The 'coolest' place for astronomy

High on the Antarctic Plateau, in one of the coldest places on Earth, a group of telescopes are peering through stellar dust clouds into the heart of our galaxy.

The cold helps counteract interference from the telescopes and surrounding equipment, which can hinder our ability to see relatively 'cool' objects in space, such as asteroids, young stars, and interstellar gas.

The skies above China's Kunlun Station, based in the Australian Antarctic Territory, are not only cold, but dry, calm, and free of light pollution. This makes it the perfect place for infrared telescopes, which can also see through dust.

Setting up equipment in Antarctica is not easy: it needs to work through the dark of a long winter and temperatures as low as -80°C. But for more than a decade, Australian and Chinese astronomers have been combining their expertise to overcome these challenges, demonstrating the value and viability of Antarctic astronomy.

Their success has led to a solid consortium of Chinese-Australian researchers, with plans to expand their exploration of the skies—including a $70 million telescope similar in size to the Hubble Space Telescope. The Kunlun 'KDUST' Dark Universe Telescope will use optical and infrared light to search for Earth-like planets, probe dark matter, and study the formation of the first stars. KDUST builds on the successful AST3 pathfinder telescopes installed by China at Kunlun.

"Both countries have made what can only be described as heroic efforts to ensure that equipment is delivered on time and made to operate at Kunlun Station," says Professor Michael Ashley of the University of New South Wales (UNSW). He was part of the original Australian team that began working with Professor Lifan Wang, Professor Ji Yang, and colleagues from Purple Mountain Observatory and other Chinese institutions in 2004.

"The plans to install new state-of-the-art telescopes at the best observing site on the Earth's surface are a tribute to the expertise and trust that each country has brought to the consortium," says Nobel Laureate Professor Brian Schmidt, co-chair of the consortium.

The collaboration began in 2004, when a Chinese expedition travelled over 1,200 km, and carried with them a small telescope built at UNSW to monitor the cloud coverage during the Antarctic winter. China then established a research base, Kunlun Station, at Dome Argus (a massive ice dome that rises 4,000 metres above sea level), followed by the first automatic observatory, (PLATeau Observatory), and its upgrade, PLATO-A, which were both designed and built at UNSW. PLATO has hosted eight instruments from five countries, looking for planets and supernovae, mapping the Milky Way, and measuring atmospheric distortion and the brightness of the sky.

The collaboration is supported by the Australian-ChinA ConsortiuM for Astrophysical Research (ACAMAR) with the support of the National Astronomical Observatories of the Chinese Academy of Sciences, the Australian Government, Astronomy Australia Limited and various universities.

Also...

The Square Kilometre Array, now under construction in Africa and Australia, will comprise thousands of receiver dishes. It will help in the search for dark energy; look back to the Big Bang; and seek out Earth-like planets. A Chinese-led consortium is developing SKA dishes and revealed a prototype in February 2018.

A natural basin in the Guizhou mountains is now home to the world's largest single-dish radio telescope. The Five-hundred-metre Aperture Spherical radio Telescope (FAST) is using radio receivers developed by CSIRO that can simultaneously capture and process 19 different radio signals from space. In 2017 FAST made its first discovery when it found two pulsars which were then confirmed by Australia's Parkes Observatory.

Photos: Chinese side, top left, Kunlun Research Station (Chinese Academy of Sciences); Chinese side, top right The Australian Square Kilometre Array Pathfinder in the West Australian desert (Neal Pritchard); all other images courtesy Shutterstock.

For further information visit www.china.embassy.gov.au

Australian Government

ASTRONOMY

天文学之巅

在高高的南极冰原上——地球上最寒冷的地方之一——一组望远镜透过恒星尘埃云窥视着银河系的中心。

望远镜和周围设备的干扰会阻碍我们观察太空中的炫酷物体，如小行星、年轻恒星和星际气体。而寒冷气候有助于抵消这些干扰。

中国南极昆仑站位于澳大利亚南极洲领地，那里的天空寒冷、干燥、平静且没有光污染。这使它成为了红外望远镜的理想场所。红外望远镜可以透过尘埃观测天空。

在南极洲安装设备并不容易，这不仅需要在漫长的冬季极夜中进行安装操作，还需要面临最低可达零下 80°C的低温天气。但十多年来，澳大利亚和中国的天文学家一直通力合作，用他们的专业知识来应对这些挑战，展现出了南极天文研究的价值和可行性。

一起成功克服困难使中澳研究人员团结起来，也让他们决定扩大对天空的探索。这其中就包括新建价值 7000 万澳元的昆仑暗宇宙巡天望远镜(KDUST)，其尺寸将与哈勃太空望远镜相当。它将使用可见光和红外线搜索类地行星、探测暗物质并研究第一批恒星的形成。昆仑暗宇宙巡天望远镜是基于中国在昆仑站成功安装的 AST3 探路者望远镜。

新南威尔士大学 (UNSW) 的迈克尔•阿什利教授 (Michael Ashley) 表示：“可以说，中澳两国都做出了艰苦卓绝的努力，确保了设备的按时交付和在昆仑站的正常运作。”阿什利教授是澳方团队最初的成员，该团队自 2004 年起就与王力帆教授、杨戟教授以及来自紫金山天文台的和其他中国机构的同行展开合作。

“计划在地球表面最好、最独一无二的观测站安装最先进的望远镜，这体现了两国对中澳天文联合研究的专业支持和信心，”诺贝尔奖得主、中澳天文联合研究中心联席主任布莱恩•施密特 (Brian Schmidt) 教授说道。

这一合作始于 2004 年，当时一支中国探险队带着由新南威尔士大学建造的小型望远镜跋涉了 1200 多千米，去监测南极冬季的云层覆盖范围。随后，中国在冰穹 A (一个海拔 4000 米的巨大冰穹) 设立了一个研究基地——昆仑站，紧接着又建立了第一个自动天文台——PLATO 天文台 以及后续设施 PLATO-A，均由新南威尔士大学设计和建造。PLATO 天文台囊括来自五个国家的八种仪器，用于寻找行星和超新星、绘制银河系星图、测量大气畸变和天空亮度。

在中国科学院国家天文台、澳大利亚政府、澳大利亚天文联合组织(AAL)和多所大学的支持下，中澳天文联合研究中心 (ACAMAR) 为这项合作提供了大力支持。

更多合作

目前正在非洲和澳大利亚建造的平方公里阵列射电望远镜 (SKA) 将包含数千个碟形接收机。它将为寻找暗能量、回顾研究“大爆炸”、寻找类地行星做出贡献。由中国牵头的研究团队正在研发SKA的碟形接收机，并于 2018 年 2 月举办了首台天线出场仪式。

坐落在贵州山区天然盆地之中的“中国天眼”是世界上最大的单口径射电望远镜。这台500 米口径球面射电望远镜 (FAST) 使用的是澳大利亚联邦科学与工业研究组织 (CSIRO) 研发的无线电接收机，它可以在同一时间捕捉和处理19 处来自太空的无线电信号。2017 年，“中国天眼”首次发现了两颗新脉冲星，随后得到了澳大利亚帕克斯天文台的确认。

中文版左上角：中国南极昆仑站（中国科学院）；中文版右上角：西澳大利亚沙漠里的平方公里阵列射电望远镜（图片来自 Neal Pritchard）；其他图片鸣谢Shutterstock

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