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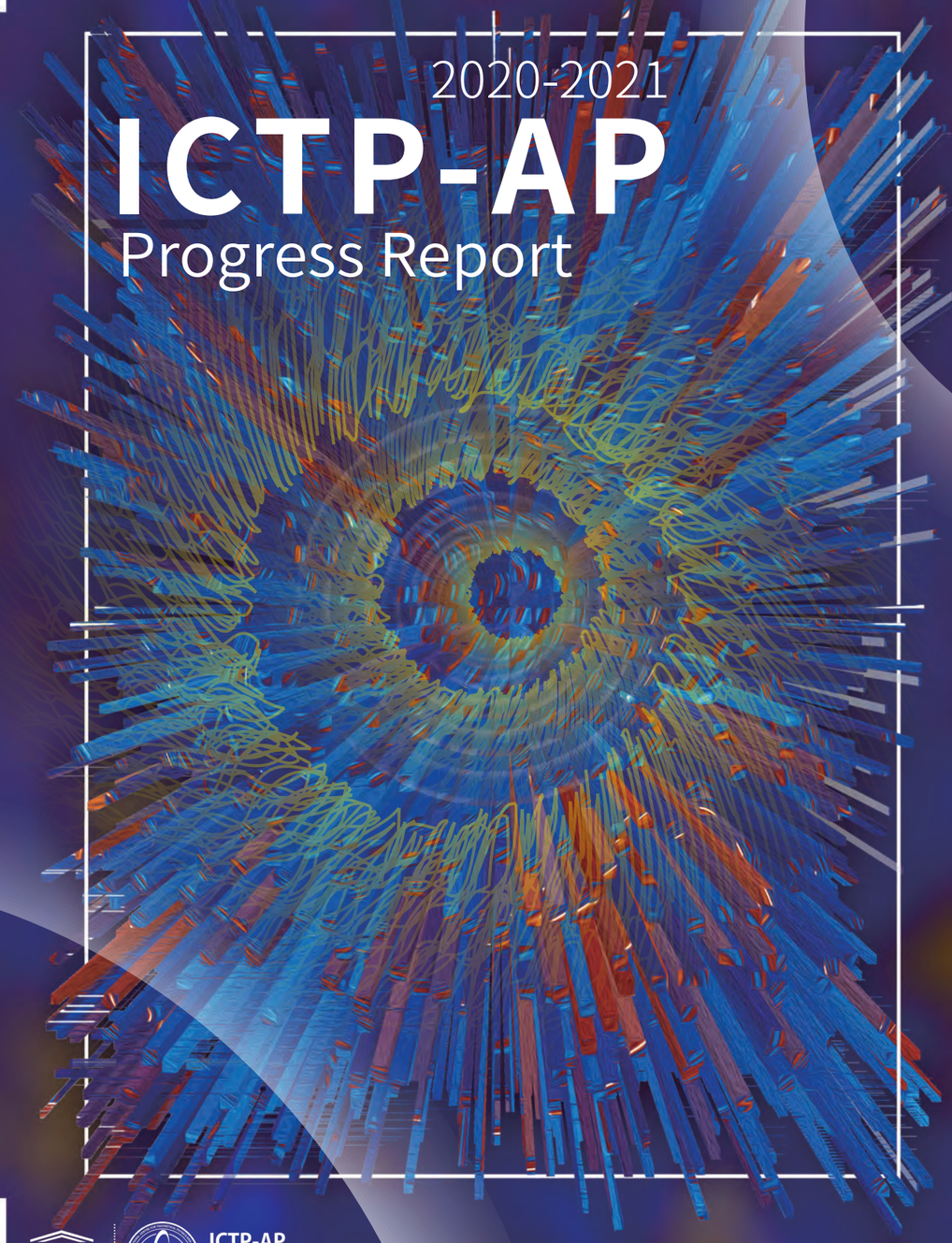
2020-2021

ICTP-AP

Progress Report



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

International Centre for Theoretical Physics Asia-Pacific

ICTP-AP
国际理论物理中心
(亚太地区)

The United Nations Educational, Scientific and Cultural Organization (UNESCO) seeks to build peace through international cooperation in Education, the Sciences and Culture. UNESCO's programmes contribute to the achievement of the Sustainable Development Goals defined in Agenda 2030, adopted by the UN General Assembly in 2015.

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。

The International Centre for Theoretical Physics Asia-Pacific (ICTP-AP) is China's first UNESCO category 2 centre in the area of basic science. ICTP-AP 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.

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。

OUR OBJECTIVES
我们的目标

ICTP-AP is to

- provide opportunities for advanced education, training and research in basic science such as frontiers of theoretical physics and the relevant 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;
- develop to be a world-class research centre, training base for talents with global eye sights and international academic exchange centre.

ICTP-AP

- 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。

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

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

2016年
9月12日

ICTP-AP成立事宜经国务院批准

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

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

May 13, 2017, President Chunli Bai, on behalf of the Chinese government, signed an agreement with Ms. Irina Bokova, Director-General of UNESCO.

2018年
11月 4日

国科大与国际理论中心签署共建“ICTP-AP”的合作备忘录，举行了揭牌仪式，并召开第一次国际理事会

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

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

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

2019年
5月13日

中心正式启动

May 13, 2019, ICTP-AP officially launched.

ORGANISATION STRUCTURE
组织关系

UCAS

UNESCO

Education

Forum & Symposium

Workshop & Schools

Training & Teaching

Research

High Energy Physics and Unified Field Theory

Cosmophysics and Gravitational Universe

Mathematics and Quantum Complexity Theory

Biophysics and Brain Science

Earth System Physics and New Energy

Support

Governing Board
Science Council

ICTP-AP Platform
- Taiji Lab Beijing+Hangzhou

ICTP-AP Office

GOVERNING BOARD
理事会

Chairman

李树深 Shu-Shen Li

院士，国科大校长，中科院副院长
Academician of CAS, President of UCAS, Vice President of CAS

曹京华 Jing-Hua Cao

中科院国际合作局局长
Director of Bureau of International Co-operation CAS

Philippe Pypaert

联合国教科文组织驻京办事处自然科学方案专员
Programme Specialist for Natural Sciences of UNESCO office in Beijing

Atish Dabholkar

国际理论物理中心主任
Director of ICTP

吴岳良 Yue-Liang Wu

院士，国科大副校长，
国际理论物理中心-亚太地区主任
Academician of CAS, Vice President of UCAS, Director of ICTP-AP

谢心澄 Xin-Cheng Xie

院士，国家自然科学基金委员会副主任
Academician of CAS,
Deputy Director of NSFC

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。

The governing board will guide and supervise the work of ICTP-AP. ICTP-AP will hold annual governing board meeting to review the annual working report and approve the next stage working plan.

INTERNATIONAL SCIENCE COUNCIL
国际科学委员会

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

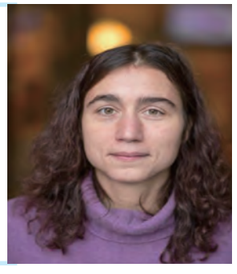
The International Science Council will provide academic guidance for ICTP-AP. Their high level of scientific research and rich experience in international exchange will effectively promote the cooperation and academic exchange between ICTP-AP and international institutions.

Chairman: Andrew Strominger
哈佛大学基本自然规律中心主任
Director of Harvard's Center for the Fundamental Laws of Nature

蔡荣根 Rong-Gen Cai
院士, 中科院理论物理所所长
Academician of CAS,
Director of ITP

Poul H. Damgaard
丹麦玻尔研究所国际研究院院长
Director of the Niels Bohr International Academy

Monica Guica
乌普萨拉大学高级讲师
Senior Lecturer of Uppsala University



Kimyeong Lee
韩国KIAS高等研究院主任
Director of KIAS

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

Fernando Quevedo
国际理论物理中心主任
Director of ICTP

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

Subir Sarkar
牛津大学教授
Professor of Oxford Univ.

Dam Son
芝加哥大学教授
Professor of University of Chicago

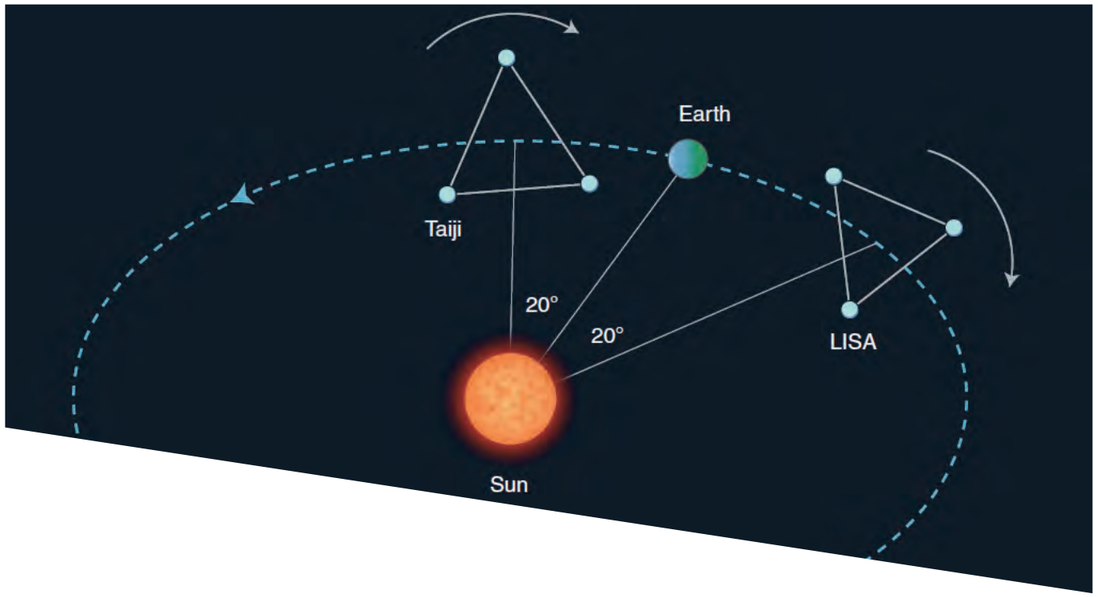
戴自海 Henry Tye
美国康奈尔大学&
香港科技大学教授
Professor of Cornell Univ. & HKUST

Spenta Wadia
印度理论科学研究中心主席
First Director of ICTS

吴岳良 Yue-Liang Wu
院士, 国科大副校长,
国际理论物理中心-亚太地区主任
Academician of CAS,
Vice President of UCAS
Director of ICTP-AP

Don Zagier
波恩马克斯普朗克数学研究所所长
Director of MPI for Mathematics in Bonn

张寿武 Shou-Wu Zhang
普林斯顿大学教授
Professor of Princeton Univ.



WORK HIGHLIGHTS

中心牵头实施的空间引力波探测计划首发星“太极一号”于2019年9月发射成功，2020年1月正式在轨交付国科大，首批科学成果于2021年7月发布。第一阶段在轨测试和数据分析结果表明：

“太极一号”实现了我国最高精度的空间激光干涉测量，干涉仪精度突破100pm/$Hz^{1/2}$，在部分频段可达25pm/$Hz^{1/2}$；

引力参考传感器噪声水平达到$10^{-10}ms^{-2}/Hz^{1/2}$，传感精度与量程比达到国内同等最好水平$2\times10^{-6}/Hz^{1/2}$；

在国际上首次实现了微牛级射频离子和双模霍尔电推进技术的在轨验证，微推进系统达到0.15μN/$Hz^{1/2}$噪声水平，推力测量精度优于0.02μN/$Hz^{1/2}$；

国内首次开展卫星无拖曳控制在轨实验，并突破$10^{-8}ms^{-2}/Hz^{1/2}$残余加速度水平；卫星平台温控达到±2.6mK。

ICTP-AP took the lead in the implementation of China’ s first gravitational wave detection satellite Taiji-1 launched successfully on 31 August 2019. The satellite was officially delivered to UCAS in orbit in January 2020. The first batch of scientific achievements are released in July 2021. The results of on orbit test and data analysis in the first stage show that:

The accuracy of displacement measurement of the laser interferometer on Taiji-1 reached 100pm/$Hz^{1/2}$, 25pm/$Hz^{1/2}$ in some frequency bands.

The accuracy of the gravitational reference sensor on the satellite reached $10^{-10}ms^{-2}/Hz^{1/2}$, and the sensing accuracy and range ratio reaches the best level of $2\times10^{-6}/Hz^{1/2}$ in China.

For the first time in the world, the on-orbit verification of the micro-thruster radio-frequency (RF) ion and dual-mode Hall electric propulsion technology has been realized. The micro-propulsion system achieves 0.15μN/$Hz^{1/2}$ noise level, and the thrust measurement accuracy is better than 0.02μN/$Hz^{1/2}$.

The first on-orbit experiment of drag-free control of satellite was carried out in China, and the residual acceleration is better than $10^{-8}ms^{-2}/Hz^{1/2}$. The temperature control of the satellite platform reaches ± 2.6mk.

上述在轨测试汇总结果正式在国际顶级科学期刊Nature子刊《通讯·物理》(communications physics)上发表。这些关键指标的实现验证了空间引力波探测核心技术的可行性，迈出了我国空间引力波探测的第一步，为我国在空间引力波探测领域率先取得突破奠定了基础。

The results of these in-orbit tests have been published in Communications Physics, one of the Nature-branded journals. The realization of these important indicators verified the feasibility of the key technology of space gravitational wave detection, and took the first step of China’ s space gravitational wave detection, laying a foundation for China to make a breakthrough in the field of space gravitational wave detection.

世界科学出版社的《国际现代物理期刊》(International Journal of Modern Physics A)以专辑形式发布了“太极一号”卫星更为详尽的实验结果，共包括26篇论文，来自180余位研究人员，30余家合作单位。专辑中的论文涵盖了干涉仪系统、引力参考传感器、微推进系统、无拖曳控制、超稳超静卫星技术等，并详细介绍了“太极一号”数据处理流程。

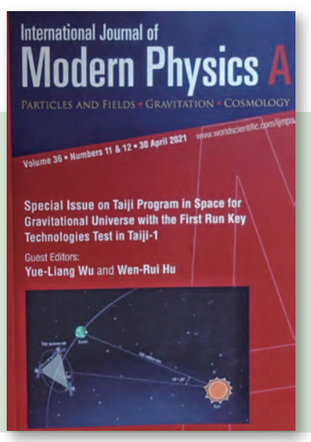
Meanwhile, International Journal of Modern Physics A of the World Scientific Press has published more detailed experimental results of Taiji-1 in the form of an album, including 26 papers, from more than 180 researchers, more than 30 cooperative units. This album covers the interferometer system, gravity reference sensor, micro-thruster system, drag-free control, ultra-stable and ultra-static satellite technology, and introduces the data processing process of Taiji-1 in detail.

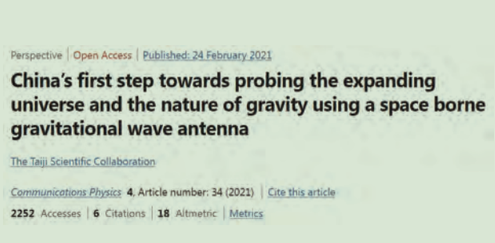
太极团队在空间引力波探测科学目标研究方面取得重大进展。在国际上首次提出利用“太极-LISA”进行联网观测的建议，有望将哈勃常数的准确度提高到千分之五。联网观测可对引力波波源的位置进行更快更准的定位，并有望提升精度达四个量级，该研究成果发表在《自然·天文》(Nature Astronomy)上。

In addition, the Taiji team has made great progress in the research of the scientific target of gravitational wave detection in space. For the first time in the world, the Taiji team proposed to use "Taiji-LISA" for networked observation, published in Nature Astronomy, which is expected to improve the accuracy of The Hubble constant to five parts per thousand. The networked observations will allow faster and more accurate positioning of gravitational wave sources and are expected to improve accuracy by up to four orders of magnitude.

researchers
180

papers
26




Perspective | Open Access | Published: 24 February 2021

China’s first step towards probing the expanding universe and the nature of gravity using a space borne gravitational wave antenna

The Taiji Scientific Collaboration

Communications Physics 4, Article number: 34 (2021) | Cite this article

2252 Accesses | 6 Citations | 18 Altmetric | Metrics


Correspondence | Published: 03 February 2020

The LISA–Taiji network

Wen-Hong Ruan, Chang Liu, Zong-Kuan Guo, Yue-Liang Wu & Rong-Gen Cai

Nature Astronomy 4, 108–109 (2020) | Cite this article

558 Accesses | 36 Citations | 11 Altmetric | Metrics

Category A Strategic Priority Research Programme of CAS

中科院A类战略性先导科技专项

中心牵头中国科学院A类战略性先导专项空间科学(二期)背景型号项目“空间引力波探测太极计划”课题，总经费为17882.37万元，执行期为2018年6月至2020年12月。课题围绕太极计划总体目标，进行科学目标凝炼、总体方案优化。在地面开展高指标激光干涉测距系统、惯性传感器、无拖曳控制与微推进器及超静超稳卫星平台关键技术攻关，并对绝大部分关键技术进行较高指标在轨搭载试验验证。成功发射“太极一号”微重力实验技术卫星，迈出了我国空间引力波探测的第一步。完成空间型激光器、冷气推进系统等21套原理样机的研制。完成ET3Dv1等10套软件及测试程序包的研发。课题共发表论文81篇，其中SCI共计57篇，EI16篇。发明专利23项，其中已授权9项。研究团队共348人，其中中高级职称85人，共培养博士研究生53名，硕士研究生65名，并培养博士后9名。为下一步太极计划工程实施、实现我国引力波基础研究和相关领域前沿取得重大科学突破奠定基础。

ICTP-AP led the ‘Taiji Programme in Space Gravitational Wave Physics’ background project under the support of the Category A Strategic Priority Research Programme of CAS (phase II), with total funding of 178,823,700 RMB. The implementation period was from June 2018 to December 2020.

The subject focused on the overall goal of the Taiji Programme, optimizes the scientific goal and the overall scheme. On the ground, the key technologies of high-index laser interferometer system, inertial sensor, drag-free control, micro-thruster and ultra-static and ultra-stable satellite platform were conducted. Most of the key technologies were verified through on-orbit test. The successful launch of Taiji-1 satellite took the first step in China’s space gravitational wave detection. The project completed the development of 21 sets of prototype machines, such as space laser interferometer and cold gas micro propulsion system, and completed the research of 10 sets of software and test packages such as ET3Dv1. This project published 81 scientific papers, including 57 SCI papers and 16 EI papers. Moreover, there were 23 invention patents, of which 9 have been authorized. The research team consisted of 348 people, including 85 with middle and senior professional titles, 53 PhD students, 65 Master students and 9 postdocs. It laid a solid foundation for the implementation of Taiji programme, and major scientific breakthroughs in the basic research of gravitational waves and related fields in China.

The Research Team Consisted of **348** people

Published **81** papers

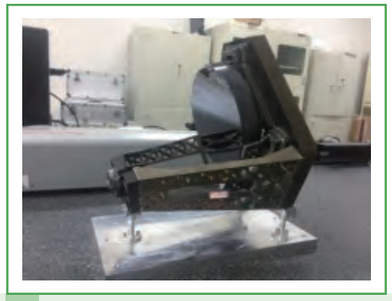
23 Invention patents

(1) 激光干涉测距系统

Laser Interferometer System

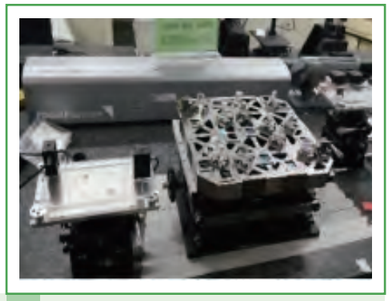
研制完成稳频激光地面原理演示样机

Developed the ground frequency-stabilized laser principle prototype.



研制完成望远镜原理样机

Developed the telescope principle prototype.



研制完成空间激光干涉仪模型样机

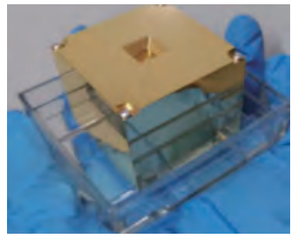
Developed the spatial laser interferometer model prototype.

(2) 惯性传感器

Inertial Sensor

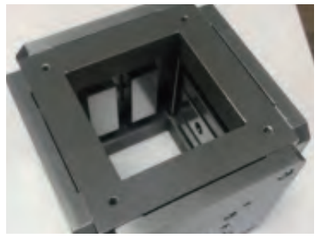
研制完成低磁化率测试质量材料，测试质量与电极笼研制关键技术，测试质量锁紧释放机构以及电荷管理系统。

Developed the low magnetic susceptibility test mass, test mass and key technologies of electrode housing, the caging and release mechanism of test mass and charge management system.



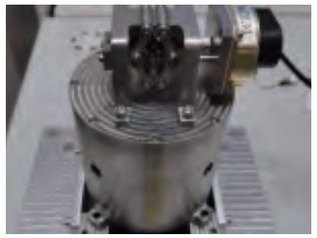
测试质量

Test mass



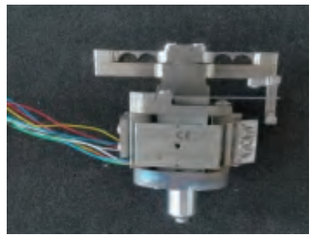
电极笼原理样件

Electrode housing principle model



锁紧机构样机

Caging mechanism prototype



释放机构样机

Release mechanism prototype

(3) 无拖曳控制与微推进系统

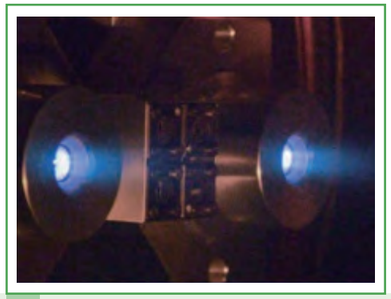
Drag-free Control and Micro-Propulsion System

研制完成冷气、射频、霍尔微推进系统原理样机。

The principle prototypes of air-conditioning, Radio Frequency and Hall-effect micro thruster system have been developed.

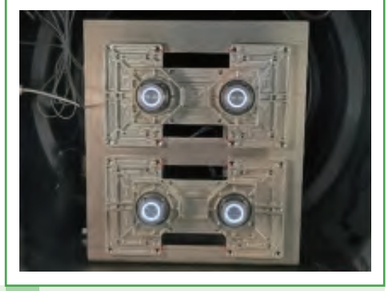
冷气微推力器

Cold gas micro thruster



射频离子微推

Radio frequency ion propulsion



霍尔微推力器

Hall-effect micro thruster

(4) 超静超稳卫星平台

Ultra-Static and Ultra-Stable Satellite Platform

完成了测温系统研制及试验验证，实现30μK高精度测温

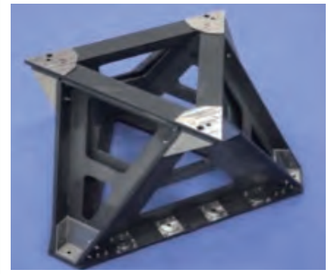
The temperature measurement system has been developed and verified by experiments, and 30 μ K high-precision temperature measurement has been realized.

高分辨测温仪样机

High resolution thermometer prototype

完成了陶瓷基复合材料超静超稳支撑结构件

Developed the ultra-clean and ultra-stable support structure of ceramic matrix composite materials.

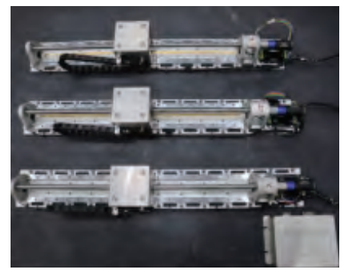


超静超稳支撑结构件

Ultra-clean and ultra-stable support structure

完成超静超稳飞行器质心调整机构样机

Developed the ultra-clean and ultra-stable spacecraft centroid adjustment mechanism prototype.



质心调整组件

Centroid adjustment assembly

Category B Strategic Priority Research Programme of CAS

中科院B类战略性先导科技专项

B 类

Research team consisted of **100** people

Published **65** papers

9 Invention patents

中心牵头中科院B类战略性先导科技专项“空间太极计划预研”项目，总经费为4566.87万元，执行期为2016年6月至2021年5月。项目开展总体规划和方案优化、科学目标和理论分析，以及激光干涉测距系统、无拖曳及卫星平台等太极计划独立发射卫星组相关的关键技术研究。项目研究团队共100人，其中中高级职称43人，共培养博士研究生16名，硕士研究生6名，并培养博士后29名。发表论文65篇，其中SCI 52篇，EI 13篇，产出发明专利9项。为空间“太极计划”的预研奠定了理论基础，也沉淀了大量的开创新技术，为我国空间引力波探测提供了不竭动力。

ICTP-AP led the “Pre-research of Taiji Programme” under the support of the Category B Strategic Priority Research Programme of CAS (phase II), with total funding of 45,668,700 RMB. The implementation period was from June 2016 to May 2021.

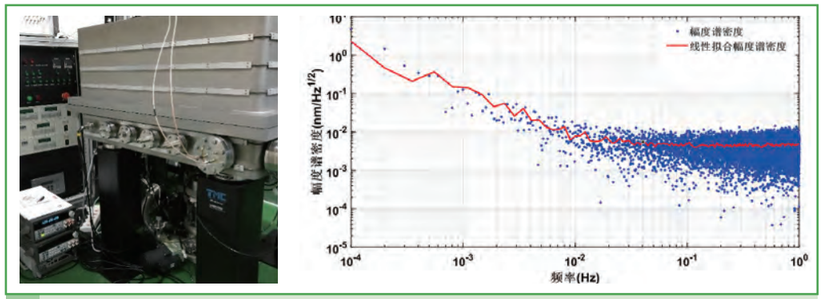
The project carried out overall planning and scheme optimization, scientific objectives and theoretical analysis and research on key technologies related to the independent launch of Taiji satellite groups, such as laser interferometer system and drag-free control and satellite platform, etc. The research team consisted of 100 people, including 43 with middle and senior professional titles, 16 PhD students, 6 Master students and 29 postdocs. This project published 65 papers, including 52 SCI papers and 13 EI papers, and output 9 invention patents. It laid a theoretical foundation for the pre-research of the Taiji Programme, and accumulated a large number of innovative technologies. Providing an inexhaustible driving force for the space detection of gravitational waves in China.

(1) 激光干涉地面实验系统

Laser Interferometer Ground Experimental System

在0.1 mHz – 10 mHz的频率范围内，激光干涉仪测量灵敏度小于等于2 nm/ $Hz^{1/2}$；在10 mHz – 1 Hz的频率范围内，激光干涉仪测量灵敏度优于5 pm/ $Hz^{1/2}$。

In the frequency range of 0.1mHz-10mHz, the measurement sensitivity of laser interferometer is less than or equal to 2 nm/ $Hz^{1/2}$, in the frequency range of 10mHz-1Hz, the measurement sensitivity of laser interferometer is better than 5 pm/ $Hz^{1/2}$.



激光干涉仪地面系统(左)与干涉精度(右)

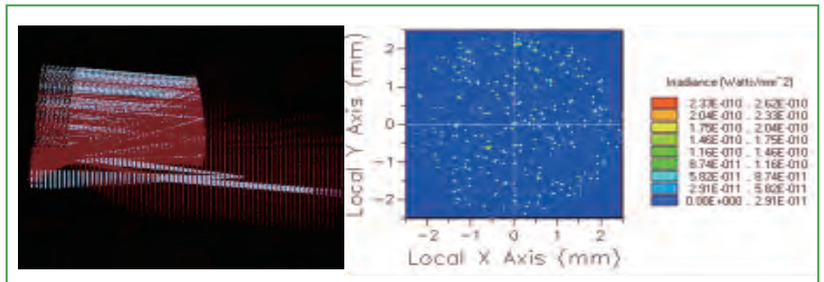
Laser Interferometer Ground System (left) and Interference Accuracy (right)

(2) 引力波望远镜总体设计

Overall Design of Gravitational Wave Telescope

结合光学仿真软件对引力波望远镜杂散光进行了仿真分析，数值分析结果表明，在上述表面粗糙度及清洁度条件下，系统杂散光水平达到6.6×10^{-11}。

The stray light of gravitational wave telescope is simulated and analyzed with optical simulation software. The numerical results show that the stray light level of the system reaches 6.6×10^{-11} under the surface roughness and cleanliness conditions above.



引力波望远镜杂散光分析

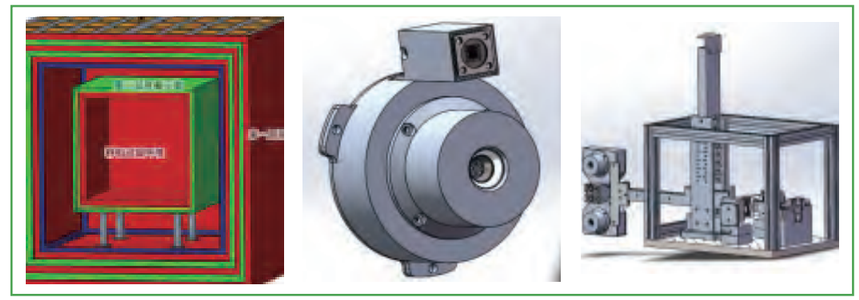
Analysis of stray light of gravitational wave telescope

(3) 无拖曳与姿态控制系统

Drag-free and Attitude Control System

完成百微牛级射频微推力器及中和器原理样机。微推力测量系统分辨力达到10纳牛级，测量噪声优于0.1μN/$Hz^{1/2}$；对光学测量系统进行多级精确温控，核心仪器的温度幅值为7.8μK。

Developed 100 micron-newton radio-frequency plasma micro-thruster and neutralizer principle prototype. The accuracy of the micro-thrust measurement system reaches 10 nano-Newton, and the noise measurement is better than 0.1μN/$Hz^{1/2}$ The optical measurement system is subject to multi-level accurate temperature control, and the temperature amplitude of the core instrument is 7.8 μ K.



Funding Support for Theoretical Physics from National Natural Science Foundation of China

获国家自然科学基金委理论物理专款项目支持

该项目拟依托我中心，联合国科大杭高院、浙江大学和南京大学，计划建立量子-宇宙理论物理创新研究中心，开展引力本质、统一理论、量子场论、物质深层次结构、黑洞物理和宇宙演化、引力波宇宙学等方面的前沿基础理论物理问题研究。探索多单位合作参与中心建设的新思路，并在交叉学科领域开展深入探索与实践。

This programme plans to rely on ICTP-AP, cooperating with Hangzhou institute for advanced study UCAS, Zhejiang University and Nanjing University, hoping to establish an innovative research centre for quantum-cosmic theoretical physics and carry out research on cutting-edge basic theoretical physics issues in gravitational essence, grand unified theories, quantum field theory, deep structure of matter, black hole physics and cosmic evolution, gravitational wave cosmology. It is planned to explore new ideas of multi cooperation and participation in the construction of ICTP-AP, and to carry out in-depth exploration and practice in interdisciplinary fields.

科技部于2020年7月正式启动“引力波探测”重点专项（分五年发布）。2021年，太极团队共争取到8项，总经费2亿。中心是“激光锁臂稳频技术与时间延迟干涉技术”项目牵头单位。

In July 2020, Ministry of Science and Technology of China launched the key programme of Gravitational Wave Detection (released in five years). In 2021, the Taiji team successfully applied eight projects with a total funding of 200 million RMB. ICTP-AP takes the lead in the project of “Frequency-Stabilized Laser Technology and Time-Delay Interferometry Technology”.

Funding Support for Gravitational Wave Detection from China’s Key Research and Development Programme

获“引力波探测”国家重点研发计划支持

2021 ICTP-AP夏令营及引力波暑期学校

2021 ICTP-AP and Gravitational Wave Summer School

为促进高校优秀大学生之间的交流与学习，培养青年学生从事科学研究的兴趣，拓展当代大学生学术视野，选拔优秀大学生来我中心深造，2021年7月15-21日，中心和引力波探测太极联盟在北京联合主办了“2021 ICTP-AP夏令营及引力波暑期学校”。本次活动邀请了中国科学院大学副校长、ICTP-AP主任吴岳良院士等17位专家老师围绕引力、黑洞与量子宇宙、引力波探测与精密测量技术展开二十余场讲座，与学员共话理论物理科学前沿。来自全国三十余所高校及科研院所的同学参加了此次活动并顺利结业。本次暑期学校共选出了10位优秀学员，他们将获得优先录取为中心研究生的资格。

To promote exchanges and learning among outstanding college students, cultivate young students’ interest in scientific research, expand their academic horizons, and select outstanding students to come to our centre for further studies. On July 15-21, 2021, ICTP-AP and the Taiji Consortium jointly organised the "2021 ICTP-AP and Gravitational Wave Summer School" in Beijing. This school invited 17 experts including academician Yueliang Wu (Vice President of UCAS and Director of ICTP-AP), to give more than 20 lectures on gravity, black holes and quantum universe, gravitational wave detection, precision measurement technology Students from more than 30 universities and research institutes gathered together to communicate frontiers of theoretical physics. The summer school awarded 10 outstanding students for their excellent performance, and they could have priority for postgraduate admission at ICTP-AP.

ICTP-AP青年学者“格物穷理”沙龙

ICTP-AP Young Scholars Salon

2021年，中心发起了“ICTP-AP青年学者格物穷理沙龙”项目。通过营造轻松的学术氛围，鼓励具有一定专业知识背景的青年学者在沙龙中展开基础科学前沿和热点科学问题的跨领域交流，从而拓宽科学视野，激发新的兴趣和想法，促进相关领域的创新发展。

今年5月，首场格物穷理沙龙在国科大成功举办。我们邀请了来自奥地利科学院高能物理所的褚晓勇老师，以“黑暗之火焰-暗物质”为主题，对暗物质研究的发展历程和未来研究方向进行了介绍。褚老师的讲解层层深入，精彩纷呈，同学们也都各抒己见，反响热烈。本次活动让参与者对暗物质有了基本的认识，在交流中收获了许多新观点和看问题的新角度。

未来，我们将邀请更多来自不同领域的优秀学者来沙龙分享自己的科学观点，探讨科学前沿问题，将青年沙龙打造为开放性的跨领域思想交流平台。

ICTP-AP launched the "ICTP-AP Young Scholars Salon” project in 2021. The salon aims to broaden scientific horizons, inspire new ideas, and promote innovations in relevant research domains by encouraging young talents with related knowledge backgrounds to discuss frontiers of fundamental science and the latest interdisciplinary scientific issues in a relaxing academic atmosphere.

The first salon held successfully at UCAS in May 2021. We invited Dr. Chu Xiaoyong, from the Institute of High Energy Physics (HEPHY) of the Austrian Academy of Sciences, to introduce the development and future direction of dark matter research. Dr. Chu's lecture was so thorough and fascinating that sparked a heated discussion among students. Participants not only had a fundamental understanding of dark matter, but also gained numerous fresh ideas and views through this activity.

In the future, we are going to invite more distinguished scholars from various research areas to the salon to share their scientific views as well as discuss the latest scientific issues, and to build the salon an open platform to exchange ideas and thoughts among young scholars.

Quantum Century 2025
量子世纪2025

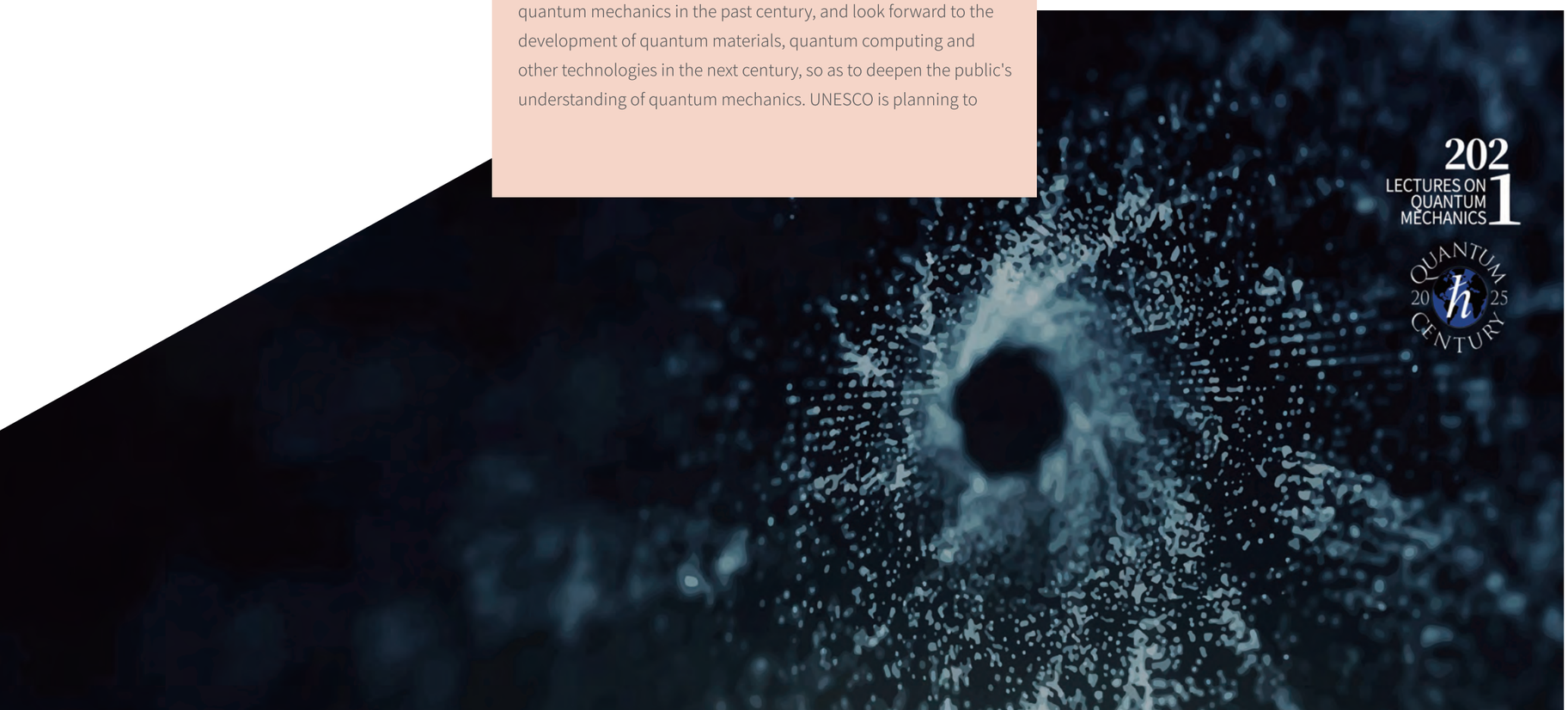
UNESCO is planning to designate 2025 as the "International Quantum Year"

"量子世纪(2025)"由美国物理学会于2020年发起，旨在回顾量子力学百年发展历程中理论、实验、技术和文化间的相互影响，前瞻未来百年量子材料、量子计算等科技的发展，以期加深公众对量子力学的理解。联合国教科文组织正筹划将2025年定为"国际量子年"，并建议从2021年起将每年的4月14日定为"国际量子日"。目前，国际上已有欧洲物理学会、欧洲核子中心等8个国家和地区的多家研究机构和大学参与了该活动。

"Quantum Century (2025)", initiated by the American Physical Society in 2020, aims to review the interaction among theory, experiment, technology and culture in the development of quantum mechanics in the past century, and look forward to the development of quantum materials, quantum computing and other technologies in the next century, so as to deepen the public's understanding of quantum mechanics. UNESCO is planning to designate 2025 as the "International Quantum Year", and suggests that April 14th should be designated as International Quantum Day from 2021. At present, research institutions and universities from eight countries and regions, including the European Physical Society and European Organization for Nuclear Research, have participated in this activity.

ICTP-AP、中科院理论物理所和中科院自然科学史所正在积极组织中国方面的活动。2021年4月14日，"量子世纪(2025)中国计划"在北京启动。目前已举办两场活动，采用线上线下相结合的方式，共吸引了三千余人的积极参与。

"Quantum Century (2025)" held in Beijing



未来，围绕这一目标和主题，我们每年都将持续开展丰富多彩的量子专题活动。我们将邀请科学家和群众共话量子科学，以此加深公众对量子科学的理解，吸引更多青年学生投身量子相关领域的研究，带动新一轮科技革命和产业变革，促进重大颠覆性科技创新。

ICTP-AP, Institute of Theoretical Physics (ITP, CAS) and the Institute for the History of Natural Sciences (IHNS, CAS) are organizing activities in China. On April 14, 2021, the kick-off conference of "Quantum Century (2025)" was held in Beijing. We have successfully held two series of lectures on quantum science in Beijing. The lectures attracted more than 3,000 participants through adopting a combination of online and offline methods.

We will continue to carry out colourful activities every year around this goal and theme. We will invite scientists to share knowledge of quantum science with the audience to deepen the public's understanding of quantum science and attract more youths to join in the research in quantum related fields, driving a new round of revolution and industrial transformation, and promoting major scientific and technological innovation.

平台搭建

Platform Construction

Indico

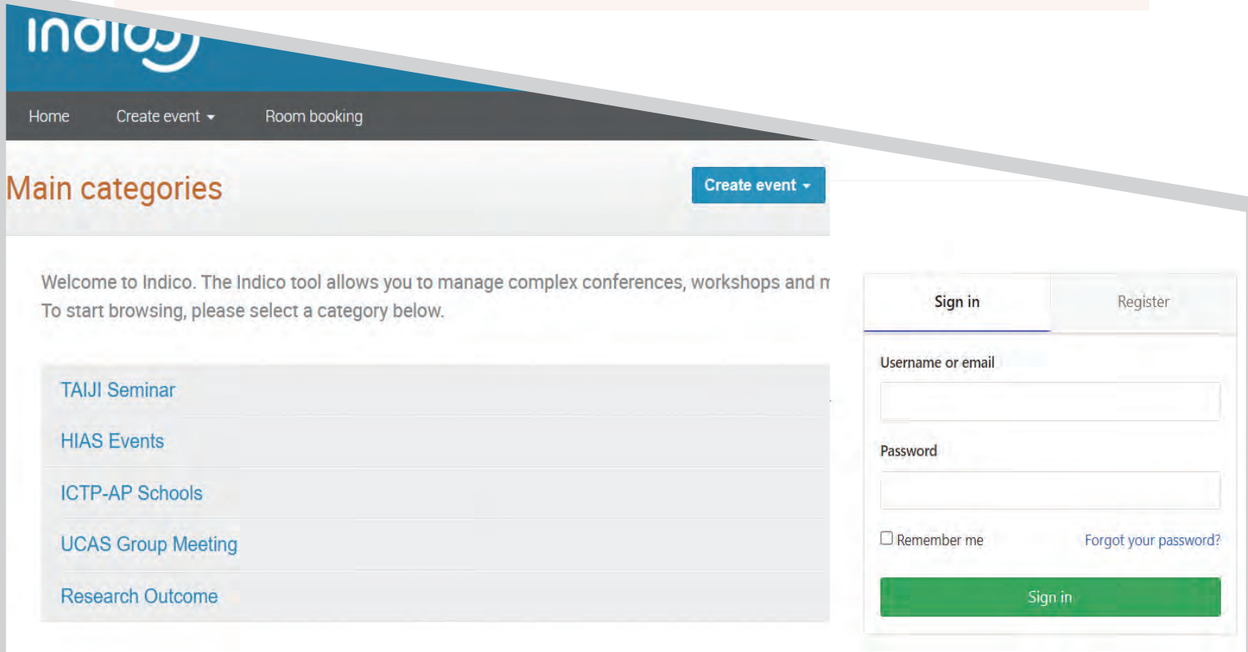
中心使用indico系统搭建了活动管理平台(http://indico.ictp-ap.org),平台为国际会议及大型活动管理、信息收集、人才管理等方面提供高效便捷的信息化服务。平台开放性强,所有用户都可以基于该平台新建活动日程并进行活动管理,有利于进行跨地区的交流和合作。

ICTP-AP has built an event management platform (http://indico.ictp-ap.org) base on the Indico system, which mainly provides efficient and convenient information services for international conference and event management, information collection and personnel management. All users could create and manage activities on this platform which is conducive to cross-regional communication and cooperation.

Gitlab

中心搭建了一个用于代码协作的开源软件GitLab(http://gitlab.ictp-ap.org)。平台为各个项目团队提供事件创建、评论发表、代码克隆、代码审查、问题追踪等服务,便于团队内部的代码共享与沟通协作。

ICTP-AP has developed an open-source platform called GitLab for code collaboration (http://gitlab.ictp-ap.org). The platform provides issues creation, comments making, code cloning, code review, problem tracking and other services for each project team, facilitating code sharing and collaboration within the team.



Communication of Science

科学传播

为普及科学知识,提升科学素养和科学精神,培养创新精神和实践能力,中心开展了面向青少年和公众,以趣味科普视频为主要形式的科普活动。该活动被纳入国科大的社会责任项目—“春分工程·青少年科普专项行动”。

In order to popularize scientific knowledge, enhance scientific literacy, and cultivate innovative spirit and practical ability, ICTP-AP has carried out a science popularization activity mainly in the form of funny popular science videos facing to teenagers and the public. This activity has been incorporated in the social responsibility project of UCAS - "Vernal Equinox Project · Science Popularization Initiative for Youth".

视频主要对热点科学问题和热门话题所涉及的科学知识进行轻松有趣的解读。视频由学生自主选题、构思创意、编写剧本、排练表演与摄影剪辑,专业教师进行学术指导以保证内容的准确性与科学性。学生通过科普实践活动不仅加深了对所学知识的理解,也获得了发挥创意、展示特长、锻炼能力的机会。

科普视频发布于中国科学院大学官方抖音账号上,依托账号超五十万的粉丝基础,取得了良好的传播效果。在生动活泼的讲解中点燃公众的好奇心,使他们了解科学知识,掌握科学方法。

The videos mainly interpreted knowledge involved in hot scientific issues and topics in an interesting way. Students are playing a leading role in videos making, such as selecting subjects, collecting ideas, writing scripts, organizing rehearsals and performances, and photography and editing. Professional teachers provide academic guidance to ensure the scientific accuracy of videos. Through this activity, students not only could deepen their understanding of the knowledge, but also got opportunities to inspire creativity, show specialities, and improve abilities.

The videos are widely spread on the official TikTok account of UCAS which has over 500,000 subscribers. The lively interpretation ignited the public's curiosity, assisted them in understanding scientific knowledge and mastering scientific methods.

活动
Activities

Pre-SUSY Summer School

2021年8月，第28届超对称物理暑期学校（Pre-SUSY Summer School）由国科大，中科院理论物理所和ICTP-AP联合举办。本次学校采用线上授课形式，吸引了国内外千余人次的参与。学校绕标准模型、超对称理论、大统一理论等专题展开了学术探讨，并为学员提供了根据个人研究方向作学术报告和国际交流的机会。

In August 2021, the 28th Pre-SUSY Summer School was jointly organized by UCAS, ITP CAS and ICTP-AP. The school adopted online teaching, and more than 1,000 people from home and abroad gathered to discuss academic topics such as standard model, supersymmetry theory, grand unified theory and so on. In addition to expert lectures, the summer school also provided a stage for students to give academic reports based on their research and communicate with audience from national and abroad.

The 16th National Conference on Physical Mechanics

第十六届全国物理力学学术会议由中国力学学会主办。我中心承办此次会议的空间引力波探测分会，会议议题主要包括星间激光干涉测距方法、惯性传感器关键技术、无拖曳控制技术、超稳超静航天器系统、引力波信号分析与处理、引力波波源物理六大主题。会议已于2021年8月13-15日在北京成功召开。

The 16th National Conference on Physical Mechanics was organized by The Chinese Society of Theoretical and Applied Mechanics. ICTP-AP was responsible for the branch meeting of space gravitational wave detection. The topics of the meeting mainly included methods of inter-satellite laser interference ranging, key technologies of inertial sensor, drag-free control technology, ultra-stable and ultra-static spacecraft system, gravitational wave signal analysis and processing, and gravitational wave source physics. The conference held successfully in Beijing from August 13 to 15, 2021.

Taiji Lecture Series

为促进学者交流合作，中心邀请曾参与太极计划或在国际上参与空间引力波探测项目的青年学者进行线上讲座分享，为从事引力波探测相关领域的青年学者提供学术交流的平台。讲座聚焦科学前沿，分享最新的研究成果，为学者拓展知识储备，开拓研究思路，从而为未来的研究添砖加瓦。

To promote exchanges and cooperation among scholars, ICTP-AP invited young scholars who have participated in the Taiji Programme or international space gravitational wave detection programme to give lectures online, providing young scholars engaged in gravitational wave detection or related fields with a platform for academic exchanges. The lectures focused on frontiers of science and shared the latest research findings, which expanded knowledge and opened avenues for future researches for scholars.

International Year of Basic Sciences for Sustainable Development 2022

2022国际基础科学年

IYBSSD2022
International Year of Basic Sciences for Sustainable Development

Consortium
37
International Scientific Unions and Scientific Organisations

Around **30** Nobel Prize Laureates and Fields Medalists Support this Initiative

联合国教科文组织(UNESCO)于2019年第40届大会批准和宣布2022年为“基础科学促进可持续发展国际年”。“国际年”指导委员会由37个国际联合会和国际组织组成,已获得全球超过50个科学院和学术团体的支持,约30位诺贝尔奖获得者和菲尔兹奖获得者也对这一倡议表示支持。

中心作为“基础科学年”参与单位之一,将在2022年展开系列活动。我们计划通过主题为“从量子到宇宙”的量子科学系列科普活动,提升公众科学素养,推动社会形成讲科学、爱科学、学科学、用科学的良好氛围。树立科学榜样,积聚创新力量,吸引更多青少年将推动人类社会的科学进步作为奋斗目标,为未来的科学发展书写新的篇章。

中心将打造一支专业的科普队伍,探索多元化科普技术手段,加强科学传播的多样性、生动性、趣味性,形成专业的科普工作机制。通过线上线下结合的形式,将包容、公平的优质教育更加广泛的传播。同时,我们计划在偏远山区和教育条件较落后的地区开展科普活动,为实现联合国教科文组织全民享有终身学习机会的可持续发展目标(SDGs4)贡献力量。

The International Year of Basic Sciences for Sustainable Development 2022 (IYBSSD 2022) is proposed to be organized in 2022 by a consortium of 37 international scientific unions and scientific organisations with the recommendation of a resolution voted by the UNESCO General Conference during its 40th session in 2019. Over 50 national and international science academies and learned societies and around 30 Nobel Prize laureates and Fields Medalists also support this initiative.

As one of the participating institutions in the IYBSSD, ICTP-AP will launch a series of activities in 2022. We plan to attract the participation of teenagers and the public through a series of science popularization activities of quantum science themed “From Quantum to Universe”, to enhance the scientific literacy of the public, and promote the society to form a good atmosphere of loving, learning and using science. We will set good scientific examples, accumulate innovative power and attract more teenagers to take promoting scientific progress as their lofty end in mind and to write a new historical chapter for scientific development.

We are going to build a professional science popularization team to explore pluralistic technical means, enhance the diversity, vividness and entertainment of science communication, and form a professional working mechanism. Through the combination of online and offline forms, inclusive and fair high-quality education will be more widely disseminated. We are planning to carry out science popularization activities in rural areas with backward educational conditions, so as to contribute to the realization of UNESCO's Sustainable Development Goal (SDGs4) of lifelong learning opportunities for all.

School of Fundamental Physical & Mathematical Sciences, HIAS, Hangzhou

国科大杭高院数理学院

国科大杭州高等研究院

HIAS, Hangzhou

2019年，中心与中科院理论物理研究所共同承建了国科大杭州高等研究院基础物理与数学科学学院。该学院是一个包括数理学科建设、研究生培养、前沿基础科学研究与教学的综合办学单元。中心计划以国科大杭高院为基地，在杭州设立ICTP-AP分中心（ICTP-AP Hangzhou Branch），充分发挥杭州分中心的辐射带动作用，促进与中国南部省市科研机构、高校的紧密合作，进一步推动相关领域的科学合作与发展。

In 2019, ICTP-AP and ITP CAS jointly established the School of Fundamental Physical & Mathematical Sciences, Hangzhou Institute for Advanced Study (HIAS), UCAS. The school includes mathematical discipline construction, postgraduate students training, cutting-edge basic scientific research and teaching. ICTP-AP plans to set up Hangzhou branch based on HIAS and give full play to its leading role, promoting close cooperation with scientific research institutions and universities in southern China, and further promoting scientific cooperation and development in related fields.

2020年

10月 October

杭高院数理学院首届学生开学
The opening ceremony of the first class of students in the School of Fundamental Physical & Mathematical Sciences, HIAS.

11月 November

量子宇宙物理前沿问题研讨会
Symposium on frontier Issues of Quantum Cosmic Physics

11月 November

致密核物质的性质研讨会
Symposium on the Properties of Dense Nuclear Matter

12月 December

引力与宇宙学研讨会
Symposium on Gravity and Cosmology

2021年

12月 December

粲物理研讨会
Symposium on Charm Physics

04月 April

引力波时代基础物理的机遇与挑战研讨会
Symposium on Opportunities and Challenges of Basic Physics in Gravitational Waves Era

07月 July

学生夏令营
Students' Summer School

Taiji Laboratory for Gravitational Wave Universe (Hangzhou)

太极实验室

April

引力波宇宙太极实验室（杭州）暨浙江省引力波精密测量重点实验室（培育）正式揭牌。

Unveiling of Taiji Laboratory for Gravitational Wave Universe (Hangzhou) and Key Laboratory of Gravitational Wave Precision Measurement of Zhejiang Province (Cultivation).

电推进实验室
Electric Propulsion Laboratory

主要开展高精度低噪声微牛级推进系统、高置信度亚微牛级推力标定方法与技术、微牛级推进系统集成测试等方向的研究。

The main research directions are high-precision and low-noise micro-newton propulsion system, sub-micro-newton thrust calibration method and technology, and integration testing of micron-newton propulsion system.

空间干涉测量实验室
Spatial Interferometry Laboratory

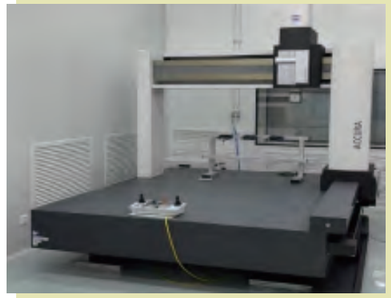
主要开展空间精密干涉测量方向研究。

The main research direction: spatial precision interferometry.

弱力测量实验室
Weak Force Measurement Laboratory

主要开展精密测量和宏观量子力学效应验证等方向研究。

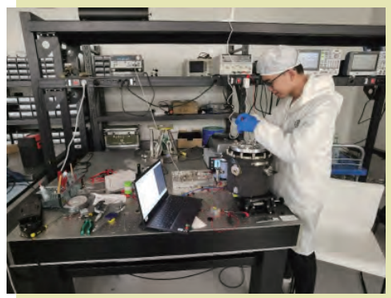
The main research directions are precision measurement and macroscopic quantum mechanical effect verification.



载荷分系统装调实验室
Load subsystem Laboratory

主要开展光链路和干涉仪载荷分系统装调联试方向研究。

The main research direction is assembly, debugging and joint testing of optical link and interferometer load subsystem.



载荷电子学联调实验室
Electronics Laboratory

主要开展空间超电子学联调以及稳激光技术方向研究。

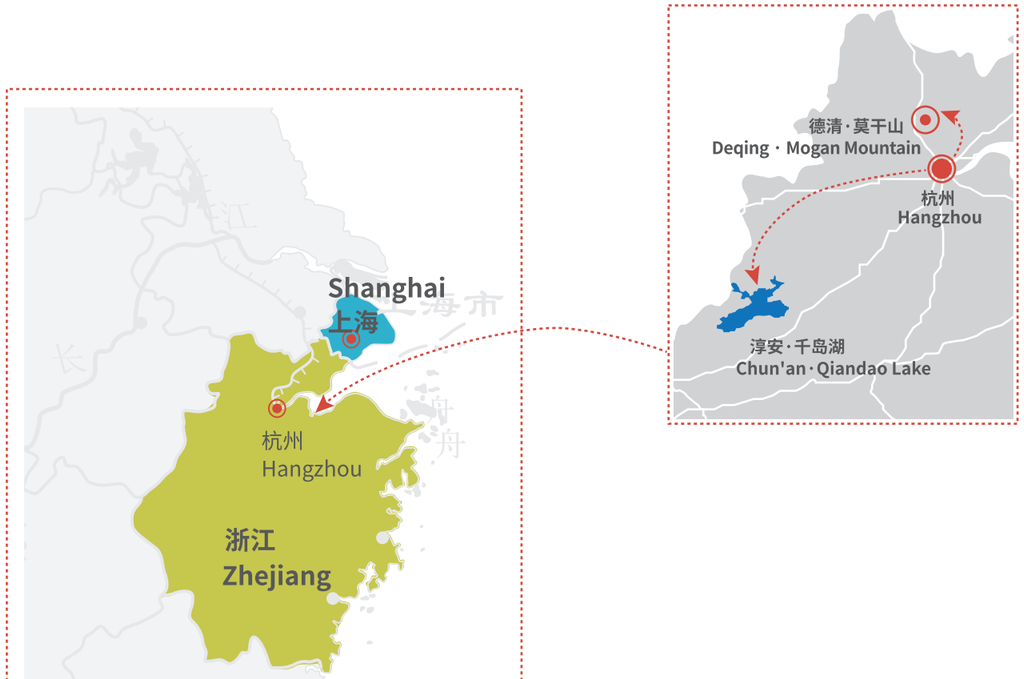
The main research direction is space electronics intermodulation and laser stabilization technology.

Expanding the Cooperation Base
拓展合作基地

中心计划与淳安县和德清市科协展开合作，将中心的国际化学术交流平台优势与当地的生态环境资源优势相结合。通过资源共享、优势互补与理念创新，为国际化学术交流活动、高水平教育培训和人才培养、基础前沿和交叉科学研讨等，营造良好的学术交流氛围和清新的研讨环境，打造“共创、共享”的可持续合作伙伴关系。

ICTP-AP plans to cooperate with Association for Science and Technology from Chun'an County and Deqing to combine the advantages of the centre as an international academic exchange platform with the advantages of local ecological environment and resources.

Through resource sharing, complementary advantages and innovative thinking, we will create a good academic exchange atmosphere and a refreshing research environment for international academic activities, high-level education and talents training, basic frontier and interdisciplinary science discussions, and build a sustainable cooperative partnership of "join creation and shared benefits".



Hangzhou | Deqing | Chun'an

Recruitment

ICTP-AP作为在发展中国家的基础科学中心，加强人才队伍建设是我们的重要任务之一。中心将持续吸引国际人才，大力推动国际人才的交流与合作。同时，注重对青年科学家的培养，为青年人才创造良好的发展环境并为他们申请相关人才计划提供支持。

ICTP-AP is a basic science centre in developing countries, it is our obligation to strengthen the construction of talents team. ICTP-AP will continue to attract international talents and promote talents exchanges and cooperation. We will attach 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 programmes.

新同事

New Colleagues

PIFI Visiting Scientist:

Francesco Hautmann, Italian

Research Interests: Quantum Field Theory

Working Experience Within 3 Years: the University of Antwerp, Belgium & the University of Oxford, UK.

Faculty

Jun Nian, Chinese

Research Interests: String Theory, Black Hole Physics, Quantum Field Theory

Working Experience Within 3 Years: the University of Michigan, USA.

Kenji Kadota, Japanese

Research Interests: Particle Physics, Cosmology

Working Experience Within 3 Years: Institute for Basic Science, S. Korea.

Postgraduate Students

中心2021年共招收研究生11名，其中博士生6名，硕士生5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，通过参与重大科研项目，促进前沿学科创新人才的培养。在学期间，学生们可以申请国科大设置的各项奖助学金：

In 2021, ICTP-AP has enrolled 11 graduate students, including 6 doctoral students and 5 master students. Most of them will participate in the research related to space gravitational wave detection. We will promote the cultivation of innovative talents in frontier disciplines through participating in major scientific research projects. During their studies, students could apply for various scholarships in UCAS:

Postgraduate Students **11** | Doctoral Students **6** | Master Students **5**

招收博士后14名　Recruit 14 postdocs

Name	Gender	Research Fields
Xiao-Nan Liu	Female	Particle Physics
Li Huang	Male	Particle Physics
Jia-Wei Liu	Male	Particle Physics
Tian-Wei Wu	Male	Particle Physics
Rui-Hong Gao	Male	Optical Physics
Bing-Dong Wan	Male	Space Physics
Yan-Bo Zhou	Male	Plasma Physics

Name	Gender	Research Fields
Zi-Yu Tang	Female	Theoretical Physics
Yong-Shun Hu	Male	Theoretical Physics
Chang Liu	Male	Theoretical Physics
Yao Ma	Male	Theoretical Physics
Yuan-Hao Zhang	Male	Theoretical Physics
Chang Hu	Male	High Energy Physics

International Students

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，维护女性权益的平等和教育公平的落实。2021年，中心与国科大国际学院联合培养的国际生共有1,283名，其中30%为女性。在这些来自五大洲七十多个国家的国际生中，有97%来自于欠发达地区。他们可以在国科大享受高质量的教育的同时申请奖学金的支持。

As a category 2 centre of UNESCO, we have always been concerned about the cultivation of talents in underdeveloped countries and regions, the protection of women's rights to education, and the implementation of education fairness. ICTP-AP is jointly cultivating international students with the International College of UCAS. In 2021, 1,283 international students are studying at UCAS and 30% of them are female. Moreover, the students are from more than seventy countries on five continents which 97% of them are from underdeveloped areas. They could apply for scholarship support while enjoying high-quality education at UCAS.

Male
642

Female
194

PhD Students
836

Male
242

Female
140

Master Students
382

Male
39

Female
26

Advanced Students
65

留学生特色活动--体验中国传统文化

Special Activities for International Students--Experiencing Chinese Traditional Culture

通过中国文化的了解可以让留学生更容易地消除文化差异带来的交流困难，深切感受到学校对国际生的人文关怀。

By understanding Chinese culture, international students could deeply feel the humanistic care of UCAS and efficiently eliminate the sense of communicative differences caused by cultures.

体验写毛笔字

Writing calligraphy

《非遗文化讲座——兔儿爷》及制作兔儿爷

《Intangible Cultural Heritage Lecture - the Lord Rabbit》and making Lord Rabbit figurine

疫苗接种

COVID-19 Vaccination

2020年3月26日起，在京外籍人士新冠疫苗接种全面启动。我校的外籍师生可通过学校预约接种疫苗。国科大秉承疫苗“接种公平”的理念，所有在校师生都有机会接种新冠疫苗，无论你来自哪个国家。在这里，来自不同国家的师生携手同战疫情，共筑免疫长城。

On March 26, 2020, Beijing has fully rolled out its COVID-19 vaccination for foreign nationals. Foreign teachers and students could make an appointment through UCAS to carry out vaccination. We strive to achieve vaccine fairness so that all teachers and students could have the opportunity to be vaccinated. Here, people from different countries make effort together to defeat the pandemic.

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Welcome To Join Us

Multiple Tenure-track & Tenured Faculty & Postdoc Positions of Theoretical Physics

Fields:

Theoretical physics and related fields.

Special consideration will be given to theoretical high-energy physics, cosmology, gravity and mathematical physics.

Job Description:

Successful candidates will not only be part of ICTP-AP but will also have joint tenure track or faculty positions at UCAS. Teaching loads are light, salaries are negotiable, and there is a good housing benefit and an excellent start-up grant.

Successful candidates will automatically be ICTP (Trieste) Associates with the ability to spend extended periods at the ICTP.

Requirements:

Candidates for the positions are required to have a postdoc, Ph.D. or equivalent degree and have a demonstrated ability to conduct outstanding research.

Candidates are expected to carry out excellent research, mentor Ph.D. students and promote the mission of the ICTP-AP in the region and beyond.

Application Materials:

CV, scans of qualification certificates, incl. degree, employment and award documents;

List of published theses;

Full text of 10 representative publications in 5 years;

Three reference letters from experts in the relevant fields;

Proposal for future research and related demand.

Application Online:

Please submit your application online at:
https://ictp-ap.org/app/8

Please email the reference letters to the following contacts.

Contacts: ICTP-AP Office

Address: No.55, Zhongguancun East Street, Beijing, China.

Phone: 10-82648142

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