
Precision problems of cryogenic space telescope of the observatory «Millimetron» unfoldable in orbit in the neighborhood of L2 Lagrange point of the Sun-Earth system

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“Millimetron” is a Russian-led 12 m in diameter submillimeter and far-infrared space observatory which is included in the Space Plan of the Russian Federation for launch around 2019. The Astro Space Centre of P.N. Lebedev Physical Institute, Moscow, Russia is the head scientific organization. The Federal State Unitary Enterprise “Science and Production Association named after S.A. Lavochkin” is parent enterprise. A general description of the space observatory «Millimetron» is given. It is intended for operation under conditions of high vacuum and low temperatures (4.5 K). The observatory includes the cryogenic space telescope (CST). CST consists of a main parabolic mirror 10 m in diameter which will be unfolded on the specified orbit. The problems of ensuring of high-precision geometry space telescope (10 μm), high-precision of its pointing (one second of arc) and stabilization (0.2 of second of arc) are shown. These problems are connected with the geometric hypersensitivity of the space telescope which is caused by its operation range of wavelengths (0.02...3 mm and 0.3...16 mm). The CST is mounted on a service system module (SSM). It is shown that the accuracy of the orientation and stabilization of SSM on the procedure below required. The orbit of observatory “Millimetron” will be located in the neighborhood of L2 Lagrange point of the Sun–Earth system at an average distance of 1.5 million km from the Earth. Therefore, the space observatory “Millimetron” is in need of an intelligent system for real-time control. Some known methods and tools to solve such problems are described. The concept design of an intelligent system of the active vibration protection and high-precision pointing the space telescope of the observatory “Millimetron”, aimed at addressing these problems is presented.

Keywords: space observatory “Millimetron”, intelligent systems of active vibration protection and high-precision pointing, parallel mechanisms.

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