

SPACE PROPULSION SYMPOSIUM (C4)  
Propulsion concepts and studies (9)

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DEVELOPMENT OF MINIATURE MICROWAVE DISCHARGE ION THRUSTER FOR DRAG-FREE  
CONTROL**Abstract**

DECIGO, a Deci-hertz Interferometer Gravitational Wave Observatory, is a space gravitational wave antenna, which is to be launched in 2027. The purpose of DECIGO is to observe gravitational waves at the frequency band mainly between 0.1 - 1.0 Hz, and to open a novel window of gravitational wave astronomy. DECIGO will consist of three spacecrafts flying in a triangular formation with a side length of 1,000 km. The position of each satellite with respect to its two counterparts has to be controlled to ensure sufficient accuracy of the scientific measurements. Therefore, the propulsion system for drag-free control which can satisfy the stringent requirements for thrust precision, thrust dynamic range, low thrust noise is indispensable. Drag-free control systems have been studied to detect gravitational waves by measuring distortions in the fabric of space-time. The purpose of drag-free control is to counteract non-gravitational forces such as residual aerodynamic drag or solar radiation pressure.

DECIGO Pathfinder (DPF) is the precursor mission to DECIGO designed to validate the core technologies for DECIGO mission. One of the enabling technologies in DPF mission is the precise micro-propulsion system necessary to achieve the uniquely stringent propulsion requirements. The objective of this study is to develop miniature microwave discharge ion thruster for this micro-propulsion system. This paper presents the results of the feasibility study of drag-free control by this novel thruster. In the first phase, to accomplish the stringent requirement for thrust dynamic range, we controlled the acceleration voltage and the input microwave power. In the second phase, thrust noise, which is frequency-resolved thrust fluctuation, was analyzed from the ion beam current. As a result, compliance with requirements of those test phases has been shown.