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PROGRESS AND PRELIMINARY EXPERIENCE SUMMARY OF IN-ORBIT EXPERIMENTS ON CHINA SPACE STATION

Abstract

After ten years of arduous and outstanding efforts, the China Space Station (CSS) has been built. In seven major fields of space science and applications including life science and biotechnology in space, microgravity fluid physics and combustion, space materials science, microgravity basic physics, space astronomy and geoscience, new technology for space application and so on, 15 racks for scientific experiments and technological tests, 3 extravehicular experimental facilities, 5 monitoring equipment for orbital space, and a large number of expandable payload installation platforms inside and outside the module have been deployed on CSS. At present, a comprehensive in-orbit testing for these facilities has been completed, which showed that the functional and performance index of some facilities have reached the international advanced level. For instance, one rack enable the microgravity at level of 10^{-7}g to be kept for 2 minutes; one enable the containerless material experiment both for metals and non-metals to be conducted, etc. At the same time, scientific experiments are being carried out comprehensively on CSS as planned with some phased results having been achieved. For example, the entire developmental cycle of seed has been witnessed in space; non mass fractionation phenomena of oxygen isotopes $^{17}O/^{16}O$ and $^{17}O/^{18}O$ was initially discovered in space; dynamic evolution maps of large-scale structural bubbles in space can be obtained, etc. Based on the in-orbit operational status of scientific experimental facilities on CSS, this article summarizes and shares the experience and shortcomings in the early ground design and development process, proposes suggestions for efficient construction of projects under the framework of cross-system cooperation, and draws a conclusion for the in-orbit testing status of scientific experiment facility and phased scientific experimental results, looking forward to the future development of space science experiments in China.