Jasmine

Series of JASMINE missions

(Japan Astrometry Satellite Mission for INfrared Exploration)

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1. Nano-JASMINE

launch date: 2011

First space astrometry in Japan

use of a very small satellite (nano-satellite)

Nano-JASMINE satellite:

- size~50^3cm^3
- weight~35 kg
- 5cm diameter of a primary mirror with a focal length of ~1.67m
- Target accuracy of parallaxes: ~3mas at zw=7.5mag
- operation in zw-band(0.6~1.0 micron)
- Orbit: sun-synchronized orbit
- Observing strategy :Hipparcos and GAIA type

Launch: August 2011 !!

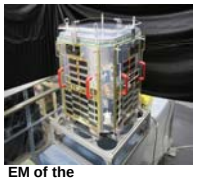
Launcher:

*Cyclone4(Yuzhnoye: Ukraine)

Development of spacecraft bus system

Prof.Nakasuka's laboratory at the University of Tokyo

Collaboration on N-J data analysis with Gaia data analysis team is ongoing.



EM of the Nano-JASMINE satellite

Objectives of Nano-JASMINE

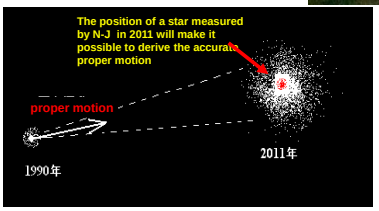
*First demonstration of space astrometry in JAPAN

We can experience almost the same process from the preliminary design, development to the operation as that in a big satellite.

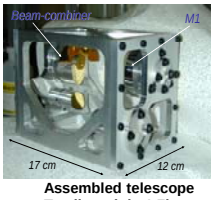
*Examinations of technical issues for Small-JASMINE and JASMINE

- on-board processing: stellar image extractor
- feed back of stellar images to attitude control

*To get proper motions with high accuracies combining ~0.1mas/yr a Nano-JASMINE catalogue with the Hipparcos catalogue



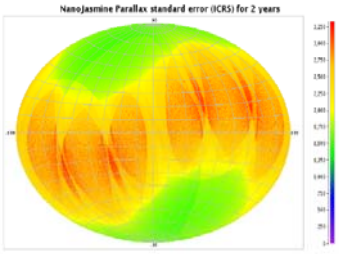
Spaceport @Alcantara, Brazil



Assembled telescope

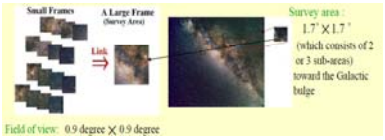
Totally weigh: 1.7kg

	Hipparcos	Tycho2	Nano-JASMINE
Limiting magnitude	(selected) (effective) (complete)	(~complete)	(complete)
Number of stars	120,000	2,500,000	200,000 (<7.5mag) 1,500,000 (<10mag) 3,000,000 (<11mag)
Position accuracy,	1mas (<10mag)	7mas (<7mag) 25mas (<10.5mag) 60mas (<11.5mag)	3mas (<7.5mag) 10mas (<10mag) 20mas (<11mag)
Proper motion,	0.8mas/yr	2.5mas/yr	3mas/yr (<7.5mag) ~0.1mas/yr (combined with HIP)



Plot 3. - Standard Error Plot for the Parallax © Michelle Picardo

Frames-Link method



Stage 1: Stellar images on this field of view will be taken with an integration time of 3 seconds. 16 sets of stellar images exposed successively 16 times on a field of view is termed ``a small-frame''.

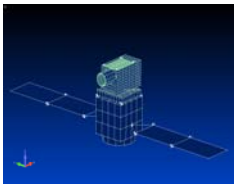
Stage 2: The telescope moves toward another adjacent field of view (small-frame) overlapping the previous small-frame (overlapping area is about a half of the frame). In about 20 minutes, the telescope takes the stellar images over the whole survey region, covering it by 16 small-frames.

Stage 3:We repeat the procedure at the stage 1 and 2 during the whole missior life and finally about 26,000 large- frames will be observed. Combining these large- frames allows determining the astrometric parameters using calibration stars whose astrometric parameters have been already determined accurately. Linear and annual variation of size, location, orientation, distortions of each large-frame can be fixed by calibration stars.

2. Small-JASMINE

Target launch date: 2016

The diameter of a primary mirror:30cm



Astrometric Measurement in Kw-band

(central wavelength: 2.0 μm, bandwidth: 1.0μm(1.5μm~2.5μm))

Infrared astrometry missions have advantage in surveying the Galactic bulge, hidden by interstellar dust in optical bands!

Accuracy:

parallax:

~10 μ as for Kw<11mag

proper motion:

~5 μ as/yr for Kw<11mag

position:

~7 μ as for Kw<11mag

Survey Area(TBD):

e.g. 3 regions, each having 1 square degree

Observing strategy : Frames –Link Method

The target launch date is around ~2016

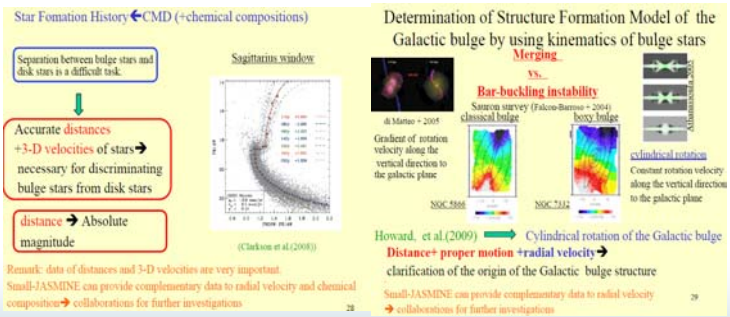
Mission life: ~2 years

Orbits: sun synchronized orbit

Launcher: solid rocket under development by JAXA

Scientific Targets of Small-JASMINE

Structure, Kinematics of the Galactic Bulge and Co-evolution of the Supper Massive BH and the bulge



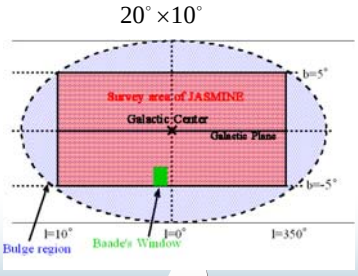


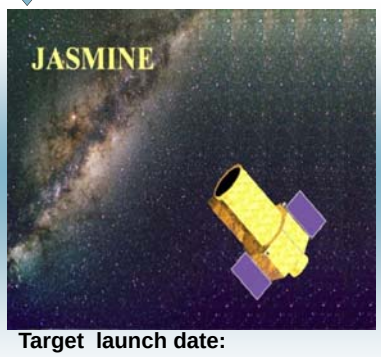
Figure 2:Survey area of JASMINE

JASMINE: about one million stars of the bulge in the survey area (with σ/π<0.1)

GAIA: 400 stars in the same area as that in JASMINE (with σ/π<0.1)

Small-JASMINE: ~ a few 10^4 stars of the bulge in its small survey area (with σ/π<0.1)

3. JASMINE



Target launch date:

the first half of 2020's

The diameter of a primary mirror:80cm

Astrometric Measurement in Kw-band

Accuracy:

parallax:

~10 μ as for Kw<11mag

proper motion:

~3 μ as/yr for Kw<11mag

position:

~7 μ as for Kw<11mag

Survey Area: l=350 degree~10 degree, |b|<10 degree

Scientific data	Small-JASMINE	JASMINE
Annual Parallax accuracy (distance accuracy)	10 μ as(for Kw<11mag) (~640pc @8kpc)	10 μ as(for Kw<11mag) (~640pc @8kpc)
Proper motion accuracy (tangential velocity accuracy)	5μ as/yr(for Kw<11mag) (~250m/s @8kpc)	3μ as/yr(for Kw<11mag) (~150m/s @8kpc)
Survey area	~3 regions, each having 1 square degree	20 degree times 10 degree
Number of stars	a few 10^4	a few 10^6