

2023 TDLI ANNUAL REPORT

2023 TDLI ANNUAL REPORT 李政道研究所



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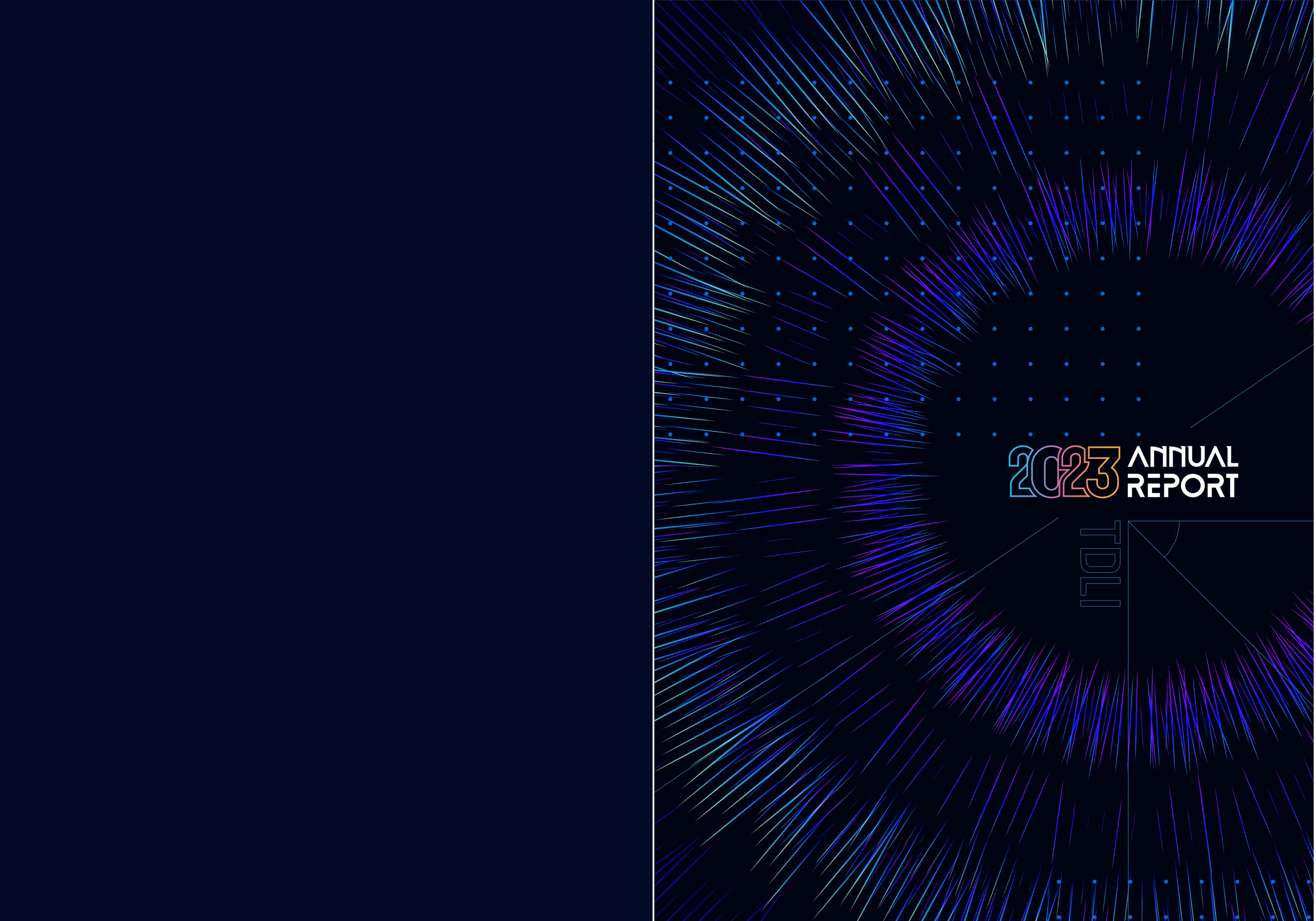
COVER : Rapid by Li Dongzhou, Ye Lujie, Wang Xuanqi

It won an Award of Excellence in 2023 Shanghai Jiao Tong University Tsung-Dao Lee Science and Art Exhibition

封面源自2023年上海交通大学李政道科艺展优秀作品 厉东洲、叶璐杰、王炫奇《湍》



李政道研究所
TSUNG-DAO LEE INSTITUTE



2023 ANNUAL REPORT

TDLI



From TDLI Director

Jie Zhang

Director, CAS Academician

Reflecting on the achievements of Tsung-Dao Lee Institute in 2023, one central theme emerges: "Mission Impossible," encapsulated by the Chinese phrase "明知不可为而为之" (míng zhī bù kě wéi ér wéi zhī) " meaning to undertake a task despite its apparent impossibility.

The aspiration to establish TDLI as a globally influential institute of fundamental research is a shared dream and mission among all TDLI members. However, achieving this goal within a mere fifteen years is akin to a monumental challenge, requiring unwavering confidence and courage.

In early 2023, we finalized the "TDLI Vision 2035" outlining our development blueprint and research path for the next fifteen years. Breaking down this seemingly unattainable goal into actionable tasks, we aimed to establish the foundational elements of a world-class research institution within three five-year periods, with the pivotal first phase spanning from 2021 to 2025.

At the outset of 2023, we set forth a series of annual key objectives:

1. Initiate and advance the construction and upgrading of three major scientific facilities—namely, the JUST Spectroscopic Telescope in Lenghu, Qinghai, the PandaX Dark Matter and Neutrino Detector in Jinping, Sichuan, and the TRIDENT Neutrino Telescope in the West Pacific Ocean. This unprecedented endeavor presented formidable challenges, both financially and operationally.



Artwork of 2023 SJTU T.D.Lee Science and Art Exhibition: *Complexity and Simplicity*

2023年上海交大李政道科艺展作品：《繁与简》

By Yuqing Ying

作者：应玉清

2. Cultivate a talented workforce aligned with our focused collaborative research goals, navigating a delicate balance between structured scientific inquiry and the ethos of academic freedom, a process requiring ongoing exploration without pre-established success models.
3. Forge a "high-standard, small-scale" global alliance of fundamental research institutions, a daunting task amidst the complexities of international collaboration.
4. Innovate doctoral training models fundamentally, necessitating thorough research to reform the traditional mentor-apprentice approach prevalent in domestic universities.
5. Secure long-term institutional funding and support from government and societal stakeholders, a challenge in the absence of established mechanisms domestically for sustained funding.
6. Foster a unique "TDLI" culture characterized by inclusivity and excellence, establishing a nurturing research environment amidst societal engagement.

Throughout 2023, we spared no effort in pursuing these ostensibly "impossible" objectives:

1. With robust support from Shanghai Jiao Tong University (SJTU), we secured a significant subsidized loan of 250 million CNY to initiate and advance the construction and upgrading of the aforementioned scientific facilities.
2. We collaborated with SJTU School of Physics and Astronomy to redefine talent development strategies and reformulate TDLI recruitment and promotion criteria and procedures for tenure positions, scientific staff, and engineering and technical support staff, ensuring alignment with our research objectives and research structure.
3. Our leadership and researchers engaged with 23 leading research institutions worldwide including Niels Bohr Institute, NORDITA, RIKEN, QUP, IPMU and etc., fostering collaboration frameworks and initiating the formation of the "Global Alliance of Fundamental Research Institutions."

4. Leveraging opportunities presented by the High-Level Talent Training Center for Mathematical, Physical, and Chemical Sciences initiatives, we secured recognition as one of three national high-level talent training centers in physics, accompanied by substantial funding and doctoral quotas.
5. Through extensive outreach efforts, we made progress in garnering recognition from both the public and private sectors, and in diversifying funding sources, laying a solid foundation for our sustainable growth. Throughout 2023, we hosted over 100 visits with more than 4,000 participants.
6. By constant communication with various offices and agencies in Shanghai Municipality and Pudong New Area, we officially renewed the road name where TDLI sits as "1 Li Suo Road", completed the construction of "Li Suo Bay," Charles H. C. Kao Reading Space and the Zhangjiang Conference Center, embodying our inclusive and nurturing culture.

Our relentless pursuit of knowledge and excellence yielded significant scientific advancements in 2023. We selected the top ten scientific highlights of 2023, some of which directly entered the national top ten scientific advancements list. We published 352 SCI papers, including 130 high-quality papers, and secured approval for 31 research projects, including three projects with funding exceeding 5 million RMB. Fifteen individuals were selected into national and Shanghai talent programs. Additionally, we garnered prestigious awards and accolades. On top of these, Professor Ding Hong's induction as an academician of the Chinese Academy of Sciences underscored our commitment to scholarly excellence.

In October and November 2023, we convened meetings of the Domestic Strategic Planning Committee and the International Academic Advisory Committee, inviting nearly fifty academicians and top experts and scholars in physics and astronomy from around the world to comprehensively evaluate the TDLI Vision 2035 and its current development status. The committee members unanimously affirmed our Vision 2035 and highly recognized the TDLI's remarkable progress over the past two years, expressing confidence in and anticipation for our future trajectory

2023 was a fruitful year, during which we completed all annual key tasks. This was made possible by the 200% efforts and dedication of all TDLI members, demonstrating the profound impact of the "Mission Impossible" spirit on the institute's development.

Looking ahead to 2024, the road ahead remains challenging, requiring the collective efforts and dedication of all TDLI members to continue transforming seemingly impossible tasks into tangible reality!

Building a world-class research institution remains our collective aspiration and driving force. Although the goal may seem distant now, as long as we maintain the confidence and determination to undertake tasks that seem impossible, and turn the impossible into the possible each year, we are poised to realize Prof. Tsung-Dao Lee's vision and leave an indelible mark on history.

We are fortunate to live in an era where dreams can be dreamed and realized. Let us inscribe our dreams in the history of Tsung-Dao Lee Institute, and the institute's history will remember each and every one of us!

March, 2024



所长寄语：

张 杰
所长、中科院院士

回顾李政道研究所2023年的工作，有一个核心词是“Mission Impossible”，中文是“明知不可为而为之”。

把李政道研究所建设成有重要学术影响力的世界顶级基础研究机构，是全体李所人共同的梦想与使命。然而，要在短短十五年内建成这样一个世界顶级研究机构，几乎是一个“mission impossible”，就需要我们有“明知不可为而为之”的信心与勇气。

2023年初，我们完成了《李政道研究所2035发展规划》的编制工作，确立了李所未来十五年的发展蓝图和科研路径，将这个看似不可能完成的目标分解为逐年可实施的具体任务，力争用三个五年的时间完成世界顶级研究机构基础要素的建立。在这其中，最为关键的就是第一个发展期2021-2025年。

2023年初，我们设立了一系列年度重点工作目标：

- 1) 同时启动和推进位于青海冷湖4300米海拔的JUST光谱望远镜、四川锦屏2400米深地PandaX暗物质与中微子探测装置，以及海南南海3500米深海TRIDENT中微子望远镜这三个前进观测基地的建设与升级，但是同时启动和推进三个大科学装置在全国乃至全世界范围内都极其罕见，且每个大科学装置的启动经费都超过亿元，这无疑是个任重道远且充满挑战的任务；
- 2) 在高校里建设一支符合有组织科研目标的人才队伍，但是在崇尚自由探索的大学环境中开展有组织科学研究，我们需要在多重目标中探索寻求平衡点，没有现成的成功经验，只能靠我们自己摸索前行；
- 3) 创建一个“高标准，小范围”的全球基础研究机构联盟，但是在当前错综复杂的国

际合作形势下想要建立这样的合作网，其难度之大，远超平时。这就要求我们必须迎难而上，主动应变；

4) 从根本上创新博士生培养模式，但是目前国内高校的博士生培养仍然是传统的“师傅带徒弟”模式，如何推进培养模式改革和创新尚需深入系统研究；

5) 争取政府与社会长期稳定的机构式经费资助与支持，但是到目前为止，国内尚未建立对科研机构实施长周期稳定资助的机制；

6) 形成“近者悦而尽才，远者望风而慕”的“李所”文化，但是对接社会资源，构建宽容关爱的科研生态环境充满诸多考验。

2023年，我们全力以赴，竭力实现这些看似“不可能”完成的任务。

1) 在学校的大力支持下，在项目筹建最关键的时期，以贷款形式支持李所2.5亿元，全面启动和推进青海冷湖4300米海拔JUST光谱望远镜、四川锦屏2400米深地PandaX暗物质与中微子探测装置和海南南海3500米深海TRIDENT中微子望远镜三大前进观测基地的建设和升级。

2) 围绕“有组织科研”推进人才工作定位与改革，与上海交大物理与天文学院联动，实现共谋划，同发展。通过一系列会议讨论确定了李所长聘系列晋升考核评价机制、研究员系列以及工程技术系列的招聘及晋升标准与流程，形成了一支具有李所特色、符合有组织科研目标、结构合理的人才队伍。

3) 2023年度所领导班子及科研人员共出访包括丹麦玻尔研究所、瑞典北欧理论物理研究所、日本理化学研究所、国际宇宙和粒子量子场测量系统研究中心、Kavli数物联携宇宙研究所等23个欧美亚一流研究所，并与其中数家机构探索全面合作与交流框架，启动“全球基础研究机构联盟”的创建工作。

4) 抢抓教育部出台数理化生国家高层次人才培养中心的机遇，我们投入了巨大的精力和努力，全校范围内组织专家反复研讨和修改申报书，最终李所作为全国首批三个物理单位之一入选教育部数理化生高层次人才培养中心（物理方向），并获得博士生名额与经费支持。

5) 2023年度共接待100余场、4000余人次来访，逐步获得了社会及政府对我们的认可，多元资助体系取得了实质性进展，获教育部、上海市、浦东新区及众多社会力量的多

渠道经费支持与资助，为李所的持续发展奠定了坚实的基础。

6) 通过与上海市、浦东新区及各委办局方方面面的反复沟通，李政道研究所地址“李所路1号”正式落地，完成“李所湾”建设并投入使用，建设完成高希均阅读空间、张江会议中心，打造“桃李荫翳，家安李所”的“李所”文化。

在探索自然极限、拓展认知疆域的征途上，我们在过去的一年里取得了一系列重要科学进展，我们从这些成果中评选出2023年度李所十大科研进展，其中有些科研进展甚至直接入选国家级十大科研进展；发表SCI论文352篇，其中高水平论文130篇；获批科研项目31项，其中500万元以上项目3项；15人次入选国家及上海市各类人才计划；我们还收获了多项重量级的荣誉奖项，尤其是丁洪教授当选中国科学院院士。

在2023年的10月与11月，我们分别召开了国内战略规划委员会会议和国际学术咨询委员会会议，邀请了世界范围内来自物理与天文领域的近五十位国内外院士、顶尖专家学者，对李所2035发展规划及现阶段发展情况进行全面评估。委员们一致肯定李所2035发展规划，并高度认可李所在过去两年所取得的令人瞩目的工作进展，对李所未来发展充满信心和期待。

2023年是成果丰硕的一年，我们圆满完成了各项年度重点工作，这是全体李所人200%的努力与付出所换来的，证明了“明知不可为而为之”的“李所”精神对研究所发展的巨大影响。

展望2024年，前行的道路上依然充满挑战，需要全体李所人不断的共同努力与付出，继续将一个个看似不可能完成的任务变成可能！

建设世界顶级研究机构是李先生的初心，也是党和国家赋予李所的使命。2035年建成世界一流研究所的目标虽然现在看来还很遥远，只要永葆明知不可为而为之的自信和勇气，每年都能将不可能变为可能，定能建成世界一流研究机构！

我们幸运地生活在能够拥有梦想并可以实现梦想的时代，让我们共同把梦想写在李所的历史上，李所的历史会记住我们每一个人！



2024年3月

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CHAPTER 1

OVERVIEW
综述



OVERVIEW

With the directorship of Academician Jie Zhang, Tsung-Dao Lee Institute (TDLI) finalized its Vision 2035 in early 2023. It highlights TDLI's focus on the origin and evolution of matter under extreme cosmic conditions and its big science research paradigm aiming to make breakthroughs in exploring the fundamental scientific questions, form a unique school of thought in advanced research areas, and become a world-class basic science research institute with significant academic influence by 2035.

In 2023, a key year in its first five-year plan leading to 2035, TDLI made solid progress in research infrastructure construction, scientific research, talent recruitment, graduate student cultivation, academic exchanges and cooperation, fundraising, and cultural development, with strong support from various national and local authorities.

Key Achievements:

1. Advancement of Three Major Remote Observation Sites:

- PandaX Dark Matter and Neutrino Detector in Jinping, Sichuan, underwent a second-stage upgrade, focusing on improvements to the photomultiplier tube (PMT) bases, Time Projection Chamber (TPC) components, and xenon impurities.
- TRIDENT Neutrino Telescope in the West Pacific Ocean Commenced its first-phase construction with the support of SJTU. And entered into a strategic cooperation agreement with Hainan Province and the CAS Sanya Shenhai Science And Engineering Institute, enhancing collaborative efforts.
- JUST Spectroscopic Telescope in Lenghu, Qinghai, Initiated its first-phase project, signed a quadrilateral agreement with the Government of Haixi Mongolian and Tibetan Autonomous Prefecture in Qinghai Province, Qinghai Provincial Science and Technology Department, and Qinghai University, and successfully obtained approval for the selection of the Lenghu, Saishitengshan B-site.

2. High-Impact Research Output:

- Published a total of 353 SCI-indexed papers in 2023, with 130 in prestigious journals such as Nature, Nature Astronomy, and PRL.
- Achieved breakthroughs in ten key research areas, including observing quantum anomalous Hall effect in bilayer MoTe₂ and discovering the precession of the M87 black hole jet.
- Observed quantum anomalous Hall effects in twisted bilayer MoTe₂.
- Explored M87's supermassive black hole jet dynamics.
- Established dark matter luminance limits from PandaX xenon recoil data.
- Proposed an efficient mechanism for GeV gamma-ray generation.
- Identified an optimal TRIDENT neutrino telescope site.
- Discovered multicomponent superconductivity in Ba_{1-x}K_xFe₂As₂.
- Observed vector boson scattering and measured Zγjj cross-section.
- Provided a model for the interaction of WASP-18b's atmosphere and magnetic field.
- Discovered vacuum quantum fluctuations' impact on chirality-dependent spectral shifts.
- Proposed a supermassive black hole mechanism for dark matter acceleration and annihilation.

3. Increased Success Rate for Research Proposals:

- New record made as successful National Natural Science Foundation grants amounted to 20.
- Granted 17 projects during the regular acceptance period, with an impressive success rate of 51.5%.
- 5 projects selected into the International Scholars Talent Program, representing 26.3% successful grants within university.
- Distinguished Professor Liu Jiang was successfully selected into the highly competitive New Keystone Investigator Program.
- Got 88 diverse ongoing projects.

4. Internationalization of Talent Pool:

In 2023, the strategic focus on "collaborated team research" facilitated the positioning and reform of talent-related initiatives, resulting in the following key highlights:

- Recruited 3 overseas high-level talents, and 19 postdoctoral researchers, including 7 foreign postdoctoral researchers.
- Chair Professor Hong Ding was elected as a member of the Chinese Academy of Sciences.
- Secured the inclusion of 15 individuals in various national and municipal talent programs.
- Academician Jie Zhang received the 4th Outstanding Teaching Award.
- Academician Yipeng Jing was honored with the The Ho Leung Ho Lee Advancement Prize.
- Academician Jinfeng Jia received the National Innovation Award.
- Distinguished Professor Jianglai Liu was awarded the National May 1st Labor Medal.
- Achieved an international scholar ratio of approximately 40% within our research body.

5. Establishment of a Comprehensive Ph.D. Program:

- Selected as one of the first institutions for the Ministry of Education's National High-level Talents Training Center in Physics, Chemistry and Biology in 2023.
- Actively attracted top domestic and international students to the PHD program at the training center, integrating the paradigm of big science research into high-level talent cultivation.

6. Deepening International Collaboration:

- Director Jie Zhang led two delegations to Northern Europe and Japan, fostering global cooperation networks with world-class research institutions.
- Hosted over 300 academic events and received more than 200 visitors in 2023,

and achieved a cumulative participant engagement of 16,000 person-days, including organizing 17 influential academic conferences, such as the TEXAS Relativistic Astrophysics Symposium, attracting over 2,300 participants.

- Hosted 10 sessions of the T. D. Lee Colloquium Series, featuring keynote speakers such as Nobel laureates and distinguished scientists, including TDLI's Chief Scientist Frank Wilczek, Academician Jianwei Pan, and Academician Yifang Wang.

7. Diverse Funding Sources:

Establishing a long-term and stable diversified funding system is crucial for researchers to focus on their scientific endeavors and ensures the sustainable development of TDLI.

Constructed a stable and diverse funding system with support from the Ministry of Education, Shanghai Municipal Government, Pudong New Area, and various social entities.

8. Enhanced Academic and Cultural Environment:

- Spread and encouraged the spirit of Quest for Infinity.
- Further fostered the LiSuo culture of Blossoms and Plentiful Shade, Where Home and Growth Reside.
- Established TDLI at "No. 1 LiSuo Road," reflecting a significant milestone with support from relevant authorities.
- Collaborated with Pudong New Area Ecological and Environmental Protection Bureau to complete the "LiSuo Bay" project, contributing to ecological development.
- Partnered with the Zhangjiang Group Party Committee to build the Zhangjiang Conference Center.

综述

在所长张杰院士的带领下，李政道研究所历经一年多的时间于2023年初正式完成《李政道研究所2035发展规划》的编制工作，明确了李所将聚焦“极端宇宙条件下的物质起源与演化”这一根本性科学问题，充分发挥大科学研究范式的优势，在根本性科学问题的探索方面做出重大突破，逐步在极端物态前沿研究领域形成“上海学派”，到2035年将李所建成有重要学术影响力的世界一流基础科学研究所的愿景目标。

2023年是李所进入2035发展规划第一个五年期承上启下的一年，在国家各部委、上海市和学校的关心与大力支持下，李所围绕根本性科学问题，在**大设施建设、科学研究、团队建设、人才培养、学术交流与合作、经费筹措、文化建设**等方面取得了显著进展。

稳步推进三大前进观测基地建设。其中，位于四川锦屏深地实验室的PandaX暗物质与中微子探测装置已经完成了探测器的二次升级，主要针对光电管的基座、TPC组件、氙杂质等方面进行了改进。位于海南南海的TRIDENT中微子望远镜——“海铃计划”已开启一期建设工作，在学校的支持下，与海南省以及中科院深海所达成战略合作意向。位于青海冷湖的JUST光谱望远镜一期项目启动，并与青海省海西州人民政府、青海省科技厅和青海大学签署了四方共建协议，获批冷湖赛什腾山B点选址。

持续产出高水平科研成果。2023年，共发表SCI收录论文353篇，其中包括Nature, Nature Astronomy, PRL等高水平论文130篇，论文数量和质量均创历史新高。在多个方面取得重大原创成果突破，十大科研亮点包括：1) 在转角双层 MoTe_2 中观察到了整数和分数量子反常霍尔效应；2) 发现了超大质量黑洞 M87 的喷流进动；3) PandaX实验从氙反冲数据得出的暗物质的亮度极限；4) 提出了电子束-固体相互作用高效产生极强

GeV伽马射线的新机制；5) 深海中微子望远镜合作组发现中微子望远镜优质台址；6) 在 $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$ 中发现了多元超导以及打破时间反演对称性的4费米相；7) 观测到中性双玻色子末态中的矢量玻色子散射，并首次测量了 $Z\gamma jj$ 全微分截面；8) 提供了关键模型以揭示超热木星WASP-18b大气层和磁场之间的强烈相互作用；9) 发现在螺旋微腔中真空量子涨落能够引起手性依赖的能谱位移；10) 提出超大质量黑洞加速暗物质，从而重新打开禁闭暗物质的湮灭过程，提供新检验机制等。

显著提升科研项目获批率。2023年，共获批国家自然科学基金项目20项，取得新的突破。其中，集中受理期17项，获批率高达51.5%，外国学者人才计划项目获批5项，占学校此类项目总数的26.3%。特聘教授刘江来入选“新基石研究员”项目。截至年底，各类在研项目88项。

加快建设国际化人才队伍。2023年，围绕“有组织科研”推进人才工作定位与改革，人才引育成效显著。讲席教授丁洪当选为中国科学院院士，引进海外高层次人才3人，入选国家级和上海市各类人才计划15人次。张杰院士荣获第四届杰出教学奖、景益鹏院士荣获何梁何利“科学与技术进步奖”，贾金锋院士荣获全国创新争先奖，特聘教授刘江来获全国五一劳动奖章。李所目前国际学者占比近40%，成为高度国际化的基础科学研究机构。

打造高质量博士生培养体系。2023年，作为首批单位入选教育部数理化生国家高层次人才培养中心，将充分发挥李所拥有的国际化顶尖师资队伍和国际一流大科学装置群的独特软硬件优势，吸引国内外顶尖高校的拔尖本科毕业生加入培养中心，将大科学研究范式贯穿到高层次人才培养的全过程管理中，从根本上提升高水平博士生培养质量。

不断深化国际交流与合作。张杰所长两次带队分别出访北欧及日本，调研世界一流基础研究机构，搭建全球合作伙伴网络。2023年，接待访问人员200余人次，组织各类学术活动近300场，总计人员参与度达16000人·天。其中包括举办TEXAS相对论天体物理研讨会等具有地区和国际影响力的学术会议17场，与会人数累计超过2300人；举办李政道讲座品牌学术报告活动10场，报告人包括诺奖获得者、李所首席科学家Frank Wilczek、潘建伟院士、王贻芳院士等，国际地位和影响力显著增强。

初步建立多元资助体系。根据国际化基础研究机构建设发展经验，构建长期稳定的多元经费资助体系至关重要。2023年，李所已陆续获得教育部、上海市、浦东新区及众多社会力量的多渠道经费支持与资助，为科研人员心无旁骛开展科研工作以及李所的可持续发展提供了实质性保障。

全面提升学术与人文环境。秉持“天问”精神，力争创造“桃李荫翳，家安其所”的文化氛围，成为“近者悦而尽才、远者望风而慕”的人文圣地。2023年，在上海市规划资源局、浦东新区各相关委办局的大力支持与关心下，李政道研究所地址“李所路1号”正式落地。积极与浦东新区生态环保局联动，完成“李所湾”建设并投入使用。与张江集团党委进行党建共建，建设完成张江会议中心，共同打造张江科创资源集聚场。

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2023 ANNUAL
REPORT

CHAPTER
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RESEARCH
HIGHLIGHTS
科研亮点

Artwork of 2023 SJTU T.D.Lee Science and Art Exhibition: *PCityB*

2023年上海交大李政道科艺展作品: 《简复纵横——集成之城》

By Lixin Wan, Yi Sha, Jinhao Gou, Yundong Wen

作者: 万礼鑫、沙毅、苟晋豪、文昀栋

Observation of Fractional Quantum Anomalous Hall Effect

👤 Tingxin Li, Xiaoxue Liu et.al.

📄 [Physical Review X 13 \(2023\) 031037](#)

The quantum Hall effect is one of the most significant discoveries in condensed matter physics, has been awarded the Nobel Prize in Physics for three times. Among them, the fractional quantum Hall effect exhibits topological order due to strong electron correlations, displaying long-range quantum entanglement and fractionally charged excitations. FQHE has been considered as one of the important candidates for topological quantum computation. Observing the fractional quantum Hall effect typically requires strong magnetic fields and extremely low-temperature environments. A natural and challenging question is whether it is possible to achieve the fractional quantum Hall states under zero magnetic field, i.e., realizing the fractional quantum anomalous Hall effect (FQAHE). Since 2011, theoretical studies have confirmed the possibility of the FQAHE from different perspectives, but in experiments, an appropriate material system for achieving the fractional quantum anomalous Hall effect has been elusive. Therefore, the experimental observation of the fractional quantum anomalous Hall effect has been a long-standing goal pursued by condensed matter physicists.

Li Tingxin and Liu Xiaoxue's experimental team in SJTU collaborated to provide the first definitive experimental evidence for the observation of the fractional quantum anomalous Hall effect in twisted two-dimensional semiconductor MoTe₂ moiré superlattice devices. The key achievements are as follows:

- (1) A three-gated device structure was designed and fabricated, forming Ohmic contacts to twisted MoTe₂ by using the two-dimensional layered metal TaSe₂, allowing independent control of the electrical contacts, vertical electric fields, and carrier densities in twisted MoTe₂ moiré superlattices.
- (2) By conducting low-temperature quantum transport measurements, the Hall resistance was observed to approach h/e^2 and $3h/2e^2$ at moiré hole filling factors of 1 and 2/3, respectively. Additionally, integer and fractional quantized Hall conductance plateaus have been observed in the zero magnetic field limit, providing compelling transport evidence for both integer and fractional quantum anomalous Hall effects.

- (3) A rich phase diagram of topological and strongly correlated quantum states in the twisted MoTe₂ system was realized, driven by gate tuning of electric fields and carrier densities. A novel topological quantum phase transition from the FQAHE to a strongly correlated electron crystal state was realized under an applied electric field.

This research, titled 'Observation of Integer and Fractional Quantum Anomalous Hall Effects in Twisted Bilayer MoTe₂', was published in Physical Review X 13, 031037 (2023) and was highlighted as "Featured in Physics" by the editors. A "news & views" commentary article in Nature highlighted that this work, along with another independent research by Prof. Xiaodong Xu's team at the University of Washington, first provides smoking-gun signature for the FQAHE. This research is one of the breakthroughs in the field of condensed matter physics in recent years, and paves the way for studying novel properties such as fractionally charged excitations and anyonic statistics under zero magnetic field, providing new opportunities for research in topological quantum computation and beyond.

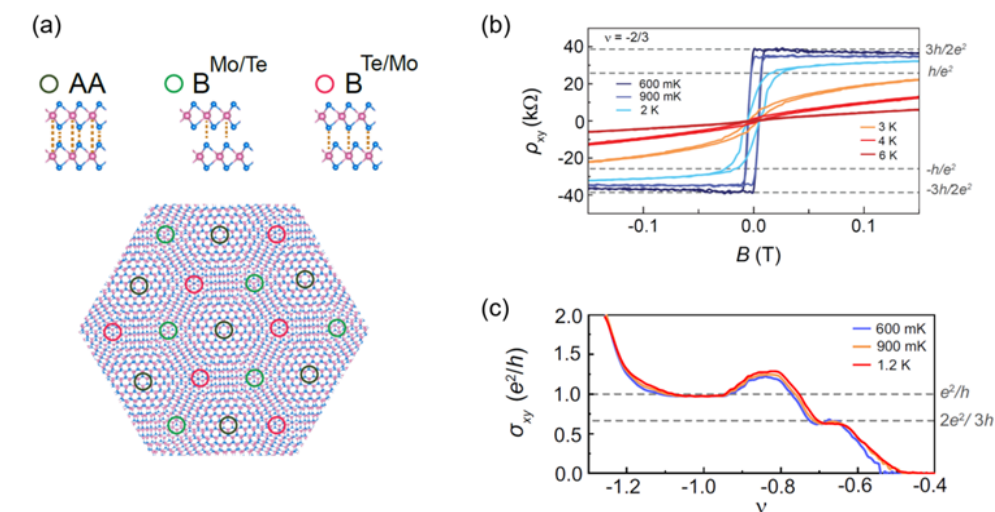


Figure 1. (a) Schematic moiré superlattices of twisted MoTe₂. High symmetry stackings are highlighted by circles. (b) Magnetic-field dependence of Hall resistance of the FQAHE at moiré filling factor $\nu = -2/3$ at varying temperatures. (c) Hall conductivity as a function of ν at varying temperatures. Distinct σ_{xy} plateaus can be observed around $\nu = -1$ and $-2/3$, with values closely approaching the quantized values of e^2/h and $2e^2/3h$, respectively.

分数量子反常霍尔效应的实验观测

量子霍尔效应是凝聚态物理最重要的发现之一，曾先后3次获得诺贝尔物理学奖。其中，分数量子霍尔效应具有由于电子关联形成的拓扑序，呈现出长程量子纠缠和分数电荷激发，是拓扑量子计算的重要候选方案之一。分数量子霍尔效应的观测一般需要强磁场和极低温环境，一个自然且有挑战性的问题是：能否在零磁场条件下实现分数量子霍尔态，即分数化的量子反常霍尔效应。自2011年以来，理论研究工作从不同角度肯定了分数量子反常霍尔效应存在的可能性，但实验上一直未能找到合适的材料体系能够实现分数量子反常霍尔效应。因此，分数量子反常霍尔效应的实验观测是凝聚态物理学家长期以来追求的目标。

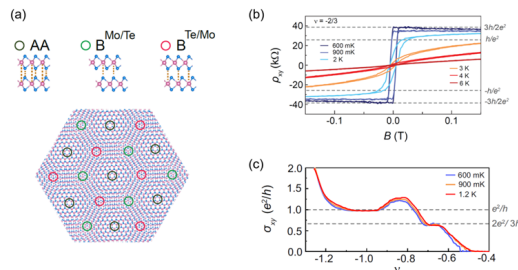
上海交通大学李昕昕、刘晓雪实验团队在转角二维半导体 MoTe_2 莫尔超晶格器件中首次观测到分数量子反常霍尔效应的确凿实验证据，主要创新成果如下：

(1) 采用二维层状金属 TaSe_2 与转角 MoTe_2 体系（图a）形成欧姆接触，设计制备了三栅极新型器件结构，实现了对转角 MoTe_2 的电极接触、垂直电场和载流子浓度的分立调控。

(2) 通过开展低温量子输运研究，观察到在莫尔超晶格空穴填充因子分别为1和2/3时，零磁场下的霍尔电阻分别逼近 h/e^2 和 $3h/2e^2$ （图b），以及零磁场极限下整数与分数量子化的霍尔电导平台（图c），给出了整数与分数量子反常霍尔效应的确凿输运证据。

(3) 通过栅极调控，揭示了转角 MoTe_2 体系中受电场和载流子浓度调节的丰富的拓扑及强关联量子物态，实现了外加电场驱使的从分数量子反常霍尔效应到强关联电子晶体态的新型拓扑量子相变。

以上研究工作以“Observation of Integer and Fractional Quantum Anomalous Hall Effects in Twisted Bilayer MoTe_2 ”为题发表在Physical Review X 13, 031037 (2023)上，并被编辑以Featured in Physics 形式重点推荐。Nature出版的“news & views”评论文章认为该工作与华盛顿大学Xiaodong Xu团队的同期的研究工作首次为分数量子反常霍尔效应提供了确定性的证据（smoking-gun signature）。该项研究是近年来凝聚态物理领域的突破性进展之一，开启了零磁场条件下研究分数电荷激发、任意子统计等新奇物性的大门，为拓扑量子计算等研究提供了新的可能和机遇。



Two-decade monitoring of M87 unveils a precessing jet connecting to a spinning black hole

Yuzhu Cui, Weikang Lin, Yosuke Mizuno et al.

Nature 621 (2023) 711–715

The nearby radio galaxy M87, located 55 million light-years from the Earth and harboring a black hole 6.5 billion times more massive than the Sun, has recently been discovered to exhibit an oscillating jet. This investigation found the jet swinging up and down with an amplitude of about 10 degrees. Through the extensive analysis of data observed from 2000 to 2022 by various international networks of radio telescopes, the research team unveils a recurring 11-year cycle in the precessing motion of the jet base, as predicted by Einstein's general relativity. This work successfully linked the dynamics of the jet with the central supermassive black hole, offering the evidence for the existence of M87's black hole spin. The work is published in Nature on September 27th, 2023 (<https://www.nature.com/articles/s41586-023-06479-6>).



Figure 1. Schematic representation of the tilted accretion disk model. The black hole's spin axis is assumed to align vertically. The jet's direction stands almost perpendicular to the disk. The misalignment between black hole spin axis and disk rotation axis will trigger the precession of disk and jet. Credit: Yuzhu Cui et al. 2023, Intouchable Lab@Openverse and Zhejiang Lab.

Supermassive Black Holes at the center of active galaxies, the most disruptive celestial objects found in our universe, can accrete tremendous amounts of materials onto them due to the extraordinary gravitational force and power the plasma outflow like jets to nearly the speed of light extending to thousands of light-years away. The energy transfer mechanism among supermassive black holes, accretion disk, and relativistic jets have been puzzling physicists and astronomers for over a century.

A prevailing theory suggests that energy can be extracted from a spinning black hole, allowing some materials surrounding the supermassive black hole to be ejected with great energy. However, the spin of supermassive black holes, a crucial factor in this process and the most fundamental parameter other than black hole mass, has not been directly observed.

To tackle this challenging question, in this work, the research team focuses on M87 which is the first observational record of an astrophysical jet in 1918. Thanks to its proximity, the jet formation regions close to the black hole can be detailedly resolved with Very Long Baseline Interferometry (VLBI), as represented by the recent black hole shadow imaging with the Event Horizon Telescope (EHT). By analyzing M87 VLBI data obtained over the last 23 years, the team has detected the periodic precessing jet at its base (see Figure 2), which can bring us an insight into the status of the central black hole.

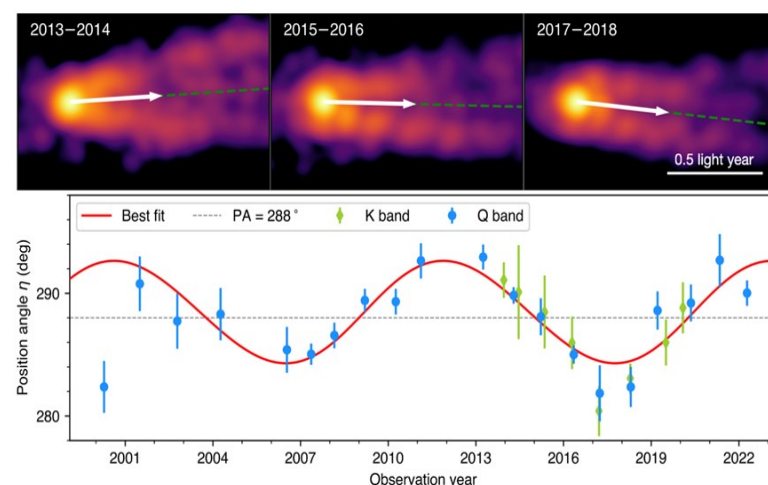


Figure 2. Top panel: M87 jet structure at 43 GHz after bi-yearly stacking data observed during 2013-2018. The corresponding years are indicated at the left-top corner. The white arrows indicate the jet position angle in each subplot. Bottom panel: Best fitting results based on the yearly-stacked image from 2000 to 2022. The green and blue points are obtained from observations at 22 GHz and 43 GHz, respectively. The red line represents the best fit according to the precession model. Credit: Yuzhu Cui et al. 2023.

At the heart of this discovery lies the critical question: what force in the universe can alter the direction of such a powerful jet? The answer could be hidden in the behavior of the accretion disk, the configuration related to the central supermassive black hole. As infalling materials orbit the black hole due to their angular momenta, they form a disk-like structure before gradually spiraling inwards until they are fatefully drawn onto the black hole. However, if the black hole is spinning, it exerts a significant impact on the surrounding spacetime, causing nearby objects to be dragged along its axis of rotation, namely "frame-dragging" predicted by Einstein's General Relativity.

The research team's extensive analysis, including a comparison with a state-of-the-art theoretical simulation using a supercomputer, indicates that the rotation axis of the accretion disk misaligns with the black hole's spin axis, leading to a precessing jet. Detecting this precession serves as a compelling support, providing unequivocal evidence that the supermassive black hole inside M87 is indeed spinning, unlocking new dimensions in our understanding of the nature of supermassive black holes.

"We are thrilled by this significant finding," said Yuzhu Cui, a postdoctoral researcher at the Zhejiang laboratory and the leading and corresponding author of the paper. "Since the misalignment between the black hole and the disk is relatively small and the precession period is around 11 years, accumulating high-resolution data tracing M87 structure over two decades and thorough analysis are essential to obtain this achievement."

"After the success of black hole imaging in this galaxy with the EHT, whether this black hole is spinning or not has been a central concern among scientists" adds Dr. Kazuhiro Hada from the National Astronomical Observatory of Japan. "Now anticipation has turned into certainty. This monster black hole is indeed spinning."

This work made use of a total of 170 epochs of observations obtained by the East Asian VLBI Network (EAVN), the Very Long Baseline Array (VLBA), the joint array of KVN and VERA (KaVA), and the East Asia to Italy Nearly Global (EATING) network. In total, more than 20 telescopes across the globe contributed to this study,

"This is an exciting scientific milestone that was finally revealed through years of joint observations by the international researchers team from 45 institutions around the world, working together as one." said Dr. Motoki Kino at Kogakuin University, the coordinator of EAVN AGN Science Working Group. "Our observational data beautifully fitted to the simple sinusoidal curve bring us new advances in our understanding of black hole and jet system."

"While this study sheds light on the mysterious world of a supermassive black hole, it also presents formidable challenges." Remarked Prof. Yosuke Mizuno at Tsung-Dao Lee Institute, Shanghai Jiao Tong University. The disk's structure and the exact value of the M87 supermassive black hole's spin are still highly uncertain. This work also predicts that there are more sources holding this configuration, which suffers more challenges to discover them. The remaining puzzles require sustained dedication to multiple long-term observations and detailed analyses, with no certainty of immediate rewards.

This pioneering research demonstrates the power of international collaboration and dedication to unraveling the universe's deepest secrets. As scientists celebrate this milestone, the journey to understand the enigmatic supermassive black holes continues, with each discovery bringing us closer to unlocking the universe's most profound mysteries.

天文学家发现M87星系中黑洞喷流周期性进动

由来自全球45个研究机构的科研人员组成的国际科研团队通过分析多个甚长基线干涉测量 (Very Long Baseline Interferometry, VLBI) 网在2000年至2022年的观测数据, 发现M87星系中心黑洞喷流呈现周期性摆动, 摆动周期约为11年, 振幅约为10度。这一现象符合爱因斯坦的广义相对论关于“如果黑洞处于旋转状态, 会导致参考系拖曳效应”的预测。这项研究成果成功地将M87星系中心黑洞喷流的动力学与该星系中心超大质量黑洞的状态联系起来, 为M87黑洞自旋的存在提供了观测证据 (详见图1)。



图1. 倾斜吸积盘模型的示意图。假设黑洞的自旋轴竖直向上, 喷流的方向几乎垂直于吸积盘的盘面, 黑洞自旋轴和吸积盘旋转轴之间的存在一定夹角, 即为倾斜的吸积盘模型。黑洞和吸积盘的角动量方向存在的夹角会触发吸积盘和喷流的进动。(来源: Yuzhu Cui et al. 2023、Intouchable Lab@Openverse和之江实验室)

活跃星系中心的超大质量黑洞, 是宇宙中最具破坏性且最神秘的天体之一。它们引力巨大, 通过吸积盘“吃进”大量物质, 同时也将物质以接近光速的高速“吐出”到数千光年以外。然而, 超大质量黑洞、吸积盘和喷流之间的能量传输机制是怎样的? 这是一个困扰了物理学家和天文学家一个多世纪的难题。目前, 科学家们广泛接受的理论认为, 黑洞的角动量是能量的来源, 一种可能是如果黑洞附近存在磁场且黑洞处于旋转状态, 会如导体切割磁力线一般

产生电场，从而加速黑洞周围的电离体，最终部分物质会携带巨大的能量被喷射出去。其中，超大质量黑洞的自旋，是这一理论的关键因素。但黑洞自旋参数极难测量，甚至黑洞是否处于旋转状态至今尚没有直接的观测证据。

为了研究这个具有挑战性的问题，科研人员针对M87星系中心超大质量黑洞及其喷流进行了研究。M87星系是一个距离地球5500万光年的近邻星系，其中心有一个质量比太阳大65亿倍的黑洞，天文学家在1918年首次在光学波段观测到M87中的喷流，这也是人类观测到的第一个宇宙喷流。这些特征让M87星系成为了天文学家研究黑洞与喷流之间关系的最佳目标源，天文学家能够利用具有超高角分辨率的VLBI技术解析出非常靠近黑洞的喷流结构。科研人员通过分析最近23年来的VLBI观测数据，成功地捕捉到M87中喷流的周期性进动（详见图2）。

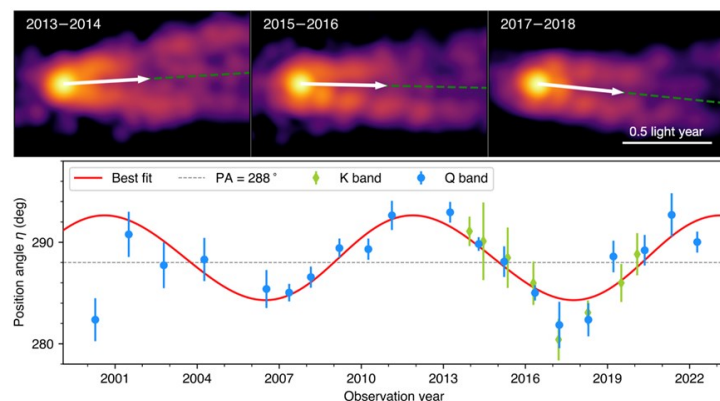


图2. 上图：2013年至2018年期间每两年合并后的M87喷流结构（观测频段为43 GHz）。对应的年份显示在左上角。白色箭头指示了每个子图中的喷流位置角度。下图：基于2000年至2022年以一年为单位合并的图像得出的最佳拟合结果。绿色点和蓝色点分别来自22 GHz和43 GHz的观测频段的数据。红线表示根据进动模型的最佳拟合结果。（来源：Yuzhu Cui et al. 2023）

宇宙中到底有什么力量可以规律地改变这一能量巨大的喷流的方向？经过大量的分析，研究团队推断问题的答案可能就隐藏在吸积盘的动力学性质中：具有一定角动量的物质会绕着黑洞作轨道运动并形成吸积盘，它们受到黑洞的引力会不断地靠近黑洞直到不可逆地被“吸食”到黑洞里。然而，吸积盘的角动量可受多种随机因素影响，极有可能与黑洞自旋轴存在一定夹角。但黑洞的超强引力会对周围的时空产生重大的影响，会导致附近的物体沿着黑洞的旋转方向被拖曳，即爱因斯坦的广义相对论预测的“参考系拖曳效应”，进而引发吸积盘和喷流周期

性的进动。

研究团队基于观测结果进行了大量细致的理论调研和分析，并使用超级计算机进行了最新的结合了M87性质的数值模拟。数值模拟的结果证实了当吸积盘的旋转轴与黑洞的自旋轴存在夹角时，会因参考系拖曳效应导致整个吸积盘的进动，而喷流受吸积盘的影响也产生进动。探测到喷流的进动可为M87中心黑洞的自旋提供有力的观测证据，带来对超大质量黑洞性质的新认知。

论文第一作者兼通讯作者、原李政道研究所博士后、现之江实验室博士后研究员崔玉竹表示：“我们很开心也很幸运能有这一重大发现。由于黑洞自旋轴与吸积盘角动量之间的夹角较小、进动周期又超过十年，积累超两个周期的高分辨率数据，并对M87结构的仔细分析，都是获得这一成果的必要条件。”

原李政道研究所博士后、现云南大学中国西南天文研究所副研究员林伟康补充说：“继使用事件视界望远镜拍摄到M87星系中的黑洞照片后，这个黑洞是否在自旋就一直是科学家们关注的核心问题。现在，我们的成果从观测上进一步肯定了以往的预期，这个饕餮般的黑洞确实在自旋。”

这项工作使用了包括东亚VLBI网（EAVN）、美国的甚长基线阵列（VLBA）、韩国KVN和日本VERA联合阵列（KaVA）以及东亚到意大利/俄罗斯联合的EATING观测网在内的多个国际观测网络的170个观测数据，全球超过20个射电望远镜为这项研究做出了贡献。

在项目进行过程中，国内的多家单位深度合作，中国科学院上海天文台65米天马望远镜和新疆天文台南山26米射电望远镜自2017年起持续参与EAVN观测，分别在提高观测灵敏度和角分辨率上发挥了重要作用。原李政道研究所博士后、现云南大学中国西南天文研究所副研究员林伟康，上海交通大学李政道研究所李政道学者Yosuke Mizuno，中国人民解放军空军预警学院俞锦涛博士，中国科学院上海天文台江悟副研究员和新疆天文台崔朗研究员等在数据分析处理和理论模型对比解释中做出了重要贡献。

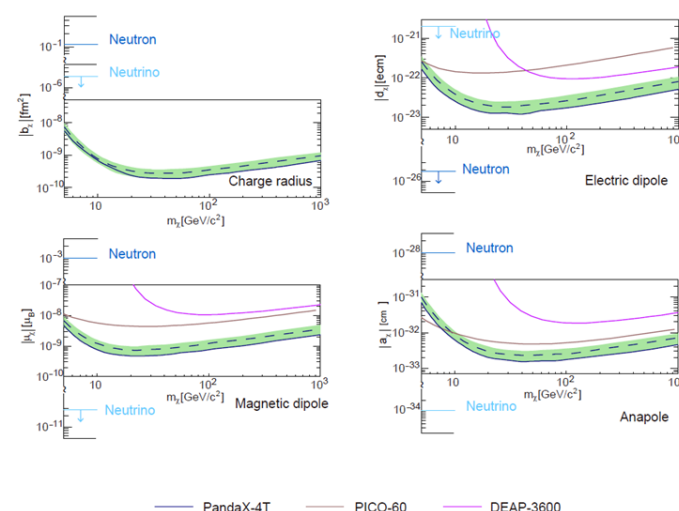
李政道学者Yosuke Mizuno说：“虽然本次研究成果揭示了超大质量黑洞的更多信息和性质，但天文学家们还要面对更多艰巨的挑战，吸积盘的精细的结构和M87超大质量黑洞的自旋精确值仍然亟待进一步研究。”基于这项工作，该研究团队预测还有更多的星系中心黑洞具有类似的倾斜的吸积盘结构，但如何探测到更多具有倾斜盘的源也面临更大的挑战。还有很多谜团需要更多的长期观测和更加详细的分析。

Limits on the luminance of dark matter from xenon recoil data

👤 PANDAX Collaboration

📄 [Nature 618 \(2023\) 47–50](#)

It is commonly conjectured that dark matter is a charge neutral fundamental particle. However, it may still have minute photon-mediated interactions through millicharge or higher-order multipole interactions, resulting from new physics at a high energy scale. Here we report a direct search for effective electromagnetic interactions between dark matter and xenon nuclei that produce a recoil of the latter from the PandaX-4T xenon-based detector. Using this technique, the first constraint on the charge radius of dark matter is derived with the lowest excluded value of $1.9 \times 10^{-10} \text{ fm}^2$ for a dark matter mass of 40 giga electron volts per speed of light in a vacuum squared (GeV/c^2), more stringent than that for neutrinos by four orders of magnitude. Constraints on the magnitudes of millicharge, magnetic dipole moment, electric dipole moment and anapole moment are also improved substantially from previous searches, with corresponding tightest upper limits of $2.6 \times 10^{-11} e$, 4.8×10^{-10} Bohr magnetons, $1.2 \times 10^{-23} \text{ ecm}$ and $1.6 \times 10^{-33} \text{ cm}^2$, respectively, for a dark matter mass of 20–40 GeV/c^2 .



从氙反冲数据得出的暗物质的亮度极限

大量的天文和宇宙学观测通过引力效应确认，宇宙中还存在比已知物质多5倍多的神秘物质。这些物质呈电中性，还未被人类用电磁手段“看”到，因此被称为“暗物质”。然而暗物质粒子是否存在“亮度”，一直是全世界科学家试图回答的基本问题。位于锦屏地下实验室的我国自主研发的新一代PandaX-4T实验，是国际首个投入运行的多吨级液氙探测实验，探测器性能显著提升。如果暗物质具有非零的“亮度”，它们可以通过交换光子同氙原子核产生长程相互作用，呈现出独特的反冲特征。PandaX实验团队基于前期同美国科学院院士Wick Haxton教授合作实现的有效场方法，把不同电磁效应转换为不同有效算符核矩阵元的组合，得到了相应的暗物质碰撞率和反冲特征；根据刻度数据构建了可靠的信号响应模型；通过似然度拟合方法对暗物质可能的电磁性质开展了系统寻找。根据观测数据，PandaX对暗物质电荷均方半径给出了国际首个实验上限，最强的上限值— $1.9 \times 10^{-10} \text{ fm}^2$ 出现在暗物质质量为40倍质子质量附近，比中微子电荷均方半径实验上限还要小1万倍，换算成实际尺寸比质子还要小约10万倍！PandaX对暗物质其他电磁性质的测量也比之前国际最好结果提升了3-10倍。PandaX的研究利用了最灵敏的氙原子核反冲数据，系统地给出了当前最好水平的暗物质“亮度”上限，显著提升了对暗物质究竟有多“暗”的定量理解。相关研究论文发表在2023年5月17日Nature [618 (7963) : 47-50]上。

上海交通大学物理与天文学院博士生宁旭阳为该论文的第一作者，学院周宁教授为该论文的通讯作者，李政道研究所副所长、物理与天文学院特聘教授刘江来为PandaX合作组的首席科学家。

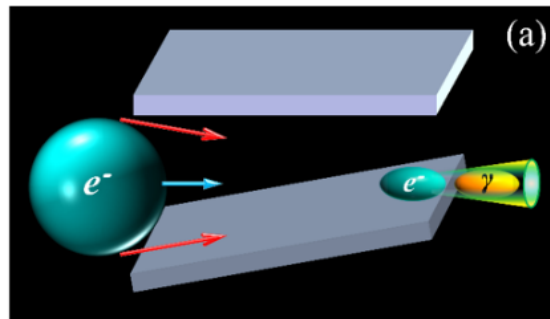
PandaX实验得到了教育部、科技部、上海市、四川省的大力支持，是自然科学基金委立项的重大项目。PandaX实验的合作单位包括山东大学、北京大学、中国科学技术大学、中山大学、北京航空航天大学、南开大学、复旦大学、原子能科学研究院以及雅砻江流域水电开发有限公司等，共有90多位科研工作者参与，美国、法国、西班牙、泰国部分科研单位也参与国际合作。PandaX实验得到了中国锦屏地下实验室的长期支持，该实验室由清华大学和雅砻江流域水电开发有限公司共同建设、管理。PandaX项目和人才还得到了香港鸿文基金会、腾讯基金会和阳阳发展基金的资助。

Efficient generation of collimated multi-GeV gamma-rays along solid surfaces

✉ Xing-Long Zhu, Wei-Yuan Liu, Min Chen, Su-Ming Weng, Dong Wu, Zheng-Ming Sheng, Jie Zhang

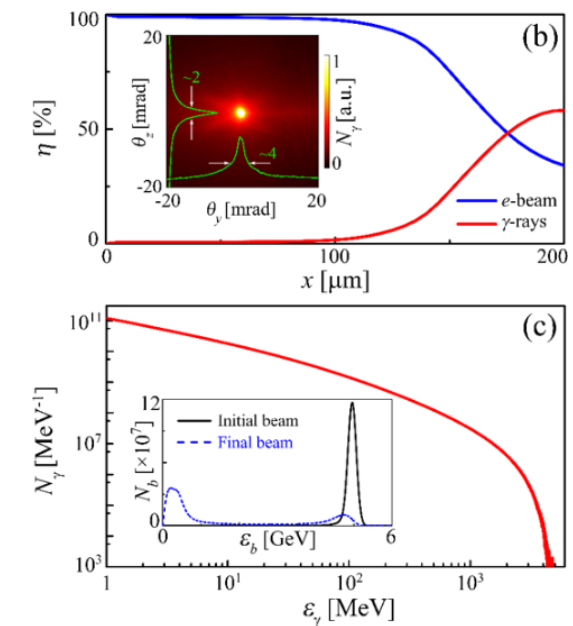
📄 [Optica 10 \(2023\) 118](#)

Bright gamma-ray sources are of great significance for fundamental research, medicine, and industry. However, gamma-ray production by bremsstrahlung, Compton scattering, and synchrotron radiation is often subjected to large divergence, wide size, and/or low efficiency, making it difficult to achieve high-brightness gamma-ray sources. Here, we have found an efficient mechanism to generate gamma-rays with, to our knowledge, unprecedented brilliance by use of an ultra-relativistic electron beam with nanocoulomb charge incident onto a solid surface at grazing incidence. With this interaction configuration, extreme high quasistatic magnetic fields up to the gigagauss level or effective electric fields up to 1014 V/m are induced by the background electron backflows at the target surface. Subsequently, the electron beam is strongly focused by such fields by over an order of magnitude to sub-micrometer diameter, and its density is increased beyond the solid density; the induced effective fields are high enough to trigger quantum electrodynamics (QED) effects. These result in the production of extremely brilliant dense gamma-ray beams with photon energy reaching multi-GeV, where the electron-to-photon energy conversion efficiency can exceed 60%. This offers a promising route to push the beam-target interaction to the QED regime, leading to ultrabright gamma-ray sources for various applications.



研究发现高效产生超高亮度伽马射线新机制

高亮度伽马射线源在基础研究、医学和工业等领域中具有重要研究与应用价值。常规的轫致辐射和康普顿散射等方式，受限于转化效率低和发散角大等因素，难以获得高亮度高能伽马射线。经过研究我们发现一种高效产生超高亮度伽马射线的新机制，其通过将纳库级相对论电子束以小角度掠入射到固体靶表面而实现的。在此相互作用过程中，电子束引起靶电子回流，由此产生高达吉高斯量级的超强准静态磁场，对应的有效电场强度为1014V/m。与此同时，电子束在其中经历了强烈的横向自聚焦，束斑尺寸压缩至亚微米量级和数密度提高至近固体范畴；在此过程中靶内激发的磁场进一步放大，从而触发强场QED效应并产生准直的高亮度伽马射线。其中，辐射的光子能量可达数GeV（取决于电子束能量），能量转化效率高达60%以上。该研究首次揭示了强场QED状态下的电子束与固体靶相互作用机制，产生了前所未有的超高亮度伽马射线源，将为诸多前沿研究与应用提供新机遇。

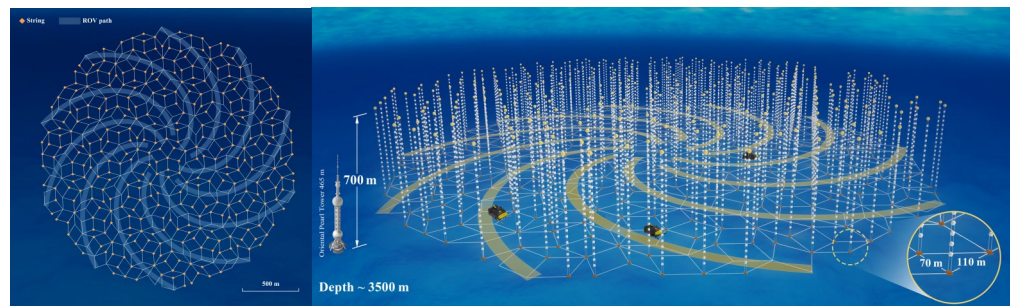


A multi-cubic-kilometre neutrino telescope in the western Pacific Ocean

Trident Collaboration

[Nature Astronomy 7 \(2023\) 1497–1505](#)

Next-generation neutrino telescopes with substantially improved sensitivity are required to pinpoint the sources of the diffuse astrophysical neutrino flux detected by IceCube and uncover the century-old puzzle of cosmic-ray origins. A detector near the Equator will provide a unique viewpoint of the neutrino sky, complementing IceCube and other neutrino telescopes in the Northern Hemisphere. Here we present results from an expedition to the northeastern region of the South China Sea, in the western Pacific Ocean. A favourable neutrino telescope site was found on an abyssal plain at a depth of ~ 3.5 km. At depths below 3 km, the sea current speed, water absorption and scattering lengths for Cherenkov light were measured to be $v_c < 10$ cm s $^{-1}$, $\lambda_{\text{abs}} \approx 27$ m and $\lambda_{\text{sca}} \approx 63$ m, respectively. Accounting for these measurements, we present the design and expected performance of a next-generation neutrino telescope, Tropical Deep-sea Neutrino Telescope (TRIDENT). With its advanced photon-detection technology and large dimensions, TRIDENT expects to observe the IceCube steady source candidate NGC 1068 with 5σ significance within 1 year of operation. This level of sensitivity will open a new arena for diagnosing the origin of cosmic rays and probing fundamental physics over astronomical baselines.



南海深海实验发现中微子望远镜优质台址

中微子不带电，且与物质的作用极微弱，可轻易从致密天体源逃逸，是研究极端宇宙、解答宇宙射线起源之谜的独特信使。天体中微子到达地球的通量极低，需要建设大型的深水（深冰）中微子望远镜来实现探测，而南海是否存在适合的台址未知。



上海交通大学李政道研究所徐东莲团队联合北京大学，清华大学，中国科学技术大学，自然资源部第二海洋研究所等科研院所，自研数套深海测光样机，带领团队于2021年9月赴南海科考，将样机布放至3500m深海，原位测量了深海海水的光学性质，采集了丰富的水文数据，经深入分析后验证了预选海域为理想的中微子望远镜台址；项目组基于所测海水光学参数，完成了TRIDENT望远镜概念设计——在传统基于多PMT的探测单元中引入快速响应的 SiPM 形成新型混合探测单元，再采用具有特殊对称性的彭罗斯密铺几何构型（更利于压制大气本底），可突破当今中微子望远镜设计的指向能力，建成后性能将引领全球同类设施，有望率先发现NGC 1068等多个潜在的中微子天体源。南海位于低纬度，随着地球的自转，TRIDENT可实现全灵敏度巡天，与升级后的南极冰立方实验（IceCube-Gen2）形成良好的竞争、互补关系，也为构建我国完备的多信使天文观测网奠定重要基础。

Multicomponent superconductivity and 4-fermion phase with broken time-reversal symmetry in $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$

Vadim Grinenko et al.,

[Nat Commun 14 \(2023\) 6734.](#)

[Science 380 \(2023\)1244-1247](#)

The properties of superconductors are related to spontaneously broken U(1) gauge symmetry. Multicomponent superconductivity can spontaneously break more than one symmetry, including rotational and time reversal (Z_2) symmetry, leading to new physical properties of the superconductors. An especially interesting situation arises when Z_2 symmetry is broken above the superconducting transition temperature, $T_{cZ_2} > T_{cU1}$. In this temperature range, a 4-fermion (quartic) state forms, a coherent state of pairs of Cooper pairs. The Quartic state is different from superconductivity, superfluidity, or magnetism and can open up possibilities for new applications in quantum electronics due to their unique electrical and magnetic properties.

An international research team led by scientists from Tsung Dao Lee Institute (TDLI), Shanghai Jiao Tong University, and KTH Royal Institute of Technology, Stockholm provided calorimetric evidence for the 4-fermion state with broken time-reversal (Z_2) symmetry [1]. The heat capacity measurements show that the quadrupling of fermions forms a distinct phase separated from the normal and the superconducting states by phase transition, at which Z_2 symmetry is spontaneously broken (Fig. 1a and 1b). Backed by experimental data from scanning tunneling microscopy (STM) measurements, this work is the first thermodynamic evidence for fluctuation-induced orders above superconducting transition in multicomponent superconductor $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$. The multicomponent superconductivity with non-trivial phase relation between components is evidenced by observation of quantum fractional vortices in $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$ at the same doping level using scanning SQUID in our collaborative research with Sandford University [2] (Fig. 1c and 1d).

The existence of the quartic phase represents a significant fundamental interest as it demonstrates the possibility of having a new kind of long-range order in condensed matter systems

that is distinct from superconductivity, superfluidity and magnetism. The authors anticipate that the quartic phase will open a possibility for new applications in quantum electronics due to its unique electrical and magnetic properties different from those of the superconducting and the normal metal states.

"The quartic state in the $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$ system appears in a very narrow "window" of doping level, and specific heat measurements are very sensitive to sample homogeneity. This represented a real challenge, says Vadim Grinenko from TDLI. Therefore, it took us a few years to accumulate data from enough samples to convincingly demonstrate a double anomaly in the heat capacity."

"I expected that it would be nearly impossible to resolve in specific heat the transition to electron quadrupling order because it was expected to be a very small contribution that can be seen only in a very clean sample, says Egor Babev from the Royal Institute of Technology in Stockholm. It is truly an outstanding experimental achievement."

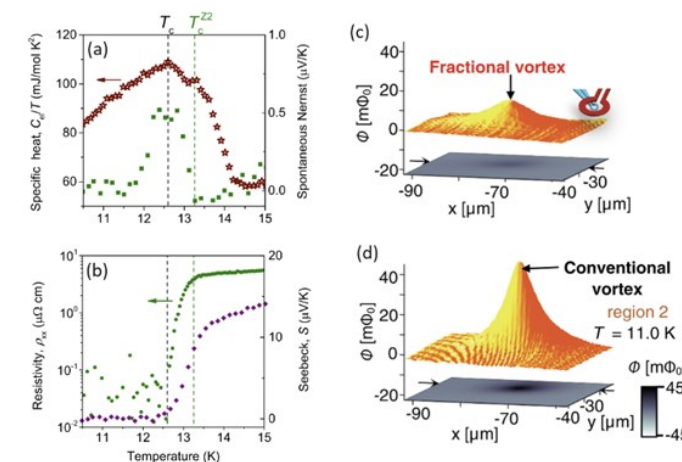


Fig. 1 (a) Temperature dependence of the specific heat compared with the spontaneous Nernst effect sensitive to T_{cZ_2} . (d) The zero-field electrical resistivity and the Seebeck effect reduce to zero at T_c . (c and d) SQUID measurements. (c) fractional vortex carrying ~ 0.3 of the flux quantum, and (d) conventional vortex appears in different cooling cycles in the same area.

时间反演对称性破缺下 $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$ 中的多元超导与四费米子相

超导体的特性与 $U(1)$ 规范对称性自发破缺有关。多组分超导可以自发地打破不止一个对称性，包括旋转对称性和时间反转 (Z_2) 对称性，从而导致超导体的新物理性质。当 Z_2 对称性在超导转变温度 ($T_{cZ_2} > T_{cU(1)}$) 以上被打破时，就会出现一种特别有趣的情况。在这个温度范围内，会形成一种 4 费米子 (四元) 态，即库珀对的梨状相干态。四元态不同于超导、超流或磁性，由于其独特的电学和磁学特性，可以为量子电子学的新应用提供可能性。

由上海交通大学李政道研究所 (TDLI) 和斯德哥尔摩皇家理工学院 (KTH Royal Institute of Technology, Stockholm) 科学家领导的一个国际研究小组为具有破碎时间反转 (Z_2) 对称性的 4 费米子态提供了热量测量证据[1]。热容量测量结果表明，费米子的四倍化形成了一个与正常态和超导态相分离的独特相位，在相位转换时， Z_2 对称性被自发打破 (图 1a 和 1b)。在扫描隧道显微镜 (STM) 测量的实验数据支持下，这项工作首次从热力学角度证明了多组分超导体 $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$ 中超导转变以上的波动诱导阶次。我们与桑福德大学 (Sandford University) 的合作研究[2]利用扫描 SQUID 在相同掺杂水平的 $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$ 中观察到量子分数涡旋，证明了各组分之间具有非三相关系的多组分超导性 (图 1c 和 1d)。

四元相的发现创造了一个重要的基础科研方向，因为该发现同时证明了在凝聚态体系中有可能存在一种与包括超导、超流及磁性等相比很不一样的新长程序。我们预期，与超导态和正常金属态相比，四元相具有截然不同的电学和磁学特性；因此，它的发现将为量子电子学的新应用开辟可能性。

李政道研究所Vadim Grinenko副教授表示：“四重态在 $\text{Ba}_{1-x}\text{K}_x\text{Fe}_2\text{As}_2$ 体系中只会在掺杂水平的一个非常窄的“窗口”中出现，再加上比热测量对样品的均匀性极为敏感，要在实验

中观测到该四重态无疑是一个巨大的挑战。为此，我们足足花了数年时间从众多样品中积累足够的数据，最终明确证明在热容中出现双重异常。”

斯德哥尔摩皇家理工学院Egor Babaev教授表示：“电子四重态相变在比热测量中只会贡献出非常微弱的信号，并且在非常干净的样品中才能观测到。因此，我原来预期在比热测量中是几乎不可能观测到该相变。四重态的发现确实是一项杰出的实验成果。”

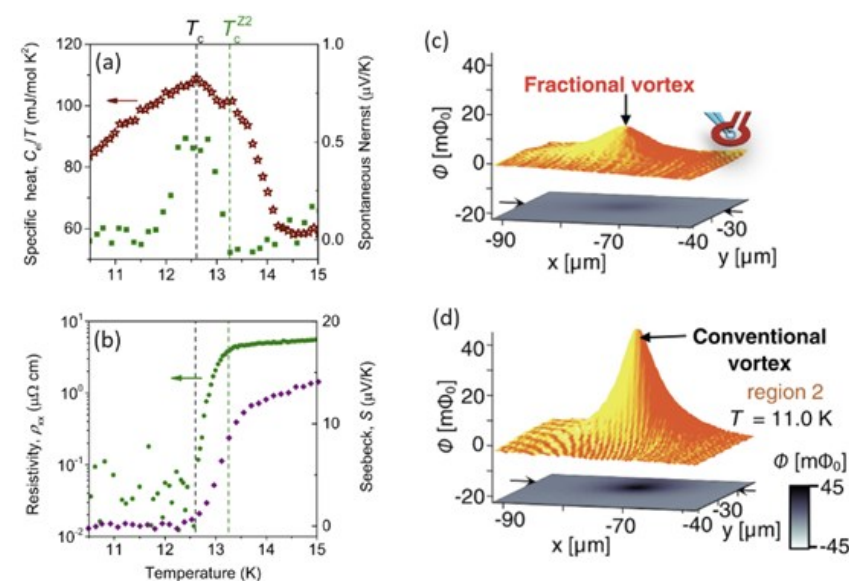


Fig. 1 (a) 比热的温度依赖性与对 T_{cZ_2} 敏感的自发恩斯特效应的比较。(b) 零场电阻率和塞贝克效应在 T_c 时降至零。(c and d) SQUID 测量。(c) 分数涡旋携带 ~ 0.3 的通量量子。(d) 在同一区域的不同冷却循环中会出现常规涡流

Observation of Vector Boson Scattering in neutral di-boson final states (ZZ and Z γ) and 1st total differential cross section measurement

Shu Li, Kun Liu, Qibin Liu, Haijun Yang et al.

Nature Physics 19 (2023) 237–253

Electroweak Symmetry Breaking (EWSB) is one of the most important fundamental phenomena and research focuses in particle physics. The Vector Boson Scattering (VBS) process is a key to probe the EWSB mechanism and the Higgs mechanism in unitarization of boson scatterings, through the longitudinal polarization components. Without the presence of Higgs, the rate of VBS process would grow indefinitely with the collision energy. Besides, being one of the rare processes in Standard Model (SM) Electroweak Sector, VBS provides not only deeper understanding of SM, but also sensitive to BSM new physics through Vector Boson Fusion (VBF).

The Large Hadron Collider has by far observed, with more than 5-sigma significance, the VBS processes in di-boson pair final states: same-sign WW, opposite-sign WW, WZ and now finally in ZZ final states for the 1st time at LHC by ATLAS experiment. It's an extremely challenging task due to the scarceness of the signal with high electroweak coupling orders and in presence of large and irreducible QCD background in proton-proton collisions.

Such accomplishment has been widely regarded as "new milestone in the study of electroweak symmetry breaking" by the physics briefing of ATLAS collaboration (~40 countries, ~180 institutions, ~6000 members and ~2900 authors), as it for 1st time demonstrates the evident signature of the di-neutral-bosons produced by pure EWK interactions at tree-level in particular through VBS preferentially opposite to each other in direction along beamline, striking a rare but remarkable footprint in ever measured SM processes.

W/Z+photon can be also produced through VBS and provide unique advantage for precision test of SM EWK theory given the relatively larger rate. With careful estimation and sophisticated optimization against backgrounds, the Z γ VBS process is measured for the 1st time at ATLAS with way more than 5-sigma significance. More importantly, the precise measurement is performed differentially to not only Z γ VBS but also the total cross section of pp Z γ jj including electroweak and strong interactions plus interference in a well defined fiducial volume for 1st time. Such measurements provide invaluable physical information to thoroughly and precisely examine all three fundamental interactions (Electromagnetic, Weak and Strong) in SM all together at the same time taking into account interference effects, too.

双电中性矢量玻色子散射过程观测和首次完成

电弱对称性破坏 (EWSB) 是粒子物理前沿的重要基础研究热点课题之一。矢量玻色子散射 (VBS) 是深入研究电弱对称性破坏机制, 以及散射过程中的希格斯么正性机制的重要过程, 并以纵向极化分量为直接探针。在无希格斯机制作用假设下的标准模型预言中, 纵向极化的 W/Z 矢量玻色子散射振幅将会随能量增加最终在TeV能区破坏么正性。此外, VBS作为树图阶纯电弱作用稀有过程, 为检验标准模型电弱理论提供独特视角, 同时与其类似的矢量玻色子融合 (VBF) 过程也是寻找超越标准模型新物理的重要工具。

大型强子对撞机 (LHC) 实验目前为止已经在5倍标准偏差以上统计显著度观测到了同号WW、异号WW、WZ以及最新的ZZ末态的VBS过程。ATLAS此次所观测到的ZZ VBS过程是LHC实验中的首次。因为LHC实验中的大量QCD背景干扰和VBS本身作为电弱高阶过程的稀有性, 该工作非常具有挑战性。ZZ VBS的发现曾被ATLAS国际合作组 (~40个国家, ~180个研究所, ~6000名成员, ~2900名物理作者) 作为物理成果热点报导称其为“电弱对称性破坏研究的里程碑”, 是LHC上首个被以5倍标准偏差以上的统计显著度观测到的双电中性矢量玻色子散射过程, 在实验现象学中体现为双轻衰变的ZZ双玻色子伴随前后向端盖部的强子喷注, 且ZZ及双强子喷注在树图阶均由纯电弱相互作用顶点产生, 是LHC实验中极具代表性的标准模型稀有过程成功观测的范例之一。

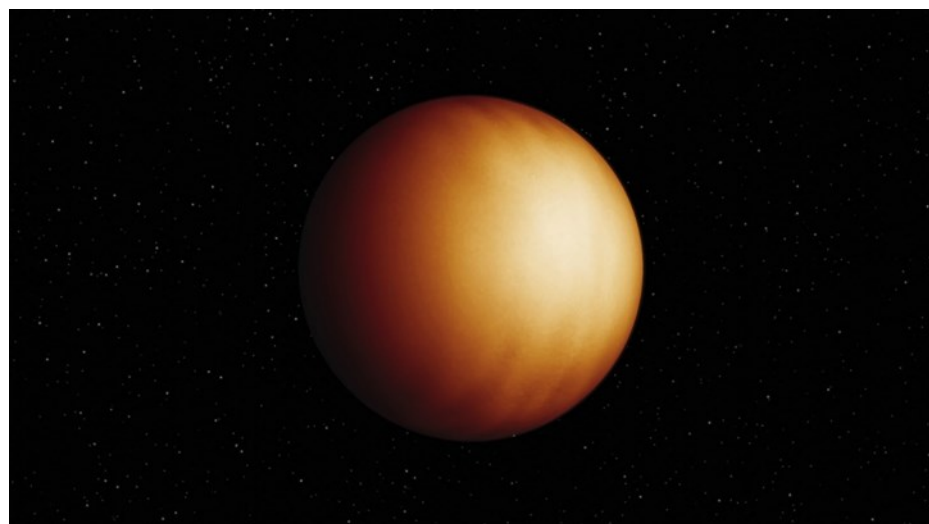
W/Z+光子(γ)末态的VBS测量同样重要, 其物理意义主要在于可以通过LHC上更高的产生截面来为标准模型电弱与强相互作用理论的精确检验提供天然有利条件。

Z γ VBS过程的重要且不可约背景为Z γ 伴随强相互作用的强子喷注。经过细致的分析与优化工作, Z γ VBS过程在LHC-ATLAS上首次被以5倍标准偏差以上的统计显著度观测到。该研究工作中更重要的意义在于: 同时对于 $pp \rightarrow Z\gamma jj$ 完整过程完成了电弱、强相互作用和干涉项在约化相空间中首次完成了微分截面测量。由于该工作对标准模型所包含的所有三大相互作用 (电磁、弱、强) 及其干涉项的完整且精确的测量, 对于更加深刻地理解和检验标准模型最基本相互作用规律及干涉机制的具有非常重要的物理价值。

Discovery Alert: Webb Maps and Finds Traces of Water in a Super-hot Gas Giant 's Atmosphere

👤 Xianyu Tan et al.

📄 [Nature 620, \(2023\) 292–298](#)



WASP-18 b, seen in an artist concept, is a gas giant exoplanet 10 times more massive than Jupiter that orbits its star in just 23 hours. Researchers used NASA's James Webb Space Telescope to study the planet as it moved behind its star. Temperatures there reach 5,000 degrees Fahrenheit (2,700 °C). Credit: NASA/JPL-Caltech (K. Miller/IPAC)

There's an intriguing exoplanet out there – 400 light-years out there – that is so tantalizing that astronomers have been studying it since its discovery in 2009. A year for WASP-18 b, one orbit of star (slightly larger than our Sun), takes just 23 hours. There's nothing like it in our solar system. In addition to observatories on the ground, NASA's Hubble, Chandra, TESS, and Spitzer space telescopes have all been used to observe WASP-18 b, an ultrahot

The discovery: Scientists identified water vapor in the atmosphere of WASP-18 b, and made a temperature map of the planet as it slipped behind, and reappeared from, its star. This is known as a secondary eclipse. Scientists can read the combined light from star and planet, then refine the measurements from just the star as the planet moves behind it.

The same side, known as the dayside, of WASP-18 b always faces the star, just as the same side of the Moon always faces Earth. The temperature, or brightness, map shows a huge change in temperature – up to 1,000 degrees – from the hottest point facing the star to the terminator, where day and night sides of the tidally-locked planet meet in permanent twilight.

Researchers made a brightness map, tracing the glow from hot regions of WASP-18 b as it slipped behind, and reappeared from, its star. This event is known as a secondary eclipse. Scientists can measure the combined light from star and planet, then measure the light from just the star as the planet moves behind it. The plot is a light curve, the measured change in brightness of a star as a planet moves in front of or behind it. The planet's brightness map, obtained using NASA's James Webb Space Telescope, allowed researchers to determine a temperature map of the planet's atmosphere. Credit: NASA/JPL-Caltech (K. Miller/IPAC)

"JWST is giving us the sensitivity to make much more detailed maps of hot giant planets like WASP-18 b than ever before. This is the first time a planet has been mapped with JWST, and it's really exciting to see that some of what our models predicted, such as a sharp drop in temperature away from the point on the planet directly facing the star, is actually seen in the data!" said Megan Mansfield, a Sagan Fellow at the University of Arizona, and one of the authors of the paper describing the results.

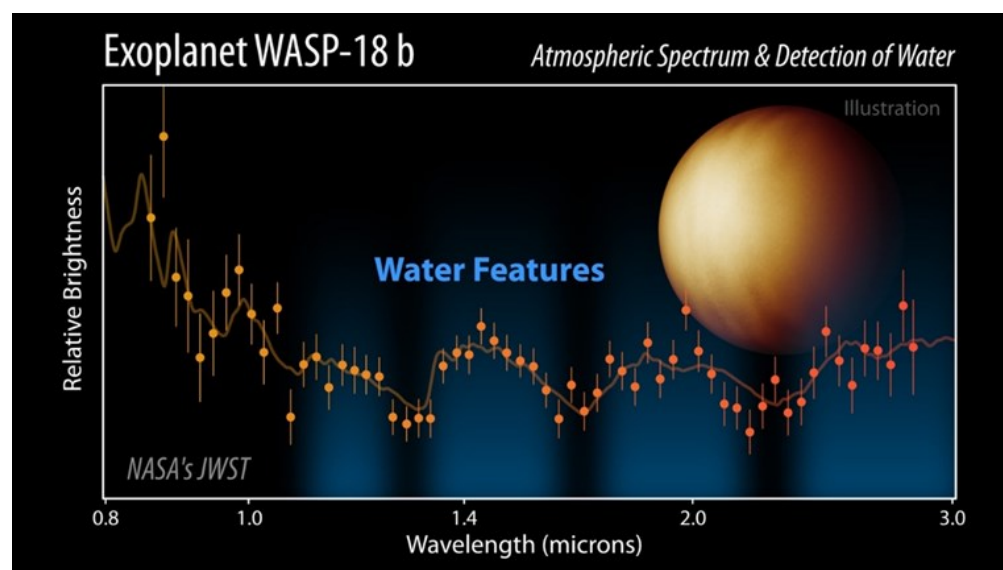
The team mapped temperature gradients across the day side of the planet. Given how much cooler the planet is at the terminator, there is likely something hindering winds from efficiently redistributing heat to the night side. But what is hindering the winds is still a mystery.

"The brightness map of WASP-18b shows a strong symmetry around the substellar point in the east-west direction which is in contrast to models for other hot Jupiters. One possible explanation is that the planetary atmosphere effectively interacts with the planetary magnetic field and this suppresses the formation of a strong eastward jet stream. It is exciting to see this effect directly from the thermal map!" said co-author Xianyu Tan, of Shanghai Jiao Tong University.

One interpretation of the eclipse map is that magnetic effects force the winds to blow from the planet's equator up over the North pole and down over the South pole, instead of East-West, as we would otherwise expect.

Researchers recorded temperature changes at different elevations of the gas giant planet's layers of atmosphere. They saw temperatures increase with elevation, varying by hundreds of degrees.

The spectrum clearly shows multiple small but precisely measured water features, present despite the extreme temperatures of almost 5,000 degrees Fahrenheit (2,700 °C). It's so hot that it would tear most water molecules apart, so still seeing its presence speaks to Webb's extraordinary sensitivity to detect remaining water that survived. The amounts recorded in WASP-18 b's atmosphere indicate water vapor at various elevations.



The team obtained the thermal emission spectrum of WASP-18 b by measuring the amount of light it emits over NASA's James Webb Space Telescope's NIRISS SOSS 0.85-2.8 um wavelength range, capturing 65% of the total energy emitted by the planet. WASP-18 b is so hot on the day side of this tidally-locked planet (the same side always faces its star, as the Moon to Earth) that water vapor molecules would break apart. The Webb Telescope directly observed water vapor on the planet in even relatively small amounts, indicating the sensitivity of the observatory. Credit: NASA/JPL-Caltech (R. Hurt/IPAC)

"It was a great feeling to look at WASP-18 b's JWST spectrum for the first time and see the subtle but precisely measured signature of water," said Louis-Philippe Coulombe, a graduate student at the University of Montreal and lead author of the WASP-18 b [paper](#). "Using such measurements, we will be able to detect such molecules for a wide range of planets in the years to come!"

Researchers looked at WASP-18 b for about six hours with one of Webb's instruments, the Near-Infrared Imager and Slitless Spectrograph (NIRISS), contributed by the Canadian Space Agency.

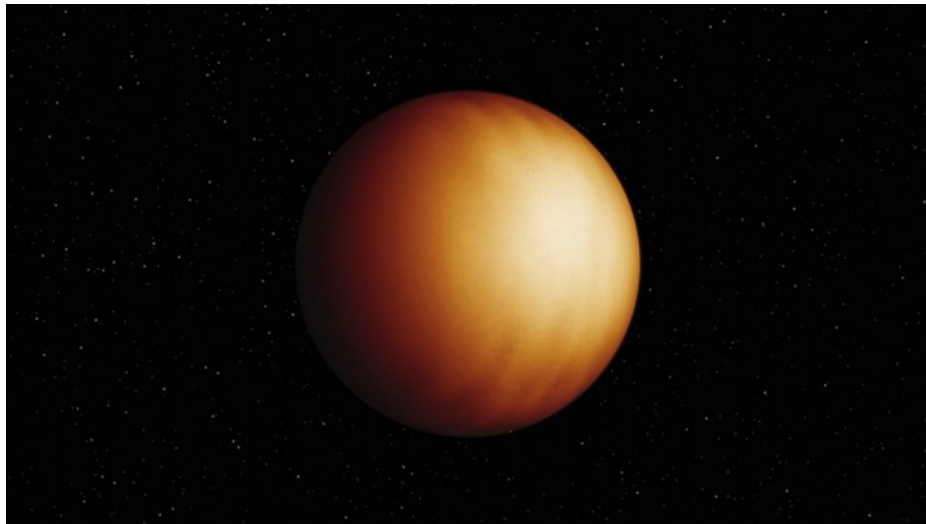
"Because the water features in this spectrum are so subtle, they were difficult to identify in previous observations. That made it really exciting to finally see water features with these JWST observations!" said Anjali Piette, a postdoctoral fellow at the Carnegie Institution for Science who is one of the authors of the new research.

The discoverers: More than 100 scientists around the globe are working on early science from Webb through the Transiting Exoplanet Community Early Release Science Program led by Natalie Batalha, an astronomer at the University of California, Santa Cruz, who helped coordinate the new research. Much of this groundbreaking work is being done by early career scientists like Coulombe, Challener, Piette, and Mansfield. Associate professor Xianyu Tan at the Tsung-Dao Lee Institute, Shanghai Jiao Tong University, contributed numerical models and interpretations of the data to this study.

Proximity, both to its star and to us, helped make WASP-18 b such an intriguing target for scientists, as did its large mass. WASP-18 b is one of the most massive worlds whose atmospheres we can investigate. We want to know how such planets form and come to be where they are. This, too, has some early answers from Webb.

"By analyzing WASP-18b's spectrum, we not only learn about the various molecules that can be found in its atmosphere but also about the way it formed. We find from our observations that WASP-18 b's composition is very similar to that of its star, meaning it most likely formed from the leftover gas that was present just after the star was born," Coulombe said. "Those results are very valuable to get a clear picture of how strange planets like WASP-18 b, which have no counterpart in our solar system, come to exist."

韦伯望远镜为一颗超热气态巨行星的大气层绘制地图并发现水的踪迹



在这张艺术家的构想图中，WASP-18 b 是一颗气态系外巨行星，质量比木星大 10 倍，仅需 23 小时即可绕其恒星运行一周。研究人员使用詹姆斯韦伯太空望远镜研究了这颗行星在其恒星后面移动时的情况。行星大气的温度高达 2,700 摄氏度。图片来源：NASA/JPL-Caltech (K. Miller/IPAC)。

距地球 400 光年的 WASP-18 b 是一颗有趣的系外行星，它的质量是木星的 10 倍，自 2009 年发现它以来，天文学家一直在研究它。WASP-18 b 的一年，也就是围绕恒星的一个轨道周期，仅有 23 小时，这比我们太阳系内任何的行星轨道周期要短得多。除了地面天文台外，美国宇航局的哈勃望远镜（Hubble）、钱德拉望远镜（Chandra）、苔丝望远镜（TESS）和斯皮策太空望远镜（Spitzer）都已被用于观测 WASP-18 b。现在，天文学家用詹姆斯·韦伯太空望远镜（JWST）对它进行了观测，“第一”不断涌现。

科学发现：科学家们在 WASP-18 b 的大气层中发现了水蒸汽，并根据这颗行星从其恒星

后面经过并重新出现的过程绘制了这颗行星的大气温度图。该观测方法被称为星食。科学家们读取来自恒星和行星的组合光，然后当行星移动到恒星后面时，根据仅有的恒星光来提炼行星的测量结果。

WASP-18 b 很可能是潮汐锁相的，即行星的同一侧（日侧）始终面向恒星，就像月球的同一侧始终面向地球一样。温度图，或亮度图，显示了该行星从面向恒星距离最近的点（下日点）到日侧的边缘含有高达 1,000 摄氏度的巨大温差。

研究人员在 WASP-18 b 进入恒星背后然后又重新出现的过程中追踪了 WASP-18 b 的热辐射光，为其绘制了一张亮度图。此事件称为星食。科学家们可以测量来自恒星和行星的组合光，然后测量当行星被恒星掩盖时单独来自恒星的光。该图是一条光变曲线，是一颗行星在其前方或后方移动时测得的恒星亮度变化。使用詹姆斯韦伯太空望远镜获得的行星亮度图使研究人员能够确定行星大气层的温度分布图。图片来源：NASA/JPL-Caltech (K. Miller/IPAC)。

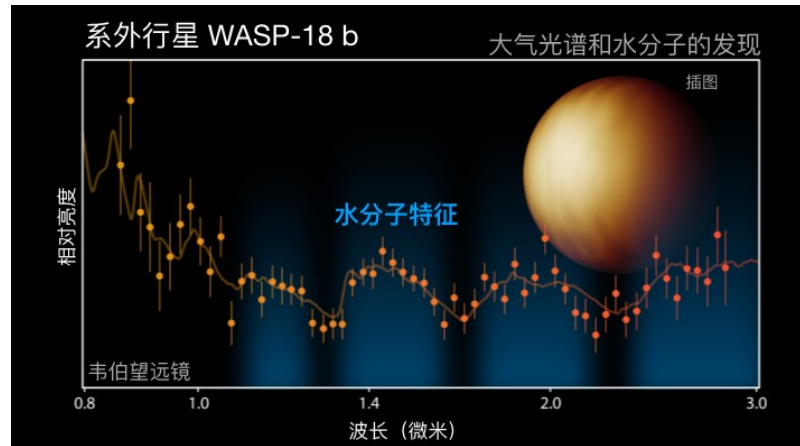
“JWST 的高灵敏度使我们能够为类似 WASP-18 b 的热巨行星绘制比以往任何时候都更详细的地图。这是 JWST 首次绘制行星地图，从结果中看到我们此前的一些理论模型预测真的很令人兴奋，例如温度随着远离下日点而急剧下降，这在数据中真实地体现了出来！”梅根·曼斯菲尔德说，她是亚利桑那大学的萨根博士后奖金获得者，论文的作者之一。

该团队绘制了该行星日侧温度梯度图。考虑到日侧边缘的温度如此的低，该结果说明可能有一些物理过程阻碍了风有效地将热量重新分配到夜间。但到底是什么阻碍了风，至今仍是谜。

“WASP-18b 的亮度图显示了其在东西方向相对下日点的强烈对称性，这与其他热木星的模型形成了鲜明的对比。一种可能的解释是行星大气与行星磁场有效地相互作用，这抑制了强烈的向东急流的形成。直接从温度图上看到这种效果是非常令人振奋的！”论文的合著者，上海交通大学副教授谭先瑜说。

对日食地图的一种解释是，行星磁场迫使风从行星赤道向上吹过北极，向下吹过南极，而不是像我们预期的那样吹向东西方向。

研究人员同时记录了这颗气态巨行星大气温度随着高度的变化。他们看到温度随着海拔升高而升高，垂直温差达到数百摄氏度。



光谱清晰地显示出多个小的但精确测量的水蒸汽特征，尽管日侧温度达到近2,700 摄氏度。日侧是如此之热以至于高温撕裂了大部分水分子，但我们仍然看到水分子的存在说明韦伯的非凡敏感性能检测到幸存的水分子。 WASP-18 b 大气光谱的变化幅度告诉我们不同高度的水蒸汽含量。

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该团队利用詹姆斯韦伯太空望远镜的 NIRISS SOSS 仪器在0.85-2.8 微米波段范围内测量 WASP-18 b 的热发射光谱，该光谱包含了该行星发射总能量的 65%。这颗被潮汐锁相的行星的白天非常热（同一面总是朝向它的恒星，就像月球朝向地球一样）以至于水蒸汽分子会被分裂。韦伯望远镜直接观测到该行星上相对少量的水蒸汽，显示了望远镜的高灵敏度。图片来源：NASA/JPL-Caltech (R. Hurt/IPAC)

“第一次看到 WASP-18 b 的 JWST 光谱并看到微妙但精确测量的水特征，感觉很棒，”蒙特利尔大学研究生和WASP-18 b论文的主要作者 Louis-Philippe Coulombe 说。“使用这样的测量，我们将能够在未来几年为广泛的行星检测到这样的分子！”

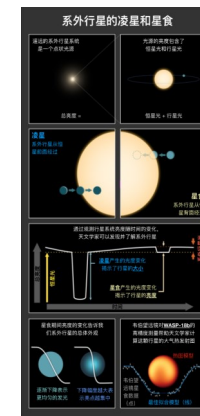
研究人员使用韦伯的一个仪器——加拿大航天局提供的近红外成像仪和无狭缝光谱仪 (NIRISS)，对 WASP-18 b 进行了大约六个小时的观察。

“因为这个光谱中的水分子特征非常微妙，在以前的观察中很难识别它们。最终通过 JWST 的这些观测结果看到了水的特征，这真是令人兴奋！”卡内基科学研究所的博士后研究员，这项新研究的作者之一，Anjali Piette 说。

研究团队：全球 100 多名科学家正在通过由加州大学圣克鲁兹分校的天文学家娜塔莉·巴塔利亚 (Natalie Batalha) 领导的凌星系外行星社区早期发布科学计划，从韦伯开展早期科学研究，她帮助协调了这项新研究。这些开创性的工作大部分是由早期职业科学家完成的，例如 Coulombe、Challener、Piette 和 Mansfield。上海交通大学李政道研究所的谭先瑜副教授为该研究贡献了数值模拟和理论解释。

WASP-18 b 与其恒星和我们的距离都非常近，且质量巨大，这使得 WASP-18 b 成为科学家们感兴趣的目标。 WASP-18 b 是可以为我们提供大气研究的大质量行星之一，我们想知道这些行星是如何形成并到达它们所在的位置的。这也有一些来自韦伯的早期答案。

“通过分析 WASP-18b 的光谱，我们不仅可以了解在其大气层中发现的各种分子，还可以了解它的形成方式。我们从观察中发现，WASP-18 b 的成分与它的恒星非常相似，这意味着它很可能是由恒星诞生后留下的剩余气体形成的，”Coulombe 说。“这些结果对于清楚地了解像 WASP-18 b 这样在我们的太阳系中没有对应物的奇怪行星是如何存在的非常有价值。”



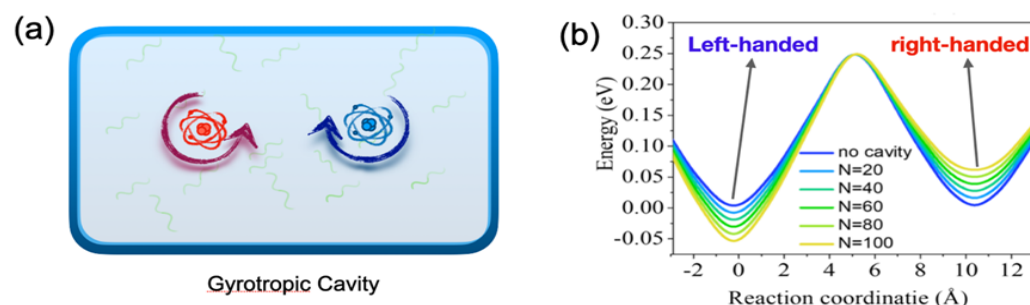
科学家们使用詹姆斯·韦伯太空望远镜观测了系外行星 WASP-18 b 及其恒星在行星被遮挡之前、期间和之后的情况。通过测量行星在恒星后面运行时的光线变化，可以揭示行星的亮度分布。通过这些测量，科学家们能够绘制出该行星日面的温度图。显示温度范围：1,500 至 2,600 摄氏度。图片来源：NASA/JPL-Caltech (R. Hurt/IPAC)

Vacuum quantum fluctuations in gyrotropic microcavity can induce a chirality-dependent spectral shift of chiral molecules

Qingdong Jiang et al.

Phys. Rev. Lett. 131, 223601

The notion of chirality dates back to 1848, when Louis Pasteur observed two crystals that, similar to our hands, were mirror images of each other but could not completely superposed on each other. Chirality is a basic concept of nature; many organic molecules in life only appear in one type of chirality, not the other. A pair of molecules that are mirror images of each other are called enantiomers. Due to the similarity in physical properties of enantiomers, how to effectively identify and select molecules with specific chirality has become an important key scientific issue.



Qingdong Jiang's research group proposed that in a gyrotropic microcavity, vacuum quantum fluctuations can lead to chirality-dependent energy spectrum shifts [1], as shown in schematic diagram (a). Since the microcavity causes enantiomers of opposite chirality to have different ground state energies, the reaction barriers they need to cross when participating in chemical reactions are also different (see figure (b)). Therefore, this effect can be used to effectively produce molecules with specific chirality through chemical reactions.

Exploiting vacuum quantum fluctuations to select molecules with specific chirality in chemical

reactions is a promising research direction. At first glance, this may seem impossible because, by definition, a vacuum contains no matter, and therefore should not have an impact on chemical reactions. However, this is not the case, because the vacuum is not completely "empty". Quantum fluctuations in the vacuum lead to many famous phenomena, including the anomalous magnetic moment of electrons, Lamb shift, Casimir effect, and atomic spontaneous emission.

In previous studies, it is generally believed that vacuum quantum fluctuations do not contain any symmetry breaking information and can only induce the same energy level shift of enantiomers, making it difficult to distinguish chiral molecules. However, in 2018, Qingdong Jiang and Nobel Prize winner Frank Wilczek, chief scientist of the Tsung-Dao Lee Institute and professor at MIT, proposed the concept of quantum atmospheric effects. The quantum atmosphere effect refers to the fact that symmetry breaking can be transmitted from materials to their vicinity via vacuum quantum fluctuations. The vacuum in proximity to a symmetry-broken material is referred to as its quantum atmosphere [2]. Since the quantum atmosphere contains symmetry-breaking characteristics, the quantum state of the material or molecule can be actively controlled by utilizing the quantum atmosphere of the material. This study shows that the quantum atmosphere inside a gyrotropic microcavity can chirality-dependent energy shifts, providing a new solution for the selective synthesis of chiral molecules.

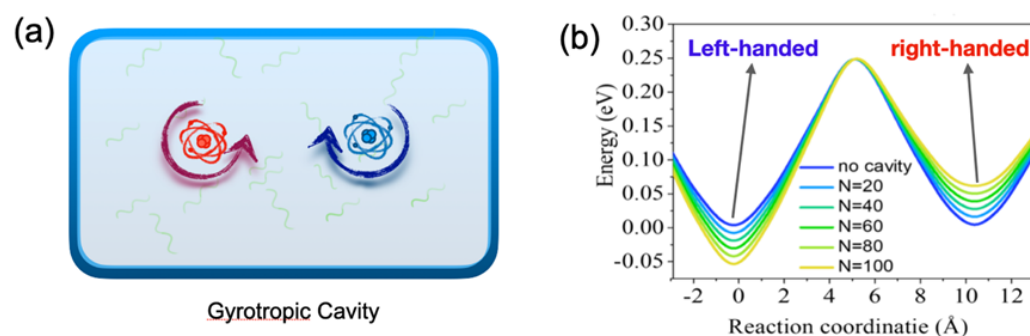
This research work was completed under the guidance of Prof. Qingdong Jiang: Undergraduate student Yanzhe Ke, as the first author, did an excellent job in analytical derivations; Harvard University postdoctoral fellow Zhigang Song, as the co-first author, provided important calculations for support. This research was funded by Pujiang Talent Plan, Jiaotong University 2030 Plan, and Science and Technology Innovation 2030 Plan.

[1] Vacuum-Induced Symmetry Breaking of Chiral Enantiomer Formation in Chemical Reactions, Yanzhe Ke, Zhigang Song, and Qing-Dong Jiang, Phys. Rev. Lett. 131, 223601 (2023)

[2] Quantum atmospheric effects for materials diagnosis, Qing-Dong Jiang and Frank Wilczek, Phys. Rev. B 99, 201104(R) (2019)

在螺旋微腔中，真空量子涨落能够引起手性依赖的能谱位移

手性的概念最早可追溯到1848年，当时路易·巴斯德观察到有两种晶体类似于我们的双手，彼此互为镜像但无法完全叠合。手性是自然界的基本属性，许多分子会形成互为镜像的两种结构，这两种结构无论如何旋转都无法完全重合，因此这些分子通常被称为手性分子。互为实物与镜像的一组分子被称为对映异构体。有趣的是，构成生命体的大多数有机分子都是手性分子，并且几乎都以单一异构体的形式存在。由于对映异构体在物理性质上的相似性，如何有效



地鉴别和选择特定手性的分子则成为了一个关键的科学问题。

蒋庆东研究组提出，在螺旋微腔（gyrotropic microcavity）中，真空量子涨落能够引起手性依赖的能谱位移 [1]，如图（a）所示。

由于微腔的影响，相反手性的对映异构体具有不同的基态能量，它们在参与化学反应时需要越过的反应势垒也不同，如图（b）所示。因此，利用该效应可以通过化学反应的方式，有效地产生特定手性的分子。

利用真空量子涨落来在化学反应中选择特定手性的分子，这一研究方向的前景十分广阔。初听之下，此举似乎是不可能的，因为根据定义，真空中不包含任何物质，也就不应对化学反

应产生影响。然而，事实并非如此，因为真空并非完全“空无一物”，真空中的量子涨落引发了多种著名现象，包括电子反常磁矩、兰姆位移、卡西米尔效应以及原子自发辐射等。

在过去的研究中，通常认为真空量子涨落不牵涉对称性破缺信息，通常只能导致对映异构体发生相同的能级位移，从而难以区分手性分子。然而，在2018年，蒋庆东与诺贝尔奖得主 Frank Wilczek 提出了量子大气效应的概念。量子大气效应指的是材料内部的对称性破缺能够通过量子涨落传递至其邻近的真空区域，这一真空区域被称为该材料的量子大气。

例如，螺旋微腔（gyrotropic cavity）破坏了镜面对称性，因此其内部的量子大气具备了镜面对称性破缺特征，从而能够对处于其中的对映异构体产生不同的影响。这项研究成果表明，螺旋微腔内部的量子大气能够引起手性相反的分子发生不同的能级移动，为实现手性分子的选择性合成提供了全新的方案。

该项研究在上海交通大学李政道学者蒋庆东的指导下完成：本科生柯彦哲作为第一作者，出色地完成了核心解析推导工作；哈佛大学博士后宋志刚作为共同第一作者为该项研究提供了重要的计算支持。这项研究得到了浦江人才计划、交大2030计划以及科技创新2030计划的资助。

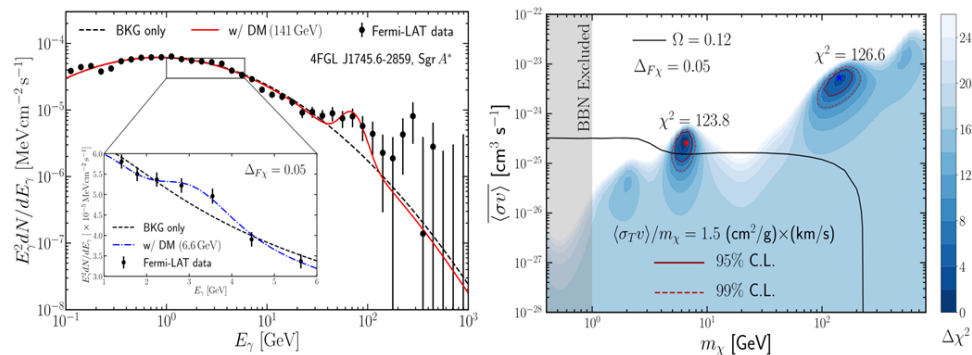
参考文献：

[1] Vacuum-Induced Symmetry Breaking of Chiral Enantiomer Formation in Chemical Reactions, Yanzhe Ke, Zhigang Song, and Qing-Dong Jiang, Phys. Rev. Lett. 131, 223601 (2023)

[2] Quantum atmospherics for materials diagnosis,

Qing-Dong Jiang and Frank Wilczek, Phys. Rev. B 99, 201104(R) (2019)

-standing painful issue for this intricate theory.



One theory group from the Particle and Nuclear Division, including two PhD students Yu Cheng and Jie Sheng as well as their advisors Chair Professor Xiao-Gang He and Tsung-Dao Lee Fellow Shao-Feng Ge, proposed the possibility that a SMBH can accelerate DM to reactivate the forbidden annihilation [Phys.Lett.B 847 (2023) 138294 [arXiv:2211.05643 [hep-ph]]]. The gravitational attraction of the SMBH is very strong and can significantly affect the DM density profile in the galaxy. Closer to the SMBH, the DM density becomes higher and the DM velocity also becomes larger. With the radius from the SMBH being comparable with the BH horizon, the DM particles can be even accelerated to around the speed of light. This allows the DM kinetic energy to be comparable with the DM rest energy which is large enough to overcome the threshold of the forbidden annihilation. In other words, the SMBH can serve as DM accelerator to make DM particles collider and annihilate into SM particles.

The SM particles from the DM annihilation also move fast, which is especially true for the massless photons that can leave the central SMBH at the speed of light. Since the DM annihilation happens outside the BH horizon, photons can escape from the gravitational confinement in spite of gravitational redshift. Such photon signal can happen only around a SMBH and can be observed with astronomy telescopes. Observing the DM annihilation signal only around a SMBH but not anywhere else is a unique signal of the forbidden DM. This solves the difficulty of testing the forbidden DM scenario by indirect detection.

We compare the Fermi-LAT gamma ray observation data (Black data points in the left panel of the figure above) for the Sgr A* area around the Milky Way galaxy center with the theoretical predictions, including both the background only (black) and background plus signal (red or blue). The result shows that there are two local best-fit points around the gamma ray energies of 3GeV and 70GeV. Including the forbidden DM signal can improve the agree-

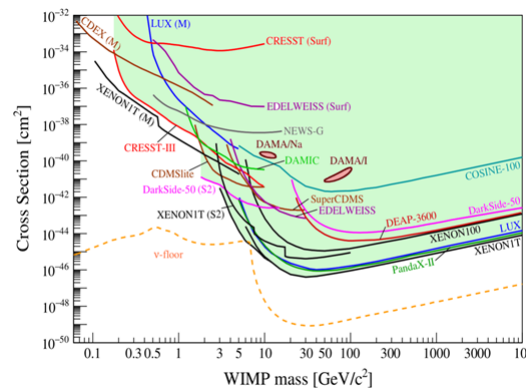
ment between the theoretical predictions and the experimental data. Although the current significance is not so high and needs further observational data to verify, preliminary analysis shows the viability and importance of this method for testing the forbidden DM scenario. Currently, this allowed cross section for the DM annihilation around SMBH can be as large as 10-25cm³/s which can predict the correct DM relic density (black line in the right panel).

Together with Chair Professor Tsutomu Yanagida, Shao-Feng Ge, Yu Cheng, and Jie Sheng further propose a concrete model. Based on the Type-I seesaw mechanism proposed by Prof. Yanagida back in 1979 for explaining why the neutrino mass is so tiny, the third right-handed heavy neutrino is adapted to serve as DM candidate. This second paper [Phys.Rev.D 107 (2023) 12, 123013 [arXiv:2304.02997 [hep-ph]]] completes a full circle from phenomenological study to model building. Further more, we propose a new forbidden scenario using the Breit-Wigner resonance mechanism which was originally proposed by Prof. Yanagida in 2008 for explaining the positron excess observed in cosmic rays. With the light mediator scenario replaced by a heavy mediator one, the DM annihilation can be suppressed and effectively forbidden in the late Universe [arXiv:2309.12043 [hep-ph]]. Our new forbidden scenario significantly extends the physical meaning of forbidden DM.

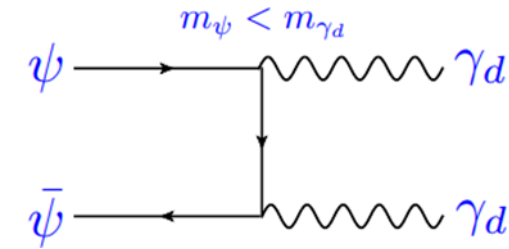
These three papers about the forbidden DM scenarios form a coherent series, ranging from phenomenological observation signal and model building to further proposing a new forbidden DM scenario with resonance. With the research developing and broadening, our study significantly enhances the study of forbidden DM.

超大质量黑洞作为暗物质加速器检验禁闭型暗物质

禁闭型暗物质是一种特殊的暗物质类型，它们无法成对湮灭，从而无法通过宇宙射线等手段被间接观测到，如何验证禁闭型暗物质是一大难题。粒子分部的理论家们——博士生程昱和盛杰、以及他们的导师何小刚讲席教授、李政道学者葛韶锋副教授，还有柳田勉讲席教授——在过去的一年中，提出超大质量黑洞可以作为暗物质加速器，将星系中的暗物质加速到接近光速，从而重新激活暗物质的禁闭湮灭反应道，使之能够湮灭到标准模型粒子，一举克服了禁闭型暗物质无法通过间接观测手段进行检验的难题；并在此基础上，进一步提出具体的模型实现、以及新型的共振型禁闭暗物质理论。



如上图所示，目前暗物质直接探测的灵敏区间在GeV及其以上的质量区间，对于sub-GeV质量暗物质的探测并没有很好的灵敏度，暗物质和标准模型粒子耦合的强度可以比较大。但小质量的暗物质和较大的耦合常数天生不是特别相洽，会对宇宙早期暗物质的产生造成不利影响。对于通过冻出机制（Freeze-out Mechanism）产生的暗物质，其遗留密度和暗物质质量成正比、而和湮灭反应截面成反比；为和观测到的暗物质遗留密度相符，对于小质量的暗物质，其耦合强度也应该比较小，就无法去填满上图左侧尚未被排除的参数空间。对于通过冻入机制（Freeze-in Mechanism）产生的暗物质，其耦合强度更是不能太大，否则产生过多的暗物质。两者都无法填满整个参数空间。



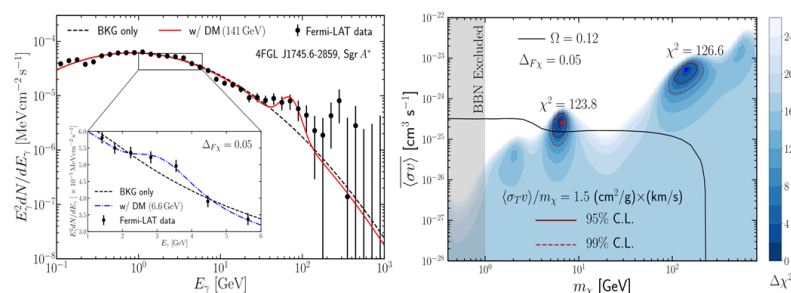
禁闭型暗物质的提出是为了充分发掘GeV以下质量区间的参数空间，同时具有小质量和大的耦合常数。通常而言，暗物质湮灭的截面随着耦合常数增大，较大的耦合常数意味着较大的湮灭截面，从而造成通过冻出机制产生的暗物质过少。为解决这个问题，需要在保持较大耦合常数的同时，通过动力学限制压低暗物质湮灭的反应截面，这可以通过要求暗物质的质量较小实现。如上面费曼图所示，如果暗物质的质量（ m_ψ ）小于末态粒子的质量（ m_{γ_d} ），暗物质的成对湮灭就会被禁闭掉。在宇宙早期，由于温度较高，初态暗物质粒子的动能可以补足质量差，这一湮灭反应可以部分激活。通过暗物质粒子和湮灭末态粒子的质量差，可以调节湮灭反应的截面，即使暗物质粒子的耦合强度较大，湮灭反应的截面也可以较小。禁闭型暗物质非常巧妙地同时实现了较小的暗物质质量、和较大的耦合强度，充分利用了sub-GeV暗物质可以具有的参数空间，为暗物质的理论模型构造打开了一片新的天地。

但随着宇宙膨胀，温度不断下降，暗物质粒子的动能也无法弥补初末态粒子质量差造成的能量亏损，暗物质的湮灭反应在今天的宇宙中被完全禁闭，也就无法通过探测暗物质湮灭反应产生的额外宇宙线来检验禁闭型暗物质模型。如何检验禁闭型暗物质，就成了这个巧妙理论的痛点，是一个长期未解决的问题。

粒子和核物理分部的理论团队——两位博士生程昱和盛杰以及他们的导师讲席教授何小刚、李政道学者葛韶锋副教授——提出超大质量黑洞可以加速暗物质，从而重新激活被禁闭的暗物质湮灭过程【Phys.Lett.B 847 (2023) 138294 [arXiv:2211.05643 [hep-ph]]】。超大质量黑洞的引力非常强，显著影响星系内的暗物质密度分布，越靠近黑洞，暗物质的密度越高；同时，暗物质的速度也越快，在与黑洞之间的距离和黑洞视界的大小差不多时，暗物质的速度甚至可以被加速到接近光速。

这就使得暗物质的动能能够达到其静止能量的大小，足以克服禁闭暗物质湮灭反应道的阈值。也就是说超大质量黑洞可以作为暗物质加速器，将暗物质粒子加速后进行对撞，初态的正反暗物质湮灭到标准模型粒子。

暗物质成对湮灭产生的标准模型粒子速度也很快，尤其是无质量的光子，以光速离开黑洞。由于湮灭过程发生在黑洞视界之外，光子可以脱离黑洞引力的束缚传播开来，虽然光子在这个过程中会发生引力红移。这样的光子信号只发生在超大质量黑洞附近，可以通过天文望远镜进行观测。如果在超大质量黑洞附近能看到暗物质湮灭的信号、而其它地方没有，将是证明禁闭暗物质存在的独特信号，一举解决了无法通过间接探测验证禁闭暗物质的难题。



我们采用Fermi-LAT空间望远镜对银心附近Sgr A*的观测数据（左图中的黑色数据点），将之与理论预言的背景（黑色）或者背景+信号（红色或蓝色）进行比较，发现在伽马射线能量为3GeV以及70GeV附近有两个局域的最佳拟合点，加入禁闭暗物质湮灭的信号可以改善理论预言和实验数据之间的符合程度。虽然目前置信度并不高，还需要进一步的观测数据证实，但初步的分析显示这一方法对检验禁闭型暗物质的可行性和重要性。目前这一方法得出禁闭暗物质在黑洞附近的湮灭截面较大，可以达到10-25cm³/s，而且可以正确解释暗物质的遗留密度（右图黑色线）。

在讲席教授柳田勉（Tsutomu Yanagida）的带领下，团队成员葛韶锋、程昱和盛杰进一步提出实现这一禁闭暗物质的理论模型：基于柳田勉教授于1979年率先提出的解释中微子质量为什么这么小的第一类跷跷板机制，将三个右手中微子中的第三个作为禁闭暗物质的候选者，完成从唯象机制到理论模型的完整研究【Phys.Rev.D 107 (2023) 12, 123013 [arXiv:2304.02997 [hep-ph]]】；并更进一步提出新的禁闭机制：基于柳田勉教授2008年为解释宇宙射线正电子谱超出而提出的Breit-Wigner机制，将原来的轻媒介子改造为重媒介子方案，从而实现暗物质衰变在宇宙晚期的有效禁闭，显著拓展了禁闭暗物质的物理内涵【[arXiv:2309.12043 [hep-ph]]】。

关于禁闭型暗物质的这三篇文章是一个系列工作，从提出唯象观测信号、到模型构造、再进一步提出全新的共振禁闭暗物质，研究工作逐步展开和深入，大大推进了禁闭暗物质方面的研究。

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Tsung-Dao Lee

李政道

1957 Nobel Laureate

1957年诺贝尔奖获得者

FOUNDING DIRECTOR & CHIEF SCIENTIST 首任所长、首席科学家

Frank Wilczek

2004 Nobel Laureate

2004年诺贝尔奖获得者

Foreign CAS Academician

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Foreign CAS Academician

中国科学院外籍院士

Hong Ding

丁 洪



CAS Academician

中国科学院院士

Wei Ku

顾 威



Xiaogang He

何小刚



Xiangdong Ji



季向东



Jinfeng Jia

贾金锋



CAS Academician

中国科学院院士

Yipeng Jing

景益鹏



CAS Academician

中国科学院院士

Dong Lai



赖 东



Michael Ramsey-Musolf



Tsutomu Yanagida



Jie Zhang

张 杰



CAS Academician

中国科学院院士

DISTINGUISHED FELLOWS 特聘教授

 Hong-Jian He	何红建	 Jianglai Liu	刘江来
 Dong Qian	钱 冬	 Liejia Qian	钱列加
 Zhengming Sheng	盛政明	 Dao Xiang	向 导
 Haijun Yang	杨海军	 Xiaohu Yang	杨小虎
 Pengjie Zhang	张鹏杰	 Weiping Zhang	张卫平

TENURED FELLOWS 长聘学者

 Vadim Grinenko

T. D. LEE FELLOWS 李政道学者

 Jason Evans		 Fabo Feng	冯发波
 Shao-Feng Ge	葛韶锋	 Gwenael Giacinti	
 Sophia Han	韩 君	 Qingdong Jiang	蒋庆东
 Kim Siang Khaw	许金祥	 Shu Li	李 数
 Kun Liu	刘 坤	 Xiaoxue Liu	刘晓雪
 Baiqing Lv	吕佰晴	 Hualin Mei	梅华林
 Yosuke Mizuno		 Yuichiro Nakai	
 Masahiro Ogihara		 Jinbo Peng	彭金波
 Zhen Pan	潘 震	 Xianyu Tan	谭先瑜
 Luca Visinelli		 Jianda Wu	吴建达
 Xin Xiang	向 昕	 Donglian Xu	徐东莲

 Longqing Yi	易龙卿	 Chi Ming Yim	严智明
 Ruidan Zhong	钟瑞丹	 Hao Zhou	周 浩

Full-time research & engineering staff 专职科研&专职工程人员

 Anthony Charles Hegg		 Wei Zhang	张 威
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POSTDOCS 博士后

 Ariel Alejandro Arza Conejeros		 Takenaka Akira	
 Nihal Brahimi		 Aming Chen	陈啊明
 Bowei Cheng	程博伟	 Gabriel Cardoso	
 Kaiming Cui	崔开明	 Xiangyi Cui	崔祥仪
 Yangyang Cai	蔡颢杨	 Yong Du	杜 勇
 Bowen Fu	付博文	 Fangyuan Gu	顾方圆
 Kangrou Guo	郭康柔	 Sudhakantha Girmohanta	
 Xinju Guo	郭新菊	 Ke Hu	胡 可
 Quanxin Hu	胡全欣	 Siew Yan Hoh	
 Dihingia Indu Kalpa		 Can Li	李灿
 Jiawei Liu	刘佳韦	 Iwan Morton-Blake	
 Hanghang Ma	马行行	 Zhiqiang Miu	缪志强
 Shota Nakagawa		 Titov Oleg	
 Yucheng Qiu	邱渔骋	 Ziwei Ou	区子维

 Malek Rajae	 Tong Sun 孙 童
 Van Que Tran	 Ngoc Khanh Vu
 Wei Wang 王 巍	 Yufeng Wang 王雨风
 Chen Xia 夏 晨	 Chuanyang Xing 邢传阳
 Binbin Yan 燕斌斌	 Hai Yang 杨 海
 Liu Yang 杨 柳	 Rui Yuan 袁 睿
 Shigekami Yoshihiro	 Hongzhe Zhou 周竑喆
 Jiang Zhu 朱 江	 Michael Zantedeschi
 Wenxing Zhang 张文星	 Xinglong Zhu 朱兴龙
 Zhenyu Zhu 朱镇宇	

Jun Kai Ng	Wenyi Bian 边稳懿	Zixuan Dai 戴子轩	Hong Du 杜 红
Zhiyu Fan 樊知宇	Yunjing Gao 高云静	Mingwei Li 李明蔚	Yongwei Li 李勇伟
Yuzhi Shang 尚雨芝	Xingchen Shen 沈星辰	Liang Tan 谭 亮	Ruiyi Tang 唐睿仪
Zeyuan Wang 王泽元	Yanda Wu 吴彦达	Shishen Xian 咸世莘	Yifan Xuan 宣一帆
	Guangping Zhang 张光平	Hongfei Zhang 张鸿飞	Junhua Zhang 张峻华
Yufei Zhang 张宇飞	Tao Zeng 曾 涛	Zhiyu Zhao 赵芷钰	Xuliang Zhu 朱翔量
Guan Ming Wong	Hanyu Cheng 程涵宇	Yaxing He 贺亚星	Jingtao Huang 黄惊涛
Zhonglyu Huang 黄钟吕	Hongxuan Jiang 蒋宏轩	Samy Kaci	Nan Li 李 楠
Tianyang Li 李天扬	Jiadu Lin 林嘉督	Junyuan Lyu 吕君缘	Yicheng Rui 芮易成
Zhu Tao 陶 竹	Jiangtao Wang 王江涛	Jie Wang 王 杰	Yaoduo Wang 王耀铎
Guan Ming Wong	Guotao Xia 夏国滔	Chang Yang 杨 畅	Ziwen Yin 尹孜文
	Yonghao Zeng 曾永浩	Fuyudi Zhang 张符雨笛	Mingyuan Zhang 张铭缘
	Shuyue Zheng 郑书玥	Zhihao Zhang 张志豪	Yihong Zhong 钟易宏
AKHIL UNIYAL	Qichao Chang 常起超	Xiaotong Chen 陈晓桐	Ziyang Ding 丁子洋
Xiaodong He 何晓东	Xufan Hu 胡旭凡	Yudong Hu 胡裕栋	Junxiao Hui 辉隽骁
Xiyuan Jin 金熙沅	Mengmeng Li 李萌萌	Yuan Li 李 源	Zhihan Li 李志晗
Xinyu Liang 梁新宇	Chenzi Liao 廖晨子	Yu Luo 罗 宇	MANAV SHARMA
	Muhammad Gaffar Wenzhan Ouyang 欧阳文湛		Yiding Shang 尚一丁
Peng Sun 孙 鹏	Yuxin Tian 田雨欣	Runze Wang 王润泽	Guangyao Xiao 肖光耀
Junxuan Xu 徐俊轩	Xiaotong Xu 许晓潼	Zixun Xu 徐子荀	Kaibo Yang 杨凯淳

2021

2022

2023

GRADUATE STUDENTS 研究生

2018	Haili Huang 黄海俐			
2019	Minhuan Chu 楚旻寰	Ruoshi Jiang 姜若诗	Danning Liu 刘丹宁	Qibin Liu 刘齐斌
	Wei Tian 田 玮	Zhen Wang 王 震	Jiahao Yang 杨家豪	Yu Zheng 郑 渝
2020	Chuifan Kong 孔垂范	Wenlian Li 李文莲	Kang Liu 刘 康	Jie Sheng 盛 杰
	Minwei Shi 施敏玮	Ramiro Torres Escobedo	Xiao Wang 王 骁	Yuqiang Zheng 郑玉强

GRADUATE STUDENTS

研究生

2023	Lin Yang 杨林	Runqing Zhai 翟润情	Dupeng Zhang 张笃鹏
	Luyao Zhang 张璐瑶	Chuanqi Zheng 郑传奇	Baihong Zhou 周柏宏

JOINT GRADUATE STUDENTS

联合培养研究生

School of Physics and Astronomy,SJTU 上海交大物理与天文学院

Jingning Hou 侯晋宁 Xinyao Zhang 张鑫焱

Institute of Physics,CAS 中国科学院物理研究所

Bei Jiang 江北 Zhenyu Yuan 袁震宇 Gexing Qu 屈歌星 Renjie Zhang 张任杰

STAFF

行政人员

General Affairs Office

综合事务办公室

Rongrong Zhang 张蓉蓉	Linchen Du 杜琳宸
Head 主任	Student Counsellor 思政教师
Mengzhu Lu 陆梦珠	Yu Zhao 赵昱
Finance Assistant 财务助理	Secretary of the Director 所长秘书
	International Affairs Assistant 外事助理

Research Collaboration and Educational Affairs Office

科研教务办公室

Sheng Li 李晟	Xiaoqian Jin 靳小芊
Head 主任	Deputy Head, PR Manager 副主任（兼）宣传主管
Jinghua Shi 石井花	Lin Sun 孙琳
Research Assistant 科研秘书	Project Manager of International Cooperation (Sichuan Research Base Station) 前方科研基地国际合作项目主管

STAFF

行政人员

Yuanyuan Zhang 张园园

大装置项目工程主管 Project Manager Of Big Science Facilities

Human Resources Office

人力资源办

Li Fu 付莉	Lisha Duan 段丽莎
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Jialin Yang 杨家林	Zi Yang 杨子	Wen Wang 汪雯
Administrative Assistant of QS 凝聚态研究部	Administrative Assistant of PN 粒子研究部	
	行政助理	行政助理

Office of Asset and Laboratory Management

资产与实验室管理办公室

Xiaojun Lu 陆晓钧	Banghui Ni 倪邦辉
Head 主任	IT Manager 信息技术主管

Kai Yuan 袁凯
Asset Manager 资产管理主管

Research Project Assistants

课题组科研秘书

Xiaohua Chen 陈晓华	Yiyi Cheng 程艺艺
Meng'an Ding 丁梦安	Yinghui Gao 高迎辉
Lingwen Xiao 肖凌雯	Lan Yang 杨蓝
Wanfen Zeng 曾婉芬	Tao Zhao 赵涛

NEW ALUMNAE AND ALUMNI IN 2023 2023年新增所友

Ph.D. Graduates 博士毕业生

Shuaijie Li	李帅杰	Heng Lin	林 横
Wanyun Su	苏琬云	Jin Sun	孙 进
Yaoyao Zong	宗瑶瑶		

Former Postdocs 离站博士后

Masataka Aizawa		Cheng Chen	陈 程
Yuzhu Cui	崔玉竹	Boyuan Li	李博原
Weikang Lin	林伟康	Xiaodong Ma	马小东
Yanyan Shangguan	上官艳艳	Cuiying Song	宋翠英
Jinwei Wang	王金伟	Zhen Wang	王 振
Zhipeng Xing	邢志鹏	Hao Yang	杨 浩
Shuai Zha	查 帅	Zhelin Zhang	张喆林

CHAPTER
4

MAIN
EVENTS
主要活动



Jan

12

TDLI Astro-Division 2023 Winter Camp

李政道研究所2023年天文冬令营



March

20

Jinpeng Huai, Minister of Education Inspects TDLI

教育部部长怀进鹏调研李政道研究所



March

30

Yudong Zhang, Vice Minister of Science and Technology Inspects TDLI

科技部副部长张雨东调研李政道研究所



April

15

Workshop on Muon Physics at the Intensity and Precision Frontiers (MIP 2023)

高亮度和高精度前沿缪子物理研讨会



May

08

Duo Liu, Vice Mayor of Shanghai Inspects TDLI

上海市副市长刘多调研李政道研究所

01

June

Topics of Particle, Astro and Cosmo Frontiers (TOPAC 2023)

粒子物理、天体和宇宙学前沿课题研讨会



11

June

Quantum Connections in Sweden-11 Summer School

瑞典量子暑期学校



19

June

The First International Conference on Quantum Frontiers

第一届量子前沿国际会议

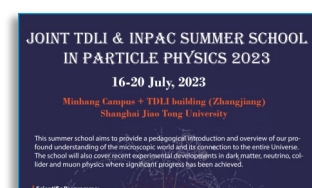


16

July

Joint TDLI & INPAC Summer School in Particle Physics 2023

2023年李所、粒子所联合粒子暑期学校



17

July

18th International Conference on X-ray Lasers

第十八届国际X射线激光大会



02

Aug

TDLI-PKU BSM Workshop 2023: Looking to the Sky

李所-北大超越标准模型研讨会





Aug

14

LAP Workshop 1

第一届实验室天体物理讨论会



Aug

21

The 1st onsite workshop of Youth Forum for Quantum Magnetism

首届量子磁性青年论坛



Sept

10

JUST Spectroscopic Telescope Project Launch Meeting and Workshop on Time-Domain Astronomical Observations

JUST光谱望远镜项目启动会暨时域天文观测研讨会



Sept

20

Mini-Workshop on Anomalies at the LHC

大型强子对撞机异常现象小型研讨会



Sept

22

The 2023 Shanghai Symposium on Particle Physics and Cosmology: Phase Transitions, Gravitational Waves, and Colliders (SPCS 2023)

2023年上海粒子物理和宇宙学专题研讨会：相变、引力波和对撞机

09

Oct

SJTU Physics and Astronomy held the first meeting of the Strategic Planning Committee

上海交通大学物理与天文学科召开战略规划委员会第一次会议



10

Oct

Director Jie Zhang Elected President of Shanghai Municipal Association for Science and Technology

张杰所长当选上海市科协主席



30

Oct

The 2nd Shanghai Assembly on Cosmology and Structure Formation

第二届上海宇宙学与结构形成大会



16

Nov

TDLI mini-School on Seven Weapons of Quantum Integrability

李所小型课程：关于量子可积性的七种武器



08

Nov

Wilczek's Lectures:Advanced Topics in Theoretical Physics

Wilczek 系列讲座：理论物理中的前沿问题





Nov

16

The 9th China LHC Physics Workshop (CLHCP2023)

第九届中国LHC物理年会



Nov

16

Lectures on Topological Classification of Quantum Materials

系列讲座：量子材料的拓扑分类



Nov

21

2023 Annual Meeting of TDLI International Advisory Committee

李政道研究所2023年度国际学术咨询委员会会议



Nov

22

Jun Ye Gives a Lecture on SJTU Foresight Forum

叶军做客交大·睿远讲坛



Nov

27

Qun Chen, Vice Chairman of China Democratic League Inspects TDLI

民盟中央副主席、上海市政协副主席、民盟市委主委陈群调研李政道研究所

27

Nov

NO.2 Trident Science and Technology Crossroads Forum

第二届海铃科技交叉论坛



29

Nov

Trident Science Forum

海铃科学论坛



11

Dec

The 32th Texas Symposium on Relativistic Astrophysics

第32届Texas相对论天体物理学研讨会



20

Dec

Tianyu Workshop I

第一期天语研讨会



26

Dec

Mini Workshop on Planet Formation and Exoplanets

行星形成与系外行星小型研讨会





Dec 29

2023 STJU International Young Scholars Forum on Physics and Astronomy

2023年上海交通大学物理与天文学科国际青年学者论坛



Jan 11

Jining Chen, Municipal Party Secretary of Shanghai Inspects TDLI

上海市委书记陈吉宁调研李政道研究所



Jan 12

Dou Xiankang, Director of NSFC Inspects TDLI

国家自然科学基金委主任窦宪康调研李政道研究所

CHAPTER
5

RESEARCH
PROJECTS
科研项目

Ongoing Projects by the End of 2023 截至2023年底在研项目

HOST 主持

@ PARTICIPATE 参与

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
1	Donglian Xu 徐东莲#	Ministry of Science and Technology 科学技术部	National Key Research and Development Program 国家重点研发计划——十四五/大科学装置前沿研究	R&D of the TRIDENT prototype string 南海中微子望远镜（海铃计划）原型样机研发	2022-12-01 ~ 2025-11-30
2	Shu Li 李 数@	Ministry of Science and Technology 科学技术部	National Key Research and Development Program 国家重点研发计划——十四五/大科学装置前沿研究	Test of Standard Model and Higgs Mechanism and Search for New Physics using the High Luminosity Data of ATLAS Experiment: Electro-weak Precision Measurements 基于ATLAS高亮度数据检验标准模型和Higgs机制与寻找新物理：电弱精确测量研究	2023-12-01 ~ 2028-11-30
3	Xiaoxue Liu 刘晓雪@	Ministry of Science and Technology 科学技术部	National Key Research and Development Program 国家重点研发计划——十四五/物态调控	Manipulation of the transport properties of two-dimensional spin-correlated matter states 二维自旋关联物态的输运性质调控	2022-12-01 ~ 2027-11-30
4	Ruidan Zhong 钟瑞丹@	Ministry of Science and Technology 科学技术部	National Key Research and Development Program 国家重点研发计划——十四五/物态调控	Various anomalous Hall effects caused by berry curvature in topological insulating matters 拓扑绝缘物质里面由Berry曲率导致的各种异常霍尔效应	2021-12-01 ~ 2026-11-30
5	Mizuno Yosuke@	Ministry of Science and Technology 科学技术部	National Key Research and Development Program 国家重点研发计划-国际合作/政府间国际科技创新合作/港澳台科技创新合作重点专项	Theoretical study of the phenomenon of high-energy body outbursts 高能天体爆发现象的理论研究	2023-07-01 ~ 2026-06-30

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
6	Xiaogang He 何小刚#	NSFC 国家自然科学基金委员会	Major Program (Sub Program) 重大项目（子课题）	Phenomenological studies of dark matter (DM) and neutrino 暗物质和中微子的唯象学研究	2021-01-01 ~ 2025-12-31
7	Shu Li 李 数#	NSFC 国家自然科学基金委员会	Specialized Program 专项项目（原创探索）	R&D on the key technologies for a dark photon search experiment at the SHINE facility 基于上海硬X射线自由电子激光装置的暗光子探测实验关键技术预研究	2022-01-01 ~ 2024-12-31
8	Tsutomu Takano#	NSFC 国家自然科学基金委员会	General Program 面上项目	Low-energy supersymmetry and its phenomenology 低能超对称及其现象学	2022-01-01 ~ 2025-12-31
9	Wei Ku 顾威#	NSFC 国家自然科学基金委员会	General Program 面上项目	Physical properties of the superfluid and metallic states of “emergent Bose liquid” “衍生玻色液体” 超流态及金属态之物性研究	2023-01-01 ~ 2026-12-31
10	Donglian Xu 徐东莲#	NSFC 国家自然科学基金委员会	General Program 面上项目	Exploring the extreme Universe with neutrinos and multi-messengers 通过中微子和多信使研究极端宇宙	2022-01-01 ~ 2025-12-31

Ongoing Projects by the End of 2023 截至2023年底在研项目

HOST 主持

@ PARTICIPATE 参与

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
11	Kim Siang Khaw#	NSFC 国家自然科学基金委员会	General Program 面上项目	Hunting for new physics at the intensity frontier with the muon anomalous magnetic moment 通过缪子反常磁矩在强度前沿寻找新物理	2021-01-01 ~ 2024-12-31
12	Masahiro Ogihara#	NSFC 国家自然科学基金委员会	General Program 面上项目	Multidisciplinary study of the formation of hot super-Earths and sub-Neptunes 关于热超级类地行星和亚海王星的形成过程的综合性研究	2023-01-01 ~ 2026-12-31
13	Mizuno Yosuke#	NSFC 国家自然科学基金委员会	General Program 面上项目	Numerical study of astrophysical black hole and relativistic jets in Event Horizon Telescope era 事件视界望远镜时代的天体物理黑洞和相对论喷流的数值研究	2023-01-01 ~ 2026-12-31
14	Jianda Wu 吴建达#	NSFC 国家自然科学基金委员会	General Program 面上项目	Research on the dispersion and decay of quantum E8 particles 量子E8粒子的色散及衰变研究	2023-01-01 ~ 2026-12-31
15	Zhenyu Zhu 朱镇宇#	NSFC 国家自然科学基金委员会	Young Scientists Funding 青年科学基金项目(包干制)	Binary quark star merger in the multi-messenger astronomy era 多信使天文学时代的双夸克星并合研究	2023-01-01 ~ 2024-12-31

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
16	Ke Hu 胡可#	NSFC 国家自然科学基金委员会	Young Scientists Funding 青年科学基金项目(包干制)	Spin-orbit interaction of light and high-harmonic generation in a laser-irradiated plasma waveguide 强激光在等离子体波导管中的光子自旋-轨道相互作用以及高次谐波产生	2023-01-01 ~ 2025-12-31
17	Xinglong Zhu 朱兴龙#	NSFC 国家自然科学基金委员会	Young Scientists Funding 青年科学基金项目(包干制)	Study of gamma-ray emission enhancement via intense laser-driven plasma structured targets 强激光驱动等离子体结构靶增强伽马辐射产生研究	2023-01-01 ~ 2025-12-31
18	Xiangyi Cui 崔祥仪#	NSFC 国家自然科学基金委员会	Young Scientists Funding 青年科学基金项目(包干制)	Study of the Kr-85 and Rn-222 distillation efficiency in the PandaX-4T experiment with the trace method 对PandaX-4T实验氪85和氡222在线精馏效率的示踪研究	2023-01-01 ~ 2025-12-31
19	Hao Yang 杨浩#	NSFC 国家自然科学基金委员会	Young Scientists Funding 青年科学基金项目(包干制)	Detection of multiple majorana zero modes in superconducting topological crystalline insulator Sn1-xPbxTe 在超导的拓扑晶体绝缘体Sn1-xPbxTe中探测多重Majorana零能模	2022-01-01 ~ 2024-12-31
20	Gang Yao 姚钢#	NSFC 国家自然科学基金委员会	Young Scientists Funding 青年科学基金项目(包干制)	Upward curvature of the critical field in FeSe film investigated by in situ two-coil mutual inductance and scanning tunneling microscopy 通过原位双线圈互感测量和扫描隧道显微镜研究FeSe薄膜的正曲率临界场行为	2022-01-01 ~ 2024-12-31

Ongoing Projects by the End of 2023 截至2023年底在研项目

HOST 主持

@ PARTICIPATE 参与

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
21	Zhen Zhu 朱 朕#	NSFC 国家自然科学基金委员会	Young Scientists Funding 青年科学基金项目 (包干制)	STM study of segmented Fermi surface of Bogoliubov quasiparticles and Majorana zero mode Bogoliubov分段费米面及该体系中马约拉纳零能模的STM研究	2022-01-01 ~ 2024-12-31
22	Masahiro Ogi-hara#	NSFC 国家自然科学基金委员会	Research Funding for International Scientists 外国学者研究基金项目/外国优秀青年学者研究基金项目	Formation of hot super-Earths and sub-Neptunes around low-mass stars 低质量恒星周围热超地球和亚海王星的形成	2023-01-01 ~ 2024-12-31
23	Takenaka Akira#	NSFC 国家自然科学基金委员会	Research Funding for International Scientists 外国学者研究基金项目/外国青年学者研究	Development of methodology for high precision energy measurement in the JUNO experiment JUNO实验中高精度能量测量方法的开发	2023-01-01 ~ 2024-12-31
24	Shu Li 李 数@	NSFC 国家自然科学基金委员会	Research Fund for International Young Scientists 国际（地区）合作与交流项目	Measurement of the Vector Boson Scattering Orocess and Search for New Physics with the ATLAS Detector ATLAS实验上研究希格斯粒子性质和寻找新物理	2021-01-01 ~ 2025-12-31
25	Zhen Pan 潘 震#	NSFC 国家自然科学基金委员会	Research Funding for Excellent Young Scientists (Oversea) 优秀青年科学基金项目（海外）	Features and applications of gravitational wave emissions from compact binaries 致密双星系统的引力波辐射特征和应用	2023-12-19 ~ 2026-12-19

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
26	Baiqing Lv 吕佰晴#	NSFC 国家自然科学基金委员会	Research Funding for Excellent Young Scientists (Oversea) 优秀青年科学基金项目（海外）	Investigation of the characteristic electronic structure of novel quantum states 新奇量子态的特征电子结构研究	2023-06-01 ~ 2026-05-31
27	Jinbo Peng 彭金波#	NSFC 国家自然科学基金委员会	Research Funding for Excellent Young Scientists (Oversea) 优秀青年科学基金项目（海外）	Atomic-scale detection of non-equilibrium dynamics 非平衡态动力学的原子尺度探测	2023-01-01 ~ 2025-12-31
28	Xiaoxue Liu 刘晓雪#	NSFC 国家自然科学基金委员会	Research Funding for Excellent Young Scientists (Oversea) 优秀青年科学基金项目（海外）	Quantum transportation in low-dimensional electronic systems 低维电子系统的量子输运	2023-01-01 ~ 2025-12-31
29	Longqing Yi 易龙卿#	NSFC 国家自然科学基金委员会	Research Funding for Excellent Young Scientists (Oversea) 优秀青年科学基金项目（海外）	Laboratoary astrophysics study based on high-power laser interacting with micro-structured targets 基于强激光与微结构靶的实验室天体物理研究	2022-01-01 ~ 2024-12-31
30	Fabo Feng 冯发波#	NSFC 国家自然科学基金委员会	Research Funding for Excellent Young Scientists (Oversea) 优秀青年科学基金项目（海外）	Search for Earth 2.0 寻找第二个地球	2022-01-01 ~ 2024-12-31
31	Shu Li 李 数#	NSFC 国家自然科学基金委员会	Research Funding for Excellent Young Scientists (Oversea) 优秀青年科学基金项目（海外）	Standard Model measurement and Beyond Standard Model new physics search at the High Energy Frontier 高能前沿标准模型测量与超越标准模型的新物理寻找	2019-03-01 ~ 2024-12-31

Ongoing Projects by the End of 2023 截至2023年底在研项目

HOST 主持

@ PARTICIPATE 参与

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
32	Aming Chen 陈啊明#	China Postdoctoral Science Foundation 中国博士后基金	Special Funding 特别资助	Multi-wavelength studies of gamma-ray binaries 伽马射线双星的高能辐射研究	2023-08-18 ~ 2024-12-31
33	Jiawei Liu 劉佳韋#	China Postdoctoral Science Foundation 中国博士后基金	General Program 面上项目	CP violation in charmed baryon nonleptonic decays 粲重子的非轻衰变中的CP破坏	2023-11-27 ~ 2025-06-25
34	Hongzhe Zhou 周竑喆#	China Postdoctoral Science Foundation 中国博士后基金	General Program 面上项目	Mechanisms of Nonhelical Large-scale dynamos and Applications in Accretion Models 无螺旋度大尺度发电机的机制研究及在吸积模型中的应用	2023-08-01 ~ 2024-07-31
35	Yong Du 杜 勇#	China Postdoctoral Science Foundation 中国博士后基金	General Program 面上项目	Precision free neutron lifetime calculation and its impact on the standard models of particle physics and cosmology 自由中子寿命的精确计算及其对粒子物理的标准模型和标准宇宙学的影响	2023-07-26 ~ 2025-07-26
36	Hanghang Ma 马行行#	China Postdoctoral Science Foundation 中国博士后基金	General Program 面上项目	Study on multi beam effects in parametric instability developed in large-scale plasma 大尺度等离子体中参量不稳定性的多光束效应研究	2022-12-09 ~ 2024-01-01
37	Zhenyu Zhu 朱镇宇#	China Postdoctoral Science Foundation 中国博士后基金	General Program 面上项目	The study of multi-messenger signal from binary quark star merger 双夸克星并合的多信使信号研究	2022-09-20 ~ 2024-09-19

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
38	Kaiming Cui 崔开明#	China Postdoctoral Science Foundation 中国博士后基金	General Program 面上项目	Deep learning-based detection of transiting exoplanet 基于深度学习的系外行星凌星信号探测研究	2022-09-15 ~ 2024-09-15
39	Zhenyu Zhu 朱镇宇#	China Postdoctoral Science Foundation 中国博士后基金	General Program 面上项目	Probing the properties of quark stars through multi-messenger astronomy 基于多信使天文学探索夸克星的性质	2022-09-08 ~ 2024-09-07
40	Yuzhu Cui 崔玉竹#	China Postdoctoral Science Foundation 中国博士后基金	General Program 面上项目	Estimation or derivation of the constraints on BH spin based on the mas-scale jet variation 利用毫角秒尺度的相对论喷流的结构变化计算和约束超大质量黑洞的旋转参数	2022-09-07 ~ 2024-09-07
41	Shuai Zha 查 帅#	China Postdoctoral Science Foundation 中国博士后基金	General Program 面上项目	The Explosion Mechanism of Core-collapse Supernovae Based On Quark-deconfinement Phase Transition 基于夸克退禁闭相变的核坍缩超新星爆发机制的研究	2022-09-01 ~ 2024-08-31
42	Donglian Xu 徐东莲#	Shanghai Science & Technology Commission 上海市科学技术委员会	Science and Technology Innovation Action Plan 科技创新行动计划/基础研究	Detecting multi-frequency neutrinos 多波段中微子探测研究	2022-10-01 ~ 2025-09-30
43	Mizuno Yosuke#	Shanghai Science & Technology Commission 上海市科学技术委员会	Science and Technology Innovation Action Plan 科技创新行动计划/基础研究	Numerical investigation of theory of gravity by astrophysical black hole shadow 利用天体物理黑洞阴影数值模拟研究引力理论	2022-12-01 ~ 2024-11-30

Ongoing Projects by the End of 2023截至2023年底在研项目

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@ PARTICIPATE 参与

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
44	Shu Li 李 数#	Shanghai Science & Technology Commission 上海市科学技术委员会	Special Program for Basic Research 基础研究特区计划	R&D on a dark photon search experiment with a novel approach based on high-frequency electron beam energy&momentum loss 基于高频电子丢失能动量方法的暗光子寻找实验研究	2021-11-01 ~ 2026-10-31
45	Kim Siang Khaw#	Shanghai Science & Technology Commission 上海市科学技术委员会	Special Program for Basic Research 基础研究特区计划	A study of muon sources based on Shanghai SHINE facility' s accelerator electrons 基于上海SHINE装置加速器电子的缪子源研究	2022-11-01 ~ 2026-10-31
46	Baiqing Lv 吕佰晴#	Shanghai Science & Technology Commission 上海市科学技术委员会	Original Exploration Project 原创探索项目	Manipulation and braiding possibilities of Majorana zero-energy modes in iron-based superconductors 铁基超导体中马约拉纳零能模的调控与编织方案探索	2023-04-01 ~ 2026-03-31
47	Hao Zhou 周 浩#	Shanghai Science & Technology Commission 上海市科学技术委员会	Natural Science Funding 自然科学基金（包干制）	TeV gamma-ray sky survey with LHAASO-WCDA data 基于LHAASO-WCDA数据的甚高能伽马射线巡天	2021-04-01 ~ 2024-03-31
48	Xiaoxue Liu 刘晓雪#	Shanghai Science & Technology Commission 上海市科学技术委员会	Pujiang Talent Program 上海市浦江人才计划/A类（科研开发类）	The experimental study of interlayer exciton condensate in graphene hetero-structures 基于石墨烯系统的层间激子凝聚研究	2022-10-01 ~ 2024-09-30

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
49	Xiaogang He 何小刚#	Shanghai Science & Technology Commission 上海市科学技术委员会	Local Supporting Funding 国家重要科技计划项目上海市地方配套	Phenomenological studies of dark matter (DM) and neutrino 暗物质和中微子的唯象学研究	2021-01-01 ~ 2025-12-31
50	Hong Ding 丁 洪#	Tencent Foundation 腾讯基金会		New Cornerstone Investigation Program 新基石研究员项目	2023-01-01 ~ 2027-12-31

Beginning Operating Projects in 20242024年启动项目

HOST 主持

@ PARTICIPATE 参与

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
1	Xiaogang He 何小刚#	NSFC 国家自然科学基金委员会	General Program 面上项目	High precision tests of standard model and beyond for electroweak interactions at low energies 高精度低能量弱相互作用标准模型与新物理研究	2024-01-01 ~ 2027-12-31
2	Michael Ramsey-Musolf#	NSFC 国家自然科学基金委员会	General Program 面上项目	Studies of the Electroweak Phase Transition 电弱相变研究	2024-01-01 ~ 2027-12-31
3	Vadim Grinenko#	NSFC 国家自然科学基金委员会	General Program 面上项目	Effect of dimensionality on fermion pairing and quadrupling states in multicomponent superconductors 维度对多分量超导体中费米子配对和四分量子态的影响	2024-01-01 ~ 2027-12-31

Beginning Operating Projects in 2024 2024年启动项目

HOST 主持

@ PARTICIPATE 参与

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
4	Shaofeng Ge 葛韶锋#	NSFC 国家自然科学基金委员会	General Program 面上项目	Threshold Related Theoretical and Phenomenological Studies of Dark Matter 阈值相关的暗物质理论和唯象研究	2024-01-01 ~ 2027-12-31
5	Jinbo Peng 彭金波#	NSFC 国家自然科学基金委员会	General Program 面上项目	Probing the carrier dynamics in 2D semiconductors with ultrahigh spatio-temporal resolution 二维半导体载流子动力学的超高分辨探测	2024-01-01 ~ 2027-12-31
6	Ruidan Zhong 钟瑞丹#	NSFC 国家自然科学基金委员会	General Program 面上项目	A study of quantum magnetism in a novel Kagome lattice material 新型笼目晶格材料的探索与量子磁性研究	2024-01-01 ~ 2027-12-31
7	Baiqing Lv 吕佰晴#	NSFC 国家自然科学基金委员会	General Program 面上项目	Sr2RuO4 unconventional superconductor: multimodal manipulation (strain and ultrafast laser) and the characteristic electronic structure investigation Sr2RuO4非常规超导体的压力和超快激光调控与特征电子结构研究	2024-01-01 ~ 2027-12-31
8	XiaoXue Liu 刘晓雪#	NSFC 国家自然科学基金委员会	General Program 面上项目	The quantum transport study on superconductivity in graphene multilayers 石墨烯体系中超导态调控的量子输运实验研究	2024-01-01 ~ 2027-12-31

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
9	Qingdong Jiang 蒋庆东#	NSFC 国家自然科学基金委员会	General Program 面上项目	Manipulating Quantum States of Matter with Micro-cavities 关于利用微腔调控量子物态的理论研究	2024-01-01 ~ 2027-12-31
10	Hanghang Ma 马行行#	NSFC 国家自然科学基金委员会	Young Scientists Funding 青年科学基金项目(包干制)	Study of impacts of parametric instabilities on the radiation symmetry in the inertial confinement fusion 参量不稳定性对ICF中激光辐照对称性的影响研究	2024-01-01 ~ 2026-12-31
11	Can Li 李 灿#	NSFC 国家自然科学基金委员会	Young Scientists Funding 青年科学基金项目(包干制)	Interplay between quantum nanomagnets and superconductors 利用SPM对量子磁体与超导体界面系统中电磁性质的研究	2024-01-01 ~ 2026-12-31
12	Luca Visinelli#	NSFC 国家自然科学基金委员会	Research Funding for International Scientists 外国学者研究基金项目/外国优秀青年学者研究基金项目	Astrophysical Axion Laboratories 天体物理轴子实验室	2024-01-01 ~ 2025-12-31
13	Gwenael Thibaud Giacinti#	NSFC 国家自然科学基金委员会	Research Funding for International Scientists 外国学者研究基金项目/外国优秀青年学者研究基金项目	Calculation of the Galactic gamma-ray emission at very high energies 计算非常高能量下的银河系伽马射线发射	2024-01-01 ~ 2025-12-31

Beginning Operating Projects in 20242024年启动项目

HOST 主持

@ PARTICIPATE 参与

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
14	Vadim Grinenko#	NSFC 国家自然科学基金委员会	Research Funding for International Scientists 外国学者研究基金项目/外国优秀青年学者研究基金项目	Spontaneous magnetic fields and vortex clustering in superconductors that break time-reversal symmetry 超导体中的自发磁场和涡旋聚集破坏了时间反对称性	2024-01-01 ~ 2025-12-31
15	Tran Van Que#	NSFC 国家自然科学基金委员会	Research Funding for International Scientists 外国学者研究基金项目/外国青年学者研究基金项目	Exploring the interplay between gravitational wave and future collider signals 探索引力波与未来对撞机信号之间的相互作用	2024-01-01 ~ 2024-12-31
16	Jianglai Liu 刘江来#	Tencent Foundation 腾讯基金会		New Cornerstone Investigation Program 新基石研究员项目	2024-01-01 ~ 2028-12-31

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
3	Jie Zhang 张 杰#	NSFC 国家自然科学基金委员会	Specialized Program 专项项目	Extreme states of matter - emerging frontiers in interdisciplinary research 极端物态-新兴前沿交叉学科科研判断研究	2023-01-01 ~ 2023-12-31
4	Michael Ramsey- Musolf#	NSFC 国家自然科学基金委员会	General Program 面上项目	Electroweak Phase Transition 电弱相变	2020-01-01 ~ 2023-12-31
5	Xiaogang He 何小刚#	NSFC 国家自然科学基金委员会	General Program 面上项目	Phenomenology of Abelian and Non-Abelian Dark Photons 阿贝尔和非阿贝尔暗光子唯象研究	2020-01-01 ~ 2023-12-31
6	Cuiying Song 宋翠英#	NSFC 国家自然科学基金委员会	Young Scientists Funding 青年科学基金项目(包干制)	The evolution of massive stars and the formation of long gamma-ray 大质量恒星演化和长暴中心引擎的形成	2022-01-01 ~ 2023-12-31
7	Yuichiro Nakai#	NSFC 国家自然科学基金委员会	Research Funding for International Scientists 外国学者研究基金项目/外国优秀青年学者研究基金项目	Unified solutions to the origin of mass and the strong CP problem 质量起源和强CP破坏问题的统一解决方案	2022-01-01 ~ 2023-12-31

Completed Projects During 20232023年内已结题项目

HOST 主持

@ PARTICIPATE 参与

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
1	Shu Li 李 数@	Ministry of Science and Technology 科学技术部	National Key Research and Development Program 国家重点研发计划	Measurements and Searches for other Beyond Standard Model New Physics 标准模型测量和其他超出标准模型的新物理寻找	2018-05-01 ~ 2023-04-01
2	Shu Li 李 数@	Ministry of Science and Technology 科学技术部	National Key Research and Development Program 国家重点研发计划	Analogue Hadronic Calorimeter technology R&D and Demonstration 成像型强子量能器技术验证	2018-05-01 ~ 2023-04-01

Completed Projects During 2023 2023年内已结题项目

HOST 主持

@ PARTICIPATE 参与

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
8	Chen Xia 夏晨#	NSFC 国家自然科学基金委员会	Theoretical Physics Research Project 理论物理专款项目	Theoretical and phenomenological studies based on PandaX experiments PandaX相关的暗物质理论和唯象研究	2023-01-01 ~ 2023-12-31
9	Chuangyang Xing 邢传阳#	NSFC 国家自然科学基金委员会	Theoretical Physics Research Project 理论物理专款项目	Generation detection signals of dark matter in celestial bodies 暗物质在天体中的产生与探测信号	2023-01-01 ~ 2023-12-31
10	Hao Yang 杨浩#	China Postdoctoral Science Foundation 中国博士后基金	General Program 面上项目	Detection of multiple majorana zero modes in superconducting topological crystalline insulator Sn1-xPbxTe 在超导的拓扑晶体绝缘体Sn1-xPbxTe中探测多重Majorana零能模	2021-06-30 ~ 2023-06-30
11	Xinglong Zhu 朱兴龙#	China Postdoctoral Science Foundation 中国博士后基金	General Program 面上项目	Study of ultrahigh brilliance gamma-ray radiation 超高亮度伽马辐射产生研究	2021-04-29 ~ 2023-04-28
12	Zhipeng Xing 邢志鹏#	China Postdoctoral Science Foundation 中国博士后基金	General Program 面上项目	The study of heavy flavor baryon transition matrix element in QCD 重味重子弱衰变矩阵元的量子色动力学研究	2023-01-05 ~ 2023-09-15

No.	Name 姓名	Resources 项目来源	Category 项目类别	Project Name 项目名称	Period 起止时间
13	Jianda Wu 吴建达#	Shanghai Science & Technology Commission 上海市科学技术委员会	Natural science funding 自然科学基金（包干制）	Spin dynamics and many-body excitation in quantum critical transverse field Ising chain with longitudinal field perturbation 纵场扰动下的量子临界及近量子临界横场伊辛链的自旋动力学及多体激发	2020-07-01 ~ 2023-06-30
14	Longqing Yi 易龙卿#	Shanghai Science & Technology Commission 上海市科学技术委员会	Pujiang talent program 上海市浦江人才计划/A类（科研开发类）	Advanced accelerators and light sources based on micro-plasma waveguide 基于等离子体微波导的新型加速器与光源	2021-10-01 ~ 2023-09-30
15	Qingdong Jiang 蒋庆东#	Shanghai Science & Technology Commission 上海市科学技术委员会	Pujiang Talent Program 上海市浦江人才计划/A类（科研开发类）	Novel quantum interfacial control 新型界面量子调控	2021-10-01 ~ 2023-09-30
16	Donglian Xu 徐东莲#	SJTU 上海交大	Frontier Exploration Program 人才团队/重点前瞻布局/前沿探索	Construction of TRIDENT Phase II 南海中微子望远镜探路项目二期	2021-07-13 ~ 2023-07-12
17	Jie Zhang 张杰#	CAS 中国科学院	Consulting Project 咨询项目	Developing direction, selection rules and operation management of national major scientific and technological infrastructures 国家重大科技基础设施发展方向、遴选原则及运行管理	2023-07-10 ~ 2023-12-31
18	Jie Zhang 张杰#	CAS 中国科学院	Consulting Project 咨询项目	Extreme states of matter - emerging frontiers in interdisciplinary research 极端物态-前沿交叉学科研判研究	2023-01-01 ~ 2023-12-31

6
CHAPTER

SEMINARS AND
COLLOQUIA
学术报告

Artwork of 2023 SJTU T.D.Lee Science and Art Exhibition: *Faces*

2023年上海交大李政道科艺展作品：《相》

By Po Huang, Yuxin Tian, Jiapeng Zou

作者：黄珀、田雨欣、邹家鹏

T. D. Lee Colloquium

NO.1 Quantum Entanglement and Beyond

Jian-Wei Pan (潘建伟)

University of Science and Technology of China

2023-02-08

NO.3 Binary stars in the new millennium

Zhanwen Han (韩占文)

Yunnan Observatories, CAS

2023-03-17

NO.5 High-Sensitivity Superconducting Detectors for Terahertz Astronomy

Sheng-Cai Shi (史生才)

Purple Mountain Observatory, CAS

2023-05-16

NO.7 Particle View in Crystals

Qian Niu (牛谦)

University of Science and Technology of

2023-09-21

NO.9 Quasiparticles and Quasiworlds

Frank Wilczek

Tsung-Dao Lee Institute & Massachusetts Institute of Technology

2023-11-27

NO.2 Topology and exotic electronic phases in two-dimensional kagome superconductor CsV3Sb5

Xianhui Chen (陈仙辉)

University of Science and Technology of China

2023-02-17

NO.4 Quest to infinity — Challenges and Opportunities for China

Yifang Wang (王贻芳)

Institute of High Energy Physics , CAS

2023-03-30

NO.6 Ordered and tunable Majorana-zero-mode lattice in naturally strained LiFeAs*

Hong-Jun Gao (高鸿钧)

Institute of Physics, CAS

2023-06-14

NO.8 从飞秒到阿秒-2023年诺贝尔物理奖解读

Zhiyi Wei (魏志义)

Institute of Physics, CAS

2023-11-02

NO.10 Exploring the Nonthermal Universe with high energy gamma-rays

Felix Aharonian

The Max Planck Institute for Nuclear Physics

2023-12-07

Master Distinguished Lecture

NO.176 量子信息技术的物理基础

Tao Xiang (向涛)

Institute of Physics, CAS

2023-03-23

NO.180 探索生命系统中的设计原理

Chao Tang (汤超)

University of Geneva

2023-04-21

Joint TDLI/SPA Colloquium

The XENON project

Elena Aprile

Columbia University

2023-11-09

IceCube: Opening a Neutrino Window on the Universe from the South Pole

Francis Halzen

Wisconsin IceCube Particle Astrophysics Center and University of Wisconsin–Madison

2023-11-24

The future of high-energy physics with colliders

Michelangelo Mangano

CERN

2023-11-20

Looking for the Biggest Bangs since the Big Bang

John Ellis

CERN & King's College London

2023-07-28

All the dark we can not see - the state-of-the art in direct searches for particle dark matter

Laura Baudis

University of Zurich

2023-11-24

MM/DD	Title	Speaker
1/5	Giants in the Universe — A Dynamic View of Galaxy Clusters	Congyao Zhang
1/5	QCD matter and phase transitions in the early universe and inside compact stars	Mei Huang
1/6	Fast timing detector R&D at ATLAS for HL-LHC	Mengqing Wu
1/9	Uncovering Impacts of Gas Accretion, Mergers, and Environment Across Cosmic Time via Multivariate Spatio-temporal Analysis of Star Formation, Metals, and Sub-structures.	Hassen Yesu
1/10	Toward Multi-Channel Studies of Dark Matter	Weikang Lin
1/10	High precision study of antineutron and hyperons interact with nuclei at a future super J/ψ factory	Weimin Song
1/11	Neutron-Star Cooling Effects on Type-I X-ray Bursts	Akira Dohi
1/11	Observational signatures of compact objects in active galactic nuclei	Hiromichi Tagawa, JSPS
1/12	Time-varying resonant mass at collider and beam dump experiments	Jia Liu
1/13	Amplitude Analysis and BF Measurement of $D_s^+ \rightarrow \pi^+ \pi^0 \eta'$	Tong Sun
1/20	Emergent space-time meets emergent quantum phenomena	Jinwu Ye
2/8	A glimpse of RIXS and its applications in quantum materials	Ke-Jin Zhou
2/9	New Physics Search With Novelty Detection	Xuhui JIANG
2/10	Weak Lensing Cosmology and its Error Analysis	Ji Yao
2/13	In the search for dark matter	Xin Xiang

MM/DD	Title	Speaker
2/14	The haonic Equation of State for Neutron Stars	Laura Tolos
2/16	Configuration-Interaction Shell Model and Its Recent Progress	Cenxi Yuan
2/21	Dark matter and high-energy neutrinos confronting terrestrial experiments	Ningqiang Song
2/21	10 years after Higgs discovery, we are building a new detector	Hualin Mei
2/22	Constraining high-density deconfinement phase transitions with gravitational wave spectroscopy of binary neutron star mergers	Peo Espino
2/22	Evolution of Helicity Property of Relic Neutrinos	Jen-Chieh Peng
2/23	Tree unitarity, gauge invariance, and coupling-kinematics in on-shell amplitudes	Zhewei Yin
2/24	Probing and manipulating topology and quantum geometry in 2D materials	Anyuan Gao
2/24	Search for New Physics with di-Higgs Process	Hao Zhang
2/27	Asteroseismic masses of GK giant stars in East Asian Planet Search Network (EAPS-Net) with TESS	Huanyu Teng
2/28	Pattern of global spin alignment of $\phi(1020)$ and $K^*_0(892)$ mesons in heavy-ion collisions	Jinhui Chen
3/1	A Landau-Zener formula for the adiabatic gauge potential	Gabriel Cardoso
3/1	Dark Matter Induced Nucleon Decay Signals in Mesogenesis	Joshua Berger & Gilly Elor
3/1	利用LHC上电弱物理过程测量质子结构	Siqi Yang
3/2	Constraining Axion-like Particles from Multimessenger signals of GW170817	Yongchao Zhang

MM/DD	Title	Speaker
3/7	Search for New Physics with Atomic Magnetometers	Wei Ji
3/8	Fermion quaupling condensates, theory and experimental status	Egor Babaev
3/9	B-meson LCDA and LaMET	Ji Xu
3/10	The central engine, jet structure, and high-energy emission of gamma-ray bursts	Yun-Wei Yu
3/10	Exploring the Weakly Interacting Massive Particle Paradigm beyond: Dark Matter and Colliders	Jia Liu
3/14	Long baseline neutrino experiments NOvA and DUNE	Jianming Bian
3/16	Development of transition edge sensor microcalorimeter and SQUID-based readout system	Bo Gao
3/21	Extending the Horizon of Dark Matter Searches	Shengchao Li
3/22	The Nature of Hot and Dense Strongly-Interacting Matter	Anew W. Steiner
3/22	Complementarity of Lepton Collider Probes of Dark Matter	Kai Ma
3/22	Chiral TSC, Charge-4e SC and Chiral Metal Phases in the Twisted-Bilayer Quasicrystals	Fan Yang
3/23	Thinking about Particle Physics at 10 TeV and Above	Michael E. Peskin
3/23	First WIMPs Dark Matter Search with XENONnT	Fei Gao
3/28	Experimental Search for Charge Lepton Flavor Violation	Zhengyun You
3/28	Flares from the Supermassive Black Hole Sgr A*	Xi Lin
3/29	Making Fire Balls from Primordial Black Holes	Minxi He
3/29	Aneev spectroscopy of iron-based superconductors of the 1111, 111, and 122 families	Tatiana Kuzmicheva

MM/DD	Title	Speaker
3/31	Measuring Microlensing Event Rate Towards the Galactic Center	Bo Ma
3/31	Quantum Computing for New Physics Searches	Yingying Li
4/4	Progress and Prospects of Accelerator Research at IHEP	Yuhui Li
4/6	CP violation induced by the interference of intermediate resonances in multi-body decays of heavy haon	Zhen-Hua Zhang
4/11	Short-Range Correlations and EMC Effects	Zhihong Ye
4/12	Pressure-induced Superconductivity at 32 K in MoB2	Yanpeng Qi
4/12	Transport in strongly interacting van-der-Waals stacks	Alessano Principi
4/13	Lattice calculation of Collins-Soper kernel	Hai-Tao Shu
4/14	On the formation of dark matter deficient galaxies	Go Ogiya
4/18	Studies on Higgs Boson Yukawa Couplings and Self-coupling at ATLAS Experiment	Yanlin Liu
4/19	Absence of vestigial order: how a nematic superconductor (not) behaves	Pye Ton How
4/20	High Precision Proton Charge Radius Experiments at Jefferson Lab	Weizhi Xiong
4/20	Scanning Probe Study of 2D Devices	Jiamin Xue
4/21	量子机器学习在高能物理数据处理中的应用研究	Teng Li
4/25	BESIII Physics after 15 Years: Recent Results and Prospects	Dayong Wang
4/26	Chiral molecular polaritons: cavities, analytical models, and applications	Denis G. Baranov
4/27	Lattice Quantum Chromodynamics and High-Precision Frontier Studies in High-Energy Physics	Xu Feng

MM/DD	Title	Speaker
4/28	Algebraic Geometry and Bethe Ansatz	Yunfeng Jiang
4/28	FU Ori episodic accretion: a class I protostar powered by destruction of a very young hot Jupiter that came all the way from 50 AU	Sergei Nayakshin
5/4	Supercritical growth of seed BHs at cosmic dawn and co-evolution with host galaxies: a perspective regarding outflows	Haojie Hu
5/5	Simulating Bondi-like and Super-Eddington Accretion Flows around Black Holes	Jane Lixin Dai
5/8	Growth of curvature perturbations in non-minimal curvaton scenario revisited	Chao Chen
5/9	From Particle Physics to Medical Physics: PET Research at the University of Texas at Austin	John Cesar
5/10	Electron-phonon coupling and symmetry breaking in the CDW phase of Kagome metals	Dirk Wulferding
5/11	A Beautiful Path to Quantum Chromodynamics	Yu-Ming Wang
5/12	Jitter Radiation Applied in the High-energy Astrophysics	Jirong Mao
5/12	Topological quantum computing in iron-based superconducting nanowires	Xin Liu
5/12	First results from the FASER experiment at LHC	Ke Li
5/16	Spectroscopy and exotic haons	Zhiqing Liu
5/17	Magneto-infrared spectroscopy of Weyl Fermion in new spatial dimension	Yuan Xiang
5/18	Non-strong CP violation in flavor physics	Qin Qin
5/18	Magnetic Topological Materials: Design, Synthesis and Characterizations	Shiming Lei

MM/DD	Title	Speaker
5/19	Type-II Planet-disk interaction in windy circum-stellar disks	Yuhiko Aoyama, Boya
5/19	New frontiers of electroweak physics at the LHC	Philip Chang
5/24	Utilizing scanning SQUID microscopy to explore 2D quantum materials	Yihua Wang
5/24	Beta processes in atoms and ions: applications in neutrino physics	Oleg Titov
5/25	Effective Field Pathway to New Physics	Jiang-Hao Yu
5/25	Magnetic properties of orbital Chern insulators	Jihang Zhu
5/26	Turbulence in outer protoplanetary disks	Can Cui
5/26	Invisible Higgs & trigger challenges on ATLAS: A discussion on Dark sector, Higgs boson, Trigger, and ML/AI on FPGA	Tae Min Hong
5/29	Landau school, Landau's puzzle on QED, and the birth of renormalization group	Wei Liao
5/30	JUNO's potential for atmospheric neutrinos	Duyang Hongyue
6/1	Gluon Transverse Momentum Dependent Parton Distribution Functions at LaMET	Ruilin Zhu
6/5	Effective Field Theory in Electroweak Physics and Dark Matter	Honghao Zhang
6/6	A Common Tracking Software for particle and nuclear physics experiments	Xiaocong Ai
6/6	Accelerating event reconstruction in neutrino telescopes using sparse convolutional neural networks	Felix Yu
6/7	Identification of DM, neutrino and new neutrino interaction statistically in DM direct detection experiments	Bing-Long Zhang

MM/DD	Title	Speaker
6/12	Entanglement and Bell's inequalities with boosted semi-leptonic top quarks at the LHC	Zhongtian Dong
6/13	Search for dark photons and collider neutrinos with FASER	Xin Chen
6/14	Matter, dark matter and primordial black holes from first-order phase transitions	Kepan Xie
6/16	Ray-tracing Based General Relativistic Radiative Transfer: Development and Application	Mikiya Takahashi
6/16	The Top-Higgs Coupling: A Key to Inferring Higgs Physics	Shuo Han
6/16	Particle Production during and after Inflation	Wei Xue
6/19	From Cosmic Surveys to Dark Matter & Black Holes	Ting Li
6/20	Recent Results from AMS experiment on the International Space Station	Hai Chen
6/27	Crime Scene Investigation at JUNO	Wuming Luo
6/29	3D Nature of Massive Star Envelopes and its Implication for Massive Star Evolution	Yan-Fei Jiang
6/30	Type Ia Supernovae from the Detonation of a Helium Shell — From Rare Weirdos to the Population	Chang Liu
7/3	The R&D and physics of mini neutrino detectors	Jing Liu
7/4	A statistical study of exoplanets near the Neptunian Desert: methodology and early results	David Armstrong

MM/DD	Title	Speaker
7/4	Searching for matter creation via neutrinoless double beta decay	Pin-Jung Chiu
7/6	Realistic scattering of puffy dark matter	Wenyu Wang
7/7	The Universe in a Computer Shell	Lile Wang
7/12	Orbital Fulde–Ferrell–Larkin–Ovchinnikov state in an Ising superconductor	Noah F. Q. Yuan
7/14	Newborn super star clusters at Cosmic Noon under gravitational lenses	Liang Dai
7/14	Signatures of Strong Dark Matter Self-Interactions: from Dwarf Galaxies to Supermassive Black Holes	Haibo Yu
7/18	Kagome Metals and Superconductors - A “Basket” Full of Novel Correlated and Topological Matter	Ziqiang Wang
7/19	How does Nernst effect probe strange metals?	Hui Xing
7/21	New results at the forefront of nanohertz gravitational wave astronomy	ZHU Xingjiang
7/26	Neutrino Tomography of the Earth	PETCOV S.T
7/26	Emergent Quantum Phenomena in Diamond and Other Materials	Gufei Zhang
7/27	MHD processes in planet formation	Cong Yu
7/27	Millisecond-Lived Circular Rydberg Atoms in a Room-Temperature Experiment	Haiteng WU
7/27	Implementation and Application of A Multifluid Dust Module in Athena++	Pinghui Huang

MM/DD	Title	Speaker
7/27	A blue depression in M dwarfs - a tale of two M5 dwarfs	Hugh Jones
7/31	How Effective is the Standard Model?	John Ellis
7/31	Nonlinear optical responses and quantum geometry	Guang-Yu Guo
8/7	Emergent criticality in a fully frustrated quantum magnet	Rong Yu
8/15	Coupling the inflated interiors, atmospheric dynamics, and mineral clouds of hot and ultra-hot Jupiters	Thaddeus Komacek
8/15	Probing New Physics with Double Beta Decay	Frank Franz Depisch
8/16	Kilohertz gravitational-wave astronomy	Huan Yang,
8/16	Developments towards a small stable high-resolution spectrograph	Hugh Jones
8/18	A scenario for Galactic cosmic-ray origins	Brian Reville
8/18	Majorana Neutrinos, Lepton Number Violation and Double Beta Decay	Frank Franz Depisch
8/21	Hunting for PeVatrons in the Milky Way	Ke Fang
8/21	High-resolution spectroscopy of ultra-hot Jupiter's atmosphere	Fei Yan
9/1	A unified framework of mean-field dynamo and angular momentum transport in accretion disks	Tushar Mondal
9/5	Enhancing Understanding of Observation Results through 2D Simulations of Dusty Protoplanetary Disks with Planet-disk Interaction	Yinhao Wu
9/5	Stellar Object Formation and Evolution in AGN Disks	Yi-Xian Chen

MM/DD	Title	Speaker
9/6	An introduction to isometric tensor network states in two dimensions	Yantao Wu
9/8	Distortion of gravitational-wave signals by astrophysical environments	Xian Chen
9/13	Phonon contributions to transport anomalies in candidate quantum spin liquid materials	Xiaochen Hong
9/14	New Understandings of Gamma-ray Bursts Origins & Mechanisms	Binbin Zhang
9/14	Particle dispersion in ultralight dark matter	Eung Jin Chun
9/15	Introduction to axion physics (Sep15+Sep18+Sep25+Sep27,2023)	Eung Jin Chun
9/15	缪子反常磁矩测量的新突破	Liang LI
9/18	Like a wrecking ball: understanding giant planets as the key to finding Earths	Rob Wittenmyer
9/18	Searching for the Creation of Matter (Without Anti-matter!) with MAJORANA and LEGEND	Jason Detwiler
9/19	The Tomography of Nucleon: Lattice QCD calculation of the unpolarized transverse-momentum-dependent parton distributions	Qi-An Zhang
9/19	New Semiconductor Devices for Dark Matter Detection	Peizhi Du
9/20	(Un-) Conventional pairing in multiband superconductors: Role of Fermi surface geometry	Aneas Kreisel
9/21	Plasma-based particle acceleration and laboratory astrophysics	Yipeng Wu
9/22	Identifying quark aspects of compact stars in multi-messenger astronomy era	Enping Zhou
9/26	自旋相关标准模型之外的新相互作用若干探测研究	Haiyang Yan

MM/DD	Title	Speaker
9/27	The Law of Temperature Transformation	Jinwu Ye
9/27	Holographic quantum error-correcting code built from boundary quantum gates	Wei Wang
9/28	The Top-Higgs Coupling: A Key to Inferring Higgs Physics	Shuo Han
10/10	Baryons in the light-front approach: The three-quark picture	Zhen-Xing Zhao
10/11	Observation of Unquantized Vortices in Superconductor	Yusuke Iguchi
10/12	The Destiny of Gas Filaments in Molecular Clouds	Pak Shing Li
10/12	Image The Milky Way With Multi-Messengers	Lili Yang
10/13	From the discovery of the Higgs boson to modelling COVID-19 and beyond: The role of AI	Bruce Mellado
10/18	Strong Gravity Frontier of Particle Physics	Yifan Chen
10/19	Time-reversal symmetry breaking superconductivity of Pr-based superconductors	Lei Shu
10/19	Grand Unified Theories in light of upcoming neutrino experiments and recent GW measurements	Yeling Zhou
10/19	Real time non-perturbative dynamics in Schwinger model - jet production, charge transport, and more	Shuzhe Shi
10/20	在 高能加速器上“热冻”引力	Shouhua Zhu
10/23	Modeling neutrinoless double-beta decay with operators from chiral effective field theory	Jiangming Yao
10/24	The theory of neutrinoless double-beta decay in atomic nuclei (-,-)	Jiangming Yao

MM/DD	Title	Speaker
10/24	用于低本底物理实验的低温CMOS粒子探测器读出专用集成芯片研制	Zhi Deng
10/26	Probing coherent charge transfer by time-resolved ARPES	Shijing Tan
10/26	Transition-Edge Sensor Development and Application	Daikang Yan
10/27	The synergy between binary stars and asteroseismology: Mass transfer, tides and nonlinearity	Zhao Guo
10/30	Efficient generation of bright gamma-rays and dense positrons in plasmas	Xinglong Zhu
10/30	Conditional Entanglement Transfer Via Black Holes	Ali Akil
10/31	Chiral Symmetry and Pion Nucleon Scatterings	Hanqing Zheng
10/31	Primordial Black Holes as Dark Matter	Wencheng Shao
11/1	Symmetry breaking in iron chalcogenides and kagome metal systems probed by electronic Raman spectroscopy	Shangfei Wu
11/1	Black Holes as Neutrino Factories	Xiao Xue
11/2	Understanding the Planetary formation and evolution in Clusters	Liu Hui-Gen
11/2	The Hyper-Kamiokande Experiment	Jost Migenda
11/3	Possible anomalous Z mass from the model of the instantaneous symmetrical breaking and the expansion of the universe	Yaquan Fang
11/3	Nearby Supernovae and Kilonovae: Matters of Life and Death	John Ellis
11/9	Nonlinearities of the curvature perturbation	Shi Pi

MM/DD	Title	Speaker
11/9	Strong magnetic field impact on the neutrino transportation inside the SNe	Yudong Luo, Boya
11/9	Magnetogenesis and Baryogenesis from Axion Inflation	Kohei Kamada
11/9	Primordial Black Holes as Dark Matter	Florian Kühnel
11/9	Cryogenic particle detection using magnetic microcalorimeters for neutrino studies: AMoRE and LiFE	Yong-Hamb Kim
11/13	Introduction to Generalized Global Symmetries	Sungwoo Hong
11/14	Exploring neutral current pi0 events at the Super-K detector and the sensitivity on neutrino oscillation parameters at T2K	Tailin Zhu
11/14	核子基本性质的未解之“谜”	Chao Peng
11/15	Probing the signature of dark matter collinear splitting	Jinmian Li
11/16	Milli-Hz Gravitational Wave Astronomy	Wenbiao Han
11/16	Axion Domain Walls, Small Instantons, and Non-Invertible Symmetry Breaking	Sungwoo Hong
11/23	Fast Radio Bursts	Ue-Li Pen
11/24	An Overview of Stellar Evolution and Pollution in AGN Disk (SEPAD) and their Implication on the Stellar Dynamics in the Galactic Center and around other Super-massive Black Holes.	Douglas Lin
11/24	All the dark we can not see - the state-of-the art in direct searches for particle dark matter	Laura Baudis
11/24	Imaging quantum oscillations and millitesla pseudomagnetic fields in graphene	Haibiao Zhou
11/27	"Real" multi-gap topologies in materials	Aien Bouhon

MM/DD	Title	Speaker
11/28	Exploring high energy haonic scatterings by quantum computing	Hongxi Xing
11/29	Connecting the formation and atmospheric characterization of exoplanets through space telescope observations	Yifan Zhou
11/30	The landscape of stellar explosions -- from canonical supernovae to other exotic transients	Ping Chen , Benojiyo
12/5	NeatIBP v1.0, Using Algebraic Geometry for the Reduction of Multi-loop Feynman Integrals	Yang Zhang
12/5	Astrophysical sources of very high energy neutrinos	Dmitri Semikoz
12/6	The Casimir effect and related phenomena at micro-nano scales	Lixin Ge
12/7	Physics opportunities and challenges at future multi-TeV lepton colliders	Yang Ma
12/08	CANDIDATE COSMIC-RAY ACCELERATORS AT PEV ENERGIES	Silvia Celli
12/20	Generation and amplification of cosmic magnetic fields in a collisionless plasma	Muni Zhou
12/27	Quest for New physics of Charged Lepton Flavor Violation - Search for Muon to Electron Conversion with the COMET experiment	Yoshitaka Kuno



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REPORT

CHAPTER
7

PUBLICATIONS

论文

Artwork of 2023 SJTU T.D.Lee Science and Art Exhibition: *God's Hands*

2023年上海交大李政道科艺展作品: 《上帝之手》

By Yanpu Yin

作者: 尹燕谱

01

Limits on the luminance of dark matter from xenon recoil data

PandaX Collaboration

[NATURE 618 7963 \(2023\) 47](#)

02

A broadband thermal emission spectrum of the ultra-hot Jupiter WASP-18b

Coulombe, Louis-Philippe; Tan, Xianyu et.al.

[NATURE 620 \(2023\) 292](#)

03

Precessing jet nozzle connecting to a spinning black hole in M87

Cui, Yuzhu; Lin, Weikang; Mizuno, Yosuke et al.

[NATURE 621 7980 \(2023\) 711](#)

04

An evolutionary continuum from nucleated dwarf galaxies to star clusters

Wang, Kaixiang; Liu, Chengze et.al.

[NATURE 623 7986 \(2023\) 296](#)

05

Superconducting vortices carrying a temperature-dependent fraction of the flux quantum

Iguchi, Grinenko, Vadim et.al.

[SCIENCE 380 6651 \(2023\) 1244](#)

06

A tera-electron volt afterglow from a narrow jet in an extremely bright gamma-ray burst

LHAASO Collaboration

[SCIENCE 380 6652 \(2023\) 1390](#)

07

Colloquium: Quantum and classical discrete time crystals

Zaletel, Michael P.; Lukin, Mikhail; Monroe, Christopher; Nayak, Chetan; Wilczek, Frank; Yao, Norman Y.

[REVIEWS OF MODERN PHYSICS 95 3 \(2023\) 31001](#)

08

Light-Induced Giant Rashba Spin-Orbit Coupling at Superconducting KTaO₃(110) Heterointerfaces

Gan, Yulin; Yang, Fazhi; Kong, Lingyuan; Chen, Xuejiao; Xu, Hao; Zhao, Jin; Li, Gang; Zhao, Yuchen; Yan, Lei; Zhong, Zhicheng; Chen, Yunzhong; Ding, Hong

[ADVANCED MATERIALS 35 25 \(2023\) 2300582](#)

09

Universal Stripe Symmetry of Short-Range Charge Density Waves in Cuprate Superconductors

Choi, Jaewon; Ding, Hong et.al.

[ADVANCED MATERIALS \(2023\) 2307515](#)

10

Observation of electroweak production of two jets and a Z-boson pair

ATLAS Collaboration

[NATURE PHYSICS 19 2 \(2023\) 237](#)

11

An ultrahigh-energy gamma-ray bubble powered by a super PeVatron

LHAASO Collaboration

[SCIENCE BULLETIN 12 \(2023\) 040](#)

12

Transient dynamics of the phase transition in VO₂ revealed by mega-electron-volt ultrafast electron diffraction

Xu, Chenhang; Jin, Cheng; Chen, Zijiang; Lu, Qi; Cheng, Yun; Zhang, Bo; Qi, Fengfeng; Chen, Jiajun; Yin, Xunqing; Wang, Guohua; Xiang, Dao; Qian, Dong

[NATURE COMMUNICATIONS 14 1 \(2023\) 1265](#)

13

Orbital-symmetry effects on magnetic exchange in open-shell nanographenes

Du, Qingyang; Su, Xuele; Liu, Yufeng; Jiang, Yashi; Li, Can; Yan, KaKing; Ortiz, Ricardo; Frederiksen, Thomas; Wang, Shiyong; Yu, Ping

[NATURE COMMUNICATIONS 14 1 \(2023\) 4802](#)

14

Spin-orbit driven superconducting proximity effects in Pt/Nb thin films

Flokstra, Machiel; Yim, Chi-Ming et.al.

[NATURE COMMUNICATIONS 14 1 \(2023\) 5081](#)

15

From Stoner to local moment magnetism in atomically thin Cr₂Te₃

Zhong, Yong; Jia, Jin-Feng et.al.

[NATURE COMMUNICATIONS 14 1 \(2023\) 5340](#)

16

Calorimetric evidence for two phase transitions in Ba_{1-x}K_xFe₂As₂ with fermion pairing and quadrupling states

Shipulin, Ilya; Stegani, Nadia; Maccari, Ilaria; Kihou, Kunihiro; Lee, Chul-Ho; Hu, Quanxin; Zheng, Yu; Yang, Fazhi; Li, Yongwei; Yim, Chi-Ming; Huehne, Ruben; Klauss, Hans-Henning; Putti, Marina; Cagliaris, Federico; Babaev, Egor; Grinenko, Vadim

[NATURE COMMUNICATIONS 14 1 \(2023\) 6734](#)

17

Bipolaronic High-Temperature Superconductivity

Zhang, C.; Sous, J.; Reichman, D. R.; Berciu, M.; Millis, A. J.; V. Prokof'ev, N.; V. Svistunov, B.

[PHYSICAL REVIEW X 13 1 \(2023\) 11010](#)

18 Observation of Integer and Fractional Quantum Anomalous Hall Effects in Twisted Bilayer MoTe₂
Xu, Fan; Sun, Zheng; Jia, Tongtong; Liu, Chang; Xu, Cheng; Li, Chushan; Gu, Yu; Watanabe, Kenji; Taniguchi, Ta-kashi; Tong, Bingbing; Jia, Jinfeng; Shi, Zhiwen; Jiang, Shengwei; Zhang, Yang; Liu, Xiaoxue; Li, Tingxin
[PHYSICAL REVIEW X 13 3 \(2023\) 31037](#)

19 Collective Quantum Magnetism in Nitrogen-Doped Nanographenes
Zhu, Gucheng; Jiang, Yashi; Wang, Ying; Wang, Bing-Xin; Zheng, Yuqiang; Liu, Yufeng; Kang, Li-Xia; Li, Zhanbo; Guan, Dandan; Li, Yaoyi; Zheng, Hao; Liu, Canhua; Jia, Jinfeng; Lin, Tao; Liu, Pei-Nian; Li, Deng-Yuan; Wang, Shiyong
[JOURNAL OF THE AMERICAN CHEMICAL SOCIETY 145 13 \(2023\) 7136](#)

20 Evidence for baryon acoustic oscillations from galaxy-ellipticity correlations
Xu, Kun; Jing, Y. P.; Zhao, Gong-Bo; Cuesta, Antonio J.
[NATURE ASTRONOMY 7 \(2023\) 1259](#)

21 A multi-cubic-kilometre neutrino telescope in the western Pacific Ocean
Trident Collaboration
[NATURE ASTRONOMY 7 \(2023\) 1497](#)

22 Filamentary structures as the origin of blazar jet radio variability
Fuentes, Antonio; Mizuno, Yosuke et.al.
[NATURE ASTRONOMY 7 \(2023\) 1359](#)

23 Magnetic molecular orbitals in MnSi
Jin, Zhendong; Li, Yangmu; Hu, Zhigang; Hu, Biaoyan; Liu, Yiran; Iida, Kazuki; Kamazawa, Kazuya; Stone, Matthew B.; Kolesnikov, Alexander I.; Abernathy, Douglas L.; Zhang, Xiangyu; Chen, Haiyang; Wang, Yandong; Fang, Chen; Wu, Biao; Zaliznyak, Igor A.; Tranquada, John M.; Li, Yuan
[SCIENCE ADVANCES 9 1 \(2023\) eadd5239](#)

24 Quantum magnetic gradiometer with entangled twin light beams
Wu, Shuhe; Bao, Guzhi; Guo, Jinxian; Chen, Jun; Du, Wei; Shi, Minwei; Yang, Peiyu; Chen, Liqing; Zhang, Weiping
[SCIENCE ADVANCES 9 15 \(2023\) eadg1760](#)

25 Low-energy quasi-circular electron correlations with charge order wavelength in Bi₂Sr₂CaCu₂O_{8+δ}
Scott, Kirsty; Zhong, Ruidan et.al.
[SCIENCE ADVANCES 9 29 \(2023\) eadg3710](#)

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Qian, Xiang-Li; Sun, Hui-Ying; Chen, Tian-Lu; Danzengluobu; Feng, You-Liang; Qi, Gao; Gou, Quan-Bu; Guo, Yi-Qing; Hu, Hong-Bo; Kang, Ming-Ming; Li, Hai-Jin; Cheng, Liu; Liu, Mao-Yuan; Wei, Liu; Qiao, Bing-Qiang; Xu, Wang; Zhen, Wang; Xin, Guang-Guang; Yao, Yu-Hua; Qiang, Yuan; Yi, Zhang

[ACTA PHYSICA SINICA 72 4 \(2023\) 49501](#)

345 Expectation on observations of Fermi-LAT gamma-ray sources using the HADAR experiment

Sun, Hui-Ying; Qian, Xiang-Li; Chen, Tian-Lu; Feng, You-Liang; Gao, Qi; Gou, Quan-Bu; Guo, Yi-Qing; Hu, Hong-Bo; Kang, Ming-Ming; Li, Hai-Jin; Liu, Cheng; Liu, Mao-Yuan; Liu, Wei; Qiao, Bing-Qiang; Wang, Xu; Wang, Zhen; Xin, Guang-Guang; Yao, Yu-Hua; Yuan, Qiang; Zhang, Yi

[ACTA PHYSICA SINICA 72 19 \(2023\) 20230977](#)

346

Heisenberg uncertainty principle: an advanced undergraduate laboratory experiment based on quantum quadrature operators

Chen, Yu; Liu, Zhaoyang; Chen, Xin; Liu, Shuqi; Jiang, Jiatong; Wu, Yuan; Guo, Jinxian; Chen, L. Q.

[EUROPEAN JOURNAL OF PHYSICS 44 2 \(2023\) 25302](#)

347

ARPES studies of the band structures of topological insulators

Hu, JiaYuan; Liu, XiangRui; Liu, Chang; Qiang, Dong

[SCIENTIA SINICA-PHYSICA MECHANICA & ASTRONOMICA 53 6 \(2023\) 267008](#)

348

Angle-resolved photoemission spectroscopy study on iron-based

Wang, ZhengGuo; Huang, Yong; Zhang, Yan; Zhang, Peng; Ding, Hong

[SCIENTIA SINICA-PHYSICA MECHANICA & ASTRONOMICA 53 6 \(2023\) 267004](#)

349

Type-II seesaw Complex Triplet Model: Phase Transition and Global Fit Analysis

Du, Yong

[NUCLEAR AND PARTICLE PHYSICS PROCEEDINGS 330 \(2023\) 28](#)

350

Search for $H \rightarrow aa \rightarrow 4b$ exotic decays and VBF $HH \rightarrow 4b$ with CEPC and ATLAS

Wang, Zhen

[NUCLEAR AND PARTICLE PHYSICS PROCEEDINGS 330 \(2023\) 51](#)

351

Geometric and topological Higgs mechanisms: Mass generations and massive scattering amplitudes

He, Hong-Jian

[NUCLEAR AND PARTICLE PHYSICS PROCEEDINGS 336 \(2023\) 1](#)

352

Efficient generation of collimated multi-GeV gamma-rays along solid surfaces

Zhu, Xing-Long; Liu, Wei-Yuan; Chen, Min; Weng, Su-Ming; Wu, Dong; Sheng, Zheng-Ming; Zhang, Jie

[OPTICA 10 1 \(2023\) 118](#)

NO.	Teaching object 授课对象	Semester 学期	Course 课程	Credits 学分	Credit hours 学时	Teachers in TDLI 李所教师
1	Undergraduate 本科生	Spring 2023	Introduction to Physics I (Honor)物理学引论（荣誉）I	5	80	Sheng Li 李晟
2	Undergraduate 本科生	Spring 2023	Quantum Mechanics I(B) 量子力学I（B类）	4	64	Kun Liu 刘坤
3	Undergraduate 本科生	Spring 2023	University Physics (A)（2） 大学物理(A类）（2）	4	64	Chi Ming Yim 严智明
4	Undergraduate 本科生	Spring 2023	Introduction to Physics Research 物理研究导论	2*2	32*2	Kim-Siang-Khaw
5	Undergraduate 本科生	Autumn 2023	Introduction to Physics II (Honor) 物理学引论（荣誉）II	5	58	Sheng Li 李晟
6	Undergraduate 本科生	Autumn 2023	Electromagnetism 电磁学	4	64	Shao-Feng Ge 葛韶锋
7	Undergraduate 本科生	Autumn 2023	University Physics (A)（1） 大学物理(A类）（1）	4	64	Ruidan Zhong 钟瑞丹
8	Undergraduate 本科生	Autumn 2023	Probability and Statistics 概率与统计	3	48	Kun Liu 刘坤

NO.	Teaching object 授课对象	Semester 学期	Course 课程	Credits 学分	Credit hours 学时	Teachers in TDLI 李所教师
9	Undergraduate 本科生	Autumn 2023	Thermology 热学	3	48	Shu Li 李数
10	Undergraduate 本科生	Autumn 2023	Computational Physics 计算物理	3	48	Donglian Xu 徐东莲
11	Undergraduate 本科生	Autumn 2023	Introduction to Astronomy Research 天文研究导论	2	32	Hao Zhou 周浩
12	Undergraduate 本科生	Autumn 2023	University Physics (A) (3) 大学物理(A类) (3)	2	32	Qingdong Jiang 蒋庆东
13	Undergraduate 本科生	Autumn 2023	Advanced Topics in Theoretical Physics 理论物理学的高级专题	1	32	Frank Wilczek
14	Undergraduate 本科生	Autumn 2023	Physical Research Practice I 物理研究实践I	1	50	Sheng Li 李晟
15	Graduate 研究生	Spring 2023	Advanced Condensed Matter Physics 高等凝聚态物理	4	64	Jianda Wu 吴建达
16	Graduate 研究生	Spring 2023	Particle Astrophysics 粒子天体物理	3	48	Hao Zhou 周浩

NO.	Teaching object 授课对象	Semester 学期	Course 课程	Credits 学分	Credit hours 学时	Teachers in TDLI 李所教师
17	Graduate 研究生	Spring 2023	From Earth to Extraterrestrial Civilization 从地球到系外文明	3	48	Xianyu Tan 谭先瑜 & Fabo Feng 冯发波 &Masahiro Ogihara
18	Graduate 研究生	Spring 2023	Frontiers of Experimental Nuclear and Particle Physics 粒子物理与核物理实验前沿选讲	3	48	Haijun Yang 杨海军 & Kun Liu 刘坤
19	Graduate 研究生	Spring 2023	Discussion of Current Topics in Astrophysics 天体物理前沿课题讨论	2	32	Fabo Feng 冯发波 & Masahiro Ogihara
20	Graduate 研究生	Autumn 2023	Advanced Electrodynamics 高等电动力学	4	64	Jason Evans
21	Graduate 研究生	Autumn 2023	Group Theory In Physics 物理学中的群论	4	64	Yuichiro Nakai
22	Graduate 研究生	Autumn 2023	Astrophysical hydrodynamics 天体物理流体力学	3	48	Mizuno Yosuke
23	Graduate 研究生	Autumn 2023	Radiative Processes in Astrophysics 天体物理中的辐射机制	3	48	Gwenaël Giacinti & Xianyu Tan 谭先瑜
24	Graduate 研究生	Autumn 2023	Frontiers of Particle Physics 粒子物理前沿选讲	3	48	Xiaogang He 何小刚 & Haijun Yang 杨海军
25	Graduate 研究生	Autumn 2023	Topics in Modern Physics and Astronomy (Particle and Nuclear Physics): New Physics 现代物理与天文专题（粒子与核物理类）：新物理	0.5	8	Shao-Feng Ge 葛韶锋



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CHAPTER 9

HONORS AND AWARDS

荣誉奖励

i

Artwork of 2023 SJTU T.D.Lee Science and Art Exhibition: *Birds of a Feather Flock Together*

2023年上海交大李政道科艺展作品：《物以类聚》

By Jun Wu, Nannan Sun, Siyu Wu

作者：吴骏、孙楠楠、吴思语



Hong Ding Selected as CAS Academician

丁洪当选中国科学院院士



Jie Zhang Gets the 4th Outstanding Teaching Award

张杰获第四届杰出教学奖



Jing Yipeng Gets the 2023 Ho Leung Ho Lee Foundation Award for Scientific and Technological Advancement

景益鹏获2023年度何梁何利基金科学与技术进步奖



Jianglai Liu Awarded the 2023 National May Day Labor Medal

刘江来获2023年全国五一劳动奖章



Xiaogang He Awarded Pudong Pearl Plan Leading Talent in 2023

何小刚获2023年度“明珠计划”领军人才

Shaofeng Ge, Hualin Mei, Yipeng Wu Awarded Pudong Pearl Plan Young Talent in 2023

葛韶锋、梅华林、吴益鹏获2023年度“明珠计划”菁英人才

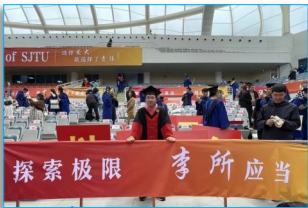


Baiqing Lv Gets the Most Potential Award of 2023 DAMO Academy Young Scholars Award

吕佰晴获2023年度达摩院青橙奖最具潜力奖

Yanfeng Hang Awarded 2022 Development Scholarship for Outstanding Doctoral Graduates in SJTU

杭岩峰获上海交通大学2022年优秀博士毕业生发展奖学金



Wei Tian and Jiahao Yang Awarded 2022-2023 National Scholarship for Graduates

田玮、杨家豪获2022-2023学年研究生国家奖学金



Shu Li Awarded "Top 10 Class Teachers" ; Shao-Feng Ge& Ruidan Zhong Awarded "Outstanding Class Teachers" by SJTU in 2023

李数获2023年度上海交通大学“十佳班主任”



Shu Li Awarded the Second Prize in the 7th Youth Education Competition of SJTU; Ruidan Zhong and Kun Liu Awarded the Third Prize in the 8th Youth Education Competition of SJTU

李数获上海交通大学第七届青教赛二等奖
钟瑞丹、刘坤获上海交通大学第八届青教赛三等奖



Li Fu Nominated for SJTU 2023 Management Service Award

付莉获上海交通大学2023年管理服务奖提名奖



Shushu Li Gets TDLI 2023 Distinguished Research Management Award

李姝姝获李政道研究所2023年度杰出科研管理奖



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CHAPTER 10

OUTREACH AND PRESS CLIPS 科普与媒体聚焦



张杰开展十余场科普报告
Jie Zhang Conducts Over Ten Popular Science Lectures



Frank Wilczek、丁洪等出席《探寻万物原理》公众科普活动
Frank Wilczek, Hong Ding, and Others Attend "Exploring the Principles of Everything" Public Science Event



杨小虎、Vadim Grinenko、徐东莲组队亮相上海科技节百米科学红毯
Xiaohu Yang, Vadim Grinenko, and Xu Donglian Team Up for Shanghai Science Festival's Science Red Carpet



刘江来拍摄《暗物质的追光者》
Liu Jiang Filming "Chasers of Dark Matter"



首届“明珠讲坛”公众科普报告从量子比特到宇宙
Pudong Pearl Forum Public Science Lectures: From Quantum Bits to the Universe



第五届“交二代”夏令营
The 5th Next Generation SJTUsers Summer Camp



科普主题进驻地铁“科技追光号”
“Science-themed Subway Train”
Science Pursuit" Launched



“天问”创享荟暨“逐梦星海”音乐会
Quest of Infinity:
Dreaming of the Starry Sky Concert



文汇报 | 张杰：发挥大科学研究范式优势，争做更多科技领域领跑者

Wenhui Daily: Interview with Jie Zhang



文汇报 | ‘跨界’带来科研灵感与激情
中国科学院院士、李所副所长丁洪专访

Wenhui Daily: Interview with Hong Ding



浦东发布 | Yosuke Mizuno专访

Pudong Release: Interview with Yosuke Mizuno



新市民，新梦想 | 许金祥

New Citizen, New Dreams: Kim Siang-Khaw



青年报 头版头条 | 李政道学者徐东莲参与
2023年浦江创新论坛

Youth Daily Front Page Headline: T. D. Lee
Fellow Donglian Xu Participates in the 2023
Pujiang Innovation Forum



解放日报 头版 | 万仞孤山上，深入“未至之境”——李政道研究所基础研究生生态调查

Jiefang Daily Front Page



浦东人才港宣传片 | Luca Visinelli

Pudong International Talent Hub Promo:
Luca Visinelli



浦东发布 | 李数：不忘初心、不负韶华，
永做浩瀚星海的追光者

Pudong Release: Interview with Shu Li



外籍人士看自贸

Vadim Grinenko Foreigners' Perspective on
Free Trade: Vadim Grinenko



广州新闻联播 | 赵昕 上海：从产业到科学
“张江”跑出“加速度”

Guangzhou Broadcasting Network: Interview
with Xin Zhao



张江发布 | Samy Kaci

Zhangjiang Release: Samy Kaci



青春会客厅 | 黄惊涛

Youth Salon: Jingtao Huang



B站 | 张江遇见UP主

Bilibili: Zhangjiang Meets Bloggers

List of Science Arts Illustrations

科艺插画列表

Rapid 湍 Dongzhou Li 厉东洲, Lujue Ye 叶璐杰, Xuanqi Wang 王炫奇 Mixed Media 版画拼贴	Cover 封面
Complexity and Simplicity 繁与简 Yuqing Ying 应玉清 Watercolour 纸本水彩	Title Page 扉页
PCityB 简复纵横——集成之城 Lixin Wan 万礼鑫, Yi Sha 沙毅, Jinhao Gou 苟晋豪, Yundong Wen 文昀栋 Mixed Media 综合材料	P14
Faces 相 Po Huang 黄珀, Yuxin Tian 田雨欣, Jiapeng Zou 邹家鹏 Engraving 版画	P92
God's Hands 上帝之手 Yanpu Yin 尹燕谱 Lacquer Painting 漆画	P110
Birds of a Feather Flock Together 物以类聚 Jun Wu 吴骏, Nannan Sun 孙楠楠, Siyu Wu 吴思语 Painting 绘画	P162