Update on NEO-related activities in JAXA

Space Mission Planning Advisory Group (SMPAG), 19th Meeting
20 October 2022, (online)

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Summary of JAXA's activities for planetary defense

Observations

- Discovery of high-speed moving objects by stacking method
- NEO observation at Bisei Spaceguard Center (BSGC)
- APAON (Asia-Pacific Asteroid Observation Network)　* currently suspended

Space Missions

- Hayabusa, Hayabusa2, Hayabusa2 extended mission, DESTINY+
- Participation in ESA's Hera mission
- Initial study : impactor mission (for Hayabusa2 proposal), NEO observation satellite

International activities

- SMPAG, PDC, Asteroid Day,　*IAWN (JAXA is considering joininng IAWN)

Planetary defense WG, which was established in October 2021, has meetings regularly to discuss issues related to the planetary defense.

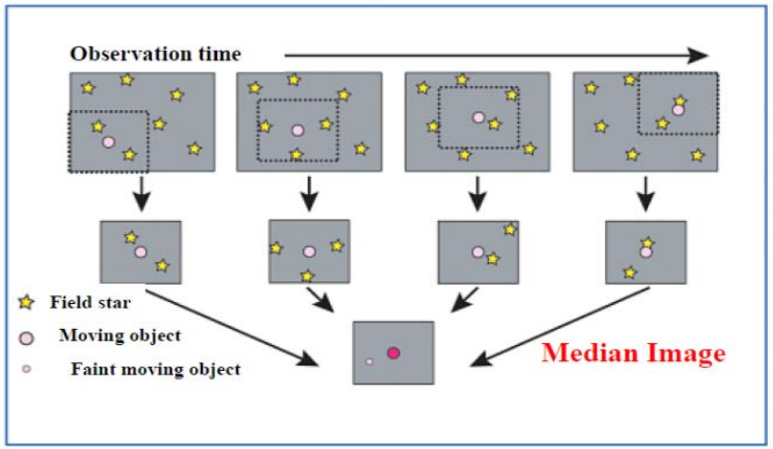
Asteroid discovery observation : Stacking method

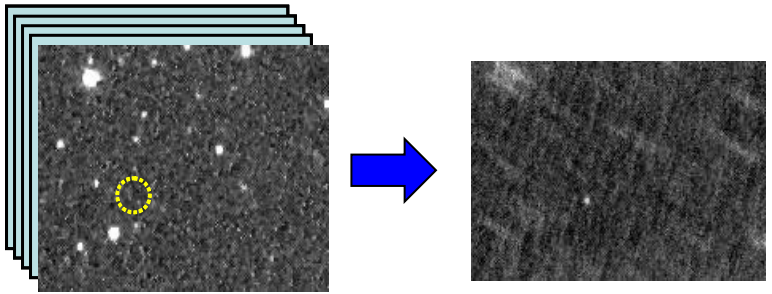
(by Toshifumi Yanagisawa)

To find faint fast moving objects, we use a stacking method.

The stacking method uses multiple CCD images to detect very faint NEOs that are undetectable on a single CCD image.

Concept of the stacking method





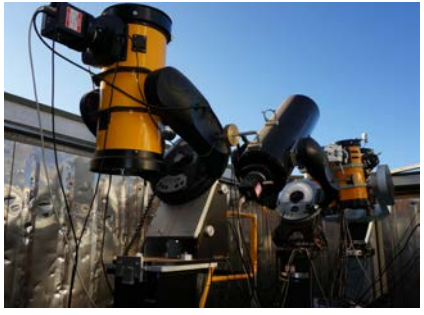
We assume various movements of the faint object and overlap the images to find faint objects.
The FPGA board was developed to reduce analysis time.

The FPGA board for the stacking method

（Image credit：JAXA）

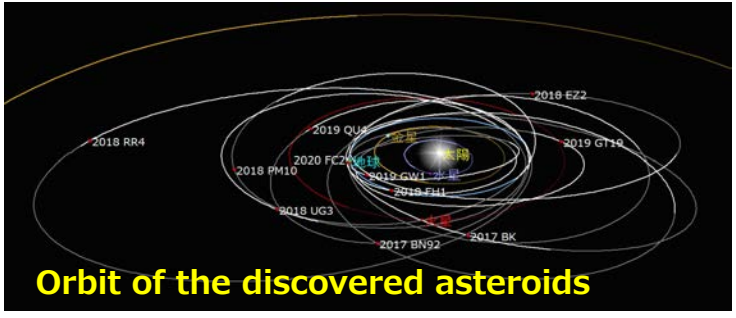
Discovered NEOs by the stacking method

Provisional designation	Discovery date & time (UTC)	Mag. at discovery	Orbit type	e	a (au)	i (deg)	Distance at discovery (au)	Abs. Mag.	Size(m)
2017 BK	2017.1.17 14:51	17.5	Apollo	0.489	1.909	6.6359	0.051	24.0	67
2017 BN92	2017.1.31 16:04	17.1	Apollo	0.483	1.921	1.0734	0.014	25.6	32
2018 EZ2	2018.3.12 10:06	18.2	Apollo	0.510	1.951	4.9718	0.01	26.6	20
2018 FH1	2018.3.18 12:36	18.7	Aten	0.177	0.938	3.5468	0.013	26.6	20
2018 PM10	2018.8.9 10:36	18.3	Amor	0.427	1.780	9.2065	0.001	27.0	17
2018 RR4	2018.9.11 12:21	18.0	Apollo	0.621	2.637	3.1793	0.015	27.1	16
2018 UG3	2018.10.31 12:51	19.4	Apollo	0.423	1.662	6.1673	0.03	24.5	53
2019 GW1	2019.4.4 11:36	17.5	Aten	0.114	0.934	13.2945	0.009	26.1	25
2019 GT19	2019.4.12 13:06	18.2	Apollo	0.370	1.273	7.7488	0.01	27.5	13
2019 QU4	2019.8.28 10:06	18.1	Apollo	0.332	1.426	10.1313	0.017	24.8	46
2020 FC2	2020.3.17 13:36	18.5	Apollo	0.398	1.644	6.8153	0.006	28.0	11



We used small telescopes like these. (18cm, 25cm)

（Image credit：JAXA）



Orbit of the discovered asteroids

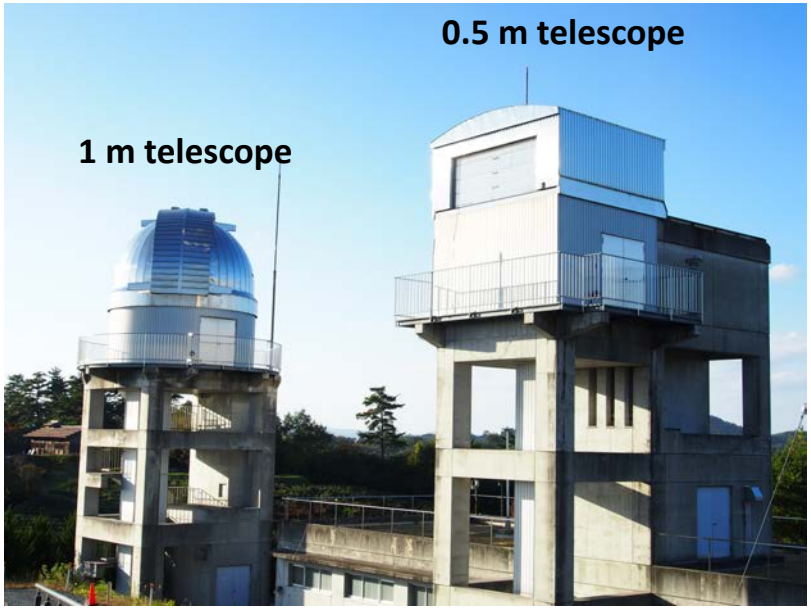
Bisei Spaceguard Center (BSGC)

Observation targets:

Space debris

NEO (asteroids)

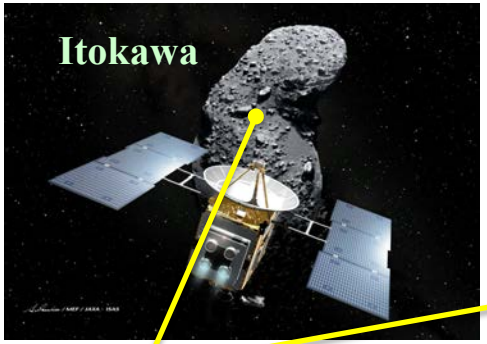
(Image credit：JAXA)



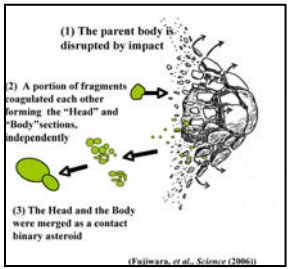
- Built in 2000 and owned by the Japan Space Forum, it was transferred to JAXA in April 2017.
- The observation work is carried out by the Japan Spaceguard Association (NPO).

JAXA's Asteroid Missions

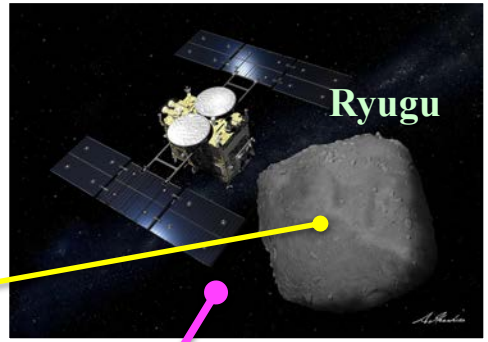
Hayabusa 2003-2010



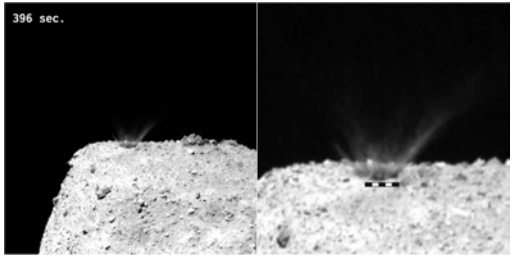
"Rubble Pile" structure



Hayabusa2 2014-2020



Impact crater



(Image credit：JAXA / A. Ikeshita)　©Arakawa et al., Science 2020

Hayabusa2 Extended mission
Hayabusa2#

Arrival in 2031

30 m

1998 KY26

Future mission

DESTINY^{+} : Phaethon

Launch 2024

Hayabusa3 ? ・・・

Hayabusa2 Extended mission : Hayabusa2#

(SHARP) : Small Hazardous Asteroid Reconnaissance Probe

- The spacecraft is still operational.
- 50% of xenon, the fuel for ion engines, remains.

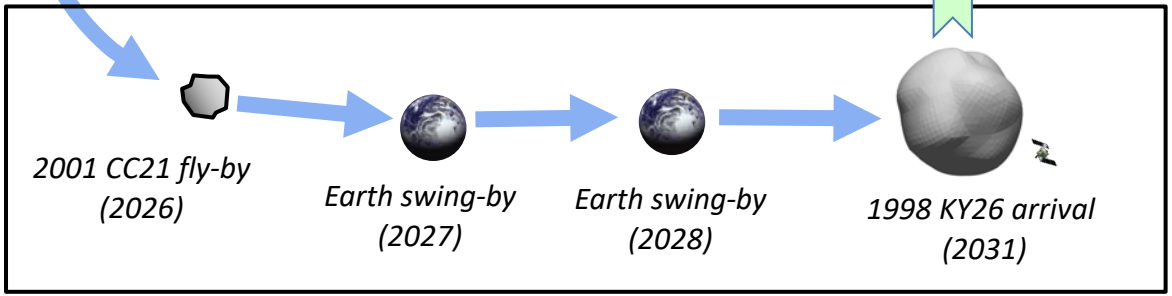
Mission to 1998 KY26

- The technical challenge of long-term space navigation
- A type of celestial body that has never been explored (30 m in size, 10 minutes in rotation period)
- Science and technology related to planetary defense

6 Dec. 2020

1998 KY26

Shape	Spherical (from radar observation)
Av. diameter	About 30 m
Spin period	10.7 min (0.178 hr)
Tumbling motion	No short-term variability detected
Spectral type	Possible carbonaceous asteroid
Semimajor axis	1.23 au
Orbital period	1.37yr（500 day）



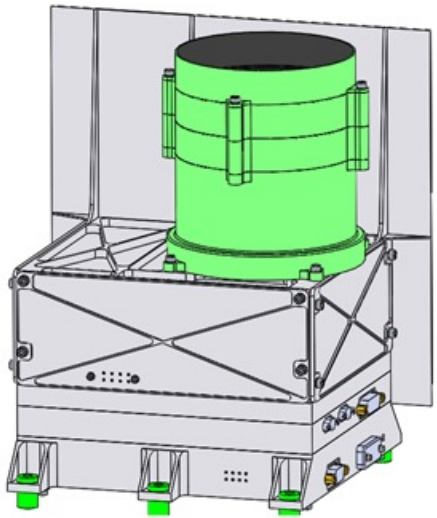
（Image credit：JAXA）

Collaboration with Hera

(by Tatsuaki Okada)

JAXA will provide a thermal infrared imager (TIRI) to Hera.
The PDR has been finished, and we have started to make EM.
(TIRI is developed based on TIR of Hayabusa2.)

Hera TIRI



（Image credit：JAXA）

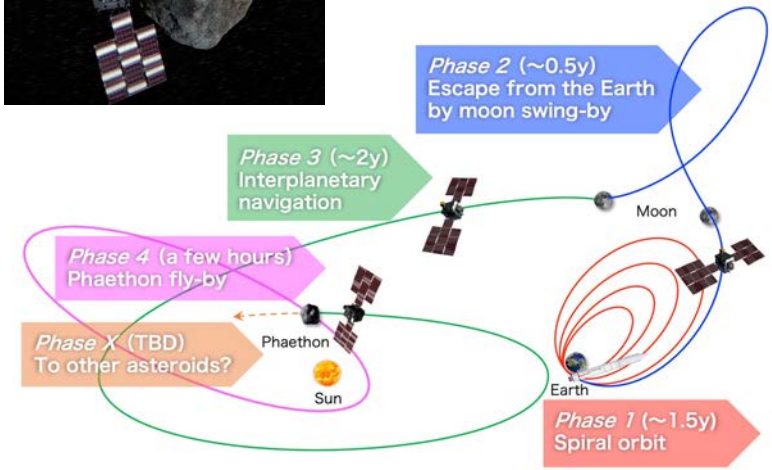
Detector	**Lynred PICO1024**
Wavelength	**7-14 [μm], with 6 narrow bands**
Pixels	**1024 x 768**
FOV	**13.3 x 10.0 [deg]**
IFOV	**0.013 [deg]**
Temperature	**150-400 [K]**
NETD(@300K)	**< 0.1 K**
Mass	**4.0 +/- 0.4 kg**
Power	**17 +/- 3 W**

DESTINY+

Demonstration and Experiment of Space Technology for INterplanetary voYage with Phaethon fLyby and dUst Science

(by Takeshi Takashima)

- Target object is Phaethon.
- Fly-by observation in the relative velocity of 35-36 km/sec.
- Interplanetary dust observation
- The basic design (Phase B) is almost finished. The preliminary design reviews (PDR) for the components have finished.
- PDR for whole system is ongoing and will finish in Q3 2022..
- Launch : FY2024, Phaethon fly-by : 2028



International collaboration : DLR