

Preface

As its name implies, space science is the study of space, i.e., “Taikong” in Chinese, or more specifically scientific research that has to be carried out in space. To be exact, with spacecraft as the main tools, space science is defined as the study of natural phenomena and their underlying rules in physics, astronomy, chemistry, and life sciences which exist in solar-terrestrial space, interplanetary space, and even the universe as a whole. In October 1957, the first man-made satellite “Sputnik” was launched. Since then, unprecedented new instruments and methods have been developed in order to explore space, and a stream of revolutionary discoveries has been achieved. These discoveries have, in essence, revealed a completely new universe and profoundly changed our understanding of nature and human beings, as well as human life itself. Einstein predicted that the frontier of natural science would gradually shift to both macro- and micro-forefronts, and current research in space science is aimed at both the universe in the macroscopic sense, and particles and the origin of life in the microscopic sense. Among them, the search for dark matter and dark energy, detection of gravitational waves, and so on continues to lead the development of human society, and open up new scientific frontiers.

Being highly explorative, the study of space science constantly demands novel instruments and spacecraft technologies, and the acquisition of new data mainly rests on the progress of new techniques. This trend greatly boosts the development of space technologies, which also extends to applications, bringing about potential economic benefits. Thus, space science has become the main driving force of space technologies and applications. It is also one of the major areas which engenders international cooperation. The first reason to go for international cooperation is that any discoveries need not to be duplicated. It is vital for both the decision makers and scientists to avoid duplication when planning a mission. The second reason is that the number of approved missions is always much less than that of the proposals due to the limited funds. The scientists’ demands are unlimited, while the government’s investment is limited. The need to combine financial resources is becoming more and more pressing because of the increasing size and scope of space programs, and smoothly coordinated programs can often at least double their overall output.

China has launched more than 100 application satellites since 1970 when her first man-made satellite—Dongfanghong-1—was successfully launched. A relatively comprehensive satellite system for various applications has been established, and China has gradually developed into one of the world's space powers. After the liftoff of the “Wukong” mission on December 2015, i.e., DArk Matter Particle Explorer (DAMPE) satellite whose official delivery to the scientific user was in March 2016, and the launch of SJ-10 in April 2016, the first Chinese microgravity and life sciences mission, further missions will follow. QUantum Experiment at Space Scale (QUESS) and Hard X-ray Modulation Telescope (HXMT) have been launched successively on Aug 16, 2016, and Jun 15, 2017. Chinese space science is entering its most exciting era. However, the existing space science missions generally follow the principle of a case-by-case approval system, lacking a stable funding system as well as a long-term national program.

In order to advance China's space science, and provide scientific input and suggestions for future development and national budget allocation, the National Space Science Center, Chinese Academy of Sciences (NSSC-CAS) has led a study on future space science programs in China in 2016–2030 supported by the Space Priority Program (SPP) on space science of CAS. The report, one of the results of the study, is a short version of the original study report in Chinese. It consists of 7 chapters. The first chapter is the overview. Chapter 2 introduces the status of space science in China. Chapter 3 poses the scientific questions to be addressed by the Chinese space science community in 2016–2030, of which the two themes are as follows: (a) How did the universe and life originate, and how do they evolve? (b) What's the relationship between the solar system and human beings? Chapter 4 is the core of this report. The strategic goals, space science programs and missions, the road map through 2030, and the implementation approaches are proposed hereby in the chapter. Chapter 5 probes into the technologies required. Chapter 6 provides an outlook of space science beyond the year 2030. Chapter 7 concludes the report.

List of Main Contributors

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After the draft compiled, it has been presented to the National Space Science Committee, and valuable advice has been obtained. It has also been forwarded to a number of recognized international scholars affiliated to the institutes and universities in France; Russia; USA; the Netherlands; Italy; UK; Germany; Finland; Belgium; Canada; Hong Kong, China; and Taiwan, China, to review the report, whose suggestions and comments are very helpful and valuable. Our heartfelt thanks go to the following scientists, of whom Roger-Maurice Bonnet is the lead reviewer:

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We would like to express our most sincere appreciation to all those who have contributed to the report.

It is expected that the report can further readers' understanding of space science and allow the public to become more interested in it. We also hope that it could provide input for China's future space science planning and decision-making and act as a bridge for international cooperation in space science.

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