United Nations/China Cooperation on the Utilization of the China Space Station (CSS)

联合国/中国围绕中国空间站应用开展合作

Selected Experiment Projects to be executed on board the CSS for the 1st Cycle

Announced on the occasion of the 62nd Session of the Committee on the Peaceful Uses of Outer Space

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第一轮合作入选项目

2019 年 6 月 12 日在奥地利维也纳举行的第 62 届和平利用外空委员会大会期间发布

The United Nations Office for Outer Space Affairs (UNOOSA), in cooperation with the China Manned Space Agency (CMSA) and with the support of the Government of China, published on 28 May 2018 the 1st "Announcement of Opportunity (AO)" under the United Nations/China Cooperation on the Utilization of the China Space Station (CSS) initiative, inviting all Member States of United Nations to submit applications for conducting their scientific experiments on board the CSS.

2018 年 5 月 28 日，联合国外空司与中国载人航天工程办公室合作，并在中国政府的支持下，对外发布了在 “联合国/中国围绕中国空间站应用开展合作” 项目框架下的第一轮合作机会公告，邀请所有联合国成员国申请拟在中国空间站上开展的科学实验项目。

As of 30 September 2018, which was the application deadline, a total of 42 applications from institutions in 27 countries were received, and then carefully evaluated by around 60 experts from UNOOSA, CMSA and international space community, in line with the eligibility and selection criteria outlined in the first AO. Eighteen (18) projects out of the 42 received were shortlisted, and their Principal Investigators were invited to prepare their Implementation Scheme Proposals (ISPs) for further review towards a final selection. By the submission deadline of 20 April 2019, 15 ISPs from the 18 shortlisted were received and an in-depth review in terms of technical scheme, implementation feasibility, onboard resource requirements, safety analysis, risk analysis, and financial support for their own development was executed.

截止 2018 年 9 月 30 日，来自 27 个国家的不同机构提交了 42 份项目申请。来自联合国外空司、中国载人航天工程办公室、国际航天届的约 60 位专家，依据第一轮机会公告中提出的资格条件和评判规则，对这些项目申请进行了认真评估，初步筛选出 18 个项目，并邀请这些项目团队编制项目实施方案，为终选做准备。截止 2019 年 4 月 20 日，共收到 15 个项目实施方案。之后，对这 15 个项目依据其技术方案、实施可行性、对空间站资源的需求、安全性分析、风险性分析、项目自身研制经费保障等，进行了深度评审。

As a final outcome from the application and selection process, nine experiments were selected for entering preparation and implementation process, among which six were fully accepted, and three were

conditionally selected. These 9 projects involve 23 institutions from 17 Member States of the United Nations in Asian-pacific, European, African, North American and South American regions, including governmental organizations, private sectors, and international associations. It is, indeed, great to see that most of the projects are collaborative international efforts reflecting the creativity and commitment of the involved scientists from public and private entities in both developing and developed countries. The research areas involve space life science, biotechnology, microgravity fluid physics, microgravity combustion, astronomy, and space technologies. Details about the selected experiment projects are as follows:

经过上述申请和选拔过程，这一轮最终选拔出 9 个计划在中国空间站上实施的实验项目，其中 6 个为完全入选项目，3 个为有条件入选项目。这 9 个项目涉及来自亚太、欧洲、非洲、南美洲和北美洲的 17 个国家的 23 个申请机构，包括政府性研究机构、私人航天企业和国际性组织。非常突出的特点是，所有项目都是多个机构联合申请和联合实施的项目，反映了来自发展中国家和发达国家的公共和私人实体的科学家们的创造力和协作意志。项目研究领域包括空间生命科学、生物技术、微重力流体物理、微重力燃烧科学、空间天文学、航天新技术等。入选项目详细情况如下:

I. Fully accepted experiment projects:

完全入选项目

No.1: POLAR-2: Gamma-Ray Burst Polarimetry on the China Space Station

Building on the previous investigation on China's TG-2 space lab, this project aims to answer the most important open questions in astrophysics regarding the nature of Gamma-Ray Bursts (GRBs) by using the most promising investigation approach of polarization measurements allowing to observe even the weakest gamma-ray transients, such as those connected to gravitational waves.

It is an experiment project in astronomy in space. It was applied and will be implemented by four institutions from four countries, which are: The University of Geneva from Switzerland, the National Center for Nuclear Research of Poland, the Max Plank Institute for Extra-terrestrial Physics of Germany, and the Institute of High Energy Physics of Chinese Academy of Sciences.

第 1 个项目：POLAR-2：中国空间站上的伽玛暴偏振探测仪

基于前期在中国天宫-2空间实验室上的研究基础，该项目旨在回答空间天文学领域最重要的关于伽玛暴特性的开放性问题。项目团队将使用最有应用前景的偏振探测方法进行研究，该方法可以探测到甚至最为微弱的伽马射线瞬变，例如与重力波相关的瞬变等。

这是一个空间天文实验项目，由来自四个国家的四个机构联合申请并实施，他们是：瑞士的日内瓦大学、波兰的国家核研究中心、德国的麦克斯普朗克外层空间物理研究所和中国科学院高能物理研究所。

No.2: Spectroscopic Investigations of Nebular Gas (SING)

This project is aimed to map the sky using an ultraviolet long-slit spectrograph by taking advantage of the CSS. It is targeted to the extended nebulae in our own Galaxy, star formation in nearby galaxies and on an even larger scale, the cosmic web.

It is an experiment in astronomy in space. It was applied and will be implemented by two institutions from two countries, which are: The Indian Institute of Astrophysics, and the Institute of Astronomy of the Russian Academy of Sciences.

第2个项目：星云气体的光谱研究

本项目旨在研制并在中国空间站上安装一台紫外线长缝成像光谱仪，用于研究银河系和宇宙网中的星云和星体形成等。

这是一个空间天文实验项目，由来自两个国家的两个机构共同提出申请并联合实施，他们是：印度天体物理研究所和俄罗斯科学院天文研究所。

No. 3: Behaviour of Partially Miscible Fluid in Microgravity

This project is aimed to study the concentration diffusion phenomenon during local mixing of unmixed liquid caused by temperature change under microgravity, including droplet migration, accumulation and thermal diffusion caused by Marangoni effect in local mixing area. The theory obtained will guide the industrial process of foundation and understand the complex interface process.

It is an experiment in microgravity fluid physics and combustion. It was applied and will be implemented by two organizations from two countries, namely the Indian Institute of Technology (BHU) and the Université Libre de Bruxelles (ULB) in Belgium.

第3个项目：部分混相流体在微重力下的行为研究

该项目旨在利用微重力环境，研究温度变化对不混合液体中发生局部混合过程中的浓度扩散现象，包括在局部混合区域发生的由Marangoni效应引起的液滴迁移、聚集和热扩散。所获得的研究理论将指导地基的相关工业过程，认识复杂界面过程。

这是一个微重力流体和燃烧科学实验项目，由来自两个国家的两个机构联合提出申请并组织实施，他们是：印度理工学院和比利时布鲁塞尔自由大学。

No. 4: Flame Instabilities Affected by Vortices and Acoustic Waves (FIAVAW)

This project is aimed to investigate the instabilities of edge flames in the absence of gravity, as well as the potential control and effects from external flow oscillations taking advantage of the long-duration and buoyancy-free environment onboard the CSS. The research looks at the most fundamental problems of flame stabilisation in a convective flow that is related to aircraft and rocket engine combustion, as well as fire safety problems in space.

It is an experiment project in microgravity fluid physics and combustion. It was jointly applied and will be jointly implemented by two institutions from two countries, which are: Tsinghua University from China and the University of Tokyo from Japan.

第4个项目：受涡流和声波影响的火焰不稳定性研究

该项目主要是利用中国空间站提供的长期无重力条件对火焰的不稳定性进行研究。由于所研究的问题是飞机和火箭的发动机燃烧过程中有关火焰稳定性的基本问题，也关系太空中的防火安全，因此，该项目具有很强的应用前景。

这是一个微重力流体物理和燃烧科学实验项目，由来自两个国家的两个机构联合申请并实施，他们是：中国的清华大学和日本的东京大学。

No. 5: Tumours in Space: Signatures of early mutational events due to space-flight conditions on 3D organoid cultures derived from intra-individual healthy and tumour tissue

This project is aimed to thoroughly test the two important hypotheses: The gravitational force and the galactic cosmic radiation (GCR), respectively, causes a unique mutational signature in the DNA of 3D human organoids derived from intra-individual healthy and colorectal cancer tissue. The results could have a major scientific impact on the current understanding of cancer aetiology and offer new perspectives on prevention and treatment of cancer, including on crew health on long-term deep-space missions.

It is an experiment project in space life sciences and biotechnology. It was jointly applied and will be jointly implemented by four institutions from four countries, namely the Norwegian University of Science and Technology, International Space University, Vrije University Amsterdam in the Netherlands, and the Belgium Nuclear Research Centre.

第5个项目：太空肿瘤实验：空间飞行条件下的个体内健康和肿瘤组织的3D类器官培养物的早期突变特征研究

该项目的研究目的是，充分验证两个重要的假设，即：重力和宇宙辐射会分别对人类个体内的健康和肿瘤结肠组织的3D类器官DNA产生独特的突变特征。如果这两个或其中一个假设成立，研究成果将会对当前的癌症病因学产生重大的科学影响，并对预防和治愈癌症提供新的见解，也将回答长期深空探测飞行任务中有关致癌风险和乘组健康的不确定性问题。

该项目是一个空间生命科学与生物技术实验项目，由来自四个国家的四个研究机构共同提出申请并联合实施，他们是:挪威科技大学、国际空间大学、荷兰阿姆斯特丹自由大学，和比利时核研究中心。

No. 6: Effect of Microgravity on the Growth and Biofilm Production of Disease-Causing Bacteria

This project studies the differences between the growth and biofilm production of bacterial colonies grown on Earth and those on board of the China Space Station. It will contribute to understanding how disease-causing bacteria behave on an altered/reduced gravitational environments.

This is an experiment project in space life sciences and bio-technology. It was jointly applied and will be jointly implemented by the Mars Society - Peru Chapter, and the Mars Society - Spain Chapter.

第6个项目：微重力对致病菌生长和生物膜产生的影响

该项目主要利用中国空间站，研究微重力条件对致病菌生长和生物膜产生的影响，并于地面条件下的影响进行对比，对于深入了解致病菌在可变的重力条件或低重力条件下的表现具有重要意义。

该项目属于空间生命科学与生物技术实验项目，由火星学会秘鲁分会和火星学会西班牙分会联合提出申请并组织实施。

II. Conditionally accepted experiment projects

有条件入选项目

No. 7: Mid infrared platform for Earth observations

With this project, two infra-red (MIR) cameras will be installed on the CSS to observe the Earth. It is used to monitor the land and the atmosphere of the Earth. The results could give clue information for a better knowledge of humidity flows and improve forecasting of heavy precipitations and hurricanes for early preventing civil population. It could also obtain experience in the development of payloads for nano-satellites, in order to develop a MIR solar space telescope that could fit in a 3U CubeSat among other scientific projects.

It is an experiment project in Earth science in space. It was jointly applied and will be jointly implemented by two organizations from one country, which are: the National Institute of Astrophysics Optics and Electronics (INAOE), and Benemérita Universidad Autónoma de Puebla (BUAP) from Mexico.

第7个项目：中红外地球观测平台

该项目的目的是在中国空间站上安装两台红外相机，对地球上的陆地和大气进行观测。观测结果可增进对湿气流的了解，改善强降雨和飓风的预报和早期预警。通过本项目积累的经验，也将应用于纳米卫星以及星上红外太阳望远镜等载荷的研制。

这是一个地球科学实验项目，由来自一个国家的两个机构联合申请并实施，他们是墨西哥的国家天体物理光学电子研究所和普埃布拉自治大学。

No. 8: Development of Multi-Juction GaAs Solar Cells for Space Applications

The project is aimed to design and manufacture high-efficiency solar cells. After exposing the solar cells on the outside of the CSS, the comprehensive properties of the solar cell will be investigated and quantitatively measured. The data will support the re-design to mitigate these effects.

It is an experiment project in space utilization technology. It was jointly applied and will be jointly implemented by two institutions from one country, which are: the National Center for Nanotechnology and Advanced Materials, and the King Abdulaziz City for Science and Technology (KACST) from Saudi Arabia.

第8个项目：用于空间应用的多结砷化镓（GaAs）太阳能电池的开发

该项目的目的是设计制造高效的太阳能电池。项目通过将太阳能电池材料安装在中国空间站舱外进行暴露实验，对其综合性能进行研究并进行定量测定，使用获得的实验数据对设计进行优化。

这是一个空间应用技术实验项目，由来自一个国家的两个机构联合申请并组织实施，他们是：沙特阿拉伯的国家纳米技术和先进材料中心，以及阿卜杜勒阿齐兹国王科学和技术城。

No. 9: BARIDI SANA - High Performance Micro 2-Phase Cooling System for Space Applications

This project is aimed to conduct research and testing of the next generation of cooling systems for space applications by replacing ordinary liquid cooling loops with two-phase cooling system, taking advantage of the CSS. The cooling agent will be organic and non-toxic, which is a new concept and in particular of high value for human space exploration systems. Thanks to the lower power required to operate the system, it has a strong impact on carbon footprint in ground applications.

It is an experiment in microgravity fluid physics and combustion. It was applied and will be implemented by three institutions from two countries, which are: the Sapienza University of Rome in Italy, In Quattro s.r.l. in Italy, and the Machakos University in Kenya.

第9个项目：高性能微两相冷却系统的空间应用

该项目的目的是，利用中国空间站提供的优势，通过使用两相冷却系统替代常规的液体冷却系统，研究和测试能够用于空间应用的新一代冷却系统。该冷却系统将使用全新的有机无毒介质，对于载人航天飞行系统具有极高的应用价值。由于功耗较低，该系统可应用于地面，有效减少碳排放量。

这是一个微重力流体物理和燃烧实验项目，由来自两个国家的两个机构联合提出申请并实施，他们是：意大利罗马萨皮恩扎大学，意大利In Quattro s.r.l.公司，和肯尼亚的马查科斯大学。