellations induced by the bosonic negative modes of the orbifold saddles, implementing the stringy exclusion principle from the bulk.

June 30, 2026 (Tuesday)

Measuring the universe: perturbative aspects of inflationary scalar perturbations

June 30 (Tuesday)
09:00-09:55

Juan Maldacena
Institute for Advanced Study

Abstract: We discuss aspects of inflationary scalar perturbations in the regime that is close to eternal inflation. We will make some connections to Liouville-like theories, gaussian multiplicative chaos, and previous work by cosmologists on this regime.

Bulk reconstruction and Hamiltonian dynamics across the horizon of an extended AdS black hole in the maximal slicing gauge

June 30 (Tuesday)
09:55-10:50

Spenta Rustom Wadia
International Centre for Theoretical Sciences

Abstract: We discuss well defined and regularised quantum dynamics of matter across the horizon of a black hole in asymptotically AdS spacetime and bulk reconstruction formulas in the Hamiltonian formulation of GR in the maximal slicing gauge.

The Bulge Quantum Extremal Surface in the Gravity Path Integral

June 30 (Tuesday)
11:05-12:00

Arvin Shahbazi-Moghaddam
Stanford University

Abstract: A lesson of holography, central to the black hole information problem, is that the bulk-to-boundary map need not be isometric. The extent of this non-isometricity has been conjectured to be controlled by the "bulge" quantum extremal surface, but a derivation of this relation has remained open. I will present work in progress that begins to uncover the role of the bulge directly from the gravity path integral.

Seeing Quantum Many-body Chaos

June 30 (Tuesday)
13:30-14:25

Hui Zhai 翟荟
Tsinghua University

Abstract: The emergence of the arrow of time in quantum many-body systems stems from the inherent tendency of Hamiltonian evolution to scramble quantum information and increase entanglement. While, in principle, one might counteract this temporal directionality by engineering a perfectly inverted Hamiltonian to reverse entanglement growth, such a scenario is fundamentally unstable because even minor imperfections in the backward evolution can be exponentially amplified, a hallmark of quantum many-body chaos. Therefore, successfully reversing quantum many-body dynamics demands a deep understanding of the underlying structure of quantum information scrambling and chaotic dynamics. By using solid-state nuclear magnetic resonance on a macroscopic ensemble of randomly interacting spins, we measure the out-of-time-ordered correlator and validate key predictions of scramblon theory, a universal theoretical framework for information scrambling. Crucially, this theory enables us to isolate and mitigate errors in the out-of-time-ordered correlator caused by imperfections in the backward evolution. As a result, this protocol uncovers the anticipated exponential behavior of quantum many-body chaos and extracts the quantum Lyapunov exponent in a many-body experimental system for the first time. Our results push the fundamental limits of dynamical reversibility of complex quantum systems, with implications for quantum simulation and metrology.

Probing D0 Black Holes with BMN Protected Sectors

June 30 (Tuesday)
14:25-15:20

Chi-Ming Chang 张其明
Tsinghua University

Abstract: BMN matrix quantum mechanics is a mass deformation of the BFSS matrix model that lifts the flat directions, providing a controlled setting for studying protected sectors of D0-brane holography. In this talk, I will explain how protected quantities in BMN matrix quantum mechanics can be used to probe black-hole microstates. I will first review the relation between BFSS/BMN matrix quantum mechanics and D0-brane black holes, emphasizing how the BMN deformation lifts the flat directions and makes protected counting well-defined. I will then describe the finite-N BMN Witten index across vacuum sectors, where the all-sector computation exhibits an N^2 entropy signal and identifies the vacuum sectors that dominate the protected count. Finally, I will discuss why Q-cohomology contains finer information than the index, as well as a mass-flow argument showing that BMN Q-cohomology is invariant under changes of the mass parameter at nonzero mass, subject to analytic domain control. The broader goal is to use protected BMN sectors as a sharp window into the microscopic structure of holographic black holes.

July 1, 2026 (Wednesday)

Can quantum theory handle multiple observers?

July 1 (Wednesday)
09:00-09:55

Renato Renner
ETH Zürich

Abstract: Thought experiments in quantum gravity often involve multiple observers who have access to different descriptions of the same physical situation. A prominent example is the firewall paradox, which contrasts the perspective of an observer outside a black hole with that of one crossing the event horizon. This raises the fundamental question of whether the perspectives of multiple observers can be consistently combined.

In this talk, I will first review recent work in quantum foundations, where this question has been studied extensively within bare quantum theory, stripped of gravitational effects. Drawing on these insights, I will then argue that the contradiction underlying the firewall paradox is not necessarily gravitational, but points to a fundamental inability of quantum theory to consistently handle multiple observers.

Quantum computation and quantum simulation based on neutral atoms

July 1 (Wednesday)
09:55-10:50

Li You 尤力
Tsinghua University

Abstract: Atomic internal states exhibit unparalleled coherence and can be used to encode and manipulate quantum information with high precision. Their intrinsic indistinguishability provides a natural advantage for scalability, making them a promising platform for quantum information science and technology. In this report, we briefly summarize our recent progress in quantum simulation and quantum computation using strongly interacting atomic arrays and Rydberg states. Our work includes: the first experimental observation of anomalous quantum information scrambling (1); the development of practical algorithms demonstrating quantum advantage (2,3); the observation of a disorder-induced topological quantum phase transition protected by ensemble-averaged inversion symmetry in a one-dimensional random SSH chain, via measurements of spatial correlation functions with single-spin resolution, as well as the real-time observation of extended lifetimes of topological edge states (4); and the simulation of multi-particle interactions driving decay from a false vacuum based on instanton pictures (5).

Beyond Page's theorem: aspects of tripartite Haar random states

July 1 (Wednesday)
11:05-12:00

Beni Yoshida
Perimeter Institute for Theoretical Physics

Abstract: We show that no EPR-like bipartite entanglement can be distilled from a tripartite Haar random state by local unitaries or local operations when each subsystem has fewer than half of the total qubits. Viewing it as a bipartite quantum error-correcting code, this implies that neither the output subsystem supports any non-trivial logical operator, exhibiting complete breakdown of complementary recovery. We then discuss a physical interpretation in the AdS/CFT correspondence, indicating that a connected entanglement wedge does not necessarily imply bipartite entanglement, contrary to a previous belief. This also suggests an interpretation where a closed baby universe emerges as logical degrees of freedom that cannot be accessed from either boundary alone, circumventing previous no-go arguments. Finally, we propose a general method to evaluate distillable entanglement for chaotic spin systems.

Haag duality violations, order parameters, and some classification results

July 1 (Wednesday)
12:00-12:55

Horacio Casini
CONICET & Centro Atómico Bariloche

Abstract: We will describe how order parameters for confinement are expressed algebraically as violations of Haag duality (HDV). Then we describe general results about classification of HDV for different topologies, and in particular ring-like regions in d=4. An important tool in this classification is the DHR (Doplicher-Haag-Roberts) theorem, that we briefly describe.

July 2, 2026 (Thursday)

Blast Freezing a Black Hole

July 2 (Thursday)
09:00-09:55

Xiaoliang Qi 祁晓亮
Stanford University

Abstract: What happens to information carried through an evaporating black-hole horizon? We introduce a solvable model of evaporation built from coupled Sachdev-Ye-Kitaev systems, in which an initially two-sided black hole is coupled at a finite time to a larger, colder bath. Evaporation is rapid in this model, so we refer to the process as "blast freezing" of a black hole. In an appropriate large-N and large-p limit, the two-point functions and certain four-point probes can be computed analytically. Using the two-point functions as input to a generalized HKLL reconstruction, we obtain the emergent bulk geometry of the evaporation process. We then track the information carried by an infalling particle using operator size and Renyi-2 mutual information, showing how it is preserved in nonlocal many-body degrees of freedom after the blast-freezing transition.

An AdS Window into de Sitter Spacetime

July 2 (Thursday)
09:55-10:50

Daniel Jafferis
Harvard University

Abstract: I will describe the CFT dual of dS branes, as pure states of the unitary CFT at an AdS boundary, which can be produced by complex path integrals. I will discuss connections with dS/CFT, one dimensionality of closed universe QM, and observables in dS.

Observable and computable entanglement in time

July 2 (Thursday)
11:05-12:00

Alexey Milekhin
University of Kentucky

Abstract: Entanglement is a key feature of quantum mechanics. Usually, it is discussed in the context of two subsystems at a given time. A natural question is whether the notion of entanglement can be extended to subsystems at different times. I will present a family of such entanglement measures. Their key property is providing upper bounds to time-separated correlation functions, akin to the bound on spatially separated correlators in terms of the mutual information. For relativistic quantum field theories our definition agrees with the analytic continuation from space-like to time-like separated regions. I will also discuss the measurement protocols and sample computations for free fermions, conformal field theories and holography.

At the end of my talk I will outline the connections to entanglement of purely time-like regions. Based on https://arxiv.org/abs/2502.12240 and on-going work with Juan Santos Suarez.

Towards a microscopic description of de Sitter dynamics

July 2 (Thursday)
13:30-14:25

Vladimir Narovlansky
Princeton University

Abstract: Understanding a gravitational universe with positive cosmological constant quantum mechanically has been a long standing problem, and even more so for dynamical questions. We will discuss a way to approach this, identifying a quantum mechanical system that is desirable to study. Aiming at a broader understanding, we propose a principle for constructing such a quantum mechanical system microscopically. This proposal knows nothing about de Sitter space, and we should check that it agrees with the known semiclassical results.

I will then discuss the chaotic behavior using the out-of-time-order correlator in de Sitter and in the microscopic proposal and compare them. In particular, when embedding the chaotic behavior of de Sitter in a quantum framework, it gives rise to a tension through the bound on chaos, and we examine it in the microscopic construction.

Single-Sided Black Holes in Double-Scaled SYK Model and No Man's Island

July 2 (Thursday)
14:25-15:20

Ping Gao 高苹
UCAS

Abstract: We study a single-sided black hole with an end-of-the-world (EoW) brane behind the horizon in the double-scaled SYK (DSSYK). The new Hamiltonian is a deformation of the original DSSYK Hamiltonian with an extra exponential wormhole length operator, which leads to a new chord diagram rule. The boundary algebra is defined as generated by the new Hamiltonian and boundary matter.

There is an alternative but equivalent definition with a q-coherent state due to a nontrivial isomorphism of the vN algebra of DSSYK. This isomorphism induces a unitary equivalence, which yields a surprising result that the boundary algebra of a single-sided black hole in DSSYK has a non-trivial commutant and is a type II_1 vN factor. It follows that the full bulk reconstruction from the boundary is impossible, and there is a "no man's island" behind the horizon in the semiclassical JT limit. Inspired by the EoW brane, we construct a family of matter-brane states with an arbitrary number of matter chords and behaving like an EoW brane. They exactly solve the full spectrum of DSSYK. We take different ways to understand the nontrivial commutant.

We show that the commutant is complex on chord number basis and thus non-geometric. In the semiclassical JT limit, the commutant becomes the canonical purification of the boundary algebra and claims the no man's island. In the context of Hawking radiation after Page time, the unitary equivalence is interpreted as encoding the canonical purification into the old Hawking radiation, and the no man's island has the same essence as the island. Including the exponential wormhole length operator independently, the boundary algebra is extended to all bounded operators and reconstructs the no man's island. This can be regarded as a different choice for the definition of boundary algebra. This type I_ ∞ algebra is closely related to the EoW brane in Kourkoulou-Maldacena.

July 3, 2026 (Friday)

Holographic Dual of PT Symmetric BCFT

July 3 (Friday)
09:00-09:55

Tadashi Takayanagi
Kyoto University

Abstract: We present a holographic dual of a two dimensional conformal field theory with non-hermitian but Parity-Time (PT) symmetric boundary conditions, by applying the AdS/BCFT duality and by introducing an imaginary valued scalar field localized on an end-of-the-world brane. We find that as we will increase the strength of the non-hermitian PT symmetric interactions, the system experiences a spontaneous PT symmetry breaking. We also consider its Wick rotated setup as a new quantum quenched state and show that its growth of entanglement entropy can be larger than the standard results obtained from standard Cardy states.

Entanglement and topology

July 3 (Friday)
09:55-10:50

Abhijit Gadde
Tata Institute of Fundamental Research

Abstract: A gapped system is expected to be described by a topological field theory at long distances. In this talk, I'll show how the multi-partite entanglement properties of the ground state characterize this topological field theory. Multiplicative local unitary invariants - known as multi-invariants - play an important role in this discussion. We can construct q-partite multi-invariants given a bi-partite triangulation of a q-1 dimensional manifold. We conjecture that the genuine q-partite entanglement extracted from such a multi-invariant is independent of the triangulation and in fact captures the partition function of the low energy TQFT on the manifold in question. This conjecture is proved for a large class of models called Levin-Wen stringent models.

Smoothing the Bouncing-Geodesic Singularity in AdS/CFT

July 3 (Friday)
11:05-12:00

Shanming Ruan 阮善明
Peking University

Abstract: Black-hole singularities remain among the central open problems in quantum gravity. In this talk, I will discuss how the interior of an AdS black hole can be probed by low-dimensional extremal surfaces, with spacelike geodesics as the simplest example. In the classical large-N limit, such probes can develop a finite-time divergence associated with a nearly null surface that bounces off the black-hole singularity. I will show that this bouncing-geodesic singularity is not a genuine physical divergence, but instead emerges from the strict semiclassical limit. Finite-N corrections naturally induce a universal Gaussian smoothing of the divergence. A complementary boundary perspective arises from finite-c deformations of quasinormal-mode data.

Are holographic entropy inequalities true in time-dependent states?

July 3 (Friday)
13:30-14:25

Matthew Headrick
Brandeis University

Abstract: The famous Ryu-Takayanagi formula computes entanglement entropies in static holographic states. Those entropies obey a set of special inequalities, not obeyed by general quantum states, whose structure and interpretation remain somewhat mysterious. An important open question is whether those inequalities remain valid for non-static states. I’ ll explain why this question is hard and review what we know about it, including recent progress that exposed a new combinatorial structure intrinsic to the inequalities.

Stabilizer Rényi Entropy in SYK-like Models

July 3 (Friday)
14:25-15:20

Pengfei Zhang 张鹏飞
Fudan University

Abstract: Quantum entanglement and quantum magic are two distinct fundamental resources that enable quantum systems to exhibit complex phenomena beyond the capabilities of classical computer simulations. While quantum entanglement has been extensively used to characterize both equilibrium and dynamical phases, the study of quantum magic, typically quantified by the stabilizer Rényi entropy (SRE), remains less explored. In this talk, I will introduce our recent work on investigating the SRE in SYK-like models by representing the corresponding partition function using auxiliary spin degrees of freedom. We apply this method to three examples: (1) the single-site SYK model, (2) the coupled SYK model, and (3) thermofield double dynamics. Our results reveal various transitions in the SRE that are not visible in conventional observables or Rényi entropies of density matrices.

From Science-for-QC to QC-for-Science

July 3 (Friday)
15:35-16:30

Chaoyang Lu 陆朝阳
USTC

Abstract: I will go through our recent efforts in my group using photons and atoms to build increasingly large-scale quantum computers and, in turn, how these early quantum computers can already be used for studies of fundamental problems in mathematics, quantum physics, and condensed matter physics. We use the protocol of Gaussian boson sampling to demonstrate quantum computational advantage, with up to 3050 detected photons [Zhong et al. Science 2020, PRL 2021, Deng et al. PRL 2023, Liu et al. Nature 2026]. We develop an AI-enabled constant-time-overhead rearrangement protocol to prepare a 2024 defect-free atomic array [Lin et al. 2025]. Using a single atom trapped in an optical tweezer and cooled to the motional ground state in three dimensions, we faithfully realize the Einstein-Bohr recoiling-slit gedankenexperiment tunable at the quantum limit [Zhang et al. 2025]. Based on a bottom-up quantum engineering approach, we experimentally created the fractional quantum Hall state using strongly interacting photons [Wang et al. Science 2024]. We further use the quantum computing platform to rule out a real-value description of standard formalism of quantum theory [Chen et al. PRL 2022].

Flat Space Entanglement: A Coulomb Branch Perspective

July 3 (Friday)
16:30-17:25

Robert Myers
Perimeter Institute for Theoretical Physics

Abstract: We study holographic entanglement entropy in Coulomb-branch solutions describing spherical shells of Dp-branes. The corresponding throat geometries contain a flat-space bubble in the infrared region, providing a concrete top-down framework for exploring holographic entanglement of flat space. We find that the flat-space region is associated with a reduction of entanglement and of the effective infrared degrees of freedom in the dual boundary state relative to the standard vacuum. We also examine internal RT surfaces and holographic complexity, and show that they exhibit similar qualitative behavior. Finally, we comment on the broader implications of our results for flat space holography.

会务信息
Conference Service Information

现场注册时间 On-site Registration

6 月 29 日上午 8:20-8:50 29th June, 8:20 AM - 8:50 AM

会议注册地点 Registration Location

清华大学第三教室楼 No. 3 Teaching Building, Tsinghua University

线上参会信息 Online Participation

会议将提供 Zoom 线上参会方式，相关信息如下
The conference will also be accessible via Zoom

Zoom Meeting ID: 4552601552 **Passcode: YMSC**

餐饮安排 / Catering Arrangements

6 月 29 日 -7 月 3 日 June 29 - July 3

时间 Time	餐饮 Catering	用餐人员 Participants	用餐地点 Venue
6:45-8:40	早餐 Breakfast	报告人 Speakers	以酒店通知为准 Provided by the hotel
12:00-13:00	午餐 Lunch	报告人和注册参会人 Speakers and Registered participants	清华大学玉树园餐厅（7 月 1 日 13:00） Yushuyuan Canteen of Tsinghua University （Lunch on July 1 starts at 1:00 PM）

参会期间均需凭胸牌到指定地点用餐，请您佩戴胸牌。
During the conference, you are required to bring your badge to the designated location for dining.

交通安排 / Transportation Arrangements

主办方根据会议日程安排车辆接送，具体信息如下:
The organizer will arrange shuttle buses for conference attendees. The shuttle bus schedule is as follows:

June 29	
08:20	甲所→清华大学第三教室楼二段 2101 Jiasuo → No. 3 Teaching Building 2101

June 30 - July 3	
08:40	甲所→清华大学第三教室楼二段 2101 Jiasuo → No. 3 Teaching Building 2101
12:00	清华大学第三教室楼→玉树园餐厅（7 月 1 日 13:00） No. 3 Teaching Building → Yushuyuan Canteen（July 1, 13:00）
13:00	玉树园餐厅→清华大学第三教室楼 Yushuyuan Canteen → No. 3 Teaching Building

June 30	
17:30	清华大学第三教室楼→花家怡园 No. 3 Teaching Building → Hua's Restaurant
19:30	花家怡园→甲所 Hua's Restaurant → Jiasuo

备注: 会议期间主办方安排车辆到指定地点，您也可以步行前往。所有车辆有“QIQG 2026”标识。

Note: All shuttle buses will be marked with "QIQG 2026".

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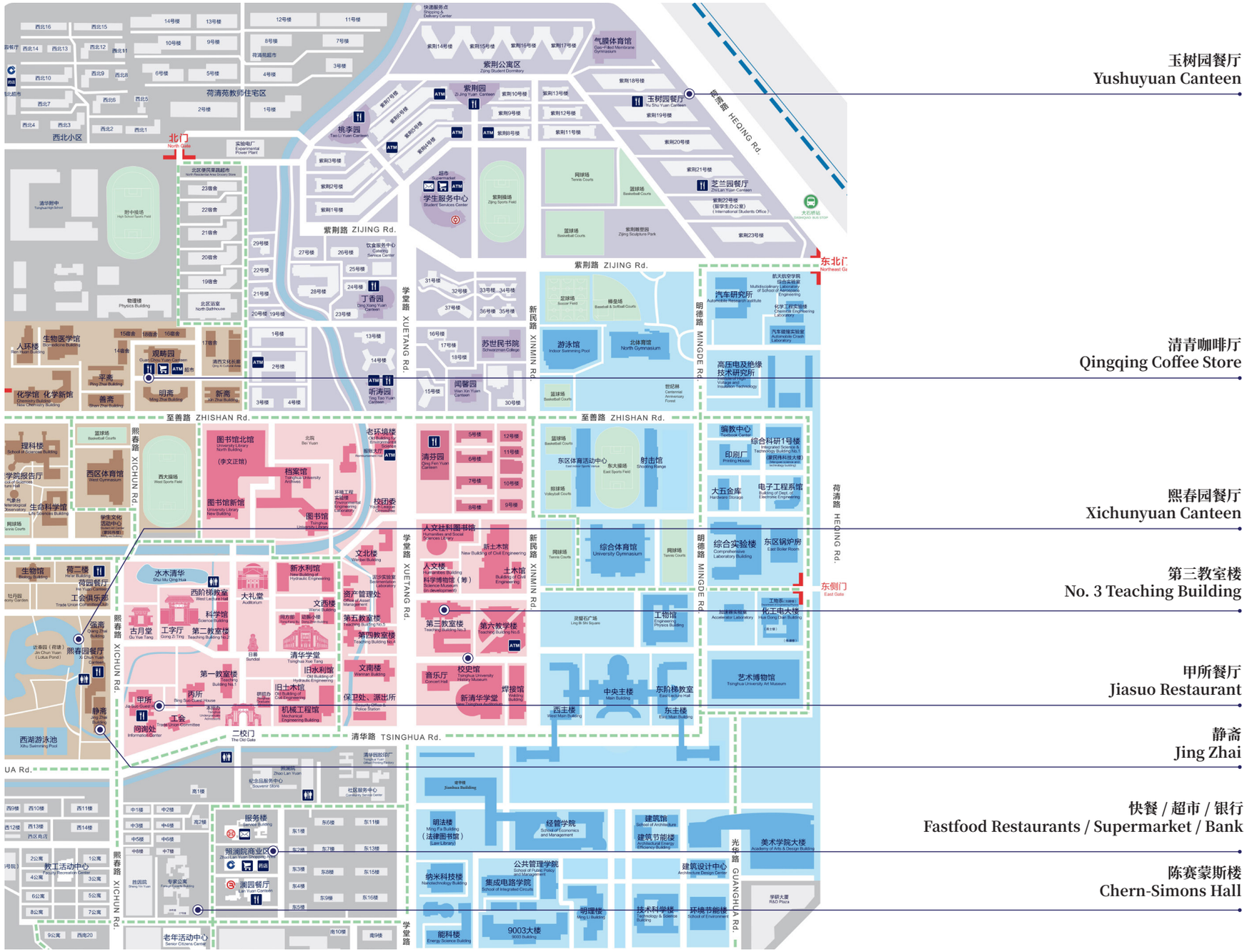
在酒店所产生的房杂费，洗衣费、房间食品、餐费等额外费用，需自付。
The hotel incidental charges, including laundry, in-room food and beverages, and dining expenses, are at your own expense.

会场地图 / Maps



咖啡店信息
Scan for Nearby Coffee Shops

蒙楼咖啡 (新清华学堂店)
Menglou Coffee (New Tsinghua Xuetang Store)
营业时间 (Opening Hours)：09:00-20:00
地址：北京市海淀区新清华学堂负一层国际交流中心
Around a 5-minute walk from Teaching Building No. 3

拾年咖啡 (清华大学店)
Ten Years After Café (Tsinghua University Store)
营业时间 (Opening Hours)：07:30-24:00
地址：海淀区双清路 30 号清华大学清华园胶印厂（近清华大学蒙民伟音乐厅）
Around a 5-minute walk from Teaching Building No. 3

瑞幸咖啡 (清华大学清芬园店)
Luckin Coffee (Qing Fen Yuan Canteen Store, Tsinghua University)
营业时间 (Opening Hours)：07:00-20:00
地址：海淀区双清路 30 号清芬园学生职业发展指导中心一层大堂
Around a 5-minute walk from Teaching Building No. 3

星巴克（清华大学图书馆店）
Starbucks（University Library Store）
营业时间 (Opening Hours)：07:00-22:00
地址：北京市海淀区清华园街道清华大学图书馆店
Around a 9-minute walk from Teaching Building No. 3

库迪咖啡 (清华观畴园店)
Cotti Coffee (Guan Chou Yuan Canteen Store, Tsinghua University)
营业时间 (Opening Hours)：08:30-19:00
地址：海淀区清华园街道双清路 30 号观畴园餐厅 B1 天猫超市内
Around a 9-minute walk from Teaching Building No. 3


清華大學 丘成桐数学科学中心
Yau Mathematical Sciences Center, Tsinghua University
清華大學 高等研究院
Institute for Advanced Study, Tsinghua University
中国科学院大学
University of Chinese Academy of Sciences
復旦大學
FUDAN UNIVERSITY
東南大學
SOUTHEAST UNIVERSITY