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Outline of Infrared Space Astrometry missions:JASMINE

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Abstract. Japanese group is promoting infrared space astrometry missions, JASMINE project series, in international collaboration with Gaia DPAC team. In this paper, the outline of Nano-JASMINE and Small-JASMINE missions is shown.

Keywords. infrared space astrometry missions, the Milky Way, the Galactic nuclear bulge, supermassive black hole

1. Introduction

JASMINE(Gouda(2011)) is an abbreviation for Japan Astrometry Satellite Mission for INfrared Exploration. We are now focusing on the development of two projects; those are Nano-JASMINE and Small-JASMINE whose missions are complementary to the Gaia mission.

2. Nano-JASMINE

The Nano-JASMINE micro-satellite project, with a primary mirror aperture of 5-cm class, is planned to produce scientific results based on the astrometric information of bright objects in the neighboring space as the first foray into space astrometry in Japan.The size and weight of the satellite are $(50\text{cm})^3$ and about 35 kg, respectively. Nano-JASMINE will operate in zw- band ($0.6 \sim 1.0\mu$m) to perform an all sky survey with a precision of 3 mas for positions, annual parallaxes and proper motions of stars brighter than zw=7.5 magnitude. The combination of the observational data from Nano-JASMINE and the Hipparcos Catalogue is expected to produce more precise data on proper motions (precision $\sim$ 0.1mas/yr) and annual parallaxes (precision $\sim$ 0.75mas). Assembly of the flight model that will be actually launched into space was completed in 2010. The original launch schedule was August 2011. However, the launch date has been delayed due to complex international situations and we are now looking for another opportunity for the launch. Steady progress has been also made in the development of algorithms and software required to determine astrometric information from raw observational data at the required level of precision with good international cooperation with the data analysis team (DPAC) for Gaia.

3. Small-JASMINE

An additional plan is underway to launch Small-JASMINE in around 2023. We have been aiming at the realization of the Small-JASMINE mission as a mission of the small science satellite program(JAXA Competitive M-class missions (Epsilon rocket missions)).

Figure 1. Flight model of the Nano-JASMINE satellite.

Figure 2. Artist'impression of the Small-JASMINE satellite.

The objective of the Small-JASMINE project is to perform infrared astrometric observations (Hw band: $1.1 \sim 1.7\mu$m) by the use of a three-mirror optical system telescope with a primary mirror aperture of 30 cm. The goal is to measure annual parallaxes with a precision of $\sim 20\mu$as and proper motions with a precision of $<\sim 50\mu$as/year for stars brighter than Hw=12.5 magnitude in the direction of an area of few square degrees around the Galactic center within the nuclear bulge and the direction of a number of specific astronomical objects of interest in order to create a catalogue of the positions and movements of stars within these regions. The project is unique in that unlike Gaia, observation will be performed in the near-infrared band, in which the effect of absorption by dust is weak, and the same astronomical object can be observed frequently.

The main scientific objective of Small-JASMINE is to clarify the dynamical structure of the Galactic nuclear bulge. In particular, our main goal is that Small-JASMINE will provide an understanding of the past evolution processes of the supermassive black hole through knowledge of the phase space distribution of stars in the Galactic nuclear bulge and also a prediction of the future activities of our Galactic center through knowledge of the gravitational potential in the nuclear bulge, and that this understanding can contribute to a better understanding of the co-evolution of the supermassive black holes and bulges in external galaxies. Next to this primary goal, Small-JASMINE will have many other scientific targets. Small-JASMINE can measure the same target every 100 minutes, so it is useful to resolve phenomena with short periods such as X-ray binaries, extrasolar planetary systems and gravitational lens effects. For example, the orbital elements of the star accompanying Cygnus X-1 can be resolved by Small-JASMINE.

In 2016, we, JASMINE working group, submitted a mission proposal for JAXA's ISAS (Institute of Space and Astronautical Science) call for JAXA Competitive M-class missions (the small science satellite program (Epsilon rocket missions)). We should have multiple-stage selection processes executed by JAXA. Small-JASMINE is now under the ISAS Mission Definition Review(MDR) as the first stage selection process (the review committee at ISAS just recently recommended Small-JASMINE to pass the MDR).

Reference

Gouda, N. 2011, *Scholarpedia*, 6(10):12021, http://www.scholarpedia.org/article/JASMINE

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