Vision
愿景

ICTP-AP is to

- provide opportunities for advanced education, training and research in basic science such as frontiers of theoretical physics and related interdisciplinary areas for scientists from Asia-Pacific region and other countries;
- develop outreach activities in cooperation with national and international institutions, providing an international forum and enhancing collaborative networks among scientists from different countries in and out of the region;
- develop and coordinate research-education-oriented advanced studies in theoretical physics and related interdisciplinary areas;
- become an international hub for high-level conferences, schools and workshops

ICTP-AP 将：

- 为来自亚太地区和全世界的科学家提供参与基础科学尤其理论物理前沿及相关交叉学科领域高水平科研、教育和培训项目的机会。
- 开展各种学术活动以加强与国内外学术机构间的合作，从而为来自亚太地区和全世界不同国家的科学家搭建国际化的平台并促进合作网络的形成。
- 发展并协调理论物理及相关交叉学科领域以科教融合为导向的高水平学术项目；
- 发展成为区域性国际一流科学研究中心、国际化人才培养基地、开放型国际学术交流平台。

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

ICTP-AP International Centre for Theoretical Physics Asia-Pacific 国际理论物理中心-亚太地区

ABOUT ICTP-AP

国际理论物理中心
（亚太地区）

Introduction

The International Centre for Theoretical Physics Asia-Pacific (ICTP-AP) is China's first UNESCO Category 2 basic science centre, which is under the auspices of UNESCO in cooperation with the Chinese Academy of Sciences (CAS), the National Science Foundation China (NSFC) and the Abdus Salam International Centre for Theoretical Physics (ICTP, Trieste). ICTP-AP is affiliated with the University of Chinese Academy of Sciences (UCAS). It is a non-profit organization that carries out high-level scientific research, education and training in basic science and the relevant interdisciplinary areas.

UNESCO is the United Nations Educational, Scientific and Cultural Organization. It contributes to peace and security by promoting international cooperation in education, sciences, culture, communication and information. UNESCO promotes knowledge sharing and the free flow of ideas to accelerate mutual understanding and a more perfect knowledge of each other's lives. UNESCO's programmes contribute to the achievement of the Sustainable Development Goals defined in the 2030 Agenda, adopted by the UN General Assembly in 2015.

国际理论物理中心（亚太地区）（简称：ICTP-AP）由中国科学院、国家自然科学基金委员会和国际理论物理中心共同建设，是联合国教科文组织在中国的第一个基础科学方面的二类中心。ICTP-AP 依托中国科学院大学进行组织建设，是进行基础科学前沿与相关交叉科学领域高水平科研、教育和培训的非营利性组织。

联合国教科文组织为联合国教育、科学及文化组织的简称，英文缩写为 UNESCO（United Nations Educational, Scientific and Cultural Organization）。联合国教科文组织致力于推动各国在教育、科学和文化领域开展国际合作，以此共筑和平。联合国大会于 2015 年通过了《2030 年可持续发展议程》，教科文组织开展的各项目将助力实现该议程中的可持续发展目标。

ICTP-AP PLATFORM

“量子 - 宇宙理论物理中心”揭牌仪式

Joint Centre for Quanta-Cosmos Theoretical Physics

量子 - 宇宙理论物理中心

The "Joint Centre for Quanta-to-Cosmos Theoretical Physics" was inaugurated in the Hangzhou Institute for Advanced Study（HIAS） of UCAS on the morning of June 30, 2022. The centre is jointly established by the ICTP-AP, HIAS , Nanjing University and Zhejiang University and will carry out key research, academic exchanges and talent cultivation in the field of unified theory, the deep structure of matter, cosmic evolution, black hole physics, gravitational wave universe, etc. The research outcome will be presented by publications. To promote high-level cooperation, the centre will roll out guest scientist programs, organize seminars and workshops on a regular basis, hold a large-scale academic conference and workshop once a year so that original breakthroughs in Quanta-to-Cosmos physics and interdisciplinary scientific fields of theoretical physics will be made in the future.

2022 年 6 月 30 日，“量子 - 宇宙理论物理中心”在国科大杭高院揭牌成立。该中心由国际理论物理中心（亚太地区）联合国科大杭高院、浙江大学与南京大学共同组建，旨在针对统一理论、物质深层次结构、宇宙演化和黑洞物理开展重点研究、学术交流和人才培养，力争产出 1-2 项有代表性的重要成果及多篇学术论文。

为了推进高水平的合作交流，“量子 - 宇宙理论物理中心”不仅会实施访问科学家计划，开展日常的学术报告和研讨会，还将每年举办一次大规模学术会议和讲习班。同时，力争在量子 - 宇宙物理的基本科学问题研究中取得原创性突破。

ICTP-AP RESEARCH

The Special Fund for Theoretical Physics

理论物理专款项目

The Special Fund for Theoretical Physics is established by the NSFC in 1993 to promote the development of theoretical physics research in China, cultivate outstanding talents in theoretical physics, and give full play to the role of theoretical physics in guiding the country's economic development and scientific and technological strategic decision-making. According to the frontier and latest research results of international and domestic theoretical physics, the special fund for theoretical physics conducts top-level design in a timely manner, mobilizes excellent personnel to tackle key problems, cultivates young talents, and extensively carries out international and domestic academic exchanges and lectures so as to improve the research environment of theoretical physics, bringing China's theoretical physics research to a new level.

The program of "Quanta-Cosmos Theoretical Physics" with a total of 12 million yuan was approved by the Special Fund of NSFC and the research period lasts from January 2022 to December 2025. Under the support of the fund, 33 papers were published by the research team and a Joint Centre for Quanta-Cosmos Theoretical Physics was established by the ICTP-AP in cooperation with the HIAS, Zhejiang University and Nanjing University in 2022.

理论物理专款是中国国家自然科学基金委员会于1993年设立的专项基金，是为促进中国理论物理学研究的发展，培养理论物理优秀人才，充分发挥理论物理对国民经济建设和科学技术在战略决策上应有的指导和咨询作用而设立。理论物理专款根据国际国内理论物理发展的前沿和最新研究成果，及时地进行顶层设计，组织优秀人员进行攻关，培养青年人才，广泛开展国际、国内的学术交流和讲习活动，改善理论物理研究环境，以促进中国理论物理研究再上一个新台阶。

中心获批国家自然科学基金“理论物理专款量子-宇宙理论物理中心”项目，总经费1200万元，研究期限为2022年1月至2025年12月。2022年，在专款的支持下，中心科研人员共计发表学术论文33篇。同时，中心还与国科大杭高院、浙江大学与南京大学联合组建了量子-宇宙理论物理中心。

南京大學 浙江大學 ZHEJIANG UNIVERSITY

國科大杭州高等研究院 Hangzhou Institute for Advanced Study,UCAS

Strategic Priority Research Program of CAS

中国科学院战略性先导科技专项课题

The Strategic Priority Research Program of the Chinese Academy of Sciences is a major science and technology program approved by the executive meeting of the State Council and set by the Chinese Academy of Sciences, which is committed to breaking through cutting-edge scientific and technological issues and strategic high-tech issues related to China's international competitiveness, long-term sustainable economic and social development, national security and the possible direction of new scientific and technological revolution, thus achieving major original outcomes. It coordinates and connects with the national science and technology innovation plans and the central finance science and technology plans, etc. It consists of three categories of second-level special programs: forward-looking strategic science and technology (Category A), basic and cross-cutting-edge scientific research (Category B), and key core technology breakthrough (Category C).

中国科学院战略性先导科技专项是经国务院常务会议批准由中国科学院设立的重大科技专项，致力于突破关系中国国际竞争力、经济社会长远持续发展、国家安全及新科技革命的可能方向的前沿科技问题和战略高技术问题，并取得重大原创成果。与国家科技创新规划和中央财政科技计划等相互协调与衔接。设有前瞻战略科技(A类)、基础与交叉前沿科研(B类)、关键核心技术攻坚(C类)3类二级专项。

Taking research on China' s space gravitational wave detection as a core, the ICTP-AP took the lead in the pilot Category B research program "Forward Research of Taiji Program in Space" (the implementation period is from June 2016 to May 2021, with a total of 40.99 million yuan), the pilot Category A research program "Taiji Program for Space Gravitational Wave Detection" (the implementation period is from June 2018 to December 2020, with a total of 178.8237 million yuan) and the Study of Key Technology in Scientific Application System (the implementation period is from July 2020 to December 2021, with a total of 10.59 million yuan).

中心围绕中国空间引力波探测研究，先后牵头先导B类“空间太极计划预研”（执行期2016年6月~2021年5月，总经费4099万元），先导A类“空间引力波探测太极计划”课题（执行期2018年6月~2020年12月，总经费17882.37万元），以及先导A类“科学应用系统关键技术研究”课题（执行期为2020年7月至2021年12月，总经费为1059.00万元）。

Among them, research outcomes of the Study of Key Technology in Scientific Application System have been reviewed. The study is aimed at resolving technological difficulties in full link coupling relationship modeling, cross-scale high-precision modeling et cetera. It also sought to develop a prototype subsystem for the simulation and analysis of Taiji-2 Scientific Application System in order to provide comprehensive verification environment for further development of key technologies of the satellite thus supporting the data analysis and verification. Also, through the research of noise suppression in spaceborne gravitational wave detection efforts and the study in signal inversion data processing, it strived to overcome key technological difficulties in core scientific measurement system of Taiji-2 such as bias correction, noise suppression and filtering in pre-processing of scientific data from laser interferomeric ranging system and inertial sensor system. It also aimed at solving problems in developing target waveform templates and signal searching for scientific data analysis.

其中，“科学应用系统关键技术研究”课题完成了结题验收工作。本课题旨在攻克全链路耦合关系建模、跨尺度高精度建模等技术难点，开发太极二号科学应用系统仿真分析原型子系统，为“太极二号”方案论证与优化提供技术支撑，为卫星系统关键技术攻关提供综合验证环境，为数据处理和验证提供支持。另外，通过空间引力波噪声抑制与信号反演数据处理研究，突破任务核心科学测量系统包括激光干涉测距系统与惯性传感器系统科学数据预处理中偏差异常矫正、噪声抑制滤除等关键技术难点，突破任务科学数据处理目标波源模板研制与信号搜索等技术难点。

Review Meeting for the Completion, examination and acceptance of the project

The research team is comprised of 142 personnel, including 35 senior professors, five postdocs, 25 doctoral students and 22 master students. On the basis of the research outcome, we have witnessed the creation of five software of Taiji-2 satellite and one prototype of full-link simulation platform, the publication of 15 papers (including 12 SCI papers) as well as the application of three patents.

课题研究团队共计142人，其中高级职称35人，前后有5名博士后，25名博士研究生25名，22名硕士研究生参与研究。基于研究成果，完成太极二号科学应用系统仿真分析原型子系统等软件5件，全链路仿真平台原理样机1套，发表论文15篇（其中SCI论文12篇），申请专利3项。

142人
课题研究团队共计

15篇
发表论文

The Gravitational Wave Detection Major Program of National Key Research and Development Program of China

国家重点研发计划“引力波探测”重点专项

The overall target of the “gravitational wave detection” program supported by the National Key Research and Development Program of China, Ministry of Science and Technology is oriented towards the cutting-edge research development of gravitational wave detection. The program focuses on major scientific problems and bottleneck technology of research on gravitational wave detection, designs an overall layout of gravitational wave detection research tasks from Ahertz to Fehertz, Nanohertz to Millahertz and so on, so as to significantly improve the innovation capacity of gravitational wave detection and research in China, and cultivate a high-level research team. A total of 51 research directions have received state-fund support in 2020 and 2021 annual programs with a total amount of around 1.2 billion yuan. Among them, 38 are for space gravitational wave detection. The centre has also helped the Taiji team to gain fund for 17programs.

中国科技部国家重点研发计划“引力波探测”重点专项的总体目标是面向引力波研究发展前沿，围绕引力波探测研究的重大科学问题和瓶颈技术，全面布局阿赫兹到飞赫兹频段、纳赫兹频段和毫赫兹频段等引力波探测研究任务，大力提升中国引力波探测研究的创新能力，培养并形成一支高水平的研究队伍。专项2020-2022年度共计立项支持51个研究方向，国拨经费约12亿元。其中空间引力波探测方向共计38项，中心推动太极团队争取到的项目共计17项。

领域	研究任务	牵头单位	年份
激光干涉测量研究	星间激光干涉测量系统分析与设计	中国科学院力学研究所	2020
	星载高功率窄线宽种子激光器	中科院上海光学精密机械研究所	2020
	星载激光频率预稳控制技术研究	中国科学院精密测量科学与技术创新研究院	2021
	星载激光锁臂稳频技术与时间延迟干涉技术研究	中国科学院大学	2021
	星间激光捕获与跟踪技术研究	中科院上海技术物理研究所	2022
惯性传感器研究	超高精度惯性传感器测试与评估技术	中国科学院长春光学精密机械与物理研究所	2020
	超高稳定性电容极板框架的设计、研制与测试技术	北京理工大学	2021
超静超稳航天器平台研究	空间引力波探测航天器的系统构建技术	中国科学院微小卫星创新研究院	2020
	多参考质量无拖曳控制方法与技术研究	中国科学院微小卫星创新研究院	2021
	高置信度亚微牛级推进器标定方法与技术研究	兰州空间技术物理研究所	2021
	高精度推进器标定系统研制与性能测试技术研究	中国科学院力学研究所	2021
	高精度星载温度测量与控制研究	中国科学院微小卫星创新研究院	2022
	零膨胀新型材料与超稳结构研究	中国科学院长春光学精密机械与物理研究所	2022
数值仿真与系统研究	空间引力波探测编队系统全链路动态数值仿真	中国科学院国家空间科学中心	2020
	空间引力波探测编队系统半物理仿真研究	哈尔滨工业大学	2021
	引力波宇宙学波源物理研究	中国科学院理论物理所	2020
	面向空间引力波探测的引力波模板库研究	国科大杭州高等研究院	2021

With the special fund for Gravitational Wave Detection allocated by the Ministry of Science and Technology of China, ICTP-AP has led the Research on Spaceborne Frequency-Stabilized Laser Technology and Time Delay Interferometry Technology. The total funding is 22.75 million yuan, and the implementation period is from November 2021 to October 2026.

中心牵头的“引力波探测”专项“星载激光锁臂稳频技术与时间延迟干涉技术研究”项目，总经费为2275万元，执行期为2021年11月至2026年10月。

Fields	Research Tasks	Leading Units	Year
Research on Laser Interferometry Measurement	Analysis and Design of Intersatellite Laser Interferometry System	Institute of Mechanics, CAS	2020
	Spaceborne High Power Narrow linewidth Seed Laser	Shanghai Institute of Optics and Fine Mechanics, CAS	2020
	Research on Frequency Pre-stabilization Control Technology of Spaceborne Laser	Innovation Academy for Precision Measurement Science and Technology, CAS	2021
	Research on Spaceborne Laser Arm Locking Frequency Stabilization and Time Delay Interferometry	UCAS	2021
	Research on Interstellar Laser Capture and Tracking	Shanghai Institute of Technical Physics, CAS	2022
Research on Inertial Sensor	Testing and Evaluation Technology of Ultra High Precision Inertial Sensor	Changchun Institute of Optics, Fine Mechanics and Physics, CAS	2020
	Design, Development and Testing Technologies of Ultra high Stability Plate Capacitor Frame	Beijing Institute of Technology	2021
Research on Hyperstatic and Hyperstable Spacecraft Platform	System Construction Technology of Space Gravitational Wave Detection Spacecraft	Innovation Academy for Microsatellites of CAS	2020
	Research on the Method and Technology of Multi-reference Mass and Drag-fee Control	Innovation Academy for Microsatellites of CAS	2021
	Research on Calibration Method and Technology of High Confidence Submicro-newton-scale Thruster	Lanzhou Institute of Physics, China Aerospace Science and Technology Corporation	2021
	Development of High Precision Thruster Calibration System and Research on Performance Testing Technology	Institute of Mechanics, CAS	2021
	Research on High Precision Spaceborne Temperature Measurement and Control	Innovation Academy for Microsatellites of CAS	2022
	Research on new Zero Thermal Expansion Materials and Ultra-Stable Structures	Changchun Institute of Optics, Fine Mechanics and Physics, CAS	2022
Numerical Simulation and System Research	Total Link Dynamic Numerical Simulation of Space Gravitational Wave Detection Formation System	National Space Science Centre, CAS	2020
	Research on Semi-physical Simulation of Space Gravitational Wave Detection Formation System	Harbin Institute of Technology	2021
	Research on Wave Source Physics of Gravitational Wave Cosmology	Institute of Theoretical Physics, CAS	2020
	Research on Gravitational Wave Template Library for Space Gravitational Wave Detection	Hangzhou Institute for Advanced Study, UCAS	2021

Fundamental Research Funds for the Central Universities

中国科学院大学自主部署项目

UCAS has set up a special program of outstanding youth innovation teams to support scientific research institutes of the university to narrow down the research direction, improve the scientific research level, strengthen the innovation capacity and gather talents. In 2022, the centre received fund support from the special innovation unit program with a total amount of 4 million yuan. This program will be centered around the "Taiji Program", gathering a research team to carry out research on space gravitational wave detection so as to lay a solid foundation for the scientific output of the "Taiji Program". So far, there are six postdoctoral researchers, 10 doctoral students and eight master's students working in the team.

中国科学院大学为支持校部科研类机构凝练研究方向、提高科研水平、加强创新能力建设、凝聚人才队伍，设立优秀青年创新团队专项。中心2022年获得该专项创新单元类项目支持，总经费400万元。在项目经费支持下，本创新单元将针对“太极”计划来建立，凝聚一支空间引力波探测研究团队，开展空间引力波探测相关研究，为“太极计划”的科学产出奠定基础。截止目前，团队已引入6名博士后，并有10名博士生，8名硕士生参与。

Global Gravity Field Model from Taiji-1 Observations

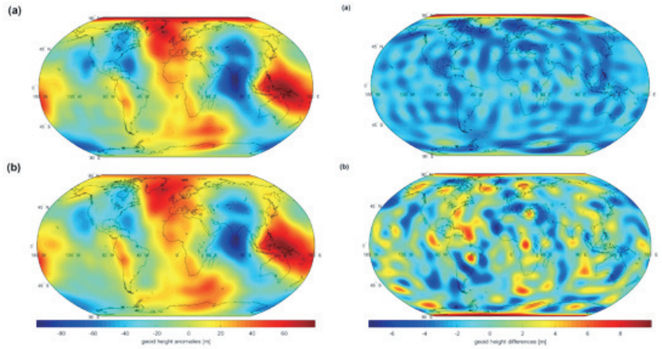
全球重力场监测数据产品

The research team of Taiji-1 has produced the first global gravity model TJGM-r1911 which is independently derived from China's own satellite mission. The geopotentials up to the 20th order from Taiji-1 agree well with those from GFO. This product and global time-variable and higher-precision static data of "Taiji-1" to be released later will constitute a systematic global gravity field data product, which will provide first-hand data on the anomalous distribution of the global gravity field and support China's independent research in both earth science and geodetic surveying and mapping.

目前，“太极一号”科学团队研发获得我国首个技术全自主的全球静态重力场监测数据产品TJGM-r1911，实现全球重力场前20阶球谐函数势的精密测量（如图），结果与GFO等任务实测数据高度吻合。本成果以及后续将发布的“太极一号”全球时变和更高精度静态数据将构成系统性全球重力场数据产品，将提供全球重力场异常分布信息的第一手数据资料，支撑我国地球科学、大地测绘领的自主研究。

The gravity field is Earth's basic physical field, and its precise measurement is of great strategic and scientific significance in the fields of national defense, civil aerospace, geophysics, climate change, and groundwater resource monitoring. Since the 1970s, Western countries have invested huge manpower and resources in the development of Earth gravity satellites, successively launching satellite missions which includes CHAMP, GRACE, GOCE and GFO to continuously monitor the global gravity field. CAS approved the Taiji-1's extended science experiment-global gravity field surveying and mapping in 2021.

重力场是地球基本物理场，其精密测量在国防、民用航天、地球物理、气候变迁与地下水资源监测等领域具有重大的战略和科学意义。自上世纪70年起，西方国家投入巨大的人力物力开展地球重力卫星任务的研制，先后发射了CHAMP，GRACE，GOCE以及GFO等卫星任务对全球重力场开展连续性监测。2021年，中国科学院批准了“太极一号”卫星全球重力场测绘的拓展科学实验。



This product has been released on arXiv website on March 11,2022 and published on the Science Journal *Microgravity Science and Technology* on July 22.

该成果于2022年3月11日发布于国际预印本arXiv.org网站，并于7月22日在微重力科学主流期刊Microgravity Science and Technology发表。

ICTP-AP TALENTS

Student Enrollment

In 2022, ICTP-AP has enrolled 14 graduate students, including 7 PhD students and 7 master's students. Most of them will participate in the research related to space gravitational wave detection. During their study in UCAS, students could apply for the following scholarships: National grants, National scholarships, scholarships of Chinese Academy of Sciences, academic scholarships of UCAS, scholarships of research institutes and allowances for "Research Assistants/Teaching Assistants/Management Assistants".

As a Category 2 centre of UNESCO, we have been actively playing our role in the cultivation of talents in under-developed countries and regions. In 2022, a total of 1,808 international students from 91 countries around the world have been jointly cultivated by the centre and the International College of UCAS, including 1,144 doctoral students and 608 master's students, 50 senior visiting students and 6 general visiting students.

2022年，中心共招收14名研究生，其中博士生7名硕士生7名。他们中的大部分将参与到空间引力波探测的相关研究中。在学期间，学生可以申请国科大设置的各项奖助学金：国家助学金、国家奖学金、中科院奖学金、国科大学业奖学金、研究所奖学金、"助研/助教/助管"岗位津贴，共计六个类别。

作为联合国教科文组织的二类机构，我们一直关注欠发达国家和地区人才的培养。2022年，中心与国科大国际学院联合培养的国际生共1808人，分别来自91个国家；其中，博士研究生1144人、硕士研究生608人、高级进修生50人、普通进修生6人。

Talent Development

ICTP-AP has attached great importance to the cultivation of young scientists, creating a favorable development climate for young talents and providing support for them to apply for talent programs. In 2022, one of our faculty members received Excellent Young Scientists Fund (Overseas), and one postdoc has successfully applied for the CAS Special Research Assistant Program.

中心高度重视青年科学家的培养，着力打造良好的氛围和环境，支持青年科学家的发展，助力人才项目申请。2022年，在中心平台的依托下，一位老师申请并获得海外优青项目，一位博后成功申请中科院特别研究助理资助项目。

Our New Faculties

Jun Zhang

Tenure-track assistant professor

Research Interests

Non-GR Signatures in Gravitational Waves, Black holes Super-radiance and Modified Gravity

Working experience

Member of LISA work package (non-GR signatures in EMRIs), 2019 - 2021
Postdoctoral Research Associate, Imperial College, London, UK, 2018 - 2021
Postdoctoral Fellow, York University, Toronto, ON, Canada, 2016 - 2018
Associate Postdoctoral Researcher, Perimeter Institute, Waterloo, ON, Canada, 2016 – 2018

Huaike Guo

Tenure-track assistant professor

Research interests

Gravitational waves, dark matter detection, new physics beyond the standard model

Working experience

LIGO Scientific Collaboration Member, Since 2019
Postdoctoral Research Associate, University of Utah, 2021-2022
Postdoctoral Research Associate, University of Oklahoma, 2018-2021
Postdoctoral Researcher, Institute of Theoretical Physics, Chinese Academy of Sciences, 2016-2018

2022 Joined Postdocs

	Name	Research Fields
01	Ju Chen	Gravitational Wave Physics
02	Jing Liu	Gravitation-alwave Cosmology
03	He Wang	Gravitational Astronomy
04	Yutong Wang	Gravitational Wave Physics
05	Yuan Zhong	High Energy Physics
06	Geng Li	Particle Physics and Cosmology
07	Yumei Wu	Gravitational Physics
08	Jiaming Shi	Gravitation and Cosmology
09	Wenhong Ruan	Physics
10	Fuguo Yang	Theoretical Physics
11	Haomin Rao	Gravitation and Cosmology

> **Aside from the following international recruitment channels: Inspire, Physics Today and Academic Jobs Online, the job vacancy will also be posted on the official website of ICTP-AP.**

OUTREACH ACTIVITIES

Yike Talks
一刻 Talks

Yue-Liang Wu, the director of the ICTP-AP and the chief scientist of Taiji Program was invited by the renowned Yike Talks, the Chinese version of the TED Talk, to deliver a speech during a special session in UCAS. With the theme of “Go to the Universe and Look for Space-Time Ripples”, Yue-Liang Wu has talked about the “Taiji Program” and super unified field theory. In his talk, Professor Wu highlighted how important precise measurement of gravitational wave is to people’s exploration of space-time, the nature of gravity as well as the origin of the universe. The successful launch of Taiji Satellite-I is a miracle in the satellite history of CAS’s space science, demonstrating the institutional characteristics and strengths of CAS. The talk was live-streamed and the speech got up to 47,256 people connected at the same time.

中心主任，太极首席科学家吴岳良院士受邀在一刻Talks中国科学院大学专场发表题为“去宇宙寻找时空涟漪”的演讲。吴岳良院士介绍了“太极计划”与超统一场论，强调了引力波的精密测量对人类认识时空和引力本质的和宇宙起源的重要性，“太极一号”的成功，创造了中科院空间科学卫星史上的奇迹，充分体现了中科院建制化的特色和优势。该演讲在线直播，共有47,256次播放量。

IYBSSD 2022

IYBSSD2022
International Year
of Basic Sciences
for Sustainable Development

2021年第76届联合国大会宣布2022年为“基础科学促进可持续发展国际年”（IYBSSD 2022）。这是联合国历史上首次应成员国的要求，以基础科学作为国际年主题，强调基础科学对研究、教育和可持续发展的重要作用。全球已有27个国际科学组织、90个国家科学院和国际科研机构、28位诺贝尔奖获得者积极表态支持基础科学国际年。

ICTP-AP作为中国首个自然科学领域的联合国教科文组织二类机构，联合国内多家科研机构和学校，举办了相关支持活动。

In 2021, the 76th UN General Assembly proclaimed 2022 as the International Year of Basic Science for Sustainable Development (IYBSSD 2022). This is the first time in the history of the United Nations that basic science has been taken as the theme of the International Year at the request of Member States, emphasizing the important role of basic science in research, education and sustainable development. Twenty-seven international scientific organizations, 90 national Academies of Sciences and international scientific research institutes, and 28 Nobel Prize winners have actively expressed their support for the IYBSSD 2022.
As China’s first UNESCO category 2 Centre in the area of basic science, ICTP-AP has organized relevant supporting activities with many scientific research institutes and schools across the country.

First Lesson of the new semester

开学第一课

Yue-Liang Wu went to the Experimental School Affiliated to the CAS and gave the "first lesson of the new semester" with the theme of “My special bond with science” to the students on February 21, 2022.This is the first activity of IYBSSD and Professor Wu he encouraged students to seize the opportunity and work hard to lay a solid foundation for the future, stay curious and nurture their interest in science so as to become a scientist for the new era.

The lesson was broadcasted to schools benefited from the pairing up assistance program and friend schools in the Inner Mongolia Autonomous Region, Hebei Province, Gansu Province and Hong Kong Special Administrative Region, with over 20,000 audiences watching online.

2022年2月21日，国际理论物理中心（亚太地区）主任吴岳良院士，为中国科学院附属实验学校的同学们带来新学期“开学第一课”——我与科学之缘，作为国际科学年的首场活动。吴院士鼓励同学们抓住机遇，努力学习，打下坚实的知识基础。平时对科学保持好奇心，培养科学兴趣，成长为新时代的科学家。

本次“开学第一课”首次通过线上平台向内蒙古、河北、甘肃、香港等地对口支援学校和友好学校分享，各地观看师生人数达2万余人。

Opening Ceremony

基础科学促进可持续发展年开幕式

The official inauguration took place on 8 July 2022 with an opening conference at the United Nations Educational, Scientific and Cultural Organization (UNESCO) headquarters in Paris, France. The launching ceremony of the “Forum on Frontiers of Quanta to Cosmos Physics” was successfully held on 30 June 2022 in Hangzhou by the ICTP-AP, Institute of Theoretical Physics, and HIAS, marking the official launch of the IYBSSD activities in China. Experts and scientists in the field of theoretical physics gathered together to discuss on basic sciences and development of humankind. This event was also broadcasted on five livestream platforms and attracted over 50,000 viewers.

“国际基础科学促进可持续发展年”于2022年7月8日在法国巴黎国际教科文组织（UNESCO）总部启动。

2022年6月30日，由ICTP-AP联合中国科学院理论物理研究所、杭高院共同举办的“从极小量子粒子到极大膨胀宇宙”量子-宇宙物理系列前沿论坛在杭州举行，标志着IYBSSD2022简称“基础科学国际年”中国活动正式启动。来自理论物理领域的科学大咖线上线下齐聚一堂，畅谈基础科学与人类发展。本次活动通过多个平台进行直播，吸引了近五万人次的积极参与。

Beyond Light Years

“光年之外”系列专题活动

IYBSSD2022 has been supported by many research institutions and media in China. Yue-Liang Wu, director of ICTP-AP, was invited to participate in the series activities" Beyond Light Years "sponsored by Shanghai Astronomical Observatory, CAS. He has written an article about the century-long road of human exploration of gravitational waves and called on more young talents to join the research of basic science.

IYBSSD2022得到了中国多家科研机构和和媒体的大力支持。ICTP-AP主任吴岳良受邀参与了中国天文学会主办的“光年之外”系列活动。他亲自撰文，讲述了人类探索引力波的百年之路，并呼吁更多的青年人才加入到基础科学的研究中。

2022 Yanqi Scholars Cloud Forum

2022 年雁栖学者云论坛

On March 12, 2022, the second "Yanqi Scholars Cloud Forum" was held in Yanqi Lake Campus of University of Chinese Academy of Sciences, with over 10,000 young scholars from 16 countries and regions including the United States, Britain, Singapore and Japan watching the live broadcast online. On April 2, a parallel session of the Yanqi Scholar Cloud Forum was held by the ICTP-AP at Tencent Meeting, which was watched by 945 international talents. This forum is aimed to attract and encourage overseas young scholars who have made good achievements in theoretical physics to work in China and make their own contribution to develop China into a major world centre for science and technology and build UCAS into a world-class university.

2022年3月12日，中国科学院大学第二届“雁栖学者云论坛”在国科大雁栖湖校区举行。来自美国、英国、新加坡、日本等16个国家和地区的1万余海内外青年学者在线观看了直播。4月2日，国际理论物理中心（亚太地区）在腾讯会议召开雁栖学者分论坛，当日观看量达945人次。此次论坛旨在吸引和鼓励在理论物理方面已取得较好成绩的海外优秀青年学者回国（来华）工作，为科技强国建设和我校世界一流大学目标贡献力量。

2022 ICTP-AP Summer School

2022 年中国科学院大学国际理论物理中心（亚太地区）优秀大学生夏令营及引力波暑期学校

2022 ICTP-AP Summer School was successfully held by ICTP-AP and Taiji Laboratory for Gravitational Wave Universe in July, 2022, attracting students from over 30 universities and science institutes across the country. This summer school was held online and we have also invited experts and professors to give a total of 20 lectures centered on gravity, black hole and quanta to cosmos, gravitational wave detection and accurate measurement, which helped students explore the myth of basic physics and enjoy the beauty of science together.

This virtual summer school has provided an important platform for the young talents to reach the frontiers of international disciplines so as to attract more youth to devote themselves to the research field of gravitational wave detection, become a member of the Taiji Program in Space and make their own contribution to Chinese space gravitational wave detection mission in the future.

2022年7月，ICTP-AP和引力波宇宙太极实验室联合主办2022年优秀大学生夏令营及引力波暑期学校，吸引到来自全国三十多所高校及科研院所的同学积极参与。此次暑期学校云端举行，邀请专家老师围绕引力、黑洞与量子宇宙、引力波探测与精密测量技术展开二十场讲座，和同学们一起共话基础物理的奥秘，体悟科学的乐趣。

此次活动为年轻学子提供了一个接触国际学科前沿的平台，将吸引更多的有志青年投身到引力波探测相关研究中。期待他们未来能够成为空间引力波探测“太极计划”的一员，为中国空间引力波探测做出卓越贡献。

First-Aid Training

急救培训活动

ICTP-AP has jointly organized the First-Aid training with University of Chinese Academy of Sciences Education Foundation (UCASEF) in October. This activity has received great support from UCASEF and enjoyed wide participation from different institutes. With the aim of raising people's awareness about first-aid, it would help the trainees grasp basic knowledge and skills in first-aid so that they could deal with emergency in a calm and helpful way.

2022年10月，ICTP-AP与国科大基金会联合举办“心动国科大”急救培训活动，此次活动受到基金会的大力支持，并获得不同院所的广泛参与。此次活动旨在帮助大家掌握基本的急救知识，学会基本急救技能，在面对突发情况时能够冷静应对并给予他人正确的帮助。

Alpine Science Classics

高山科学经典导读

Professor Yue-Liang Wu interpreted the classic popular science book *The First Three Minutes: A Modern View Of The Origin Of The Universe* on TikTok live at the invitation of a non-profit program "Alpine Science Classics" on November 5. The book written by Nobel Prize winner Steven Weinberg is the first to explain the origin of the universe and has been recognized as a milestone in the history of popular science books. This activity is aimed to lead people to read science books in a pleasant and interesting way and from a scientific and professional perspective so as to promote mass reading, especially in science books.

2022年11月5日晚八点，中心吴岳良院士参加科普公益项目“高山科学经典”，在抖音直播导读诺奖得主温伯格的著作《最初三分钟》。此书被公认为科普读物的里程碑，也是最早关于探讨宇宙起源的代表作品。活动以直播的方式，用轻松有趣、专业科学的方法带领大家一起阅读科学书籍，为引导社会大众阅读尤其是阅读科学书籍起到推动作用。

Financial Support from the Bureau of International Cooperation, CAS

获批国际合作局经费支持

中国科学院国际合作局
Bureau of International Cooperation Chinese Academy of Sciences

Since 2019, the Bureau of International Cooperation, CAS allocates around 500,000 yuan per year to the centre for international cooperation and development. The fund has been used to hold international conferences, conduct exchange programs and bring in international talents. Over the past three years, ICTP-AP has made full use of the money to strengthen its capacity construction and expand its influence.

中国科学院国际合作局，通过“全球科技治理机构建设与发展计划”向中心每年拨付50万左右经费作为中心国际合作发展的稳定经济支持。中心每年将该笔经费用于国际会议的举办、国际交流项目推进以及国际人才引进项目，在2019-2022连续三年的经费执行率均达到百分之百。该笔经费为中心的发展提供了有力支持，帮助中心加强能力建设，提升中心影响力。

STUDENT ACTIVITIES

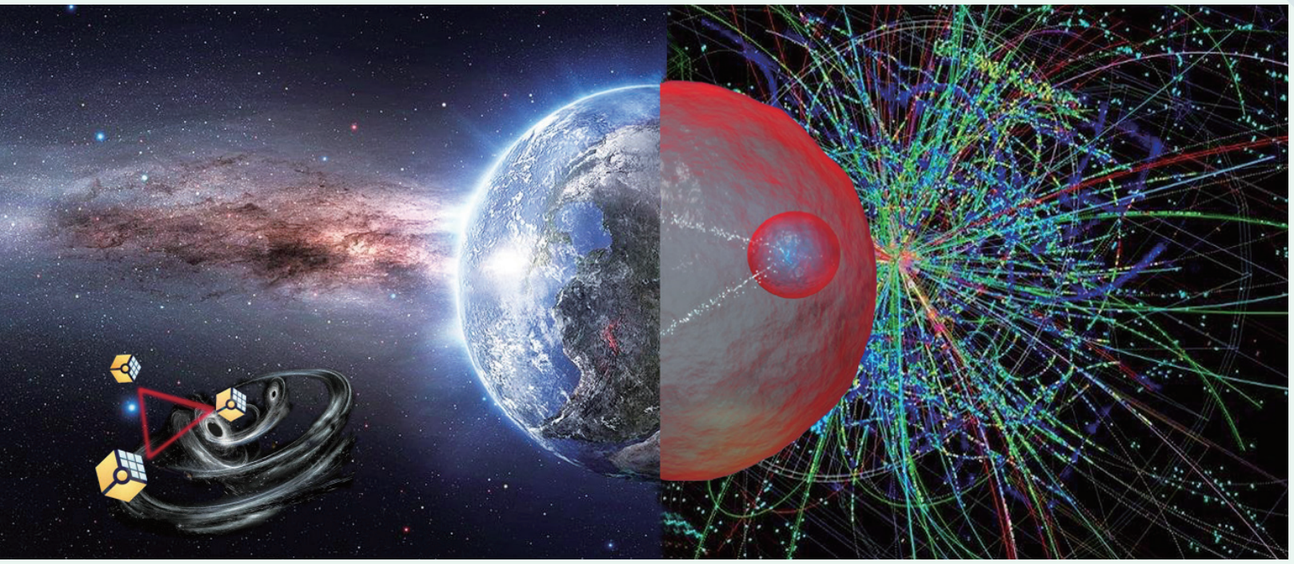
ICTP-AP has held an ice-breaking activity at the beginning of the new semester for students to better know about each other and strengthen their consolidarity.

新学期伊始，中心师生组织破冰活动，帮助学生之间增加了解，提高学生凝聚力。

Students of ICTP-AP took part in the school's sports game actively and demonstrated good team spirit.

中心学生积极参与学校运动会，展现良好的团队精神。

APPENDIX



ICTP-AP Seminars

Speaker: Zhen PAN (潘震)
Affliation: Perimeter Institute

01 March 24, 2022 Extreme mass ratio inspirals: wet, dry and mass-gap

Abstract: In this work, we propose a new subclass of extreme-mass-ratio-inspirals (EMRIs): mass-gap EMRIs, consisting of a compact object in the lower mass gap (2.5--5 Msun) and a massive black hole (MBH). The mass-gap object (MGO) may be a primordial black hole or produced from a delayed supernova explosion. We calculate the formation rate of mass-gap EMRIs in both the (dry) loss-cone channel and the (wet) active galactic nucleus disk channel by solving Fokker-Planck-type equations for the phase-space distribution. In the dry channel, the mass-gap EMRI rate is strongly suppressed compared to the EMRI rate of stellar-mass black holes (sBHs) as a result of mass segregation effect. In the wet channel, the suppression is roughly equal to the mass ratio of sBHs over MGOs, because the migration speed of a compact object in an active galactic nucleus disk is proportional to its mass. We find that the wet channel is much more promising to produce mass-gap EMRIs observable by spaceborne gravitational wave detectors.

Speaker: Yang ZHOU 周洋
Affliation: Fudan University

02 March 31, 2022 Partial Reduction and Black Hole Information

Abstract: Black hole information paradox is a well-known problem. Recent progress hints towards a new understanding of the late time black hole interior as part of the Hawking radiation, which they called island. In particular the island formula for the radiation entropy gives Page curve and therefore maintains unitarity. In this talk I will discuss how to derive Page curve from holography. We provide an explicit construction of gravity system attached with bath by gluing Randall-Sundrum reduction and Maldacena duality, and derive Page curve from holography. We also provide a holographic construction for cosmology based on partial reduction. Our approach hints towards an origin of the holographic nature of black holes as well as our universe.

Speaker: Heling DENG 邓鹤凌
Affiliation: Arizona State University

03 April 7, 2022 Gravitational Wave Background From Supermassive Primordial Black Holes

Abstract: The Peters formula, which tells how the coalescence time of a binary system emitting gravitational radiation is determined by the initial size and shape of the elliptic orbit, is often used in estimating the merger rate of primordial black holes and the gravitational wave background from the mergers. Valid as it is in some interesting scenarios, such as the analysis of the LIGO-Virgo events, the Peters formula fails to describe the coalescence time if the orbital period of the binary exceeds the value given by the formula. This could underestimate the event rate of mergers that occur before the time of recombination. As a result, the energy density spectrum of the gravitational wave background could develop a peak from mergers of supermassive primordial black holes ($M > 10^5 M_\odot$). This can be used to constrain the fraction of dark matter in primordial black holes if potential probes do not discover such a background. We then consider the effect of mass accretion onto primordial black holes at redshift $z \sim 10$, and find that the merger rate could drop significantly at low redshifts. The spectrum of the gravitational wave background thus gets suppressed at the high-frequency end. This feature might be captured by future detectors such as ET and CE.

Speaker: Cheng PENG 彭程
Affiliation: UCAS Kavli Institute for Theoretical Physics

04 May 12, 2022 Ensemble Averages, Factorization, and (Half-)Wormholes

Abstract: Ensemble average theories have attracted a lot of attention in the past few years since they are shown to be, at least as some effective descriptions, inevitable to reproduce holographic computation results from bulk gravitational path integrals. On the other hand, ensemble average theories come with their own puzzles, among which the factorization puzzle is probably the most notable one. I will briefly introduce different proposals to resolve the factorization puzzle, such as the alpha-states proposal and the half-wormhole proposal, and then discuss some of our recent exercises and findings in both directions.

Speaker:
Alejandro Cárdenas-Avendaño
Affiliation:
Princeton University

05 May 19, 2022 Tidally-induced nonlinear resonances in EMRIs with an analogue model

Abstract: One of the important targets for the future space-based gravitational wave observatory LISA is extreme mass ratio inspirals (EMRIs), where long and accurate waveform modeling is necessary for detection and characterization. When modeling the dynamics of an EMRI, several effects need to be included, such as the modifications caused by an external tidal field. The impact of such perturbations will generally break integrability at resonance, and can produce significant dephasing from an unperturbed system. In this talk, I will show how we use a Newtonian analogue of a Kerr black hole to study the effect of an external tidal field on the dynamics and the gravitational waveform. I will present a numerical framework that takes advantage of the integrability of the background system to evolve it with a symplectic splitting integrator and compute approximate gravitational waveforms to estimate the time scale over which the perturbation affects the dynamics. I will show how different entry points into resonance lead to different dynamics and the numerical scale (relative to the mass ratio) for when the tidal perturbation's impact is relevant. If these effects are not accounted for, they could lead to incorrect parameter estimation or fundamental biases when studying general relativity.

Speaker: Hector O. Silva
Affiliation: Max Planck Institute

06 June 2, 2022 Binary Black Hole Coalescence in Scalar-Gauss-Bonnet Gravity

Abstract: It was recently shown that gravity theories that couple a dynamical scalar field to the Gauss-Bonnet invariant can lead to spontaneous scalarization of black holes, allowing these objects to grow "scalar hair" once certain conditions are met and to remain "bald" otherwise. While most works on the topic have focused on isolated black holes, progress has recently been made in understanding this effect in binary black hole systems. I will give an overview of what has been achieved so far in this context. I will discuss new phenomena that happen in black-hole binaries and explore some of the potential observational consequences of these results in gravitational-wave astronomy.

Speaker: Mauro Pieroni
Affiliation: Imperial College London

07 June 9, 2022 Production (and direct detection) of signature in the stochastic gravitational wave background

Abstract: The talk is divided in two parts. Mauro Pieroni will first discuss some early Universe mechanisms that leave observable signatures (non-trivial frequency shape, chirality, ...) in the stochastic gravitational wave background (SGWB). In particular, Mauro Pieroni will discuss gauge field production during (and at the end of) axion inflation and (scalar) particle production during preheating. The second part of the talk will focus on methods to detect, and possibly characterize, these signatures with future space-based detectors like LISA and Taiji.

Speaker: Song He（何松）
Affiliation: Jilin University

08 June 16, 2022 Probing QCD Critical Point and Induced Gravitational Wave by Black Hole Physics

Abstract： The Quantum Chromodynamics (QCD) phase diagram involves the behaviors of strongly interacting matter under extreme conditions and remains an important open problem. Based on the non-perturbative approach from the gauge/gravity duality, we construct a family of black holes that provide a dual description of the QCD phase diagram at finite chemical potential and temperature. The thermodynamic properties of the model are in good agreement with the state-of-the-art lattice simulations. We then predict the location of the critical endpoint and the first-order phase transition line. Moreover, we present the energy spectrum of the stochastic gravitational-wave background associated with the QCD first-order transition, which is found to be detected by IPTA and SKA, while by NANOGrav with less possibility. If the time is allowed, we will present how to construct a holographic model for a pure gluon system.

Speaker: Huajia WANG 王华嘉
Affiliation: UCAS Kavli Institute for Theoretical Physics

09 June 13, 2022 Shape Dependence of Mutual Information in OPE Limit

Abstract： Mutual information is an important measure of correlation between disjoint regions. On the other hand, the shape dependence of entanglement measure could reveal important aspects of the organizing principles for entanglement structures. In this talk, we discuss the linear response of shape deformation about two spheres in the limit of large separation. We comment on the implication of our result in terms of extremization properties of mutual information between spheres.

Speaker: Qiang Wen 文强
Affiliation: Southeast University

10 July 1, 2022 Balanced Partial Entanglement and Mixed State Correlations

Abstract： Firstly, we will introduce the concept of the balanced partial entanglement entropy (BPE) and how to compute it. Let us consider a mixed state A \cup B in two dimensional theories, we will show that the BPE exactly gives the length of the entanglement wedge cross-section in both AdS/CFT and 3d flat holography. The BPE reduces to the reflected entropy in canonical purifications, but can be calculated in generic purifications. It can be decomposed into the mutual information and an additional universal tripartite entanglement (which is known as the Markov gap in the canonical purification) when A and B are adjacent. We find that the universal tripartite entanglement is just the minimal value of the crossing PEE. The BPE is conjectured to be independent from the purifications, and we will give serval non-trival tests for this conjecture.

Speaker: Cheng-cheng Han
Affiliation: Sun Yat-Sen University

11 July 14, 2022 Nutrino mass、Cosmic Inflation and baryon asymmetry

Abstract: In particle physics, the Standard Model accurately describes the interactions of microscopic particles such as quark leptons. At the same time, the Standard Model of Cosmology also accurately describes the evolution of the universe from the early days to the present. But there are still many problems to be solved. For example, why neutrinos have light mass, how the rapid inflation of the universe happened in the early days, and why our visible matter is dominated by baryonic matter. Our recent research found (Phys. Rev. Lett. 128, 141801) that if one new particle, the Higgs triplet, is adding to the Standard Model, the above three problems will be solved simultaneously. Specifically, the neutrino mass is produced by the vacuum breaking of the Higgs triplet model, the inflation is provided by the mixed state of the Standard Model Higgs and the Higgs triplet model, and the baryon asymmetry can be realized by the Affleck-Dine mechanism, so that the above three problems can be solved simultaneously. On the other hand, the model predicts that the Higgs triplet can only decay to two leptons, thus providing a unique test signal for its direct search at the collider, while the particle can also be tested in lepton-flavored destruction experiments. Indirect search. This model predicts that neutrinos must be Majorana fermions, and future neutrino-free double beta decay experiments will verify this prediction. At the same time, the cosmological signal predicted by the model can also be tested in the future cosmic microwave background radiation experiment LiteBIRD.

Speaker: Hongbao Zhang
Affiliation: Beijing Normal University

12 September 8, 2022, Dissipative turbulence through the lens of holography

Abstract: The conventional approach to the dissipative turbulence is phenomenological. Compared to this, holographic duality provides a first principles description of dissipation in vortex dynamics in terms of excitations absorbed by the bulk black holes. In this talk, I will report how to select a proper phenomenological effective theory to model the dissipative quantum turbulence through the lens of holography. In particular, we argue that Landau's model rather than the much more widely used one (abbreviated as KDGP) is the appropriate one to simulate the vortex dynamics at fully non-linear level. In passing, we also point out KDGP is plagued by its pathological dispersion relation, which has never been noticed before.

Speaker: Aalexander Jenkins
Affiliation: University College London

13 September 22, 2022 Bridging the μHz gap in the gravitational-wave landscape with binary resonance

Abstract: The passage of gravitational waves (GWs) through a binary perturbs the trajectories of the two bodies, potentially causing observable changes to their orbital parameters. In the presence of a stochastic GW background (SGWB) these changes accumulate over time, causing the binary orbit to execute a random walk through parameter space. In this talk I will present a powerful new formalism for calculating the full statistical evolution of a generic binary system in the presence of a SGWB, capturing all six of the binary's orbital parameters. I will show how this formalism can be used to set novel upper limits on the SGWB spectrum in the μHz frequency band, between the regions probed by LISA and pulsar timing arrays. As examples of the discovery potential of these methods, I will show how they are able to probe GWs from cosmological phase transitions in a region of parameter space that is inaccessible with LISA and other experiments, and will discuss how they might shed light on the possible SGWB signal detected by NANOGrav.

Speaker: Yue Zhao
Affiliation: University of Utah

14 September 30, 2022 Probing Axions with Event Horizon Telescope Polarimetric Measurements

Abstract： With high spatial resolution, polarimetric imaging of a supermassive black hole, like M87* or Sgr A*, by the Event Horizon Telescope can be used to probe the existence of ultralight bosonic particles, such as axions. Such particles can accumulate around a rotating black hole through the superradiance mechanism, forming an axion cloud. When linearly polarized photons are emitted from an accretion disk near the horizon, their position angles oscillate due to the birefringent effect when traveling through the axion background. Recently, the polarization properties of the radiation near the supermassive black hole M87* are measured in four individual days. This is exactly what is needed to test the existence of a dense axion cloud. We apply the azimuthal distribution of EVPA measured by the EHT and study the axion-photon coupling. The EHT data can rule out a considerable portion of the axion parameter space for the axion mass window from 10^−21 to 10^−20 eV, which was unexplored by previous experiments.

Speaker: Haixing Miao
Affiliation: Tsinghua University

15 September 29, 2022 Quantum Limit for Gravitational Wave Detectors

Abstract: Gravitational wave has opened an entirely new window on the Universe. For example, we have tested Einstein's general theory of relativity under strong gravitational fields through the detection of gravitational waves from a binary black hole merger and embraced a new era of multi-messenger astronomy thanks to the joint gravitational and electromagnetic observation of the binary neutron star. The ground-based gravitational wave detectors LIGO, VIRGO and KAGRA are large, kilometer-scale laser interferometers, which are sufficiently sensitive to detect weak gravitational-wave signals. Despite their large size, they also exhibit a quantum effect, which is usually significant in the micro-world, and quantum noise caused by quantum fluctuations of light has become one of the main constraints for the sensitivity of detectors. During the seminar, different methods to reduce quantum noise and the corresponding quantum limit will be introduced. With an understanding of the fundamental quantum limit, we can integrate different noise reduction methods into a unified framework.

Speaker: Markus R. Mosbech
Affiliation: University of Sydney

16 October 13, 2022 Probing dark matter microphysics with gravitational waves and cosmology

Abstract: Dark matter remains a mysterious component in our universe. In order to escape existing constraints, it must be at most weakly interacting, and has an upper bound on its allowed mass if it is a thermal relic. I will present a novel method of constraining the microphysics of dark matter using the observed gravitational wave signal, via the impact on structure formation. I will supplement this with forecasts for constraints from 21cm line intensity mapping, as with the next generation of obsesrvatories, these two signals may put the strongest limits yet on dark matter-neutrino scattering.

Speaker: Anna Tokareva
Affiliation: Imperial College London

17 October 17, 2022 Observing Quantum Gravity in Gravitational Waves

Abstract: Gravity can be embedded into a renormalizable theory by means of adding quadratic in curvature terms. However, this at first leads to the presence of the Weyl ghost. It is possible to get rid of this ghost if the locality assumption is weakened and the propagator of the graviton is represented by an entire function of the d'Alembertian operator without new poles and zeros. Models of this type admit a cosmological solution describing the R^2, or Starobinsky, inflation. We study graviton production after inflation in this model and show that it is negligible despite the presence of the higher derivative operators which could potentially cause instabilities.

Speaker: Alexander Ochirov
Affiliation: London Institute for Mathematical Sciences

18 October 19, 2022 Chiral Approach to Massive Higher Spins

Abstract: Quantum field theory of higher-spin particles is a formidable subject, where preserving the physical number of degrees of freedom in the Lorentz-invariant way requires a host of auxiliary fields. They can be chosen to have a rich gauge-symmetry structure, but introducing consistent interactions in such approaches is still a non-trivial task, with massive higher-spin Lagrangians specified only up to three points. In this talk, I will discuss a new, chiral description for massive higher-spin particles, which in four spacetime dimensions allows to do away with the unphysical degrees of freedom. This greatly facilitates the introduction of consistent interactions. I will concentrate on three theories, in which higher-spin matter is coupled to electrodynamics, non-Abelian gauge theory or gravity. These theories are currently the only examples of consistently interacting field theories with massive higher-spin fields.

Speaker: Karapet Mkrtchyan
Affiliation: Imperial College London

19 October 20, 2022 Clone field approach to non-linear electrodynamics and the (chiral) p-forms

Abstract: Present a new approach to field theory (initiated by me recently and developed further with collaborators), where electric-magnetic dual fields enter on the same footing. This approach allows us to write manifestly Lorentz covariant Lagrangians for free chiral p-form fields and introduce interactions for them. Using this formulation, we are able to reformulate non-linear electrodynamics so that both electric and magnetic gauge potentials enter the Lagrangian and the equations of motion, allowing the construction of arbitrary electric-magnetic duality symmetric theories in d=3+1. The special feature of this approach is the auxiliary "clone" fields (exact copy of the gauge sector) that enter the Lagrangian but can be gauged away on-shell. I detail the new results achieved in this formulation and the advantages compared to other known formulations.

Speaker: Youjun Lu
Affiliation: NAO,CAS

20 October 20, 2022 Gravitational lensing of gravitational waves: a probe to the nature of dark matter

Abstract: Dark matter occupies the majority of matter content in the universe and is probably cold (CDM). However, modifications to the standard \LambdaCDM model may be required by the small-scale observations, and dark matter may be self-interacting (SIDM) or warm (WDM). Various probes have been applied to constrain the nature of dark matter but many of them suffer from the contamination due to baryonic processes. Gravitational waves detected by LIGO/Virgo and future detectors may be gravitational lensed by galaxies and dark matter halos, and thus encode the information of dark matter. In this talk, we will briefly overview the gravitational lensing of gravitational wave, including both the strong lensing effect in the geometric optics regime and the diffractive lensing effect in the wave optics regime. We estimate the lensing effects on the gravitational wave strain by small dark matter halos with different density profiles produced in different dark matter models and talk about the detectability of these effects. We conclude that the diffractive lensing of gravitational waves from binary black hole mergers by small dark matter halos may serve as a clean probe to the nature of dark matter.

Speaker: Yi Pang
Affiliation: Tianjin University

21 October 27, 2022 Recent progress on 6d stringy alpha' corrections

Abstract: In this talk, I will first review how to construct the leading stringy corrections to Einstein gravity in D=6 using off-shell supergravity techniques. Then I will utilize them to compute leading corrections to the entropy of 3-charge black strings. I will compare the results obtained from different methods and pin down the correct one which is consistent with IIA/Heterotic duality in 6-dimensions.

Speaker: Huan Yang
Affiliation: University of Guelph & Perimeter Institute

22 November 3, 2022 Extreme Mass Ratio Inspirals: Formation, Dynamics and Astrophysical Applications

Abstract: In this talk Dr. Yang will discuss one of the primary targets of space-borne gravitational wave detectors – the Extreme Mass Ratio Inspirals, which usually comprises a massive black hole and a stellar-mass companion. In recent years there are significant progress in terms of its formation channel, rate estimation and dynamics in astrophysical environments. Dr. Yang will review these new developments and then discuss the significance of detecting these sources with gravitational waves and possibly electromagnetic counterparts.

Speaker: Xinan Zhou
Affiliation: Kavli Institute, UCAS

23 November 10, 2022 Recent Progress in Holographic Correlators

Abstract: Holographic correlators are the most basic objects to exploit and explore the AdS/CFT correspondence. They encode a wealth of theoretical data and allow one to analytically study theories in strongly coupled phases. Holographic correlators can also be viewed as scattering amplitudes in AdS space, and therefore provide a valuable opportunity to explore the curved space extensions of various remarkable properties of flat-space scattering amplitudes. However, holographic correlators are notoriously difficult to compute and only until recently efficient modern methods were invented. In this review talk, I will give an overview of the recent progress in studying holographic correlators. I will show how methods based on bootstrap ideas allow one to circumvent the unsurmountable difficulties of the traditional approach and to obtain general results in various string theory and M-theory backgrounds. In addition to reviewing these bootstrap results, I will also mention two promising new directions where explorations are just starting. The first is trying to establish an on-shell scattering amplitude program in AdS where there is now an accumulation of evidence for AdS avatars of flat-space features of amplitudes. The second is the emergence of a new connection with integrability where preliminary investigations suggest certain holographic correlators enjoy a Yangian symmetry.

Speaker: Yu Tian
Affiliation: UCAS

24 November 24, 2022 First order phase transition and dynamic critical phenomena in holography

Abstract: First order phase transitions are very common phenomena in our real world. In this talk, I will introduce a universal physical picture of first order phase transitions, which can be most clearly seen from holography (applied AdS/CFT). This picture can be made precise by the so-called landscape, from which we can understand why critical behaviors are ubiquitous in systems with first order phase transitions, where the inhomogeneous cases are of special interest.

Speaker: Yawen Sun
Affiliation: UCAS

25 December 1, 2022 Topological modes in non-inertial frames and holography

Abstract: In this talk I will show that gapless modes in relativistic hydrodynamics could become topologically nontrivial by weakly breaking the conservation of energy momentum tensor in a specific way. One possible origin for the non-conservation terms of the energy momentum tensor is an external gravitational field which could be generated by a specific coordinate transformation from the flat spacetime. This suggests that topologically trivial modes could become topologically nontrivial by being observed in a special non-inertial reference frame. A holographic realization of this system will be introduced, which is further confirmed by matching the Ward identities and hydrodynamic modes of both sides. This observation is also generalized to fermionic systems, where a topologically nontrivial Weyl semimetal could be observed from a trivial Dirac fermion by a special elastic accelerating observer.

Speaker: Li Li
Affiliation: ITP, CAS

26 December 8, 2022 What lies beyond the event horizon of a black hole?

Abstract: As an important prediction of general relativity, the existence of black holes has been confirmed by experiments and observations. While the exterior physics of black holes has been extensively investigated in the literature, the inner structure of black holes behind the event horizon has not been well understood. In this talk, I will introduce our recent progress toward understanding the interior of black holes, including the no inner-horizon theorem, the interior dynamics of a hairy black hole, and the constraint on the number of horizons with energy conditions.

Speaker: Jieqiang Wu
Affiliation: ITP, CAS

27 December 16, 2022 The geodesic network in classical AdS_3 gravity from the entanglement wedge cross section

Abstract: In this work, we construct several diffeomorphism invariant observables in AdS_3 gravity in the context of the entanglement wedge cross section. The set of observables that we construct includes the entanglement wedge cross section and four extra half geodesics' lengths. We try to study the properties of these observables in Hamiltonian formalism including: the system's evolutions generated by these observables and the brackets between these observables. We use two approaches to study these questions, by the brackets of the Brown-York tensor's components in the covariant phase space formalism and by canonical formalism, which give consistent results.
With the two methods, we get several interesting results related to these questions. We find that the entanglement wedge cross section generates a novel behavior in the system's evolution, which include a split at the HRT surface. We compute the brackets between these observables, and the only non-zero ones are the brackets of the entanglement wedge cross section with the four half geodesics. Inspired from this set-up, we also construct a slightly different geodesic network where all of the geodesics' lengths commute with each other.

Speaker: Junbao Wu
Affiliation: Tianjin University

28 December 22, 2022 A new proof of Cachazo-Svrcek-Witten rules for tree-level gluonic amplitudes

Abstract: We provide a new proof of Cachazo-Svrček-Witten rules for tree-level gluonic amplitudes. As a key step, we explicitly demonstrate the cancellation of spurious poles originating from the maximally helicity violating vertices in these rules. To achieve this, we introduce specially-defined two-off-shell-line sub-amplitudes and examine their residues at spurious poles. This talk is based on work done with Chuan-Jie Zhu and Wen-Jie Zhang.

Taiji Seminars

Speaker: Huaike Guo
Affiliation: ICTP-AP

01 Feb 14, 2022 Analysis and New Physics Searches at LIGO

Abstract: LIGO's first direct detection of gravitational waves in 2015 marked a new era for not just astronomy but also particle physics, with gravitational waves now becoming a new frontier in searches for physics beyond the standard model. However, it takes a long way to go from the raw data coming out of the photodiode to results with proper physical interpretations. In this talk, I will de- scribe the structure of the LIGO interferometers, the data processing steps and searches with the most recent O3 data including cosmological first order phase transitions cosmic strings and dark matter. I will also describe how these work can form the foundation for future terrestrial and space-based gravitational wave experiments, such as Taiji.

Speaker: Weidou Ni
Affiliation: USTC

02 April 8, 2022 Michelson interferometer and Time-delay interferometry

Abstract: Space laser interference gravitational wave detection is basically a generalized Michelson interferometry, which divides the wave of a light beam into two separate beams that recombines at the same point to produce an interference. Since its invention in the 19th century, the Michelson interferometry has been a high-precision measurement, which requires the differential between the pathlengths should be smaller than the coherence length of the light source. Gravitational wave has different impacts on the pathlengths of the light. While space laser interference gravitational wave detection employs the Michelson interferometry to detect the differential so as to measure the gravitational wave that has arrived.

Speaker: He Wang
Affiliation: ICTP-AP

03 31 October 2022, Application of Machine Learning in Gravitational Wave Data Processing

Abstract： Since the first direct detection of gravitational waves by the LIGO collaboration in 2015, more than 100 gravitational wave events have been detected so far. Consistent with theoretical expectations, binary black hole mergers, binary neutron star mergers, and black hole neutron star mergers have all been successfully observed. With the continuous improvement of detection technology, more and more gravitational wave events are expected to be detected, which not only requires us to further improve the speed and performance of gravitational wave data processing, but also means the need to discover completely unknown wave sources and gravitational wave signals grows. Compared with traditional data processing methods, machine learning is very likely to solve the technical and scientific problems mentioned above. This report will give an overview of machine learning gravitational wave data analysis and other related research progress, and briefly discuss the opportunities and challenges brought by machine learning methods.

01 Improved constraints on primordial gravitational waves in light of the H-0 tension and BICEP/Keck data, Ye, G (Ye, Gen); Piao, YS (Piao, Yun-Song), PHYSICAL REVIEW D Volume: 106 Issue: 4 Article Number: 043536

02 One-loop diagrams with quadratic propagators from the world sheet, Feng, B (Feng, Bo); He, S (He, Song); Zhang, Y (Zhang, Yong); Zhang, YQ (Zhang, Yao-Qi),JOURNAL OF HIGH ENERGY PHYSICS Issue: 8 Article Number: 240

03 Gluonic evanescent operators: classification and one-loop renormalization, Jin, QJ (Jin, Qingjun); Ren, K (Ren, Ke); Yang, G (Yang, Gang); Yu, R (Yu, Rui), JOURNAL OF HIGH ENERGY PHYSICS Issue: 8 Article Number: 141

04 Portraying double Higgs at the Large Hadron Collider II, Huang, L (Huang, Li); Kang, SB (Kang, Su-beom); Kim, JH (Kim, Jeong Han); Kong, K (Kong, Kyoungchul); Pi, JS (Pi, Jun Seung), JOURNAL OF HIGH ENERGY PHYSICS Issue: 8 Article Number: 114

05 Proof-of-principle Experimental Demonstration of Time-delay-interferometry for Chinese Space-borne Gravitational Wave Detection Missions, Li, XK (Li, Xiaokang); Liu, HS (Liu, Heshan); Wu, PZ (Wu, Pengzhan); Li, HS (Li, Haosi); Xu, P (Xu, Peng); Luo, ZR (Luo, Ziren), MICROGRAVITY SCIENCE AND TECHNOLOGY Volume: 34 Issue: 4 Article Number: 64

06 Dark matter production in Weyl R-2 inflation, Wang, QY (Wang, Qing-Yang); Tang, Y (Tang, Yong); Wu, YL (Wu, Yue-Liang), PHYSICAL REVIEW D Volume: 106 Issue: 2 Article Number: 023502

07 Performance of the KAGRA detector during the first joint observation with GEO 600 (O3GK),KAGRA Collaboration, PROGRESS OF THEORETICAL AND EXPERIMENTAL PHYSICS

08 Generating enhanced primordial GWs during inflation with intermittent violation of NEC and diminishment of GW propagating speed, Cai, Y (Cai, Yong); Piao, YS (Piao, Yun-Song), JOURNAL OF HIGH ENERGY PHYSICS Issue: 6 Article Number: 67

09 Schwarzschild quasi-normal modes of non-minimally coupled vector fields, Garcia-Saenz, S (Garcia-Saenz, Sebastian); Held, A (Held, Aaron); Zhang, J (Zhang, Jun), JOURNAL OF HIGH ENERGY PHYSICS Issue: 5 Article Number: 139

10 Universal expansions of scattering amplitudes for gravitons, gluons, and Goldstone particles, Dong, J (Dong, Jin); He, S (He, Song); Hou, LH (Hou, Linghui), PHYSICAL REVIEW D Volume: 105 Issue: 10 Article Number: 105007

11 Collapsing domain walls beyond Z(2),Wu, YC (Wu, Yongcheng); Xie, KP (Xie, Ke-Pan); Zhou, YL (Zhou, Ye-Ling), PHYSICAL REVIEW D Volume: 105 Issue: 9 Article Number: 095013

12 Truncated cluster algebras and Feynman integrals with algebraic letters (vol 12, 110, 2021),He, S (He, Song); Li, ZJ (Li, Zhenjie); Yang, QL (Yang, Qinglin), JOURNAL OF HIGH ENERGY PHYSICS Issue: 5 Article Number: 075

13 Toward early dark energy and ns=1 with Planck, ACT, and SPT observations, Jiang, JQ (Jiang, Jun-Qian); Piao, YS (Piao, Yun-Song), PHYSICAL REVIEW D Volume: 105 Issue: 10 Article Number: 103514

14 Stochastic gravitational wave background from PBH-ABH mergers *,Cui, WF (Cui, Wenfeng); Huang, F (Huang, Fei); Shu, J (Shu, Jing); Zhao, Y (Zhao, Yue), CHINESE PHYSICS C Volume: 46 Issue: 5 Article Number: 05510

15 Logarithmic corrections to the entropy of rotating black holes and black strings in AdS(5),David, M (David, Marina); Lezcano, AG (Lezcano, Alfredo Gonzalez); Nian, J (Nian, Jun); Zayas, LAP (Zayas, Leopoldo A. Pando), JOURNAL OF HIGH ENERGY PHYSICS Issue: 4 Article Number: 160

16 Operators for generic effective field theory at any dimension: on-shell amplitude basis construction, Li, HL (Li, Hao-Lin); Ren, Z (Ren, Zhe); Xiao, ML (Xiao, Ming-Lei); Yu, JH (Yu, Jiang-Hao); Zheng, YH (Zheng, Yu-Hui), JOURNAL OF HIGH ENERGY PHYSICS Issue: 4 Article Number: 140

17 Exploring SMEFT induced nonstandard interactions: From COHERENT to neutrino oscillations, Du, Y (Du, Yong); Li, HL (Li, Hao-Lin); Tang, J (Tang, Jian); Vihonen, S (Vihonen, Sampsa); Yu, JH (Yu, Jiang-Hao), PHYSICAL REVIEW D Volume: 105 Issue: 7 Article Number: 075022

18 Hadron collider probes of the quartic couplings of gluons to the photon and Z boson, Ellis, J (Ellis, John); Ge, SF (Ge, Shao-Feng); Ma, K (Ma, Kai), JOURNAL OF HIGH ENERGY PHYSICS Issue: 4 Article Number: 123

19 Causality Constraints on Gravitational Effective Field Theories, de Rham, C (de Rham, Claudia); Tolley, AJ (Tolley, Andrew J.); Zhang, J (Zhang, Jun), PHYSICAL REVIEW LETTERS Volume: 128 Issue: 13 Article Number: 131102

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22 Populating the landscape in an inhomogeneous universe, Lin, PX (Lin, Pu-Xin); Piao, YS (Piao, Yun-Song), PHYSICAL REVIEW D Volume: 105 Issue: 6 Article Number: 063534

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24 Study of charmless two-body baryonic B decays, Jin, XN (Jin, Xiang-Nan); Liu, CW (Liu, Chia-Wei); Geng, CQ (Geng, Chao-Qiang), PHYSICAL REVIEW D Volume: 105 Issue: 5 Article Number: 053005

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26 Dark fluxes from accreting black holes through several mechanisms, Cai, RG (Cai, Rong-Gen); Sun, SC (Sun, Sichun); Zhang, B (Zhang, Bing); Zhang, YL (Zhang, Yun-Long), EUROPEAN PHYSICAL JOURNAL C Volume: 82 Issue: 3 Article Number: 245

27 Primordial black hole dark matter in the presence of p-wave WIMP annihilation, Kadota, K (Kadota, Kenji); Tashiro, H (Tashiro, Hiroyuki), JOURNAL OF COSMOLOGY AND ASTROPARTICLE PHYSICS Issue: 3 Article Number: 045

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29 Searching for possible evidences of new physics in B -> V1V2,Geng, CQ (Geng, C. Q.); Liu, CW (Liu, Chia-Wei), PHYSICS LETTERS B Volume: 825 Article Number: 136883

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31 Cosmological Constraints on Nonflat Exponential f(R) Gravity, Geng, CQ (Geng, Chao-Qiang); Hsu, YT (Hsu, Yan-Ting); Lu, JR (Lu, Jhih-Rong), ASTROPHYSICAL JOURNAL Volume: 926 Issue: 1 Article Number: 74

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33 Cusp in the symmetry energy, speed of sound in neutron stars and emergent pseudo-conformal symmetry, Lee, HK (Lee, Hyun Kyu); Ma, YL (Ma, Yong-Liang); Paeng, WG (Paeng, Won-Gi); Rho, M (Rho, Mannque), MODERN PHYSICS LETTERS A Volume: 37 Issue: 03 Article Number: 2230003

34 Simulation of Quantum Circuits Using the Big-Batch Tensor Network Method, Pan, F (Pan, Feng); Zhang, P (Zhang, Pan), PHYSICAL REVIEW LETTERS Volume: 128 Issue: 3 Article Number: 030501

35 Comments on all-loop constraints for scattering amplitudes and Feynman integrals, He, S (He, Song); Li, ZJ (Li, Zhenjie); Yang, QL (Yang, Qinglin), JOURNAL OF HIGH ENERGY PHYSICS Issue: 1 Article Number: 073

36 Electroweak phase transition triggered by fermion sector, Cao, QH (Cao, Qing-Hong); Hashino, K (Hashino, Katsuya); Li, XX (Li, Xu-Xiang); Ren, Z (Ren, Zhe); Yu, JH (Yu, Jiang-Hao), JOURNAL OF HIGH ENERGY PHYSICS Issue: 1 Article Number: 001

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40 Scalar gravitational wave signals from core collapse in massive scalar-tensor gravity with triple-scalar interactions, Huang, D (Huang, Da); Geng, CQ (Geng, Chao-Qiang); Kuan, HJ (Kuan, Hao-Jui), CLASSICAL AND QUANTUM GRAVITY Volume: 38 Issue: 24 Article Number: 245006

41 Constraining Cosmological Phase Transitions with the Parkes Pulsar Timing Array, Xue, X (Xue, Xiao); Bian, LG (Bian, Ligong); Shu, J (Shu, Jing); et al, PHYSICAL REVIEW LETTERS Volume: 127 Issue: 25 Article Number: 251303

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43 A Weyl-Z(2) semimetal from holography, Ji, XT (Ji, Xuanting); Liu, Y (Liu, Yan); Sun, YW (Sun, Ya-Wen); Zhang, YL (Zhang, Yun-Long), JOURNAL OF HIGH ENERGY PHYSICS Issue: 12 Article Number: 66

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46 Linking continuum and lattice quark mass functions via an effective charge, Chang, L (Chang, Lei); Liu, YB (Liu, Yu-Bin); Raya, K (Raya, Khepani); Rodriguez-Quintero, J (Rodriguez-Quintero, J.); Yang, YB (Yang, Yi-Bo), PHYSICAL REVIEW D Volume: 104 Issue: 9 Article Number: 094509

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48 Nucleon isovector scalar charge from overlap fermions, Liu, LM (Liu, Liuming); Chen, T (Chen, Ting); Draper, T (Draper, Terrence); Liang, J (Liang, Jian); Liu, KF (Liu, Keh-Fei); Wang, G (Wang, Geng); Yang, YB (Yang, Yi-Bo), PHYSICAL REVIEW D Volume: 104 Issue: 9 Article Number: 094503

49 Fast gravitational wave bursts from axion clumps, Sun, SC (Sun, Sichun); Zhang, YL (Zhang, Yun-Long), PHYSICAL REVIEW D Volume: 104 Issue: 10 Article Number: 103009

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52 Confronting SO(10) GUTs with proton decay and gravitational waves, King, SF (King, Stephen F.); Pascoli, S (Pascoli, Silvia); Zhou, YL (Zhou, Ye-Ling); Turner, J (Turner, Jessica), JOURNAL OF HIGH ENERGY PHYSICS Issue: 10 Article Number: 225

53 Three-Loop Color-Kinematics Duality: A 24-Dimensional Solution Space Induced by New Generalized Gauge Transformations, Lin, GD (Lin, Guanda); Yang, G (Yang, Gang); Zhang, SY (Zhang, Siyuan), PHYSICAL REVIEW LETTERS Volume: 127 Issue: 17 Article Number: 171602

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Timeline

2016

Sep.12, 2016, The establishment of ICTP-AP was approved by the State Council of China.

2016 年 9 月 12 日，中心成立事宜经国务院批准。

2015

Nov.10, 2015, The proposal to establish ICTP-AP was approved by the 38th General Conference of UNESCO.

2015 年 11 月 10 日，有关成立国际理论物理中心（亚太地区）的提案获得联合国教科文组织第 38 届大会批准。

2017

May 13, 2017, CAS President Chun-Li Bai and UNESCO Director-General Irina Bokova signed the agreement.

2017 年 5 月 13 日，白春礼院长代表中国政府同 UNESCO 总干事 Irina Bokova 女士签署协议。

2018

Nov.4, 2018, UCAS signed an agreement with ICTP for the joint construction of ICTP-AP, and the unveiling ceremony and the first International Science Council was held on the same day.

2018年11月4日，国科大与国际理论中心签署共建“中心”的合作备忘录，举行了“中心”揭牌仪式，并召开第一次国际理事会。

2019

May 12, 2019, The second International Governing Board and the first International Science Council of ICTP-AP were held.

2019 年 5 月 12 日，ICTP-AP 第二次国际理事会和第一次国际科学委员会召开。

2019

May 13, 2019, ICTP-AP was officially launched.

2019 年 5 月 13 日，中心正式启动。

Governing Board
理事会

Chairman

Shu-Shen Li

Academician of CAS, President of UCAS, Vice President of CAS

中国科学院院士，国科大校长，中科院副院长

Members

Xi-Lin Chen

Director of Bureau of International Cooperation, CAS

中科院国际合作局局长

Atish Dabholkar

Theoretical physicist, director of ICTP

理论物理学家，国际理论物理中心主任

Shabhaz Khan

Director of the UNESCO Regional Science Bureau for Asia and the PACIFIC

联合国教科文组织亚太科学局主任

Yue-Liang Wu

Academician of CAS, Vice President of UCAS, Director of ICTP-AP

中科院院士，国科大副校长，国际理论物理中心（亚太地区）主任

Xin-Cheng Xie

Academician of CAS, Vice President of NSFC

中科院院士，国家自然科学基金委员会副主任

The governing board will guide and supervise the work of ICTP-AP. Meeting of the Governing Board of ICTP-AP is held annually to review the organization's working report and deliberate on the working plan for the next stage.

ICTP-AP 理事会将对中心的工作进行指导和监督。中心每年定期召开理事会会议，审议中心工作情况及下一阶段工作计划。

International Science Council

国际科学委员会

The International Science Council will provide academic guidance for ICTP-AP and effectively promote the cooperation and academic exchange between ICTP-AP and other international institutions through their high-level scientific research and rich experience in international exchange.

ICTP-AP 设立国际科学委员会，对中心进行学术指导，通过高水平的科研成果和丰富的国际合作经验，有效促进中心与国际机构间合作以及学术交流。

Monica Guica

Tenure Professor in Uppsala
乌普萨拉大学终身教授

Andrew Strominger

Director, Harvard's Center for the Fundamental Laws of Nature
哈佛大学自然基本规律中心主任

Kimyeong Lee

Director of KIAS
韩国 KIAS 高等研究院主任

Rong-Gen Cai

Academician of CAS, Dean of Institute of Theoretical Physics, CAS
中科院院士，中国科学院理论物理所所长

Hirosi Ooguri

Director of the Kavli Institute for the Physics and Mathematics at the University of Tokyo
东京大学卡弗里中心主任

Poul.H.Damgaard

Director of Niels Bohr International Academy
丹麦尼尔斯 · 玻尔研究所国际研究院主任

Fernando Quevedo

Professor of Theoretical Physics, Department of Applied Mathematics and Theoretical Physics at the University of Cambridge
剑桥大学应用数学与理论物理学院理论物理教授

Richard Schoen

Distinguished Professor of UC, Irvine Department of Mathematics
加州大学欧文分校特聘教授

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Henry Tye

Professor of Cornell University and HKUST
Part-time researcher at the Jockey Club Institute for Advanced Study in the HKUST
美国康奈尔大学教授；香港科技大学教授

Spenta Wadia

Emeritus Distinguished Professor of ICTS-TIFR
印度理论科学研究中心退休名誉教授主席