OVERVIEW OF CHINA'S LUNAR EXPLORATION PROGRAM AND SCIENTIFIC VISION FOR FUTURE MISSIONS. L. Xu, Y. L. Zou and L. Qing, General Office of the Lunar and Deep Space Exploration, Chinese Academy of Sciences / National Space Science Center, Chinese Academy of Sciences, Zhongguancun Nanertiao 1, Haidian District, Beijing, 100190 (xulin@nssc.ac.cn / zouyongliao@nssc.ac.cn).

Introduction: The current international trend of lunar exploration has changed from the past pure lunar science to a combination of science and application. The China's Lunar Exploration Program is divided into three phases: orbiting, landing and returning. On the basis of the current lunar exploration, Chinese scientists and technical experts have proposed a tentative plan by several missions to preliminarily build a lunar research station in the Lunar South Pole for lunar scientific research and lunar resource utilization in the future.

Planned missions:

Completed missions: Chang'e-1 orbiter was successfully launched in October 2007, which carried a total of 8 sets of scientific payloads, by working in the 200-km high orbit for more than 1 year, to detect the topography and geomorphology, chemical composition and the first microwave detection of the moon, and near lunar surface space environment. It was controlled to impact the Moon and completed the preset science mission in March 2009. As a backup to the Chang'e-1 orbiter, the Chang'e-2 orbiter was launched in October 2010, by working in the 100-km high orbit. Its spatial resolution has been more significantly increased than that of Chang'e-1. Since then, the Chang'e-2 is a close flyby of asteroid Toutatis to obtain a 10 m-resolution image in its extended mission.

Chang'E-3 was launched in December 2013, successfully, its lander and rover missions make China become the third nation to have achieved soft landing and patrol of the Moon after the United States and the former Soviet Union. The shallow structure and geological evolution history of the Imbrium basin are revealed through the acquired data. It was the first time for China to carry out heaven tourism in the Earth's plasmasphere in a global scale meridian view by using the Extreme Ultra-Violet (EUV) camera, and monitored variable stars, bright active galactic nuclei by a Moon-based ultraviolet telescope (LUT).

The Chang'e-4 mission includes a telecommunication relay satellite, a lander and a rover, which was successfully launched in December 2018 to explore the far side of the Moon. The relay satellite was launched in May 2018, which is currently in orbit at L2 on the Lagrange to transmit data. The Chang'e-4 spacecraft has landed safely and the rover has been separated from the lander, ready to carry out the scientific mission at a suitable time, including the lunar surface environment, and morphology, shallow structure and element composition of the landing site and patrol site. At the same time, it carries out low-frequency radio astronomy observations in the unique radio-quiet environment on the far side of the Moon. It is the first time that humans have carried out soft-landing and patrol detection on the far side of the Moon.

Underway missions: The Chang'E-5 probe is going to be launched in 2019, which will land on the near side of the Moon in a new area far from the Apollo and Luna missions' sampling sites to collect lunar rock and soil samples, and return them to the Earth.

Future missions' vision: So far, the implemented missions are mainly limited on the surface of the Moon, lack of the understanding of the composition and structure of the deep part of the Moon. The South Pole Aitken basin is the biggest, deepest and oldest crater on the Moon. It is a natural window to understand the deep composition and structure, and reveals the earliest impact history of the Moon.

Systematically considering the major scientific issues of the Moon and the lunar in-situ utilization resources, Chinese scientists and technical experts have proposed a vision to preliminarily build a research station on the Moon's South Pole by implementing 3-4 missions before 2035.

The first mission will carry out a comprehensive exploration in the South Pole of the Moon, including the topography, elemental composition and volatile contents of the Moon, and the information on the structure of the South Pole from shallow to deep levels. Water (ice) in the permanent shadow area was detected *in-situ* to reveal the content, distribution and source of water and volatiles on the surface of the Moon. After that, a sampling return mission will be arranged to collect samples from the South Pole of the Moon and return them to the Earth. In addition to the scientific exploration of the Moon, the utilization of lunar resources should also be taken into consideration. In later missions, lunar platforms will be used to make astronomical or earth observations and to consider the use of lunar resources.

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