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ICTP-AP
INTERNATIONAL CENTRE FOR
THEORETICAL PHYSICS ASIA-PACIFIC

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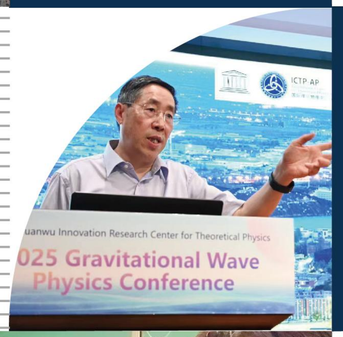
ICTP-AP
International Centre
for Theoretical Physics Asia-Pacific
国际理论物理中心-亚太地区

Progress Report

ICTP–AP

2024-2025



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ICTP-AP Research

国际理论物理中心（亚太地区），简称ICTP-AP，是联合国教科文组织（UNESCO）在中国基础科学领域设立的第一个二类中心。中心由中国科学院、国家自然科学基金委员会与国际理论物理中心共同建设，并依托中国科学院大学开展机构建设与发展工作。

The International Centre for Theoretical Physics Asia Pacific (ICTP-AP) is the first Category 2 Centre established by UNESCO in basic science in China. It was jointly developed by the Chinese Academy of Sciences (CAS), the National Natural Science Foundation of China (NSFC), and the International Centre for Theoretical Physics (ICTP), and operates under the institutional framework of the University of Chinese Academy of Sciences (UCAS).

目前，ICTP-AP已完成与UNESCO的第一期合作，期间完成了人才梯队建设、学术活动组织与国际交流平台搭建等既定目标，并顺利通过相关评估。在此基础上，中心已启动与UNESCO的第二期合作（2026–2034年），持续推进其在亚太地区基础科学研究与发展中的作用。

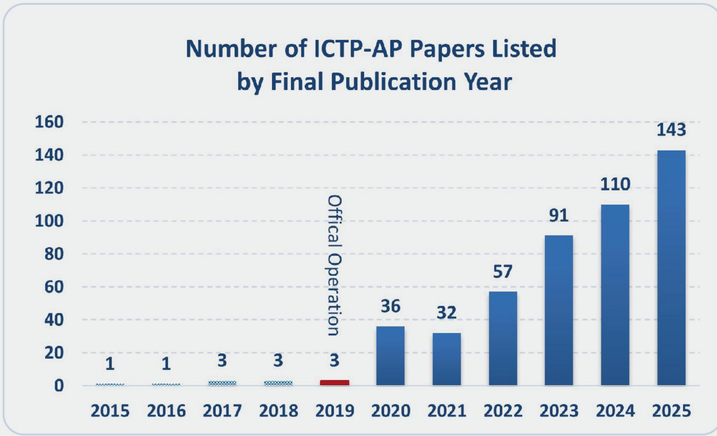
Currently, ICTP-AP has successfully concluded its first phase of collaboration with UNESCO, during which it accomplished established goals such as building a talent echelon, organizing academic activities, and establishing international exchange platforms, all of which have passed relevant evaluations. Building upon this foundation, the Centre has now launched its second phase of collaboration with UNESCO (2026–2034) to further advance its role in promoting basic scientific research and development in the Asia-Pacific region.

现阶段，中心汇聚了一批杰出的青年学者与专家，致力于多个前沿科学领域的探索与研究，主要分为以下研究小组：天体物理学与宇宙学、粒子物理唯象学、弦理论与量子引力、引力波实验物理学、计算物理与计算宇宙学，以及引力量子场论与统一理论。在接下来的几页里，可以阅读更多关于这些研究的内容。

At present, the Centre has gathered a group of outstanding young scholars and experts who are dedicated to exploring and studying multiple cutting-edge scientific fields, organized under the following main groups: Astrophysics and Cosmology, Phenomenology of Particle Physics, String Theory and Quantum Gravity, Gravitational Wave Experimental Physics, and Computational Physics and Cosmology, Gravitational Quantum Field Theory and Unification Theory. Read more about these research lines on the following pages.

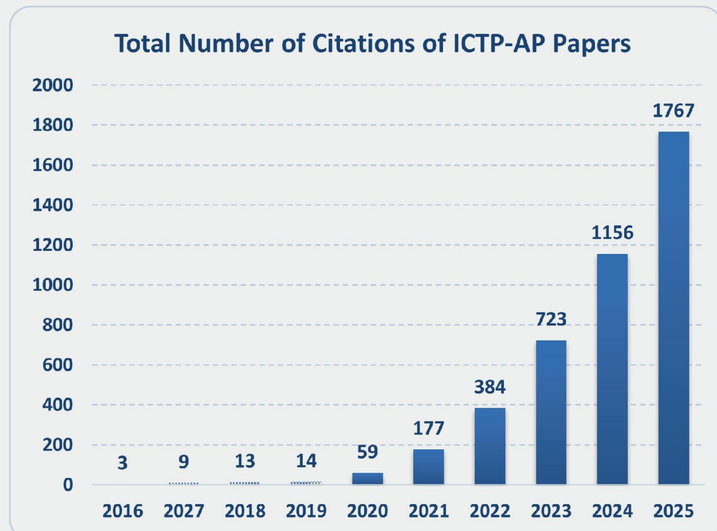
2015-2025 ICTP-AP 每年发表文章的数量

NUMBER OF ICTP-AP PAPERS LISTED BY FINAL PUBLICATION YEAR

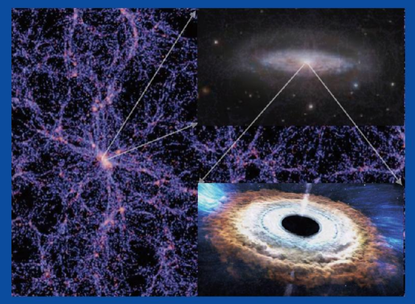


2016-2025 ICTP-AP 每年文章的引用量

TOTAL NUMBER OF CITATIONS OF ICTP-AP PAPERS



Research Direction: Astrophysics and Cosmology
天体物理学和宇宙学



The research direction of astrophysics and cosmology at ICTP-AP focuses on the early Universe, black holes, general properties of gravitational effective field theories, and dark matter particle astrophysics.

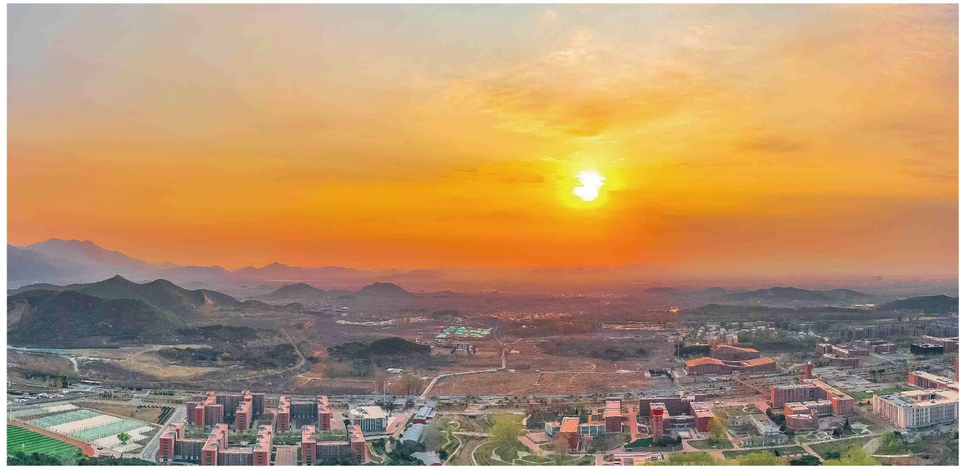
ICTP-AP的天体物理和宇宙学研究方向主要聚焦于早期宇宙、黑洞、引力有效场论的一般性质以及暗物质粒子天体物理学。

Researchers in this direction investigate the black hole superradiance process, with particular emphasis on how interactions among different dark-sector particles affect superradiance and the black hole evolution. These studies provide a theoretical foundation for probing ultralight dark bosons through black hole observations.

该研究方向的研究人员主要研究了黑洞超辐射过程，特别是不同暗粒子之间的相互作用对于超辐射过程以及黑洞演化的影响；研究结果为通过观测黑洞探测超轻暗玻色子提供了理论基础。

Future research interest in this direction involves exploring new approaches of probing dark matter and gravitational theories beyond GR with current and upcoming experiments, such as gravitational wave observations and sky survey. Given the rapid advancements in astronomical observations and deep-space missions, it is crucial to maintain a comprehensive perspective on the broader landscape of fundamental physics.

该方向的未来研究兴趣涉及探索暗物质和超越广义相对论的引力理论的新方法，这将通过当前和即将进行的实验来实现，例如引力波观测和巡天项目。鉴于天文观测和深空任务的快速发展，保持对基础物理学更广泛领域的全面视角至关重要。



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01 X. Y. Chu, M. Nikolic, and J. Pradler, Successful Freeze-Out of Strongly Interacting Dark Matter with Even-Numbered Interactions. Phys. Rev. Lett. 133 (2024), 021003.
DOI: 10.1103/PhysRevLett.133.021003

02 M. C. Chen, H. Y. Liu, Q. Y. Zhang, J. Zhang, Probing massive fields with multiband gravitational-wave observations. Phys. Rev. D 110 (2024), 064018.
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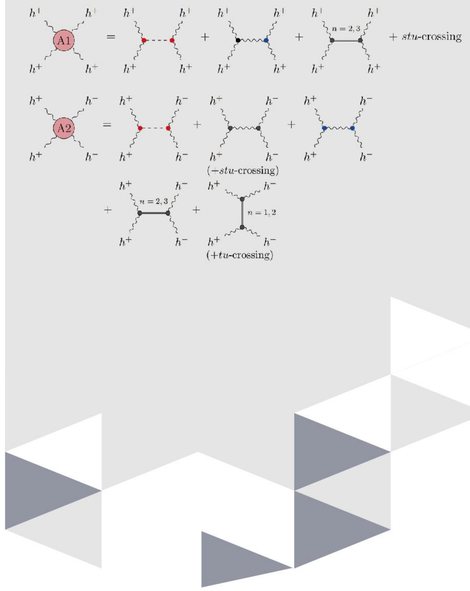
DOI: 10.1088/1674-4527/ad683d

05 J. B. He, H. L. Deng, Y. S. Piao, and J. Zhang, Implications of GWTC-3 on primordial black holes from vacuum bubbles. Phys. Rev. D 109 (2024), 044035.
DOI: 10.1103/PhysRevD.109.044035

06 H. Y. Liu, Y. S. Piao, and J. Zhang, Probing higher-spin particles with gravitational waves from compact binary inspirals. Phys. Rev. D 109 (2024), 024030
DOI: 10.1103/PhysRevD.109.024030

Research Direction: **Phenomenology of Particle Physics**

粒子物理唯象



Phenomenology of particle physics is an important research direction of theoretical physics that bridges the gap between fundamental theories and experimental observations. This research direction at ICTP-AP focuses on the study of collider phenomena, new physics beyond the Standard Model, effective field theories, and innovative frameworks S-matrix bootstrap to explore the fundamental nature of particle interactions, and strong CP problem.

粒子物理唯象是理论物理的一个重要研究方向，它架起了基本理论与实验观测之间的桥梁。ICTP-AP的这个研究方向专注于研究对撞机现象、标准模型之外的新物理、有效场理论，以及S矩阵自举这一创新框架，以探索粒子相互作用的基本性质和强相互作用问题。

While the Standard Model has been highly successful in explaining particle physics at lower energy scale, it leaves several fundamental questions unanswered, such as the nature of dark matter, the hierarchy problem and Strong CP. Currently, there is no signal of new physics, indicating the energy scales of new physics maybe be much higher than current collider energies. Effective Field Theory (EFT) provides a powerful framework to describe their effects at lower energy scale.

虽然标准模型在解释低能量尺度下的粒子物理学方面非常成功，但仍有一些基本问题未得到解答，例如暗物质的性质、层级问题和强相互作用。目前，尚未观测到新物理现象的迹象，这可能意味着新物理现象可能发生在比现有对撞机所能提供的能量更高的能区。在这种情况下，有效场论（EFT）提供了一个强有力的工具，它允许我们在低能量尺度上探讨新物理效应。

The researchers in this direction are trying to explore the other new physics theories to understand these puzzles in a better way, such as finding new solutions to solve strong CP problem and studying new dark matter theory. Additionally, the group is exploring how to use on-shell amplitude method to simplify the EFT calculations. The group also implements novel method, such as S-matrix bootstrap, to explore the space of possible quantum field theories, to understand strong dynamics and gravity scattering amplitudes, and to investigate the properties of both known and hypothetical particles.

这个方向的研究人员正在努力研究除现有理论以外的新物理理论，以便更深入地解开物理学中的未解之谜，例如通过寻找强CP问题的新解、研究新的暗物质理论等。此外，该小组还研究如何使用在壳振幅方法来简化有效场论（EFT）的计算。该小组也在使用S矩阵自举等创新方法，以探索可能的量子场论参数空间，理解强相互作用和引力散射振幅，以及分析真实和假想粒子的特性。

Publication Highlights

01 C. Csaki, T. Ma, J. Shu, Trigonometric Parity for Composite Higgs Models. Phys. Rev. Lett. 121 (2018), 231801.
https://doi.org/10.1103/PhysRevLett.121.231801

02 C. Csaki, C.-S. Guan, T. Ma, J. Shu, Twin Higgs with exact Z2. JHEP 12 (2020) 005.
https://doi.org/10.1007/JHEP12(2020)005

03 T. Ma, J. Shu, M.-L. Xiao, Standard model effective field theory from on-shell amplitudes. Chin. Phys. C47 (2023), 023105.
https://doi.org/10.1088/1674-1137/aca200

04 H. K. Liu, T. Ma, Y. Shadmi, M. Waterbury, An EFT hunter's guide to two-to-two scattering: HEFT and SMEFT on-shell amplitudes. JHEP 05 (2023), 241.
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05 T. Ma, A. Pomarol, F. Sciotti, Bootstrapping the chiral anomaly at large Nc. JHEP 11 (2023), 176.
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Research Direction:
String Theory and Quantum Gravity
弦理论和量子引力

String theory, which aims to unify general relativity and quantum mechanics, could be used to describe spacetime under extreme conditions, such as near a black hole or the big bang singularity, where quantum gravitational effects are significant.

弦理论旨在统一广义相对论和量子力学，可以用来描述极端条件下的时空，比如黑洞附近或大爆炸奇点，这些地方的量子引力效应非常重要。

The researchers in the String Theory and Quantum Gravity group broadly studied the formal aspects of high energy physics and gravity theory, with a focus on the physics of quantum black holes, strongly coupled quantum field theories, and the fundamental principles of holographic correspondence. They try to apply advanced techniques from quantum field theory and string theory to some physical problems that can be performed and observed in experiments and laboratories.

弦论和量子引力小组的人员广泛研究高能物理和引力理论的形式理论方面，重点研究量子黑洞的物理、强耦合量子场论，以及全息对应的基本原理。他们尝试将量子场论和弦论中的先进技术应用于可以在实验和实验室中进行和观察的一些物理问题。

In recent years, the researchers in this direction studied quantum gravity effects in the near-horizon region of black holes and their implications for the AdS/CFT correspondence. Recent research results in this area include quantum gravity-corrected strange metals, quasi-normal modes of near-extremal black holes, and fluid dynamics. For instance, they found that the celebrated lower bound 1/4 π for the ratio of shear viscosity to entropy density in normal fluids can be modified by quantum gravity corrections.

近年来，该方向研究人员研究了黑洞近视界区域的量子引力效应及其对AdS/CFT对应的启示。近期在这一方向的研究成果包括量子引力修正的奇异金属、近极端黑洞准正模式、流体力学。例如，他们发现正常流体剪切黏度和熵密度的著名的比值下限1/4 π就被量子引力修正所改变。

Publication Highlights

01 A. Amariti, J. Nian, L. A. P. Zayas, and A. Segati, Universal Cardy-like behavior of 3D partition functions from supersymmetric localization. Nucl. Phys. B 1018 (2025) 117045. https://doi.org/10.1016/j.nuclphysb.2025.117045

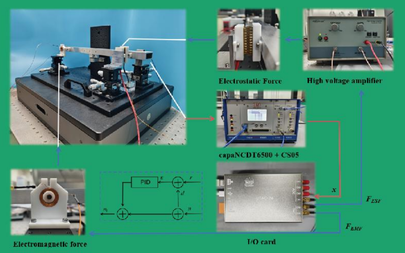
02 Z. Jiang, J. Nian, S. Cai, Y. Tian, and H. Zhang, Quantum Gravity Corrections to the Scalar Quasi-Normal Modes in Near-Extremal Reissener-Nordström Black Holes, arXiv:2506.22945, Phys. Rev. D 112 (2025) 12, 126019.

03 J. Nian, C. Y. Yue, and L. A. Pando Zayas, Quantum Corrections in the Low-Temperature Fluid/Gravity Correspondence, arXiv:2510.15411. https://doi.org/10.1103/s27b-58gw

04 S. Cremonini, L. Li, X. L. Liu, and J. Nian, Quantum Corrections to η/s from JT Gravity, arXiv:2510.21602.

05 J. Nian, L. A. Pando Zayas, and W. Zheng, Explorations of Universality in the Entropy and Hawking Radiation of Non-Extremal Kerr AdS4 Black Holes, arXiv:2508.05322.

Research Direction:
Gravitational Wave Experimental Physics
引力波实验物理



People in the direction of gravitational wave experimental physics at ICTP-AP conduct experimental research on the detection of gravitational waves, with affiliations to two major experimental collaborations in the world: Taiji and LIGO, which target relatively low and high frequency range respectively.

该研究方向的研究成员开展了引力波探测的实验研究，并参与了世界上两个主要的实验合作项目：太极计划和LIGO。这两个项目分别针对相对较低和较高频率范围的引力波探测。

The Taiji team conducts R&D in preparation for gravitational wave detection in space, which targets the millihertz frequency range. Their work includes developing hardwares such as high precision propulsion technologies operating at the micro-Newton level. Recent research has achieved the enhancement of dynamic resolution of micro-thrust vibration isolation and the design of ultra-low frequency and quasi-zero stiffness vibration isolation systems. They also work on data analysis techniques and build pipelines to detect various important targets such as supermassive black hole mergers, extreme mass ratio inspirals, stochastic background of gravitational waves, etc.

太极团队正在进行空间引力波探测的技术研发，目标是探测毫赫兹频段的引力波。他们的工作包括开发硬件，如在微牛顿级水平上运行高精度的推进技术。近期的研究已实现隔振对推力动态分辨率的增强以及超低频与准零刚度隔振的设计。此外，他们还致力于数据分析技术的研究，并构建用于探测各种重要目标的软件系统，例如超大质量黑洞并合、极端质量比旋进、随机引力波背景等。

The LIGO group works on data analysis techniques, and develops specialized algorithms and pipelines to extract key information regarding the nature of our universe from LIGO's data. They try to answer fundamental questions such as: what is the nature of dark matter? why is there more matter than anti-matter in our universe?

LIGO团队致力于数据分析技术的研究，并开发专门的算法和软件，以从LIGO的数据中提取关于宇宙本质的关键信息。他们试图回答一些基本的问题，例如：暗物质的本质是什么，宇宙中为何正物质比反物质多?

Publication Highlights

01 H. K. Guo, K. Sinha, D. Vagie, G. White, Phase transitions in an expanding universe: stochastic gravitational waves in standard and non-standard histories. J. Cosmol. Astropart. P. 1 (2021).
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04 H. K. Guo, K. Riles, F. W. Yang, Yue Zhao, Searching for Dark Photon Dark Matter in LIGO O1 Data. Commun. Phys., 155 (2019).
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08 LIGO Scientific and VIRGO and KAGRA Collaborations, Direct multi-model dark-matter search with gravitational-wave interferometers using data from the first part of the fourth LIGO-Virgo-KAGRA observing run, arxiv:2510.27022

09 LIGO Scientific and VIRGO and KAGRA Collaborations, Cosmological and High Energy Physics implications from gravitational-wave background searches in LIGO-Virgo-KAGRA's O1-O4a runs, arxiv:2510.26848

10 Shuo Guan, Huai-Ke Guo, Dian Jiao, Qingyuan Liang, Lei Wu, Yang Zhang, Measuring Gravitational Wave Spectrum from Electroweak Phase Transition and Higgs Self-Couplings, arxiv:2511.00996

11 Qingyuan Liang, Ligong Bian, Huai-Ke Guo, Yongcheng Wu, Bayesian Analysis of the Complex Singlet Model with Phase Transition Gravitational Waves, arxiv:2511.21488

Research Direction:
Computational Physics and Cosmology
计算物理和计算宇宙

Advanced data analysis and machine learning have become central to modern gravitational-wave (GW) research. Deep learning methods are now widely used across the GW analysis pipeline, particularly for denoising, feature extraction, and signal classification in complex and non-stationary noise environments. These approaches significantly enhance detection sensitivity and robustness, complementing traditional matched-filtering and Bayesian techniques.

先进的数据分析与机器学习技术已成为现代引力波研究的重要支撑。深度学习方法被广泛应用于引力波数据分析流程中，尤其在非平稳噪声背景下的信号降噪、特征提取与分类等方面表现突出。这些方法有效提升了引力波探测的灵敏度与稳健性，并与传统的匹配滤波和贝叶斯分析方法形成互补。

Recent research has increasingly focused on applying advanced machine learning methods to space-based GW detection and analysis. Future detectors such as LISA, Taiji, and TianQin will face major challenges, including overlapping sources, time-varying noise, and long-duration observations. To address these issues, machine learning techniques are being integrated into waveform modeling, noise characterization, and parameter inference. For example, neural networks have been employed to accelerate waveform generation, improve noise classification, and guide Bayesian inference through learned representations or priors. These AI-driven strategies improve the efficiency and accuracy of global fitting and parameter estimation in the demanding environment of space-based GW observatories, enabling more reliable extraction of weak signals.

近年来，研究重点逐步转向空间引力波探测中的机器学习应用。未来的空间探测计划（如LISA、太极和天琴）将面临信号高度叠加、噪声随时间变化以及超长观测时段等挑战。为应对这些问题，研究者将机器学习方法引入波形建模、噪声表征和参数反演等关键环节。例如，神经网络被用于加速波形生成、改进噪声分类以及辅助贝叶斯推断，从而提升全局拟合与参数估计的效率与精度。这些方法为在复杂空间探测环境中可靠提取微弱引力波信号提供了有力工具。

Looking ahead, gravitational-wave observations will be increasingly combined with other astrophysical probes to study dark matter and test physics beyond general relativity. Gravitational-wave “standard sirens” provide calibration-free distance measurements that complement electromagnetic observations, enabling improved cosmological inference. Machine learning techniques have also demonstrated the ability to identify non-standard or beyond-GR waveform signatures that may be missed by conventional template-based searches. By integrating GW data with multi-messenger observations—such as fast radio bursts, 21 cm intensity mapping, and strong gravitational lensing—researchers can break parameter degeneracies and achieve more precise constraints on cosmology, opening new avenues for discoveries in fundamental physics and astrophysics.

展望未来，引力波观测将与其他天文观测手段深度融合，用于探测暗物质并检验广义相对论以外的新物理。引力波“标准铃声”为宇宙距离测量提供了无需电磁标定的独立手段，有助于提高宇宙学参数推断的精度。同时，机器学习方法已展现出识别非标准或非广义相对论波形信号的潜力。通过联合多信使观测数据（如快速射电暴、21厘米强度测绘和强引力透镜等），可以有效打破宇宙学参数之间的退化关系，为基础物理和宇宙学研究开辟新的发现空间。

Publication Highlights

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03 Jun Tian, He Wang*, Jibo He*, Yu Pan, Shuo Cao, and Qingquan Jiang*. “Learning and Interpreting Gravitational-Wave Features from CNNs with a Random Forest Approach.”Machine Learning: Science and Technology. 6 035045. e-Print: arXiv:2505.20357 [gr-qc]

04 Hui Sun*, He Wang*, and Jibo He*. “Accelerating Bayesian Sampling for Massive Black Hole Binaries with Prior Constraints from Conditional Variational Autoencoder.”Physical Review D 111(10), 103053. e-Print: arXiv:2502.09266 [gr-qc]

05 Yu-Xin Wang, Xiaotong Wei, Chun-Yue Li, Tian-Yang Sun, Shang-Jie Jin, He Wang*, Jing-Lei Cui, Jing-Fei Zhang, and Xin Zhang. “Search for Exotic Gravitational Wave Signals beyond General Relativity Using Deep Learning.”Physical Review D 112 (2), 024030. e-Print: arXiv:2410.20129 [gr-qc]

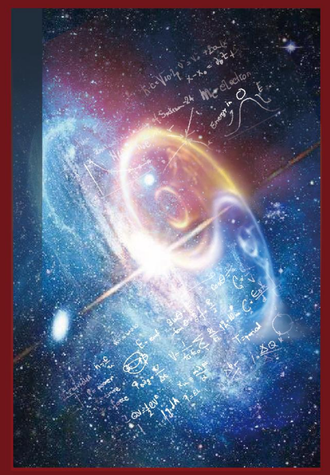
06 Yuxiang Xu, He Wang*, Minghui Du*, Bo Liang, and Peng Xu. “Gravitational Wave Signal Denoising and Merger Time Prediction By Deep Neural Network.”Physical Review D 111 (6), 063037. e-Print: arXiv:2410.08788 [gr-qc]

07 H. Wang, M. H. Du, P. Xu, and Y. F. Zhou, Challenges in Space-Based Gravitational Wave Data Analysis and Applications of Artificial Intelligence. Sci. Sin.-Phys. Mech. As. 54 (2024): 270403. DOI: 10.1360/SSPMA-2024-0087

08 H. Wang, Y. Zhou, Z. J. Cao, Z. K. Guo, and Z. X. Ren, WaveFormer: Transformer-Based Denoising Method for Gravitational-Wave Data. Mach. Learn.: Sci. Technol. 5 (2024). DOI: 10.1088/2632-2153/ad2f54

Research Direction:
Gravitational Quantum Field Theory and Unification Theory

引力量子场论和统一理论



Based on the framework of gravitational quantum field theory (GQFT), a general theory of the standard model with conformal inhomogeneous spin gauge symmetry is proposed, with massive dark graviton as the dark matter candidate [1]. It is also shown that one essential property in GQFT is energy-momentum tensor vanishes when equations of motion are imposed on all fundamental fields [2]. Furthermore, the production and detection of gravitational waves with scalar, vector and tensor polarizations are investigated in details [3], which exhibits explicit phenomena beyond general relativity. Additionally, both analytical and numerical solutions of the energy spectrum [4] are given for fermions near a spherically black hole by solving the first-order generalized Dirac equation, improving previous results. For the detection of monochromatic signals of gravitational-wave in Taiji, a proposal is initiated for the construction of null-response channels [5].

基于4维引力量子场论（gravitational quantum field theory，GQFT）的理论框架，提出了一种具有共形非齐次自旋规范对称性的标准模型一般化理论，指出其中有质量的暗引力子可被视为暗物质候选者[1]。同时还表明，在GQFT中存在一个本质性质：当对所有基本场施加其运动方程时，能动张量恒为零[2]。此外，后续文中更加详细研究了此类理论中具有标量、矢量和张量偏振的引力波的产生与探测问题[3]，展示了超越广义相对论的明确物理现象。另一方面，通过求解一阶广义狄拉克方程，给出了球对称黑洞附近费米子的能谱的解析解与数值解[4]相较于以往结果得到了显著改进。最后，针对空间引力波探测器太极中单色引力波信号的探测，提出了一种构建零响应通道（null-response channels）的方案 [5]。

Publication Highlights

01 Yue-Liang Wu, A general theory of the standard model and the revelation of the dark side of the universe. Science Bulletin 70 (2025) 1740–1744
https://doi.org/10.1016/j.scib.2025.03.026

02 Yue-Liang Wu, Gravitization equation and zero energy momentum tensor theorem with cancellation law in gravitational quantum field theory, Phys. Lett. B 868 (2025) 139689
https://doi.org/10.1016/j.physletb.2025.139689

03 Yuan-Kun Gao, Da Huang, Yue-Liang Wu, Gravitational wave generation and detection in gravitational quantum field theory, Eur. Phys. J. C (2025) 85:1159.
https://doi.org/10.1140/epjc/s10052-025-14889-1

04 G.-S. Chen, et al, Revisiting the fermionic quasibound states around Schwarzschild black holes with improved analytic spectrum, Phys. Rev. D 111, 125006 (2025)
https://doi.org/10.1103/jjlq-k5c2

05 H.-T. Xu, et al, Distinguishing monochromatic signals in LISA and Taiji: Ultralight dark matter versus gravitational waves, Phys. Rev. D 112, 095021 (2025)
https://doi.org/10.1103/xlqy-r6n3

Talent Development

ICTP-AP will introduce and cultivate relevant researchers in alignment with the Centre's strategic development plan, to enhance its research capacity and achieve its research objectives. This year, one new tenured-track assistant professor and six postdocs (including three foreign postdocs) have joined us.

ICTP-AP has attached great importance to the cultivation of young scientists and worked to create a favorable academic environment for young talents while providing support for them to apply for talent programs. In 2025, two postdoctoral researchers from the Centre, An Chen and Ping He, were awarded funding from General Program grants of the China Postdoctoral Science Foundation.

ICTP-AP就中心发展规划引进和培养相关科研人员，提升中心的科研能力，实现科研目标。今年，中心新加入一位外籍长轨助理教授，六名博士后(其中三名外籍博后）。

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。2025年，中心的陈安和何平两名博后获得了博士后面上项目资助。

Our New Member (新成员)

Andrew Miller

Tenure-track assistant professor

Research Interests (研究兴趣):

Gravitational wave physics and particle dark matter searches

Searches for gravitational waves with LIGO, Virgo and KAGRA from

- Deformed, isolated neutron stars
- Sub-solar-mass ultra-compact binaries, e.g. primordial black holes
- Remnants of supernovae or binary-neutron-star mergers
- Mini-extreme-mass-ratio inspirals (mini-EMRIs)
- Boson clouds around rotating black holes

Primordial black holes

- Constraining the existence of asteroid-mass and planetary-mass primordial black
- holes with gravitational waves

Direct dark-matter detection with gravitational-wave interferometers

- Interaction of vector dark photon dark matter with baryons in LIGO mirrors
- Interaction of scalar, dilaton dark matter with electrons and photons in LIGO
- Impact of tensor dark matter on the interferometers

Machine learning

- Developing methods to detect long-lived gravitational waves from isolated neutron stars
- Developing techniques to generate, identify and mitigate glitches for glitches

Developing data analysis methods for future gravitational-wave detectors

- Looking for the long-lived inspirals of binary neutron stars
- Characterizing the impact of nonstationary noise on LISA/Taiji data analysis for white-dwarf binaries and other sources

2025 Joined Postdocs (博士后)

An Chen (陈安)

Graduation School: Queen Mary University of London
Research Area:
Gravitational wave cosmology; tests of gravity; cosmography with gravitational lensing; gravitational wave cosmology; tests of gravity; cosmography with gravitational lensing.

Mahdis Ghodrati

Graduation School:
University of Michigan, Ann Arbor
Research Area:
AdS/CFT, Holography, Black hole physics

Ping He (何平)

Graduation School: Peking University
Research Area:
Detection of wave-like dark matter based on quantum sensor networks

Wenbin Zhao (赵文斌)

Graduation School: University of Bonn
Research Area:
Inflation; leptogenesis; gravitational waves; dark matter; supers ymmetry; modular symmetry

Ajay Kaladharan

Graduation School: Oklahoma State University
Research Area:
Cosmological phase transition and gravitational waves, baryogenesis and leptogenesis, neutrino physics, dark matter, particle cosmology and astroparticle physics, quantum tomography, collider physics and machine learning

Joana Velasco Cristian

Graduation School: University of Louvain, Belgium
Research Area:
Research on primordial black holes and gravitational waves

Visiting Scientists (访问学者)

To enhance the international development of the Centre and foster a more robust international academic atmosphere, ICTP-AP warmly welcomes visiting scholars from all over the world to conduct academic exchange and cooperation.

为加强中心国际化建设，提高中心国际化科研氛围，中心长期欢迎访问学者来中心开展学术交流与合作。

Yassine是一名三个月前加入ICTP-AP的博士生。基于过去三个月的生活与科研经历，他对中心做出了全面而积极的评价。以下是他分享的感想：

“此前我曾攻读意大利ICTP的研究生文凭，这段经历让我亲身感受了该机构的学术氛围与国际影响力。正因如此，我更能体会到ICTP-AP在建设充满活力的国际研究中心方面取得的显著进展。中心正朝着正确方向快速发展，既营造了高度包容协作的学术环境，又展现出与ICTP同样的卓越精神和全球视野——这种特质始终令人深受鼓舞。

我近期参与的ICTP-AP冬季学校堪称这段经历的亮点。这场汇聚全球教授与青年学者的活动，让我亲眼见证了中心推动国际合作与知识交融的坚定承诺。中心工作人员和博士后们的支持与交流也令我倍感温暖，他们始终亲切友善、乐于助人，让我感受到真正的归属感。

特别要感谢我的导师储晓勇教授。他不仅在我初抵中国时给予无微不至的帮助，更在科研道路上持续提供宝贵指导。目前我在他的带领下开展暗物质领域的前沿研究，这些激动人心的课题让我首次接触到顶尖水平的科研工作。这既是提升学术能力的珍贵机遇，也是为尖端领域贡献力量的难得平台。导师深刻的科学洞察力与严谨治学态度令我由衷钦佩，也激励我在未来努力攀登学术高峰。

总而言之，ICTP-AP营造了一个激发灵感、包容多元且支持有力的科研环境，在这里既能实现学术成长，又能深化国际合作。能成为这个充满活力与感召力的学术共同体的一员，我深感荣幸。”

Yassine is a PhD student who joined ICTP-AP three months ago. Based on his three-month living and research experience, Yassine provided a comprehensive and positive evaluation of the Centre. The following is his feedback:

"Previously, I was enrolled in the postgraduate diploma program at ICTP in Italy, which gave me the opportunity to experience its academic environment and international reach. From this perspective, I can truly appreciate the remarkable progress ICTP AP has made in establishing itself as a vibrant international research center. The center is rapidly evolving in the right direction, fostering a highly inclusive and collaborative environment while demonstrating the same spirit of excellence and global engagement that makes ICTP so inspiring.

A highlight of my experience has been the recent winter school organized by ICTP AP, which brought together professors and young researchers from around the world. Participating in this event allowed me to witness firsthand the center's commitment to international collaboration and the exchange of knowledge. I have also greatly appreciated the support and interactions with the center's staff and postdoctoral researchers, who have been consistently approachable, helpful, and welcoming.

In particular, my advisor, Professor Xiaoyong Chu, has provided invaluable guidance, assisting me personally with settling in China and offering continuous mentorship in my research. Under his supervision, I am currently working on exciting projects in dark matter, an area at the forefront of fundamental research. These projects represent my first experience in toptier research and provide an exceptional opportunity to develop my skills while contributing to a cutting-edge field. I deeply admire my advisor's scientific insight and professionalism and aspire to reach a similar level of academic excellence in the future.

Overall, ICTP AP offers a stimulating, inclusive, and highly supportive research environment that fosters both scientific growth and international collaboration. I feel privileged to be part of such a vibrant and inspiring community."

Visiting Scholars

Post Doctor Chen Sun, from ICTP

Post Doctor Neeraj Kumar, from S.N. Bose National Centre for Basic Sciences

Post Doctor Giovanni Maria Tomaselli, from Institute for Advanced Study

Prof. Wei-Tou Ni, from National Tsing Hua University

Post Doctor Vishwanath Barve, from IFERP

Prof. Yue Zhao, from University of Utah

Prof. Huayong Han, from Guizhou University of Finance and Economics

Prof. Camilo Garcia Cely, from University of Valencia, Spain

Prof. Bo Wang, from Ningxia University

Prof. Yakefu Reyimuaji, from Xinjiang University

Prof. Richard Brito, from Instituto Superior Técnico

Prof. Giacomo Cacciapaglia, from LPTHE

Prof. Zheng-Wen Liu, from Southeast University

Prof. Shinji Mukohyama, from YITP, Kyoto University & RESCEU, University of Tokyo

Prof. Marek Szczepanczyk. from University of Warsaw

Prof. Anna Tokareva, from HIAS

Prof. Pep Covas Vidal, from Universität de les Illes Baleares

Prof. Giovanni Villadoro, from ICTP

Prof. Shuang-Yong Zhou, from University of Science and Technology of China

Prof. Ye-Ling Zhou, from HIAS

Prof. Bin Chen, from Ningbo University/Peking University

Prof. Heng Wen, from IHNS, CAS

Prof. Gengliang Li, from Putian University

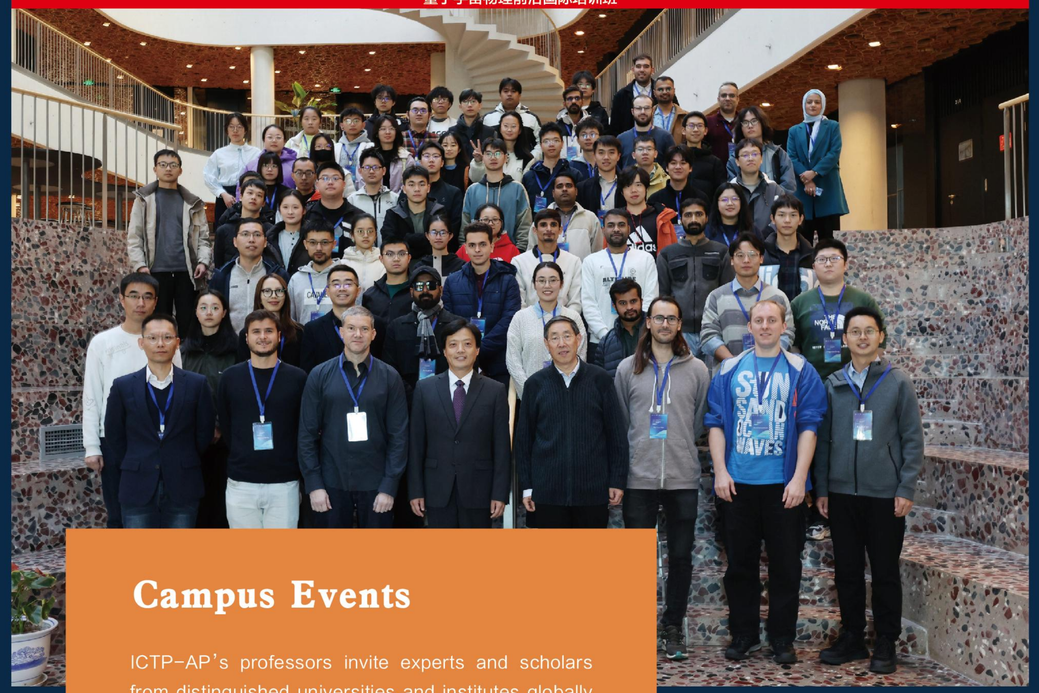
Exchange Students

- Jiaju Li, from Xi'an Jiaotong University
- Yi Li, from Sichuan University
- Xingyu Chen, from University of Chinese Academy of Sciences
- Ruhan Rao, from Tianjin University
- Jianxing Lu, from Southern University of Science and Technology
- Qingyi He, from University of Oxford

ICTP-AP Activities

Scientific Activities
学术活动

International Training Workshop on Frontiers of Quanta to Cosmos Physics
量子宇宙物理前沿国际培训班



Campus Events

ICTP-AP's professors invite experts and scholars from distinguished universities and institutes globally to deliver reports on the ICTP-AP Winter School on Theoretical Physics, aiming at conducting academic exchange and teaching students the cutting-edge hot spots and research methods in fields around theoretical physics.

中心的教授们邀请来自全球知名大学和研究所的专家学者到ICTP-AP冬季学校做报告，旨在向学生介绍理论物理领域的最新热点和研究方法，并促进学术上的交流和合作。

International Training Workshop on Frontiers of Quanta to Cosmos Physics & the Second ICTP-AP Winter School on Theoretical Physics

From November 1 to November 14, 2025, the International Training Workshop on Frontiers of Quanta to Cosmos Physics and the second ICTP-AP Theoretical Physics Winter School were successfully held in both Beijing and Hangzhou. The event focused on cutting-edge topics in particle physics, gravity, and cosmology, with an emphasis on the applications and advances of effective field theory in areas such as quantum field theory, dark matter detection, dark energy, and gravitational wave waveform construction, aiming to cultivate the next generation of research talents with a global perspective.

The training course brought together 15 experts from leading institutions both in China and abroad, including the University of Chinese Academy of Sciences, the Institute of Theoretical Physics of the Chinese Academy of Sciences, ICTP, and the University of Tokyo, who delivered 27 high-level academic lectures. The event attracted 33 outstanding young scholars from over ten countries worldwide, including China, the United States, Italy, Spain, and India. Through in-depth discussions centered on the lectures and their respective research, the participants effectively fostered international academic exchange and collaboration in the field.

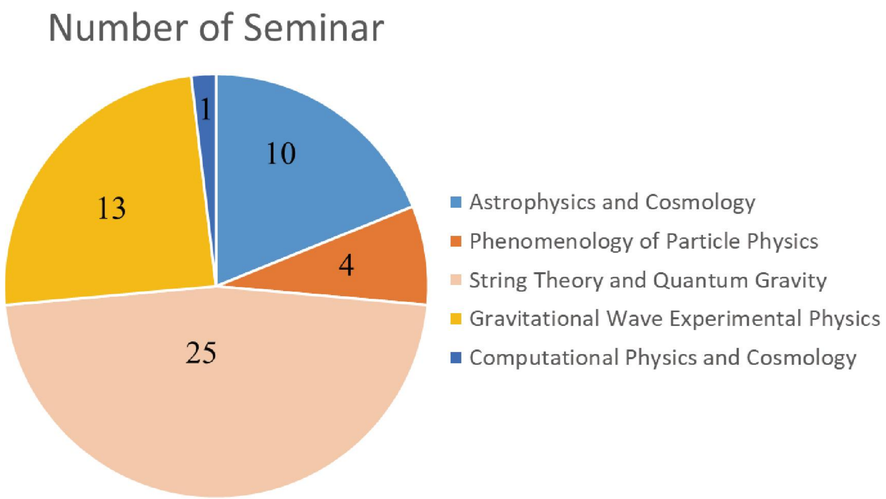
2025年11月1日至14日，“量子宇宙物理前沿”国际培训班暨ICTP-AP第二届理论物理冬季学校在北京和杭州两地圆满举行。本次活动聚焦粒子物理、引力和宇宙学前沿，重点探讨了有效场论在量子场论、暗物质探测、暗能量及引力波波形构建等领域的应用与进展，旨在培养具备国际视野的下一代科研人才。

培训班汇聚了来自中国科学院大学、中国科学院理论物理研究所、意大利ICTP、日本东京大学等国内外顶尖机构的15位专家，带来了27场高水平学术报告。活动吸引了来自中国、美国、意大利、西班牙、印度等全球十余个国家的33名优秀青年学者，围绕报告并结合各自研究展开了深入研讨，有效促进了该领域的国际学术交流与合作。

Seminars

To broaden students' academic horizons and keep them abreast of cutting-edge scientific developments, ICTP-AP's professors invite scholars from renowned universities and research institutions worldwide to deliver weekly academic lectures and engage in discussion. In 2025, the Centre organized a total of 53 seminars, inviting 52 speakers to share their latest research findings. Among them were 17 international scholars and 35 Chinese scholars. The distribution of their research fields is shown in the figure below; detailed speaker information is provided in the appendix.

为拓展学生学术视野、把握前沿科学动态，中心的教授每周邀请来自全球知名高校及研究机构的学者举办学术讲座并进行交流研讨。2025年，中心共组织53场学术研讨会，邀请了52位报告人参与分享他们最新的研究成果，其中包括17位外籍学者与35位中国学者。报告人的研究方向占比如下图所示。报告人信息见附件。



Off-Campus Events

In 2025, ICTP-AP organized a series of academic conferences aimed at promoting academic exchange, collaboration, and research development.

2025年，ICTP-AP举办了多次学术会议，旨在促进学术交流、学术合作和研究发展。

01 Frontier Forum on Gravitational Waves: Theory and Detection
“引力波：理论和探测”前沿论坛

The forum was successfully held from May 25 to May 30, 2025, at Qiandao Lake in Zhejiang Province. As a key prediction of Einstein's general theory of relativity, the detection and study of gravitational waves represent a cutting-edge hot topic in physics. This forum brought together renowned scholars from 33 universities and research institutions both domestically and internationally. They engaged in in-depth exchanges on frontier topics such as the precise calculation of gravitational wave waveforms and noise suppression in detection, fostering dialogue and collaboration between theoretical and experimental teams. The event has strengthened collective efforts and contributed to the further advancement of gravitational wave research in China.

论坛于2025年5月25日至30日在浙江千岛湖成功举办。作为爱因斯坦广义相对论的重要预言，引力波的探测与研究是物理学前沿热点。本次论坛汇聚了来自国内外33所高校及科研机构的知名学者，围绕引力波波形精确计算与探测噪声抑制等前沿课题展开深入交流，推动了理论与实验团队的对话和合作，为我国引力波研究的进一步发展凝聚了力量。

02 The 1st Workshop on Space-Based Gravitational Wave Data Analysis

第一届空间引力波科学数据分析研讨会

The Workshop was held in Beijing from August 6 to August 8, 2025. To promote substantial progress in space-based gravitational wave data analysis, the workshop focused on topics including space-based gravitational wave data challenges, galactic compact binaries, massive binary black holes, extreme mass-ratio inspirals, stochastic gravitational wave backgrounds, and AI-enabled gravitational wave data analysis.

会议于2025年8月6日至8月8日在北京举办。为推动空间引力波科学数据分析取得实质性进展，会议主要围绕空间引力波数据挑战、银河系致密双星、大质量双黑洞、极端质量比旋近、随机引力波背景以及AI赋能的引力波数据分析等议题展开。

03 Commemorating the Centennial of Quantum Mechanics: Historical Review and Future Perspectives—An International Symposium in Celebration of the "International Year of Quantum Science and Technology"

纪念量子力学百年华诞：历史回望与未来展望—“国际量子科技年”国际学术研讨会

The Symposium was held at the Southern University of Science and Technology from September 20 to September 21, 2025. It brought together renowned physicists, historians of science, philosophers, and researchers from related fields across seven countries, including China, Germany, the United States, Canada, Japan, and Denmark. Participants jointly reviewed the century-long journey of quantum mechanics, delving into its historical evolution and theoretical breakthroughs, examining its philosophical implications and societal impact, and looking ahead to the future development directions and potential applications of quantum technology.

本次研讨会于2025年9月20日至21日在南方科技大学举办，汇聚了来自中国、德国、美国、加拿大、日本、丹麦等七个国家的众多知名物理学家、科学史专家、哲学学者以及相关领域研究人员。与会学者共同回顾了量子力学走过的百年历程，不仅深入探讨其历史演进与理论突破，剖析其哲学意涵与社会影响，也展望了量子科技未来的发展方向与潜在应用。

04 2025 Gravitational wave Physics Symposium
2025引力波物理研讨会

The Symposium was successfully held from October 12 to October 20, 2025, at the "Two Mountains" High-Level Talent Hub in Chun'an County, Zhejiang Province. The event focused on gravitational wave astronomy, gravitational wave cosmology, gravitational waves and fundamental physics, gravitational wave data analysis, and related fields, facilitating in-depth academic exchanges and thematic discussions. It brought together over 110 scholars, postdoctoral researchers, and graduate students from more than 30 research institutions and universities, including Peking University, Tsinghua University, the National Astronomical Observatories of the Chinese Academy of Sciences, the University of Science and Technology of China, Beijing Normal University, and Ningbo University. Participants shared the latest research findings, discussed cutting-edge developments in the field, and engaged in fruitful academic exchanges and intellectual discussions.

本次研讨会于2025年10月12日至10月20日在浙江省淳安县“两山”高层次人才集聚区成功举办。会议聚焦引力波天文学、引力波宇宙学、引力波与基础物理、引力波数据分析等相关领域，开展了深入的学术交流与专题研讨。来自北京大学、清华大学、中国科学院国家天文台、中国科学技术大学、北京师范大学、宁波大学等三十多家科研机构和高校的学者、博士后和研究生共110多人参加了本次会议。与会人员分享了最新研究成果、解读了领域前沿动态，开展了富有成效的学术交流与思想碰撞。

05 The 4th Space Science Conference: the “Space-based Gravitational Wave Detection” session
第四届空间科学大会：空间引力波探测分论坛

The 4th China Space Science Conference was held in Beijing November 21 to November 24, 2025. Within the conference, the "Space-based Gravitational Wave Detection" session co-organized by the Centre and the Institute of Mechanics of the Chinese Academy of Sciences was successfully convened. The forum focused on gravitational wave science and detection missions, payload and satellite technologies, simulation, data-analysis techniques, and noise-reduction methods. Thirty-three experts and scholars were invited to present their latest research advances. The meeting aimed to stimulate academic exchange and cross-disciplinary collaboration, jointly advancing the disciplinary development and technological progress of space-based gravitational wave detection.

第四届中国空间科学大会于2025年11月21日至24日在北京举行。本次大会中，由中心和中国科学院力学研究所共同承办的“空间引力波探测”分论坛顺利召开。论坛围绕引力波科学与探测任务、载荷与卫星技术、仿真与数据分析及降噪技术等方向展开深入研讨，共邀请33位专家学者分享最新研究进展。此次会议旨在促进学术交流与跨界合作，共同推动空间引力波探测领域的学科发展与技术进步。

Public Outreach
公共活动

Throughout the year, ICTP-AP engages with the public through numerous outreach activities aimed at spreading the joy of science to the young and old.

在这一年中，ICTP-AP通过很多外展活动直接与公众接触，旨在向各年龄段的人群传播科学的乐趣。

Open Data Workshop 2025 Study Hubs

This online training program was held from May 13 to May 16, 2025, targeting researchers, engineers, and senior students in the field of gravitational wave studies worldwide, with a specific focus on members of the LIGO-Virgo-KAGRA collaborations and participants in space-based gravitational wave detection missions such as Taiji, LISA, and TianQin. The curriculum deeply integrates the course system of Open Data Workshop 2025 and the tasks of the Taiji Data Challenge (TDC), covering open data technology stacks, specialized modules for space detection, hands-on practice with tools including GWpy, PyCBC, and Triangle, as well as a GitHub-based open-source collaboration workflow. The training attracted over 17,000 participants online and aims to help learners systematically master the skills for accessing, processing, and analyzing gravitational wave data, enhance teamwork and complex problem-solving abilities, promote the alignment of research outcomes with international open science communities, and cultivate cross-institutional collaborative teams for future in-orbit data processing tasks in space-based gravitational wave detection.

本线上培训于2025年5月13日-16日举办，面向全球引力波研究领域的科研人员、工程师及高年级学生，重点面向LIGO-Virgo-KAGRA合作组成员及太极、LISA、天琴等空间引力波探测任务参与者。课程内容深度融合Open Data Workshop 2025课程体系与太极数据挑战（TDC）任务，涵盖开放数据技术栈、空间探测专项模、GWpy/PyCBC/Triangle等工具链实战以及基于GitHub的开源协作流程。培训吸引了超过1.7万名学员在线参与，旨在帮助学员系统掌握引力波数据的访问、处理与分析技能，提升团队协作与复杂问题解决能力，推动研究成果与国际开放科学社区对接，并为未来空间引力波在轨数据处理任务培育跨机构协作团队。

Undergraduate Admissions Talk

In 2025, a faculty member from the Centre joined the Henan admissions team and successively visited Qi County High School and Lankao No. 1 High School in Henan Province. During these visits, the team delivered a systematic introduction of the undergraduate admissions policies and personalized training features of UCAS to outstanding high school students.

2025年，中心老师参加河南招生组，先后前往河南杞县高中和兰考一高，面向高中优秀学生，系统介绍了国科大的本科招生政策与个性化培养特色。

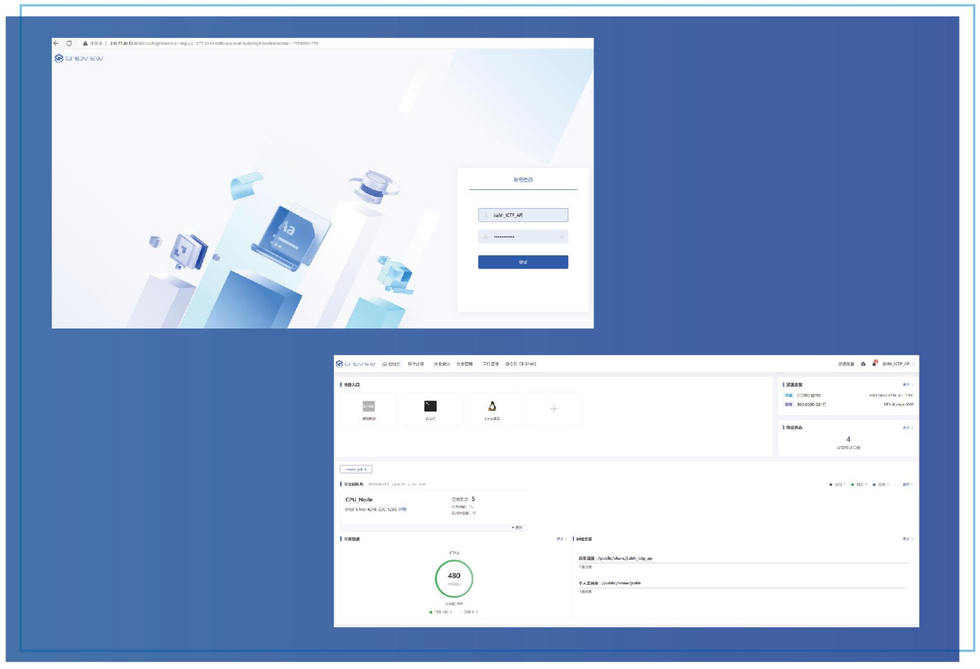
2025 Timeline

January

集群上线云桌面

2025年1月，中心集群服务器引入了Gridview统一登陆平台，在保留原有底层终端登陆的基础上，新增了web网页访问功能，在提升用户体验的同时方便服务器运维。

In January 2025, the Centre's cluster server introduced the Gridview unified login platform. While retaining the original underlying terminal login method, the platform added web-based access, enhancing user experience and facilitating server maintenance.



February

联合国教科文组织对中心工作进行评估

2025年2月，专家对中心近五年工作进行了调研和评估，并给予了积极评价。

In February 2025, experts conducted a comprehensive review and assessment of the Centre's work over the past five years, delivering highly positive feedback.

March

中心教职老师积极参与学校教学

2025年3月，中心教职老师积极参与到春季学期本科生和研究生的教学工作中。

In March 2025, faculty members of the Centre actively engaged in teaching of both undergraduate and graduate programs for the spring semester.

April

国际学生前沿与交叉科学春季学校

2025年4月22日-27日，在浙江杭州，46名来自8个国家的留学生参加了前沿与交叉科学春季学校。

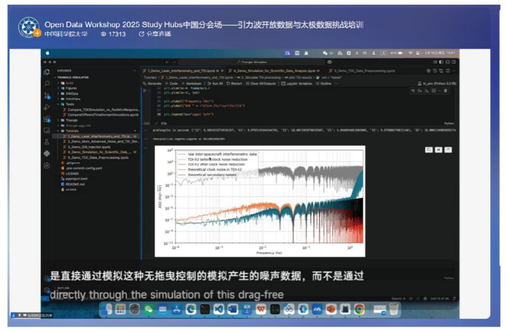
The 2025 Spring School on Frontier and Interdisciplinary Sciences was held at Hangzhou, Zhejiang Province during April 22 to April 27, 2025 with 46 international students from 11 countries participating.

May

引力波开放数据和TDC培训班

2025年5月13日至16日，中心组织了引力波开放数据和太极数据挑战的线上培训班，吸引超过17000多名学员在线参与。

From May13 to May16, 2025, ICTP-AP organized an online training workshop on gravitational wave open data and the Taiji data challenge, attracting over 17,000 participants.



“引力波：理论和探测”前沿论坛

2025年5月25日至30日，引力波：理论和探测”前沿论坛在浙江省杭州市淳安县千岛湖“两山”高层次人才集聚区成功举行。

From May 25 to May 30, 2025, the Frontier Forum on “Gravitational Waves: Theory and Detection” was successfully held at the “Two Mountains” High-Level Talent Cluster Area on Qiandao Lake, Chun’an County, Hangzhou, Zhejiang Province.

June

中心组织师生参加了龙舟赛

2025年6月，中心组织师生参与了第三届中国科学院大学龙舟赛，丰富了大家的校园文化生活。

In June 2025, the Centre organized faculty and students to participate in the Third Dragon Boat Race of University of Chinese Academy of Sciences, enriching their campus cultural life.

July

ICTP-AP 2025年优秀大学生夏令营

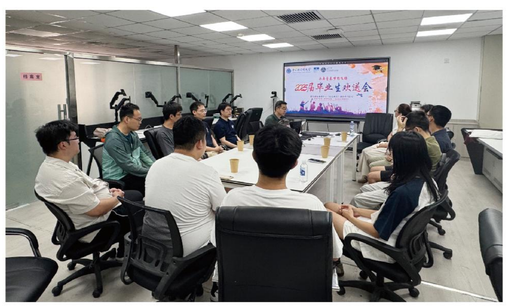
ICTP-AP 2025年优秀大学生夏令营于7月3日-7月8日在中国科学院大学中关村校区举办。

From July 3 to July 8, 2025, the ICTP-AP 2025 Summer School was held in the Zhongguancun Campus, UCAS.

中心组织毕业生欢送会

2025年7月8日，中心举办了毕业生欢送会，庆祝他们顺利完成学业，迈入人生新阶段。

On July 8, 2025, the Centre held a farewell party for the graduates to celebrate their successful completion of studies and the beginning of a new chapter in their lives.



August

第一届空间引力波科学数据分析研讨会

2025年8月6-8日，第一届空间引力波科学数据分析研讨会在北京成功举办。

From August 6 to August 8, 2025, the first Space Gravitational Wave Science Data Analysis Symposium was successfully held in Beijing.

September

纪念量子力学百年华诞：历史回顾与未来展望—“国际量子科学技术年”国际学术研讨会

2025年9月20-21日，纪念量子力学百年华诞：历史回顾与未来展望—“国际量子科学技术年”国际学术研讨会在深圳成功举办。

From September 20 to September 21, 2025, the “International Year of Quantum Science and Technology”Academic Symposium on celebrating the centennial of quantum mechanics: a historical review and prospects was successfully held in Shenzhen.

October

2025引力波物理研讨会

2025年10月12日至20日，引力波物理研讨会在浙江省淳安县“两山高层次人才聚集区”成功举办。

From October 12 to October 20, 2025, the Gravitational Wave Physics Workshop was successfully held at the “Two-Mountains High-Level Talent Cluster Zone” in Chun’an County, Zhejiang Province.

November

“量子宇宙物理前沿”国际培训班

2025年11月1日至14日，“量子宇宙物理前沿”国际培训班暨第二届ICTP-AP理论物理冬季学校，在北京和杭州两地顺利举办，来自中国、美国、意大利、西班牙、阿尔及利亚、巴基斯坦等十余个国家的33名优秀青年科研人员参加了本次培训。

From November 1 to November 14, 2025, the Internatiinal Training Workshop on Frontiers of Quanta to Cosmos Physics and the 2nd ICTP-AP Winter School on Theoretical Physics were successfully held in Beijing and Hangzhou. Thirty-three outstanding young researchers from more than ten countries—including China, the United States, Italy, Spain, Algeria, and Pakistan, participated in the training.

第四届空间科学大会：空间引力波探测分论坛

2025年11月21日-24日，第四届空间科学大会：空间引力波探测分论坛在北京顺利举办。

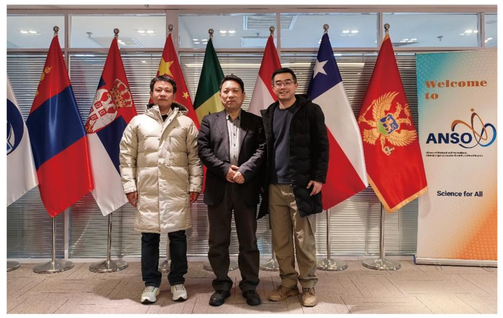
The 4th Space Science Conference: the “Space-based Gravitational Wave Detection” session was successfully held in Beijing from November 21 to November 24, 2025.

December

访问ANSO

2025年12月19日，中心代表团访问了ANSO，就争取境外办会项目支持和Anso奖学金项目展开了讨论。

On December 19, 2025, the Centre delegation visited ANSO to discuss securing support for hosting international conferences and the ANSO Scholarship Program.



联合国教科文组织全国委员会秘书处主办的合作伙伴座谈会

2025年12月30日，中心代表团出席了中国联合国教科文组织全国委员会秘书处主办的合作伙伴座谈会。会议聚焦二类中心及教席单位，部分代表交流了年度重点成果，并探讨了未来与联合国教科文组织的合作方向。

On December 30, 2025, delegations from ICTP-AP attended the partnership symposium organized by the Secretariat of the Chinese National Commission for UNESCO. The meeting focused on UNESCO Category 2 Centers and UNESCO Chairs, with some representatives sharing key annual achievements and discussing future cooperation directions with UNESCO.

Student Cultivation

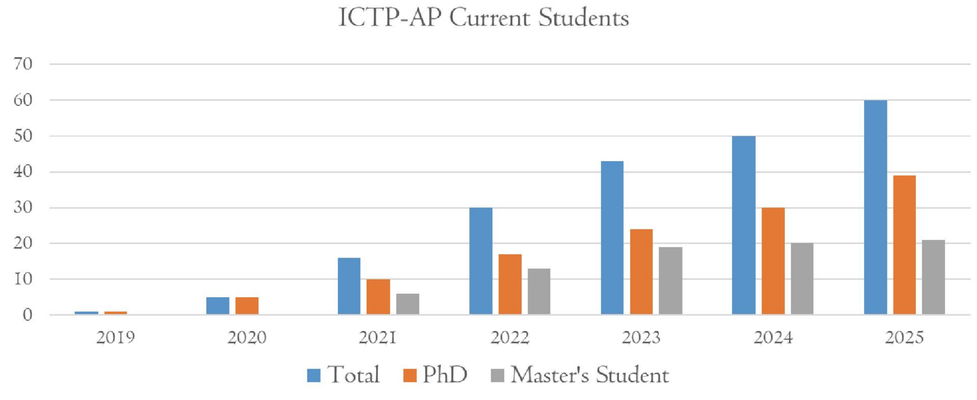
Student Admission
招生情况

The scale of students has increased year by year. Currently, the Centre has a total of 60 enrolled students, including 39 PhD students and 21 master's students. In 2025, ICTP-AP admitted 17 students, consisting of 8 PhD students and 9 master's students. During their study in UCAS, students could apply for six categories of scholarships and financial aid: National grants, Nation scholarships, scholarships of Chinese Academy of Sciences, academic scholarships of UCAS, scholarships of research institutes and allowances for "Research Assistants/ Teaching Assistants/Management Assistants".

目前，中心在校生规模已达60人，包括39名博士研究生和21名硕士研究生。2025年，中心共招收17名研究生，其中博士生8人，硕士生9人。学生在学期间可申请中国科学院大学设立的六类奖助学金，包括：国家助学金、国家奖学金、中国科学院奖学金、国科大学业奖学金、研究所奖学金，以及"助研/助教/助管"岗位津贴。

As a Category 2 Centre of UNESCO, ICTP-AP has been actively playing its role in the cultivation of talents from developing countries. We actively engage in the international student recruitment and out-reach efforts of UCAS and are committed to the training and teaching work of the International College, UCAS. In 2025, the Centre achieved a milestone by enrolling its first international doctoral candidate in a full-time program. This marks the official beginning of our journey in systematically providing high-level education for international students in China. It also represents a key step in fulfilling UNESCO's mission of fostering global scientific capacity building and knowledge sharing.

作为联合国教科文组织的二类机构，中心始终致力于支持与推动发展中国家科学人才的培养。我们积极参与中国科学院大学（国科大）的国际学生招生宣传工作，并投身于国际学院相关的培训与教学工作。2025年，中心迎来了里程碑式的进展——成功招收一名外籍学生攻读全日制博士学位。这标志着我们正式开启了系统性、高层次培养来华留学生的全新旅程，也是履行联合国教科文组织使命、促进全球科技能力建设与知识共享的重要实践。



Student Education
科教融合的培养体制

The University of Chinese Academy of Sciences is promoting a high-quality education model characterized by the fusion of scientific research and education. ICTP-AP actively responds to and practices this philosophy. Professors at the Centre are fully engaged in the teaching of undergraduate and postgraduate students, integrating cutting-edge research achievements and methodologies into the classroom. This enables students to not only build a solid foundation in professional knowledge but also gain direct exposure to the forefront of scientific research, thereby fostering a new generation of talents equipped with both robust theoretical understanding and innovative practical capabilities.

中国科学院大学正深入实施高质量科教融合办学模式。ICTP-AP积极响应并践行这一理念，中心教授全面参与本科生与研究生教学（见下表），将前沿科研成果与方法融入课堂，使学生在扎实掌握专业知识的同时，能够直接接触到科研前沿，助力培养兼具扎实理论与创新实践能力的新一代科研人才。

Name	Spring Semester 2025	Autumn Semester 2025
Jun Nian 年骏	Supergravity,Supersymmetry, and Superstring Theory 《超引力超对称超弦》	Mechanics 《力学》
Jun Zhang 张君	Advanced Quantum Mechanics 《高等量子力学》	General Relativity 《广义相对论》
Huaike Guo 郭怀珂	Fundamentals of Computational Physics 《计算物理基础》	Mathematical Methods for Physics 《数学物理方法》
Teng Ma 马腾	Thermal Physics 《热学》	Quantum Field Theory 《量子场论》
Xiaoyong Chu 储晓勇		Introduction to Modern Physics 《现代物理学概述》

ICTP-AP annually organizes an Outstanding Undergraduate Summer Camp aimed at discovering and enrolling excellent undergraduates. Through this program, students are given the opportunity to learn about the cutting-edge topics in theoretical physics. The Centre also uses this platform to select students who have a strong interest in scientific research and let them experience the academic atmosphere of graduate students.

中心每年举办优秀大学生夏令营，致力于发掘和招募具有优秀潜力的本科生，通过这一项目，学生们有机会深入了解理论物理领域的前沿热点课题。中心也借此平台选拔那些对科研有浓厚兴趣的学生，并让他们亲身体验研究生的学术氛围。

The ICTP-AP 2025 Summer School was held in the Zhongguancun Campus, UCAS, from July 3 to July 8, 2025. The Centre's office and the graduate supervisors introduced the Centre's faculty, the situations of talent cultivation, and the frontiers research of theoretical physics science to the students in detail. Students had in-depth communication with graduate supervisors on their research interests, research plans, and personal development plan.

夏令营于7月3日-7月8日在中国科学院大学中关村校区举办。ICTP-AP中心办公室和研究生导师向大家详细介绍了中心师资力量、学生培养情况和理论物理科学前沿研究。学生们就研究兴趣、研究计划和未来规划与研究生导师进行了深入的沟通交流。

Student Education
科教融合的培养体制

Besides, ICTP-AP jointly funds the International Students Frontier and Interdisciplinary Science School, an international student education and training innovation program project, with the International College of UCAS. The program focuses on the highlight and cross-disciplinary nature of cutting-edge fields, as well as the deep integration of science research and education. Its goal is to break down the boundaries between traditional disciplines, foster the integration of knowledge and technology across various fields, address complex scientific challenges, and cultivate innovative talents.

中心与中国科学院大学国际学院（IC-UCAS）共同资助了国际学生前沿与交叉科学学校。这是一项教育和培养国际学生的创新计划项目，着重突出专业方向的针对性和交叉性以及科教深度融合性。旨在打破传统学科之间的界限，促进不同领域知识和技术的整合，解决复杂的科学问题，并培养创新人才。

From April 22 to April 27, 2025, the Spring School on Frontier and Interdisciplinary Sciences for International Students was successfully held in Hangzhou, Zhejiang Province. The event focused on cutting-edge scientific topics including fundamental particles, dark matter, dark energy, gravitational waves, and black holes. It attracted 46 international students of UCAS, from 11 countries along the "Belt and Road" initiative and 27 research institutes, to engage in academic exchanges and collaborative learning.

2025年4月22日至4月27日，国际学生前沿与交叉科学春季学校在浙江杭州顺利举办。本来活动主题围绕基本粒子、暗物质、暗能量、引力波和黑洞等科学前沿问题展开讨论，吸引了来自“一带一路”11个国家、27个研究所的46名国科大留学生参与交流学习。

Student Activities
学生活动

The Centre organizes sports competitions and provides career guidance services to enrich students' campus life and improve their comprehensive abilities.

中心积极组织体育竞赛活动和提供就业指导服务，丰富学生的校园生活，并提升学生的综合素质。

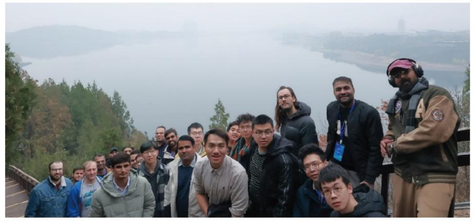
On May 25, 2025, the "Dragon Boat Race" of UCAS officially kicked off at Yanqi Lake. Faculty and students from the Centre enthusiastically joined the event, setting aside their busy research work for a while to fully unleash their energy in the racing waves and immerse themselves in the passion and joy of the competition.

2025年5月25日，中国科学院大学“龙舟大赛”在雁栖湖畔正式开赛。中心师生踊跃参与，暂别繁忙的科研工作，在碧波竞渡中尽情释放活力、享受运动的激情与乐趣。

On July 8, 2025, the Centre held a warm farewell party for the graduates to celebrate their successful completion of studies and the beginning of a new chapter in their lives. Five graduates shared their growth stories and cherished memories from their academic journey. Faculty members from the Centre also offered valuable career advice based on their respective professional backgrounds and the graduates' future development plans. The event not only deepened the graduates' sense of belonging and emotional connection to the Centre but also provided a beautiful and meaningful conclusion to their campus life.

2025年7月8日，中心为毕业生举办了一场温馨的欢送会，祝贺他们圆满完成学业、开启人生新篇章。5位毕业生回顾了求学路上的成长故事与珍贵回忆。中心老师们也结合各自的专业背景与发展方向，为他们提供了宝贵的职业发展建议。此次活动既深化了毕业生对中心的认同与情感联结，也为他们的校园岁月留下了美好而完整的句点。

From November 1 to November 14, 2025, during the International Training Workshop on Frontiers in Quantum and Cosmic Physics, the Centre organized a series of cultural experiences and campus visits in both Beijing and Hangzhou, which effectively facilitated academic exchange and cultural mutual learning. Participants visited the ancient Mutianyu Great Wall and enjoyed the tranquil beauty of Hangzhou's West Lake, immersing themselves in the nation's profound cultural heritage and picturesque landscapes. In addition, they took part in hands-on workshops where they crafted traditional lacquer fans and learned tie-dye techniques. The program also showcased China's technological advancement through visits to a modern Industrial Technology Park, the digital innovation hub Yunqi Town. The cultural exchange reached its culmination in a free-topic presentation session, where participants shared distinctive customs and landscapes of their home countries, enhancing mutual understanding and building global friendships through a celebration of diverse cultures.



2025年11月1日-14日，在量子宇宙物理前沿国际培训班期间，中心在北京与杭州两地开展了丰富的文化体验与校园参访活动，有力促进了学术交流与文化互鉴。学员们踏上了一场知行交融的旅程，既领略了中国深厚的历史积淀，也感受了其蓬勃发展的现代气象。他们登上巍峨古朴的慕田峪长城，漫步于诗意盎然的杭州西湖，沉浸在这片土地独特的人文底蕴与自然画卷之中。活动还安排了传统手工艺实践环节，学员亲手绘制漆扇、体验扎染技艺，近距离接触中国非遗文化。此外，通过走访现代工业技术园区与数字创新地标云栖小镇，学员们直观体会到中国科技发展的脉动。在自由主题分享环节，各国学员积极展示家乡的风土人情，在不同文明的对话中深化理解、缔结友谊，将文化交流推向高潮。

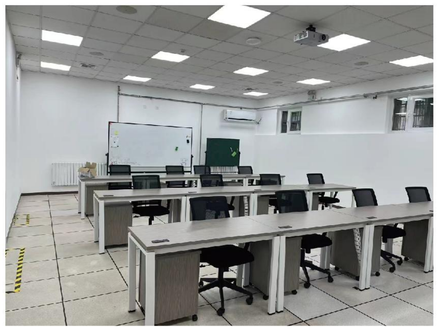
ICTP-AP Platform

Taiji Laboratory for Gravitational Wave Universe
引力波宇宙太极实验室

The Taiji Laboratory for Gravitational Wave (Taiji Laboratory), which is the core support platform of the "Taiji Program", operates under the support of ICTP-AP. The laboratory is located in both Beijing and Hangzhou.

引力波宇宙太极实验室依托国际理论物理中心建设运行，是空间引力波探测“太极计划”的核心支撑平台，实验室分布在北京和杭州两地。

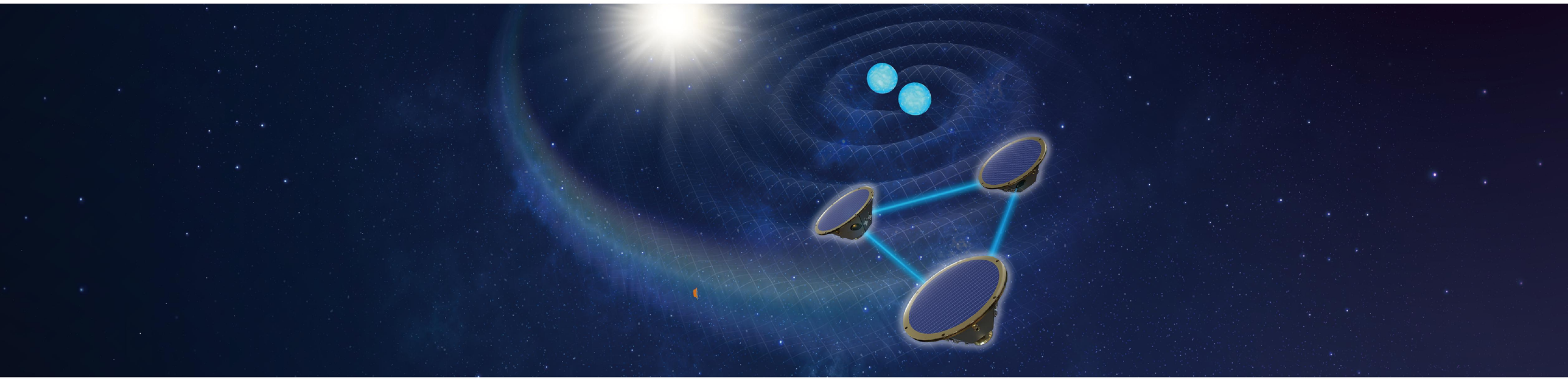
Taiji Laboratory (Beijing) provides comprehensive scientific, technical and management support, and undertakes the construction of the scientific application system of Taiji Program. In 2024, Taiji Laboratory (Beijing) deployed five subsystems: Scientific operation and data management, Preprocessing of detection data, Scientific data processing, Scientific users, and Semi-physical simulation for scientific measurement. Taiji Laboratory (Beijing) will be effectively linked with the engineering master, satellite and ground branch systems, supervising and evaluating each subsystem, coordinating the development of each subsystem, and forming an integrated scientific application system. In 2025, the laboratory further improved the research environment by renovating the student workstations.



太极实验室（北京）为空间太极计划的项目推进提供科学、技术和管理的全面支撑，同时承担“太极计划”科学应用系统建设。2024年，太极实验室（北京）论证部署科学运行和数据管理、探测数据预处理、科学数据处理、科学用户和科学测量半物理仿真五大分系统，与工程大总体和卫星、地支等系统有效衔接，对各分系统进行监督和评估、协调各分系统研制，形成科学应用系统的有机整体。2025年，实验室进一步改善了科研环境，对学生工位进行了装修改造。

Taiji Laboratory (Hangzhou), in response to the requirements of key technologies for the ground verification of Taiji Program in space gravitational wave detection, has proposed the construction of physical experimental device for ultra-precision measurement of gravitational wave in HIAS (Shuangpu Campus). Focusing on the needs of high-precision and high-sensitivity cutting-edge physics experiments, it will utilize the stable and superior geological conditions of underground to build a world-class laser interferometer measurement device based on the ultra-high precision (picometer-level) laser interferometer. In 2025, it completed the underground structural construction for the gravitational wave ultra-high-precision measurement physics facility and its basic laboratory infrastructure.

太极实验室（杭州）针对空间引力波探测太极计划开展地面关键技术攻关及实验验证需求，提出在杭高院双浦园区实施引力波超高精密测量物理实验装置建设项目，将围绕开展高精度、高灵敏度前沿物理实验需求，利用地下稳定优越的地质条件，基于超高精度（皮米量级）的激光干涉仪，建设国际一流的激光干涉极限测量装置。2025年完成了引力波超高精密测量物理实验装置以及实验室基础建设的地下结构部分施工。



In 2025, researchers affiliated with the Taiji Alliance completed the first draft of the "Taiji Program White Paper". The document systematically presents the following core elements:

1) Scientific background: the physical principles of gravitational waves and how they are generated by cosmic extreme events such as black-hole mergers and neutron-star collisions.

2) Technical design: a detailed description of the laser-interferometer architecture, covering vacuum systems, laser-stability control, vibration-isolation techniques, mirror materials, and other critical technologies.

3) Scientific objectives: direct detection and verification of gravitational waves; identification and analysis of their astrophysical sources; multi-messenger astronomy that combines electromagnetic signals, neutrinos, and other observational channels to reconstruct the full physics of cosmic events; tests of general relativity in strong-field regimes; and searches for clues to quantum gravity and other frontier physics.

4) International cooperation and data sharing: an explicit open-data policy to foster worldwide scientific collaboration and resource sharing.

5) Future outlook: a roadmap for the development of next-generation detectors and their evolution.

The white paper is not only a guiding technical blueprint but also a programmatic charter intended to lead the advance of gravitational wave astronomy. Its implementation is expected to deepen multi-messenger astronomy, accelerate the iterative innovation of cutting-edge technologies, and help unveil the most extreme and enigmatic phenomena in the universe.

2025年，太极联盟的相关研究人员完成了《太极计划白皮书》的初稿。该白皮书系统阐述了以下核心内容：

1）科学背景 阐述了引力波的物理原理，以及其如何由黑洞并合、中子星碰撞等宇宙极端天体事件所产生；

2）技术设计 详细介绍了激光干涉仪的核心技术体系，涵盖真空系统、激光稳定性控制、隔震技术、镜面材料等关键技术细节；

3）科学目标 包括直接探测并验证引力波的存在，分析其天体物理来源；开展多信使天文学研究，结合电磁波、中微子等多种观测手段，完整解析天体事件的物理过程；检验广义相对论在强场环境下的适用性，并探索量子引力等前沿物理线索；

4）国际合作与数据共享 明确数据公开政策，以促进全球范围内的科研协作与资源共享；

5）未来展望 规划下一代探测器的研发方向与发展路径。

该白皮书不仅是一份指导性的技术蓝图，更是引领引力波天文学发展的重要纲领性文件。其实施有望推动多信使天文学的深入发展，促进相关尖端技术的迭代革新，并助力揭示宇宙中的极端物理现象与未解之谜。

Computing Platform
计算平台

In 2025, to ensure the long-term stable operation of the cluster, we completed the upgrade and replacement of the management node. The previous management node occasionally displayed yellow alarm lights, indicating potential hardware risks. Therefore, we purchased a new server last year and completed the replacement early this year. The new management node features the following three main improvements compared to the old one:

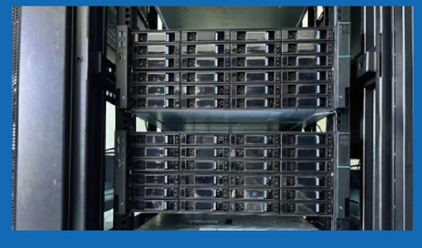
- The original PBS job scheduling system has been replaced with SLURM, which is currently the mainstream scheduling system in supercomputing environments.
- In response to the security requirements of UCAS's network center, the compute servers have been configured to prohibit internet access, thereby further ensuring data security.
- The Gridview unified user login platform has been introduced. While retaining the original terminal login method, a convenient web-based login feature has been added, enhancing the user experience.

2025年，为确保集群长期稳定运行，我们完成了管理节点的升级更换。旧有管理节点因不时出现黄灯告警，可能存在硬件隐患，为此我们于去年采购了新服务器，并于今年初完成了替换。新管理节点较旧的管理节点，主要有以下三方面的改进：

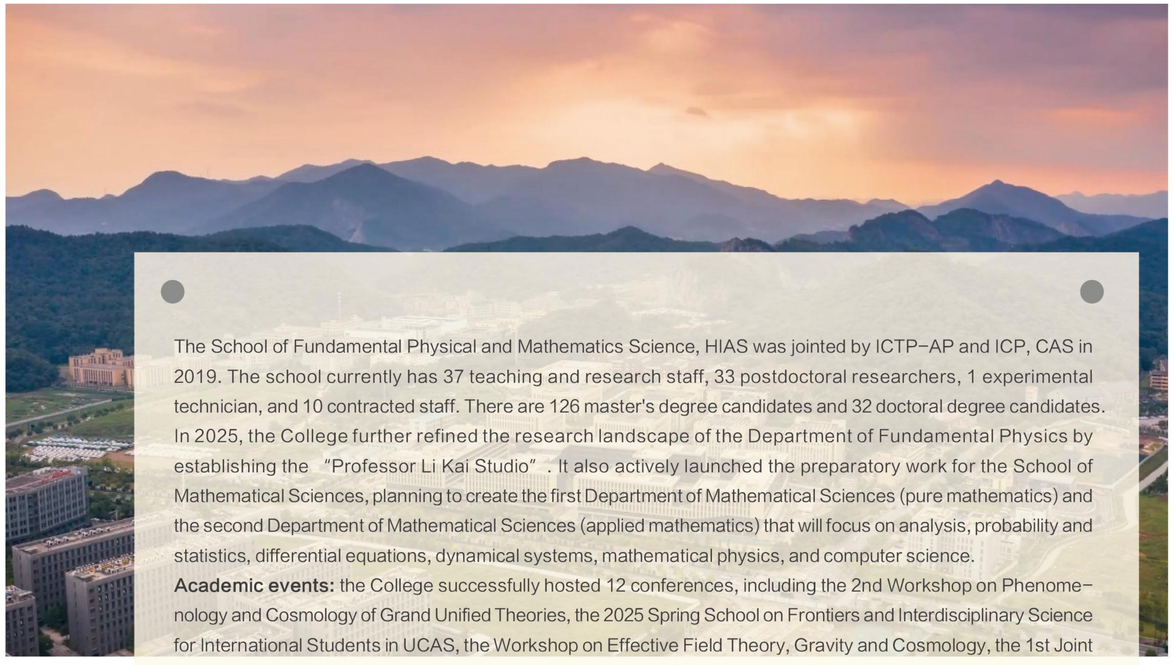
第一，将原有的PBS作业调度系统更换为目前超算主流的SLURM调度系统；

第二，响应学校网络中心的安全要求，计算服务器已设置为禁止访问互联网，以进一步保障数据安全；

第三，引入了Gridview统一用户登录平台，在保留原有终端登录方式的同时，新增了便捷的Web网页登录功能，提升了用户使用体验。



The School of Fundamental Physical and Mathematics Science, HIAS
国科大杭高院数理学院



The School of Fundamental Physical and Mathematics Science, HIAS was jointed by ICTP-AP and ICP, CAS in 2019. The school currently has 37 teaching and research staff, 33 postdoctoral researchers, 1 experimental technician, and 10 contracted staff. There are 126 master's degree candidates and 32 doctoral degree candidates. In 2025, the College further refined the research landscape of the Department of Fundamental Physics by establishing the "Professor Li Kai Studio". It also actively launched the preparatory work for the School of Mathematical Sciences, planning to create the first Department of Mathematical Sciences (pure mathematics) and the second Department of Mathematical Sciences (applied mathematics) that will focus on analysis, probability and statistics, differential equations, dynamical systems, mathematical physics, and computer science.

Academic events: the College successfully hosted 12 conferences, including the 2nd Workshop on Phenomenology and Cosmology of Grand Unified Theories, the 2025 Spring School on Frontiers and Interdisciplinary Science for International Students in UCAS, the Workshop on Effective Field Theory, Gravity and Cosmology, the 1st Joint Summer Symposium on High-Energy Theoretical Physics (Hangzhou 2025), and the 2nd Jiangmen Neutrino Summer School. These meetings provide a platform for experts, young researchers, and students at home and abroad to exchange latest results and to discuss and collaborate freely.

Research output: 14 national and 8 horizontal research grants were awarded, among them one Major Program of the NSFC, one Foreign Scholars Research Project, one General Program, five Young Scientists Fund (Type C) grants, two NSFC Special Fund for Theoretical Physics, one National Key R&D Program sub-project from the Ministry of Science and Technology, and three General Program grants of the China Postdoctoral Science Foundation. The College also received one provincial/ministerial Science and Technology Award.

Innovation & entrepreneurship: four competition prizes were won, including the Third Prize in the 9th China Hangzhou University Student Entrepreneurship Competition, the Second Prize (East-China Division) in the 5th National Undergraduate HV & Plasma Science-Technology Innovation Contest, and the Excellence Award in the Field Competition of the 14th China Innovation & Entrepreneurship Competition for Disruptive Technology Innovation.

Education & teaching: five relevant awards were granted, namely the CAS-UCAS Excellent Graduate Course Award, the Li Pei Distinguished Teacher Award, the HIAS Excellent Teaching Faculty Award, the HIAS Excellent Course Award, and the Hangzhou Excellent Educator Award.

国科大杭州高等研究院基础物理与数学科学学院（简称“数理学院”）成立于2019年12月28日，由中心和中国科学院理论物理研究所共同建设。学院现有教学科研人员37人，在站博士后33人，实验技术人员1人，聘用人员10人。在校硕士生126人，博士生32人。

2025年，在学科建设方面，学院深入完善基础物理学部科研布局，成立了李凯教授工作室。另外积极筹建数学科学学部，拟筹建数学科学一系(基础数学)和数学科学二系(应用数学)，主要开展分析、概率统计、微分方程、动力系统、数学物理、计算机科学等方向的研究。

在学术活动方面，学院成功举办12场高水平学术会议，包括第二届大统一理论的唯象学和宇宙学”研讨会、2025 中国科学院大学国际学生前沿交叉系列春季学校、“有效场论，引力和宇宙学”研讨会、第一届高能理论物理联合暑期研讨会（2025杭州）、第二届江门中微子暑期学校等。这些活动为国内外相关领域的专家学者、青年科研骨干及学生提供了重要的学术交流平台，有力促进了前沿研究成果的分享与合作对话。

在科研成果方面，获批国家级科研项目14项、横向项目8项，其中国家自然科学基金重大项目1项、外国学者研究项目1项、面上项目1项、青年科学基金项目（C类）5项、理论物理专项项目2项，科技部国家重点研发计划课题级项目1项，中国博士后科学基金会面上资助项目3项；荣获省部级科学技术奖1项。

在创新创业方面，荣获竞赛奖项4项，包括第九届中国杭州大学生创业大赛三等奖、第五届全国大学生高电压与等离子体科技创新竞赛华东赛区二等奖、第十四届中国创新创业大赛颠覆性技术创新大赛领域赛优胜奖等。

在教育教学方面，荣获相关奖项5项，分别是国科大研究生优秀课程奖、李佩优秀教师奖、杭高院院级优秀授课教师奖，杭高院院级优秀课程奖，杭州市优秀教育工作者。

Governance

ICTP-AP, which is the first Category 2 Centre established by UNESCO in basic science in China, was jointly founded by CAS, NSFC, and the International Centre for Theoretical Physics, relying on UCAS for the Centre's construction and development.

ICTP-AP has an international Governing Board, which sets general guidelines for the Centre's activities and follows a seat-based system. ICTP-AP holds regular board meetings to report on its annual working progress and propose its development plan for the next stage. ICTP-AP also has an international Scientific Council that comprises of distinguished specialists in basic sciences from different areas. The Council advises ICTP-AP on its programmed of activities in the light of major academic, scientific, educational and cultural trends relevant to its objectives.

中心由中国科学院、国家自然科学基金委员会和国际理论物理中心共同建设，依托于中国科学院大学进行机构建设和发展。是联合国教科文组织在中国基础科学方面设立的第一个二类中心。

中心设立国际理事会和国际科学委员会。国际理事会负责对中心规划和发展工作进行指导和监督，并采用席位制。中心定期召开理事会会议，进行工作汇报和总结，提出下一阶段发展计划。国际科学委员会负责对中心学术工作进行指导和监督。学术委员会委员由来自世界各地的基础科学领域的专家组成，他们根据与中心目标有关的主要学术、科学、教育和文化趋势，就中心的活动方案向中心提供咨询意见。

ICTP-AP INTERNATIONAL GOVERNING BOARD

- **CAS**
  A representative from CAS serving as the ex officio chairman of the board.
  中国科学院代表一名，担任中心理事会的当然主席
- **UNESCO**
  Two representatives of the Director-General of UNESCO, including one from the ICTP
  教科文组织总干事代表两名，包括ICTP代表一名
- **Chinese Government**
  Up to three representatives from the government (e.g. NSFC, Ministry of Education, UCAS)
  中国政府代表至多3人（如国家自然科学基金委员会、教育部、中国科学院大学）

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Supporters

ICTP-AP would like to express its deep gratitude to all who supported us in 2025.

ICTP-AP对所有在2025年支持中心的学校和院所表达深深的感谢。

- Academy of Mathematics and Systems Science, CAS
- Asia-Pacific Center for Theoretical Physics, Korea
- Bureau of International Cooperation, CAS
- Changchun Institute of Optics, Fine Mechanics and Physics, CAS
- Chinese Society of Space Research
- Hangzhou Institute for Advanced Study of UCAS
- Hunan University
- Innovation Academy for Microsatellites of CAS
- Innovation Academy for Precision Measurement Science and Technology, CAS
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- Institute of High Energy Physics, CAS
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- Kunming Institute of Botany, CAS
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- Xishuangbanna Tropical Botanical Garden, CAS
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- Vrije Universiteit Brussel, Belgium.

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SCIENTIFIC ASSOCIATE

Name	Institute	Research Field
Anna Tokareva	HIAS	Early universe cosmology/Quantum gravity
Bin Chen	Peking Univ.	Quantum field theory and gravity
Chao-Qiang Geng	HIAS	High energy physics/ Cosmology
Cong-Feng Qiao	UCAS	Quantum information/Particle physics
Da Huang	NAO, CAS	Theory of gravitational waves/Data Analysis
Fabio Marchesoni	Tongji Univ.	Statistical physics/Relativistic thermodynamics
Gang Yang	ITP, CAS	Quantum field theory
Jian-Xin Lu	USTC	Gravity and Supergravity/superstring/M theory
Jing Shu	Peking Univ.	Particle physics/ Particle cosmology
Kenji Kadota	HIAS	Particle physics /Cosmology
Kohei Kamada	HIAS	Particle cosmology
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Xin Zhang	Dongbei Univ.	Gravity and cosmology
Ye-Ling Zhou	HIAS	Neutrino physics/Particle cosmology
Yi Pang	Tianjin Univ.	Particle physics /Quantum gravity
Yi-Bo Yang	ITP, CAS	Particle physics
Yong Tang	UCAS	Dark matter/Cosmology Gravitational wave physics
Yong-Liang Ma	Nanjing Univ.	Particle physics /Field theory
Yu-Feng Zhou	ITP, CAS	Dark matter/Physics beyond the standard model
Yun-Long Zhang	NAO, CAS	Black Hole Physics/ Dark matter model
Yun-Song Piao	UCAS	Very early universe/Quantum gravitation
Yu-Xiao Liu	LanzhouUniv.	General relativity/ Gauge field theory
Zhou-Jian Cao	Beijing Normal Univ.	Gravity theory/General relativity
Zong-Kuan Guo	ITP, CAS	Gravitational theory

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Appendix

Seminar

Jan. 9, 2025

Title: How Einstein Equation Emerges from CFT2 and Realization of ER = EPR
Speaker: Prof. Haitang Yang
Affiliation: Sichuan University

Jan. 10, 2025

Title: Cosmological Stasis: Theoretical Overview,Model Realizations, and Phenomenological Implications
Speaker: Dr. Fei Huang
Affiliation: Weizmann Institute of Science

Jan. 10, 2025

Title: Refined BPS spectra for compact Calabi-Yau threefolds via 5d Wilson loops
Speaker: Dr. Xin Wang
Affiliation: University of Chinese Academy of Sciences

Feb. 19, 2025

Title: An Introduction to the Python Interface of the AMSS-NCKU Numerical Relativity Code
Speaker: Dr. ChenKai Qiao
Affiliation: Chongqing University of Technology

Feb. 27, 2025

Title: Phase Transition Properties of Black Holes
Speaker: Dr. Neeraj Kumar
Affiliation: India S. N. Bose National Centre for Basic Sciences

Mar. 6, 2025

Title: Detecting Partonic Behaviors and Chaos from Mutual Information in Confining Backgrounds

Speaker: Dr. Mahdis Ghodrati

Affiliation: Asia Pacific Center for Theoretical Physics, Korea

Mar. 27, 2025

Title: The Generation and Detection of Chiral Gravitational Wave Background

Speaker: Prof. Yun-Long Zhang

Affiliation: The National Astronomical Observatories, CAS

Mar. 27, 2025

Title: Research on multi-horizon black holes

Speaker: Prof. Changjun Gao

Affiliation: The National Astronomical Observatories, CAS

Apr. 10, 2025

Title: How entropy inequalities constrain holographic error correction

Speaker: Prof. Bartek Czech

Affiliation: Tsinghua University

Apr. 16, 2025

Title: Thermal false vacuum decay is not what it seems

Speaker: Dr. Andrey Shkerin

Affiliation: Perimeter Institute for Theoretical Physics, Canada

Apr. 24, 2025

Title: Loop Fiber Inflation in String Theory

Speaker: Prof. Xin Gao

Affiliation: Sichuan University

Apr. 28, 2025

Title: Search for Long-Lived Particles and New Physics in the Early Universe

Speaker: Associate Prof. Wei Liu

Affiliation: Nanjing University of Science and Technology

May. 8, 2025

Title: Constraints on Lorentz and parity violations with gravitational waves

Speaker: Prof. Tao Zhu

Affiliation: Zhejiang University of Technology

May. 9, 2025

Title: Bubble wall dynamics from nonequilibrium quantum field theory

Speaker: Ph.D. Matthias Carosi

Affiliation: Technical University of Munich

May. 14, 2025

Title: A Soliton Explanation for the Cosmic Coincidence Problem

Speaker: Associate Prof. Ke-Pan Xie

Affiliation: Beihang University

May. 15, 2025

Title: Realization of “ER=EPR”
Speaker: Associate Prof. Houwen Wu
Affiliation: Sichuan University

May. 23, 2025

Title: What can we learn about new physics from Jupiter?
Speaker: Dr. Lingfeng Li
Affiliation: Brown University

Jun. 5, 2025

Title: Gravitational atoms and black hole binaries
Speaker: Dr. Giovanni Marria Tomaselli
Affiliation: Institute for Advanced Study

Jun. 5, 2025

Title: Axion Dark Matter Archaeology –– Radio Echos from Ancient Supernova Remnants
Speaker: PhD. Chen Sun
Affiliation: International Centre for Theoretical Physics

Jun. 13, 2025

Title: Extracting observables for black hole binary
Speaker: PhD. Canxin Shi
Affiliation: Institute of Theoretical Physics, CAS

Jun. 19, 2025

Title: Classical Gravitational Dynamics from Quantum Field Theory
Speaker: Prof. Zheng-Wen Liu
Affiliation: Southeast University

Jun. 23, 2025

Title: An affine su (8) theory of the SM quark/lepton masses
Speaker: Associate Prof. Ning Chen
Affiliation: Nankai University

Jun. 26, 2025

Title: Degenerate Lorentz gauge symmetry with $c^2=0$ and the physical gauge symmetry of null boundaries of asymptotically flat gravitational spaces
Speaker: Prof. Laurent Baulieu
Affiliation: University of Paris

Aug. 20, 2025

Title: Search for an isotropic Gravitational Wave Background with ground based detectors, cosmological implications and current and future challenges
Speaker: Alba Romero-Rodríguez（CNRS researcher）
Affiliation: Laboratoire d'Annecy de Physique des Particules (LAPP)

Sep. 4, 2025

Title: Black holes in a swirling universe
Speaker: Dr. Adriano Vigano
Affiliation: Italian National Institute for Nuclear Physics (INFP)

Sep. 16, 2025

Title: Probing the High-Frequency Frontier of Gravitational Waves
Speaker: Camilo Garcia-Cely
Affiliation: University of Valencia

Sep. 16, 2025

Title: Waveform Calculation and Data Processing of EMRI
Speaker: Prof. Wen-Biao Han
Affiliation: Shanghai Astronomical Observatory, CAS

Sep. 18, 2025

Title: Machine learning as a cornerstone for future gravitational wave observations
Speaker: PhD. Qian Hu
Affiliation: University of Glasgow

Sep. 19, 2025

Title: AI enhanced event reconstruction and physics measurements: impact at future Higgs factory
Speaker: Prof. Manqi Ruan
Affiliation: Institute of High Energy Physics, CAS

Sep. 25, 2025

Title: Formalism and general properties of spacetime density matrix
Speaker: Associate Prof. Wu-Zhong Guo
Affiliation: Huazhong University of Science and Technology

Oct. 9, 2025

Title: Curvature singularity，geodesic completeness and infinite tidal force
Speaker: Prof. Sijie Gao
Affiliation: Beijing Normal University

Oct. 10, 2025

Title: Hilbert Space at Finite N
Speaker: Prof. Robert de Mello Koch
Affiliation: Huzhou University

Oct. 10, 2025

Title: Constraining the properties of dark matter by astronomical observations
Speaker: Prof. Xiao-Jun Bi
Affiliation: Institute of High Energy Physics, CAS

Oct. 17, 2025

Title: How can generalized symmetry help understand non-perturbative physics in strongly coupled systems
Speaker: Associate Prof. Jin Chen
Affiliation: Xiamen University

Oct. 23, 2025

Title: Frontier of Multi-loop Analytic Feynman Integrals
Speaker: Prof. Yang Zhang
Affiliation: University of Science and Technology of China

Oct. 24, 2025

Title: New perspective on 5d SCFTs with twists and folds
Speaker: Prof. Sung-Soo Kim
Affiliation: University of Electronic Science and Technology of China

Oct. 30, 2025

Title: Fast and precise logarithmic spectral analysis for dark matter searches with LIGO
Speaker: Dr. Alexandre Göttel
Affiliation: Cardiff University

Oct. 30, 2025

Title: Detecting Dark Photon Dark Matter Using Superconducting Resonant Cavities
Speaker: Associate Prof. Bo Wang
Affiliation: Ningxia University

Nov. 6, 2025

Title: The EW Portal to Composite Dark Matter
Speaker: Dr. Lingfeng Li
Affiliation: Brown University

Nov. 7, 2025

Title: Axions and Stars
Speaker: Prof. Giovanni Villadoro
Affiliation: ICTP

Nov. 7, 2025

Title: Large-small duality and SU(2) subsector of N=4 SYM
Speaker: Associate Prof. Yang Lei
Affiliation: Soochow University

Nov. 10, 2025

Title: Ground-based Gravitational Wave Detectors for Fundamental Physics. Astronomy and Cosmology
Speaker: Prof. Raffaele Flaminio
Affiliation: CNRS/LAPP

Nov. 13, 2025

Title: Classification and competition of QNM families for a black hole with double photon spheres
Speaker: Associate Prof. Xiao-Mei Kuang
Affiliation: Yangzhou University

Nov. 14, 2025

Title: Application of Weyl Invariants in Exact Solutions of Gravitational Theories
Speaker: Associate Prof. Pujian Mao
Affiliation: Tianjin University

Dec. 4, 2025

Title: M2-brane indices and black holes
Speaker: Prof. Chiung Hwang
Affiliation: University of Science and Technology of China

Dec. 9, 2025

Title: Z_2 Symmetry Breaking in Quasinormal modes
Speaker: Associate Prof. Rui-Dong Zhu
Affiliation: Soochow University

Dec. 11, 2025

Title: Unified Frameworks for Neutrino Mass and Dark Matter: Dirac/Inverse Seesaw with Discrete Symmetries
Speaker: Associate Prof. Yakefu Reyimuaji
Affiliation: Xinjiang University

Dec. 15, 2025

Title: LISA and XG Gravitational Wave Detector Network: Potentioal Challenges and Solutions in Data Analysis

Speaker: PhD. Shichao Wu

Affiliation: Max Planck Institute

Dec. 19, 2025

Title: Rapid Identification and Reconstruction of Massive Binary Black Hole Signals

Speaker: PhD. Senwen Deng

Affiliation: Université Paris Cité

Dec. 23, 2025

Title: Gravitational Wave Production and Detection in Gravitational Quantum Field Theory

Speaker: Prof. Da huang

Affiliation: The National Astronomical Observatories, CAS

Dec. 24, 2025

Title: Asymptotic Grand Unified Theories

Speaker: Dr. Wanda Isnard

Affiliation: Université Claude Bernard Lyon 1

Dec. 24, 2025

Title: A Preliminary Exploration of Multi-Source Data Analysis for the "Taiji Program" in Space-based Gravitational Wave Mission

Speaker: Associate Prof. Minghui Du

Affiliation: Institute of Mechanics, CAS

Dec. 25, 2025

Title: Nonlinear Interactions between Scalar Dark Matter and Black Holes

Speaker: Prof. Yu-Peng Zhang

Affiliation: Lanzhou University

Conclusion

As a UNESCO Category 2 Centre, ICTP-AP has always been committed to fulfilling the UNESCO mission, focusing on scientific innovation, talent cultivation, and international collaboration in the field of theoretical physics. In 2025, we successfully completed the first phase of international evaluation, received high recognition from UNESCO, and were granted the renewal of the second phase, laying a solid foundation for further deepening regional cooperation.

Throughout the year, we organized four international training workshops and academic conferences in cutting-edge areas such as quantum cosmology and gravitational wave detection, attracting researchers from over ten countries worldwide. Among these, the "Frontiers of Quanta to Cosmos Physics" Winter School has become a key platform for academic exchange in theoretical physics within the region.

In terms of talent cultivation, leveraging the advantages of integrating education and research, we trained 60 undergraduate and graduate students. Many of these young scholars have furthered their studies at top overseas institutions through international exchange programs, thereby building a pool of innovative talents with a global perspective for the Asia-Pacific region. At the same time, we actively responded to the UN's "Science for Sustainable Development Decade" initiative by organizing open data training sessions and science outreach activities to promote the dissemination of scientific knowledge and enhance public scientific literacy.

Looking ahead, marking the signing of the second-phase agreement as a new starting point, ICTP-AP will deepen cooperation with UNESCO and research institutions worldwide, with a particular focus on advancing international collaboration of the "Taiji Program" for space-based gravitational wave detection. By creating more high-level international academic exchange platforms, we aim to make even greater contributions to the development of basic sciences and talent connectivity in the Asia-Pacific region.

作为教科文二类中心，ICTP-AP始终以践行教科文组织使命为核心，聚焦理论物理领域的科研创新、人才培养与国际合作。2025年，我们圆满完成一期国际评估，得到教科文组织高度肯定，成功获批二期续约，为持续深化区域合作奠定了坚实基础。

全年围绕量子宇宙物理、引力波探测等前沿方向，举办国际培训班、学术研讨会4场，吸引全球10余个国家的科研人员参与，其中“量子宇宙物理前沿”冬季学校已成为区域内理论物理领域的重要交流平台。

在人才培养方面，我们依托科教融合优势，培养了60名本研阶段学生，其中多名青年学者通过国际交流项目赴海外顶尖机构深造，为亚太地区储备了一批具备国际视野的创新人才。同时，我们积极响应“国际科学促进可持续发展十年”倡议，通过开放数据培训、科普宣传等活动，推动科学知识传播与公众科学素养提升。

未来，ICTP-AP将以二期协议签署为新起点，深化与教科文组织、各国科研机构的合作，重点推进空间引力波探测“太极计划”的国际协同，打造更多高水平国际学术交流平台，为亚太地区基础科学发展、人才互联互通贡献更大力量。