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GB/T 44388-2024

Space environment - Laboratory calibration method for in-situ thermal plasma detection

空间环境 热等离子体原位探测载荷实验室定标方法

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part

1.Structure and drafting rules for standardization documents" Drafting is required. Please note that some of the contents of this document may involve patents. The issuing organization of this document does not assume the responsibility for identifying patents. This document was proposed by the Chinese Academy of Sciences. This document is under the jurisdiction of the National Technical Committee on Aerospace Technology and Its Applications Standardization (SAC/TC 425). This document was drafted by: National Space Science Center of the Chinese Academy of Sciences, Nanjing University, National Satellite Meteorological Center, Beijing Satellite Environment Engineering Institute of Geophysics, China Earthquake Administration. The main drafters of this document are. Wang Wenjing, Zhang Aibing, Kong Linggao, Liu Chao, Wang Xinyue, Guan Yibing, Tian Zheng, Zheng Xiangzhi, Ding Jianjing, Li Jiawei, Shen Zicai, Jiao Liguo, and Li Changhong. In-situ detection payload of thermal plasma in space environment Laboratory Calibration Methods

1 Scope

GB/T 44388-2024 gives the laboratory calibration method for the payloads that measure thermal plasma in situ on spacecraft. Thermal plasma - the cold, dense ionospheric and plasmaspheric population of a few electron volts - determines spacecraft charging, radio

propagation and the ionospheric contribution to navigation error, but the instruments that measure it cannot be calibrated in flight, so everything the mission will ever claim about density, temperature and composition is fixed on the ground before launch. The standard sets the calibration test principle, the requirements on the calibration environment, the requirements on the calibration equipment - the electron beam source, the ion beam source, the ground detection equipment for the beams, and the vacuum tank and turntable - and the calibration method itself, covering the process, the data processing and the expression of the results, with informative annexes on the common thermal plasma detection principles and on field of view, angular resolution and ion mass spectrometry calibration. It took effect on 23 August 2024.

This document specifies the calibration environment and equipment requirements for the laboratory calibration of thermal plasma in-situ detection payloads for aerospace applications. method. This document is applicable to the laboratory calibration test of the payload for detecting space thermal plasma and the calibration of the charged particle detection payload in other energy ranges. Refer to the implementation.

2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document. For referenced documents without a date, only the version corresponding to that date applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to This document.

GB/T 30114.1 Terminology of space science and its applications Part

3 Terms and definitions

The terms and definitions defined in GB/T 30114.1 and the following apply to this document.

3.1 Space thermal plasma The energy range of plasma in space is roughly from a dozen electron volts to tens of thousands of electron volts.

3.2 payload laboratory calibration The performance indicators of the spacecraft payload are tested on a ground test device to provide the response relationship between the payload and the standard signal.

3.3 In-situ thermal plasma detector An instrument installed on a spacecraft to detect (or monitor) the distribution of the thermal plasma state in the space where it is located.

Note. The physical properties used for detection (or monitoring) include the velocity distribution function of ions and electrons in the plasma and the mass spectrum of the ions.

4 Calibration test principle

During the calibration of the ground laboratory of the thermal plasma in-situ detection payload (hereinafter referred to as the "thermal plasma payload"), a thermal plasma simulation was used. The device generates a charged particle beam with a fixed direction, fixed energy and fixed flux. The load to be calibrated is installed in a ground simulation device with different The charged particle beam is received at an angle and the inversion parameters (energy range, field of view and direction, flux, ion composition, etc.) are given based on the response. The thermal plasma load calibration diagram is shown in Figure 1.