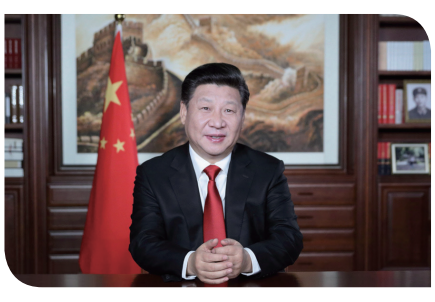
2016 1 暗物质卫星“入选”习近平主席2016新年贺词
Dark-matter satellite included in President Xi's New Year speech



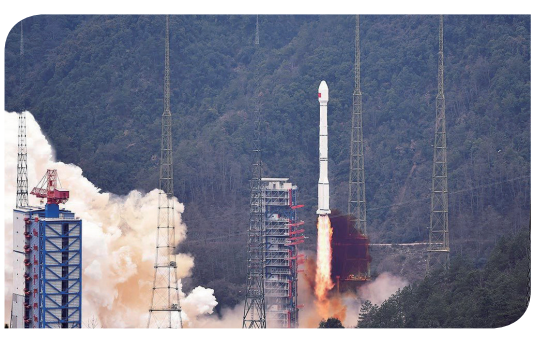
国家主席习近平在2016年新年贺词中，将“我国科学家研制的暗物质探测卫星发射升空”作为2015年重大科技成就。暗物质粒子探测卫星“悟空”于2015年12月17日成功发射，是中国科学院空间科学战略性先导科技专项首批科学实验卫星，也是我国空间科学卫星系列的首发星，是迄今世界上观测能段范围最宽、能量分辨率最优的空间探测器，有望推动人类探索宇宙奥秘取得重大突破。

In his New Year speech, Chinese President Xi Jinping listed the “successful launch of a satellite exploring dark matter, developed by our scientists”, as one of the four significant achievements in science and technology in 2015.

Launched on December 17, 2015, the Dark Matter Particle Explorer (DAMPE) Satellite, “Wukong”, was among the first scientific satellites developed under the CAS Strategic Priority Program on Space Science, as well as the first scientific satellite in a series launched by China.

The new satellite has the widest observation spectrum in energy and highest resolution of particles ever sent to space for probing the signature of dark matter and will likely lead to major breakthroughs in man’s exploration of the mysteries of the universe.

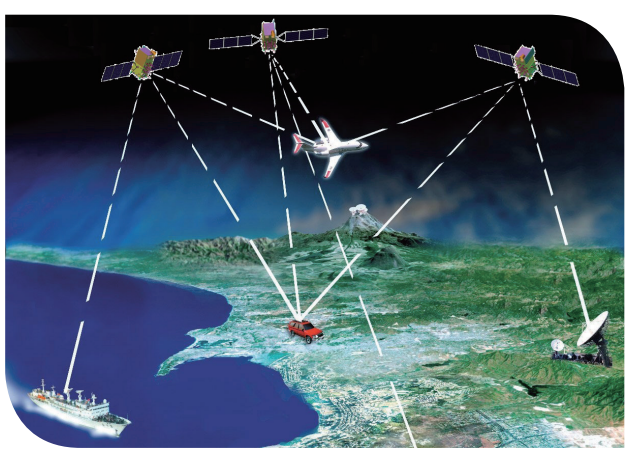
2016 2 中国北斗卫星导航系统全球组网模式基本确立
Global network mode for China's Beidou Navigation Satellite System established



2016年2月1日，中国科学院微小卫星创新研究院与中国电子科技集团等共同研制的中国新一代北斗导航第五颗组网卫星成功发射。该卫星采用中国科学院导航卫星专用平台，首次集成了自主研发的氢原子钟、高集成度空间抗辐照专用芯片等一批关键技术成果，与先期发射的4颗新一代北斗导航卫星一起，基本确立了北斗卫星导航系统的全球组网模式，具有里程碑意义。

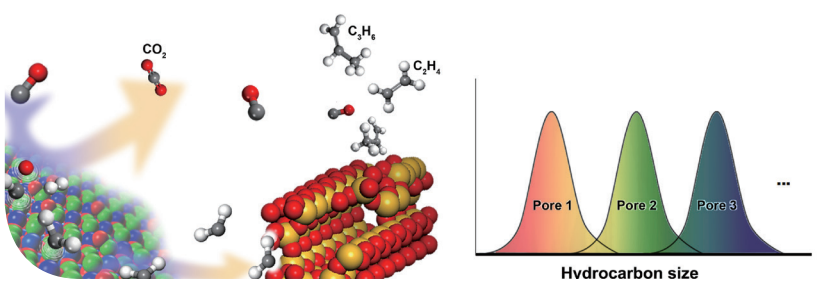
On February 1, China successfully put a new-generation Beidou satellite into orbit to support its global navigation and positioning network. As a key satellite of the Beidou Navigation Satellite System, it was co-developed by the Shanghai Engineering Center for Microsatellites and the China Electronics Technology Group Corp.

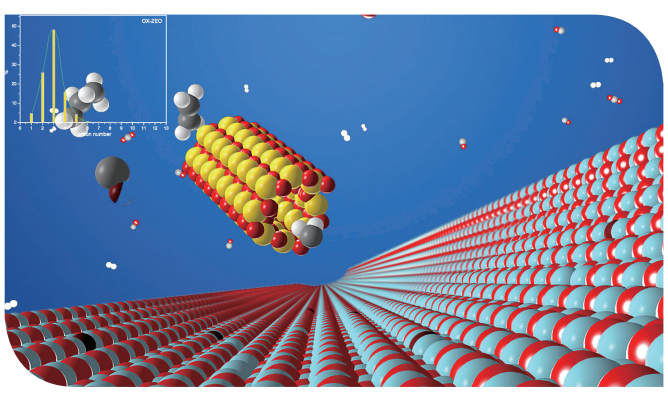
The satellite is a milestone since it has integrated CAS’s self-developed key technological achievements, including a hydrogen maser as the precision timer, and highly integrated special space radiation hardened chips. Together with the four previously-launched new-generation Beidou satellites, the satellite has basically established the global networking mode of the Beidou navigation system.



2016 3 煤气化直接制烯烃研究取得重大突破
Breakthrough on direct conversion of coal-based syngas to light olefins

2016年3月4日，中国科学院大连化学物理研究所在《科学》发表“煤基合成气直接制备烯烃”的重大研究成果。这一突破性进展摒弃了90多年来煤转化过程中传统的“费托合成”模式，从原理上创立了一条低耗水和低耗能的煤转化新途径。该成果被国内外同行誉为“里程碑式的重大突破”，为煤化工发展提供了全新思路，具有广阔的应用前景和重大的经济、社会效益。



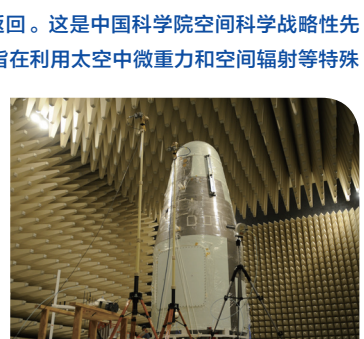


On March 4, *Science* published a breakthrough made by the Dalian Institute of Chemical Physics of CAS involving a novel technology converting coal-based syngas directly to light olefins. The finding discards the traditional process which is accompanied by the water-consuming and energy-intensive water-gas-shift reaction and has thus, in principle, created a new route for coal conversion with a low consumption of water.

The achievement offers a brand new philosophy for the development of China’s coal chemical industry and has broad applications that are likely to bring significant economic and social benefits. It is appraised as “a new horizontal in C_1 chemistry” and “a milestone” by domestic and international peers both from academia and industry.

2016 4 “实践十号”成功发射并返回
SJ-10 launched and returned to earth

2016年4月6日，我国首颗返回式微重力科学实验卫星“实践十号”成功发射，并于4月18日顺利返回。这是中国科学院空间科学战略性先导科技专项首批科学实验卫星，旨在利用太空中微重力和空间辐射等特殊环境开展科学实验，研究揭示物质运动及生命活动的规律。该卫星已成功获取大量实验数据和资料，预期产出一批重大科学发现和原创成果。



China’s first microgravity and life science satellite, SJ-10, was successfully sent into orbit on April 6 and the capsule was retrieved on April 18. It was one of the scientific satellite series developed under the CAS Strategic Priority Program on Space Science.

19 scientific experiments were conducted by taking advantage of microgravity, space radiation and other special circumstances in space to study the laws governing the motion of matter and life activities.

A large quantity of experimental data and material was obtained, which may lead to major findings and creative achievements in this area.

在2016年4月发布的“自然指数”排行榜中，中国科学院连续四年位列全球科研机构综合排名榜首，在化学、地球与环境科学、物理科学3个学科领域名列前茅。

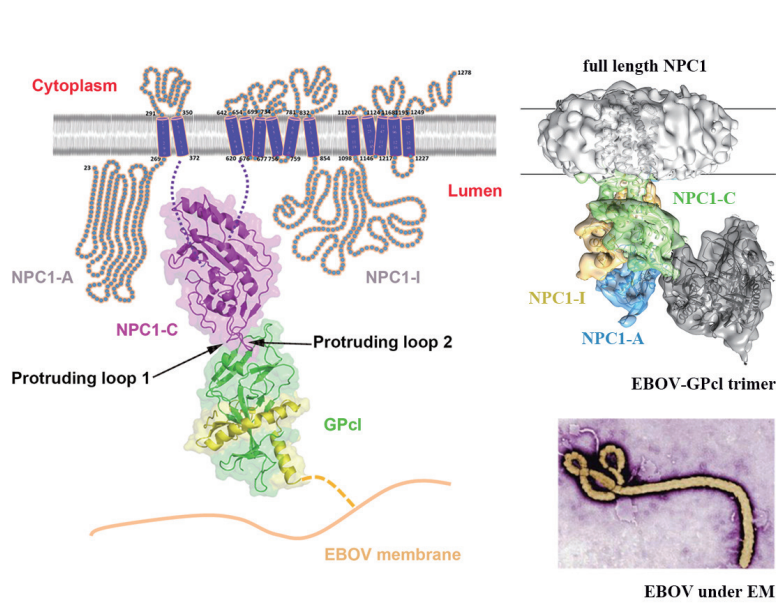
CAS topped world institutions in the *Nature Index Tables 2016* released in April for the fourth year in a row, and was also ranked among the best in three disciplines – chemistry, earth and environmental sciences, and physical sciences.

2016 5 在国际上率先揭示埃博拉病毒入侵人体细胞模式
Chinese researchers unveil mode of Ebola virus entering human cells

2016年5月26日，《细胞》在线发表中国科学院微生物研究所和清华大学合作研究成果，首次报导了人类胆固醇转运体NPC1及其与埃博拉病毒表面融合蛋白复合物的冷冻电镜结构。1月15日，《细胞》还在线发表了中国科学院微生物研究所的研究成果，从分子水平阐释了一种新的埃博拉病毒膜融合激发机制。上述研究成果为防控埃博拉病毒病疫情及抗病毒药物设计与研发提供了重要科学基础，是近年来国际病毒学领域的一项重大突破。

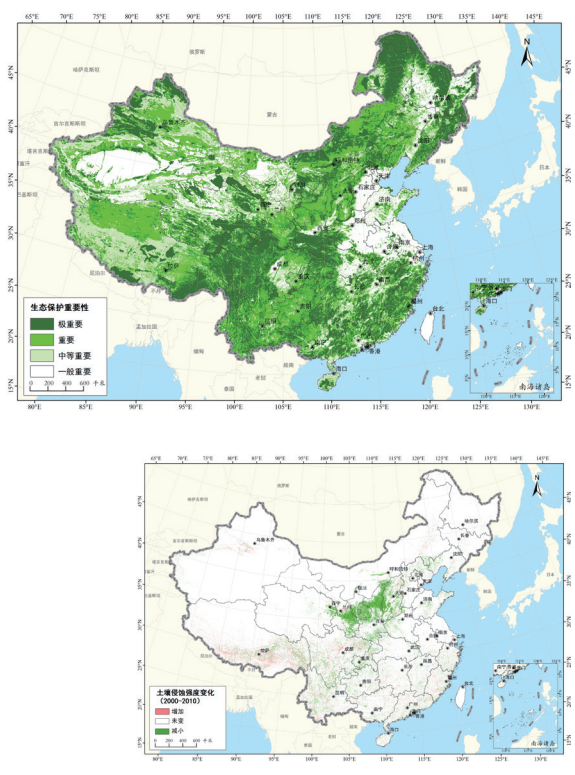
On May 26, the scientific journal *Cell* published online findings from joint research conducted by the Institute of Microbiology of CAS and Tsinghua University. It was the first time that how the human cholesterol transporter NPC1 interacting with the Ebola virus glycoprotein was revealed by cryo-electron microscopy. Earlier, on January 15, *Cell* also published research findings from the Institute of Microbiology that proposed a new triggering mechanism for Ebola virus membrane fusion at the molecular level.

The above-mentioned research findings provide a critical scientific foundation for preventing and controlling Ebola outbreaks as well as the design and development of anti-viral medicines, a major breakthrough in field of virology in recent years.



Cell:
Ebola Viral Glycoprotein Bound to Its Endosomal Receptor Niemann-Pick C1

2016 6 中国生态环境变化十年评估报告发布
China releases national ecosystem assessment report 2000 to 2010



2016年6月24日，中国科学院生态环境研究中心和环保部卫星环境应用中心发布《全国生态环境十年变化（2000–2010年）调查评估报告》，全面反映十年间我国生态环境状况，分析了我国生态格局、质量、服务、问题及其变化趋势与原因，提出了生态保护对策和建议。这次调查评估首次利用“天地一体化”手段，是迄今国际上规模最大、技术手段最先进的生态系统调查评估之一，为我国生态保护与生态文明建设提供了重要依据和科学基础。报告的主要成果发表在6月17日《科学》上。

On June 24, the Research Center for Eco-Environmental Sciences of CAS and the Satellite Environment Center under the Chinese Ministry of Environmental Protection released a China National Ecosystem Assessment (CNEA) covering the period of 2000 to 2010.

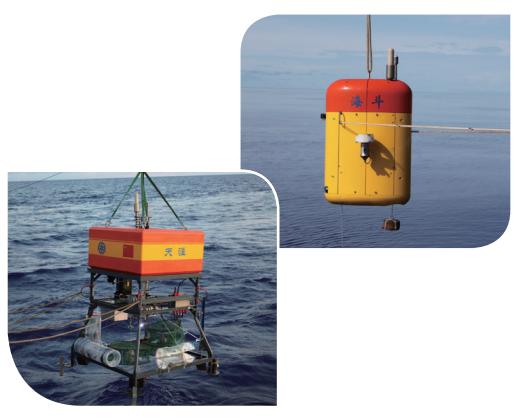
The report gave a full presentation of the state and change trends of compositions, patterns, quality, services and ecological problems of China’s ecosystem and their driving forces, strategy and policies for ecosystem conservation and restoration.

Integrating satellite monitoring and ground ecosystem survey technologies, CNEA was one of the world’s largest-scale ecosystem surveys and assessments.

The results and findings of CNEA have been applied in national and local conservation policy and regional development planning to promote sustainable development. The major findings of CNEA were published in *Science* on June 17.

2016 7 我国深海科学考察挺进万米时代
Deep-sea unmanned submersible reaches depth of 10,000 meters

2016年7月18日，中国科学院沈阳自动化研究所和深海科学与工程研究所自主研发的万米级自主遥控潜水器（ARV）“海斗号”在马里亚纳海沟挑战者深渊开展了我国首次综合性万米深渊科考活动，创造了我国无人潜水器最大下潜及作业深度纪录（10767米）。这次科考填补了我国万米深海数据和样品空白，缩短了我国与美、日、英等国在万米科考能力上的差距，标志着我国深海科考进入万米时代。

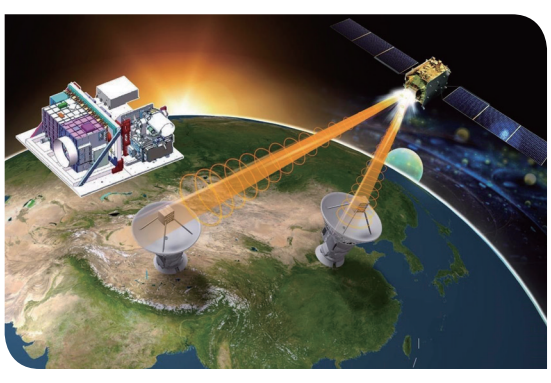


On July 18, China’s unmanned submersible, ARV Haidou, developed by the Shenyang Institute of Automation and the Institute of Deep-sea Science and Engineering of CAS, dived for the first time to a depth of greater than 10,000 meters during a scientific expedition at the Mariana Trench in the West Pacific, reaching 10,767 meters, a new record for the country.

This expedition has filled the gap in China’s deep-sea research for the in-situ data and samples covering a depth of greater than 10,000 meters, and makes China the third country, after the United States and Japan, capable of developing unmanned submersibles that can reach the greatest ocean depths.

2016 8 世界首颗量子科学实验卫星成功发射
Quantum communication satellite successfully launched

2016 年 8 月 16 日，中国科学院自主研制的世界首颗量子科学实验卫星“墨子号”成功发射。这是中国科学院空间科学战略性先导科技专项首批科学实验卫星，主要科学目标是进行星地高速量子密钥分发和广域量子密钥网络实验，并在空间尺度进行量子纠缠分发和量子隐形传态等实验研究。该卫星在世界上首次实现了星地量子通信，构建了天地一体化的量子保密通信与科学实验体系，对我国巩固和扩大量子通信领域的国际领先地位，实现从经典信息技术时代跟踪者向未来信息技术引领者的转变，具有里程碑意义。



On August 16, China launched the world’s first quantum experiment satellite, “Micius”. It was one of the scientific satellites developed under the CAS Strategic Priority Program on Space Science, and its main tasks include delivery of high-rate satellite-ground quantum keys and connection of them to two ground quantum communication networks, distribution of entangled quantum pairs from the satellite to two ground stations which are more than 1,000 km apart, and quantum teleportation from ground to satellite.

Micius, which created the world’s first ever quantum communications between satellite and ground, was designed to establish “hack-proof” quantum communications by transmitting encryption keys from space to the ground, as well as carry out fundamental scientific experiments in quantum mechanism.

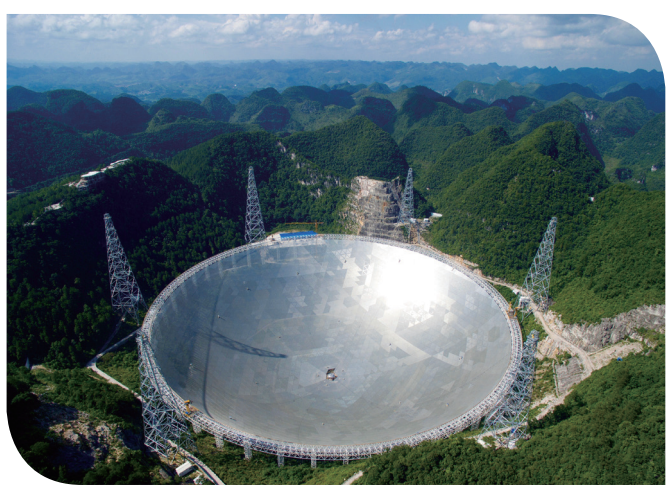
As a breakthrough in China’s quantum scientific research and application of quantum communications, it is a milestone in the sense that it will help consolidate and expand China’s leading position in this field, support the country in claiming the strategic commanding height for future development of this information technology and transform China from a follower to a leader in information technology.

2016 9 “中国天眼”FAST落成启用
World's Largest Radio Telescope Dedicated

2016 年 9 月 25 日，由中国科学院国家天文台自主设计建造的 500 米口径球面射电望远镜（FAST）落成启用，习近平总书记致信祝贺。这是世界最大单口径、最灵敏的射电望远镜，将在未来 20~30 年期间保持世界领先地位。FAST 打破了世界上射电望远镜的百米极限，将为人类发现脉冲星、探索暗物质和黑洞、研究宇宙起源和地外文明等提供独特手段，为基础研究重大发现和突破、战略高技术发展和开展国际科技合作提供一流创新平台。

On September 25, the Five-hundred-meter Aperture Spherical radio Telescope (FAST), independently designed and built by the National Astronomical Observatories of CAS, was put into use. Chinese President Xi Jinping sent a congratulatory letter to the scientists, engineers, and builders of the world’s largest and most sensitive radio telescope. The facility is expected to maintain a leading position in the next 20 to 30 years.

FAST has broken the hundred-meter limit for any other radio telescope on Earth. It will provide unique means for observing dark matter and black holes, as well as exploring extraterrestrial civilizations and the origins of the universe, facilitate new findings and breakthroughs in basic research, and provide a first-class platform to boost strategic high technology, that promoting international cooperation in science and technology.



2016 10 “天宫二号”与“神舟十一号”对接并开展科学实验
Shenzhou-11 docks with Tiangong-2

2016 年 10 月 19 日，“神舟十一号”载人飞船与“天宫二号”空间实验室成功对接。“天宫二号”是我国第一个真正意义上的空间实验室。中国科学院空间应用工程与技术中心作为空间应用系统的总体单位，牵头负责空间科学、对地观测及地球科学研究、空间应用新技术等三大领域的全部 14 项科学实验，包括全球第一台空间运行的冷原子钟、宽波段成像光谱仪、伴随卫星飞行、高等植物培养等，主要科学实验项目的研究水平位于国际前沿，技术发展处于国际先进行列。

On October 19, 2016, Shenzhou-11 manned spacecraft successfully docked at Tiangong-2, which is the first real space laboratory of China.

Technology and Engineering Center for Space Utilization, CAS, as the headquarters of the space utilization system in China Manned Space Program (CMSP), has been leading the scientific and utilization mission of Tiangong-2. More than 10 scientific and utilization experiments are conducted onboard Tiangong-2, including the world’s first Space Cold Atomic Clock, Gamma-ray Burst Polarimetry in cooperation with the European Space Agency, Multi-angle Polarization and Wide Band Spectral Imaging, Concomitant Satellite, and Higher Plant Flowering and Seed-setting in space, etc.

These utilization missions of Tiangong-2 cover fields of space life science, microgravity fluid physics, material science, fundamental physics, space environment monitoring, space astronomy, earth observation, and technology demonstration of space utilization, etc.

Main research projects of Tiangong-2 represent the science frontiers and the cutting-edge technological progress in the world.

2016 11 世界最大面积中阶梯光栅研制成功
World's largest echelle gratings successfully developed

2016 年 11 月 11 日，由中国科学院长春光学精密机械与物理研究所承担的国家重大科研装备研制项目“大型高精度衍射光栅刻划系统的研制”通过验收，并刻划出世界最大面积的中阶梯光栅（400mm×500mm），光栅刻划系统和光栅都达到国际领先水平。该成果结束了我国高精度大尺寸光栅制造受制于人的局面，为我国相关高科技领域的战略部署和光谱仪器产业竞争力的提升提供了关键核心技术支撑。

On November 11, the “large-scale high-precision diffraction grating ruling system” project, one of the major national research projects for scientific research equipment undertaken by the Changchun Institute of Optics, Fine Mechanics, and Physics under CAS passed appraisal, and the system facilitated a successful ruling of echelle gratings with the largest size (400mm×500mm) the world had ever seen. Both the diffraction grating ruling system and the gratings lived up to leading international standards.

The achievement has put an end to the era when China relied heavily on others to provide such equipment and thus was subject to certain restrictions, and will provide core technology support to help improve China’s competitiveness in the spectrometer industry.

2016 年 11 月 16 日，量子通信技术、寒武纪深度神经网络处理器、工业 4.0 互联制造解决方案等 3 项成果入选第三届世界互联网大会首次发布的 15 项世界互联网领先科技成果，标志着中国科学院在相关领域进入世界先进行列。

Quantum communications technology, the Cambrian neural network processor, and the Industry 4.0 connected manufacturing solutions were listed among the 15 world leading Internet scientific and technological achievements unveiled for the first time by the 3rd World Internet Conference on November 16, signaling that CAS had entered the world’s leading ranks in relevant fields.

2016 12 国际先进超强超短激光装置开工建设
World's leading superintense ultrafast laser facility being built

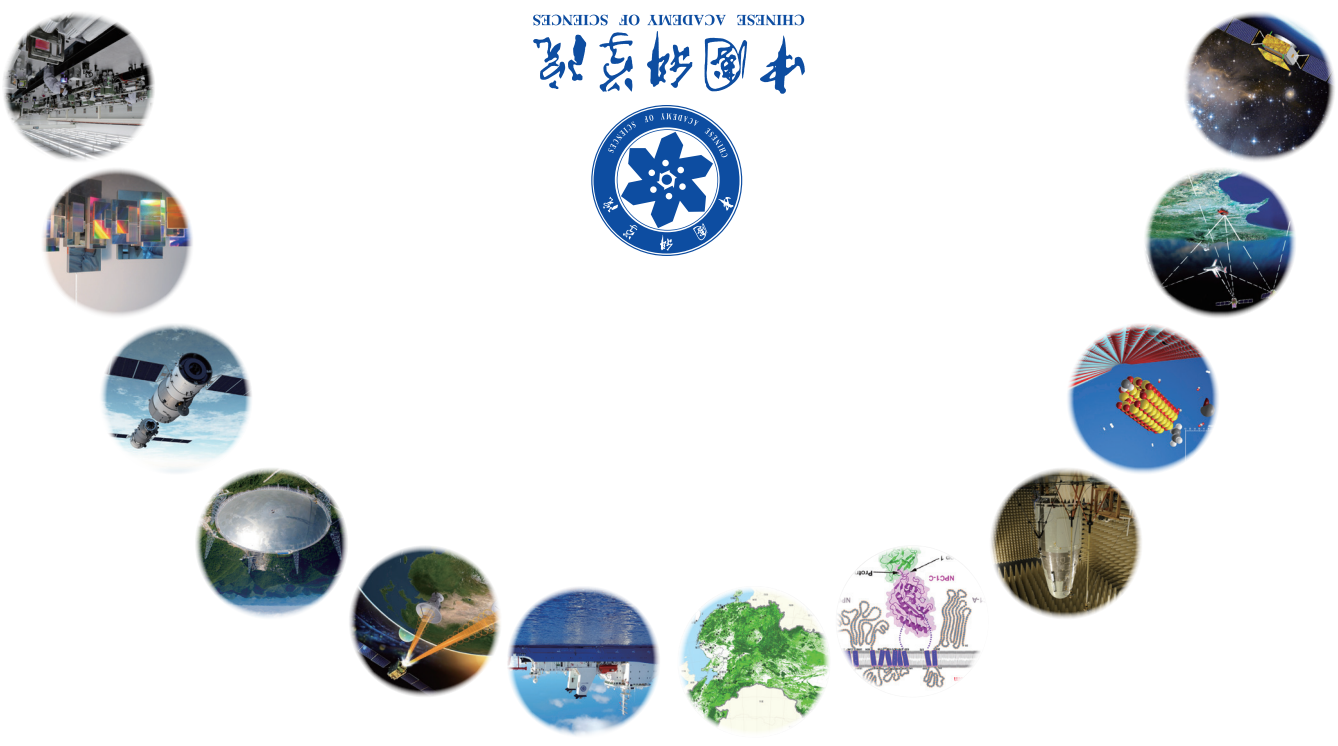
2016 年 12 月 2 日，由中国科学院上海光学精密机械研究所承建的上海超强超短激光实验装置（SULF）正式开工建设。该装置的预研工作于 2016 年 8 月取得重大突破，成功实现了峰值功率 5.3 拍瓦、脉冲宽度 24 飞秒的激光脉冲输出，是当前国际最高激光脉冲峰值功率，并为实现 10 拍瓦激光脉冲输出奠定了坚实的技术基础，标志着我国在该领域达到世界领先水平。

超高功率超短脉冲激光是国际激光科技的竞争前沿，具有重要科学意义和巨大应用价值，将推动相关战略高技术发展，并引发新技术变革和创造新产业。

On December 2, the Shanghai Institute of Optics and Fine Mechanics (SIOM) of CAS officially began construction of the Shanghai Superintense Ultrafast Laser Facility (SULF).

Earlier in August, the R&D of this laser facility made a significant breakthrough by delivering the world’s highest peak power laser pulses of more than five petawatts and a pulse width of 24 femtoseconds, which laid a solid technological foundation for realizing the 10-petawatt target of the SULF project and signaled that China has reached world-leading levels in this field.

The R&D of ultra-high peak power and ultrafast lasers is a frontier field with enormous scientific impact and huge application prospects, and thus sees fierce competition. The super-lasers may lead to technological revolutions and create new industries.



中国科学院
CHINESE ACADEMY OF SCIENCES

2016年月度重大科技成果