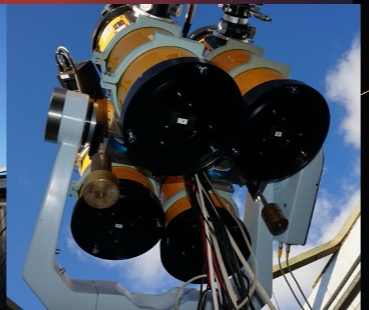
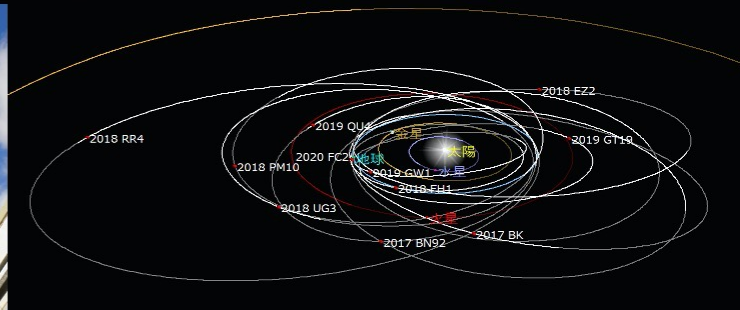
8th IAA Planetary Defense Conference

JAXA activities in NEOs and planetary defense

April 4, 2023@Vienna, Austria

Makoto Yoshikawa (JAXA)





JAXA's activities for planetary defense

Observations

- NEO observation at Bisei Spaceguard Center (BSGC)
- Discovery of high-speed moving objects by new NEO search method

Space Missions

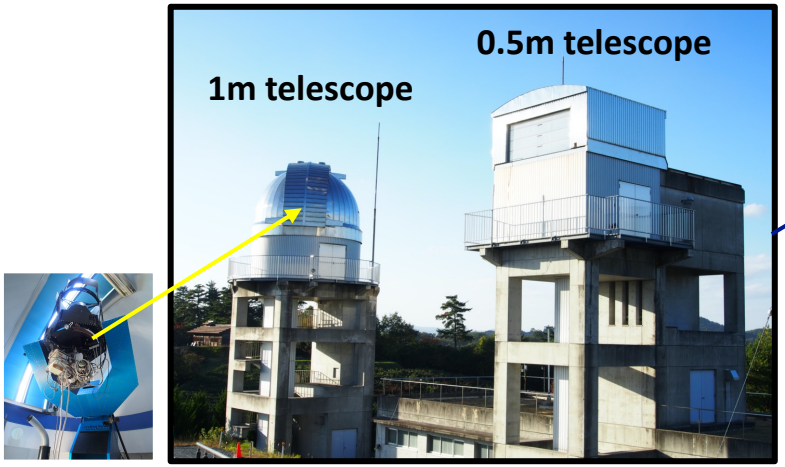
- Hayabusa, Hayabusa2, Hayabusa2 extended mission, DESTINY+
- Participation in ESA's Hera mission
- Initial study of Hayabusa2 : impactor mission → small impactor of Hayabusa2
- Study for NEO observation satellite
- Study for new mission concept : Asteroid flyby cycler

International activities

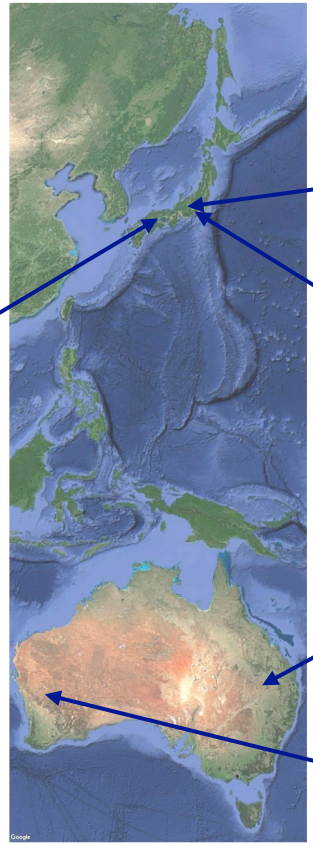
- SMPAG, IAWN, PDC, Asteroid Day

Asteroid observations in JAXA

Bisei Spacegurad Center (BSGC)
(Space Tracking and Communications Center)



- 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).
- Observation targets: Space debris, NEO (asteroids)



Observation facility of Research and Development Directorate

Mt.Nyukasa Observational facility

Chofu LEO Observational facility

Remote observation site at Siding Spring Observatory

Remote observation site at Zadko Observatory

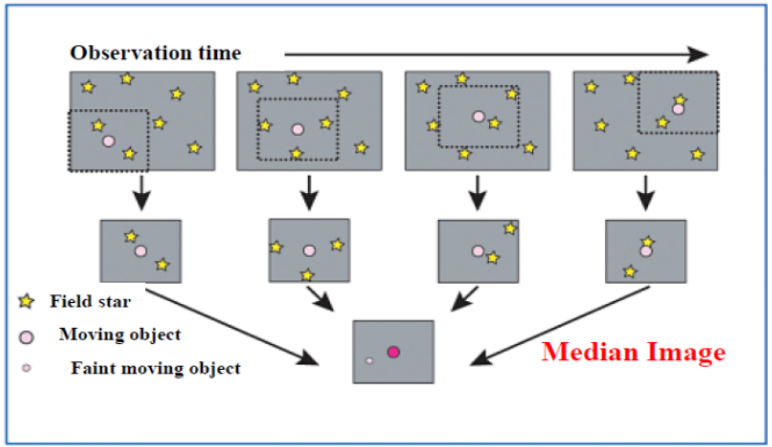
Discovery of high-speed moving objects by new NEO search method

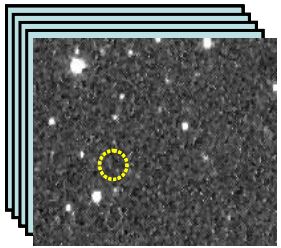
We developed a stacking method to find faint and fast-moving objects.

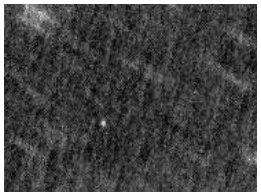
just by using 20cm telescope!

We take many images with short exposure time and superimpose them assuming various directions and velocities to search for fast-moving objects. A FPGA board was developed to reduce analysis time.

Concept of the stacking method







(Image credit：JAXA)

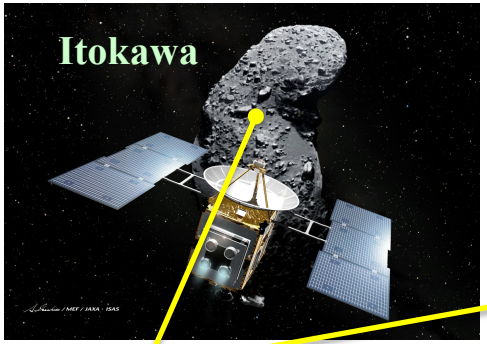
List of discovered asteroids

Provisional designation	date	Mag.	Dist. (au)	Size (m)
2017 BK	2017.1.17	17.5	0.051	67
2017 BN92	2017.1.31	17.1	0.014	32
2018 EZ2	2018.3.12	18.2	0.01	20
2018 FH1	2018.3.18	18.7	0.013	20
2018 PM10	2018.8.9	18.3	0.001	17
2018 RR4	2018.9.11	18.0	0.015	16
2018 UG3	2018.10.31	19.4	0.03	53
2019 GW1	2019.4.4	17.5	0.009	25
2019 GT19	2019.4.12	18.2	0.01	13
2019 QU4	2019.8.28	18.1	0.017	46
2020 FC2	2020.3.17	18.5	0.006	11

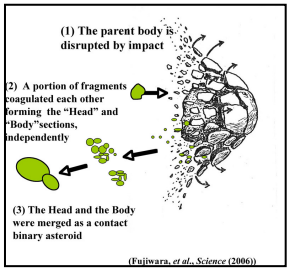
The date, brightness, and distance are those at the time of discovery.

JAXA's Asteroid Missions

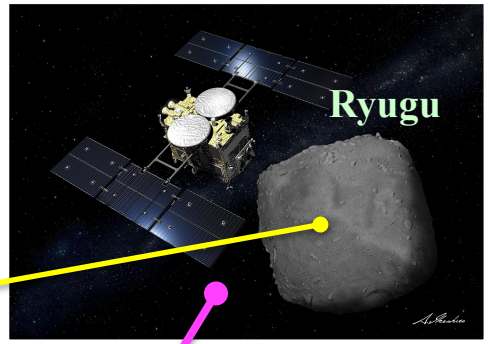
Hayabusa 2003-2010



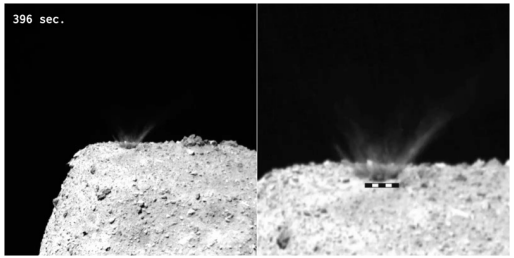
"Rubble Pile" structure



Hayabusa2 2014-2020

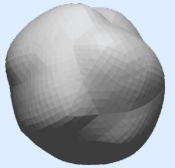


Impact crater



Hayabusa2 Extended mission
Hayabusa2#

Arrival in 2031



30 m

1998 KY26

Future mission

DESTINY$^+$: Phaethon

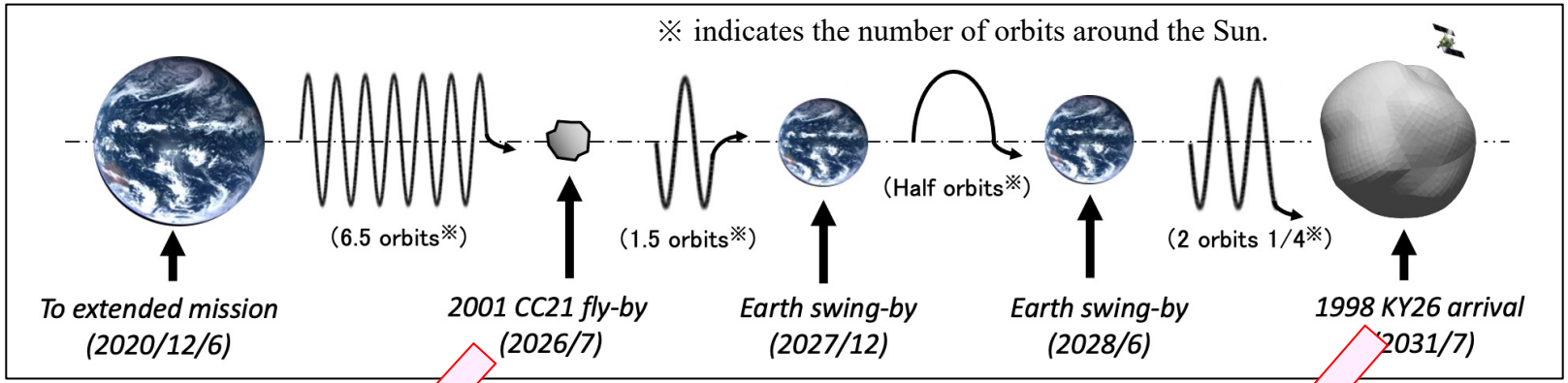
Launch 2024

Hayabusa3 ? ・・・

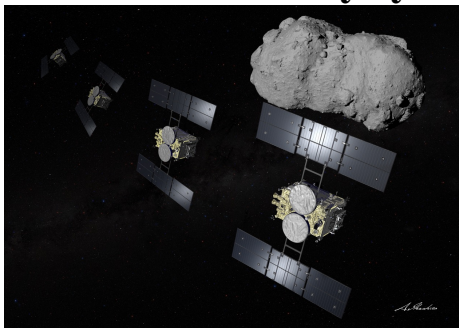
（Image credit：JAXA / A. Ikeshita）　©Arakawa et al., Science 2020

Hayabusa2 Extended mission : Hayabusa2#

 # (SHARP) : Small **H**azardous **A**steroid **R**econnaissance **P**robe

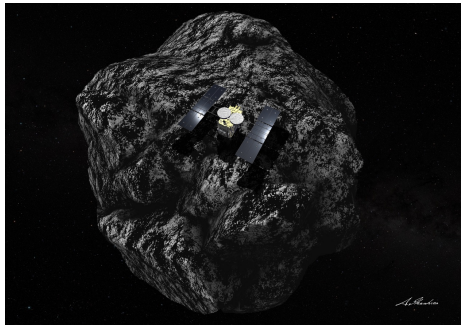


2001 CC21 flyby



size ~ 700m
rel. vel. ~ 5km/s
We need high accuracy navigation.

1998 KY26 rendezvous

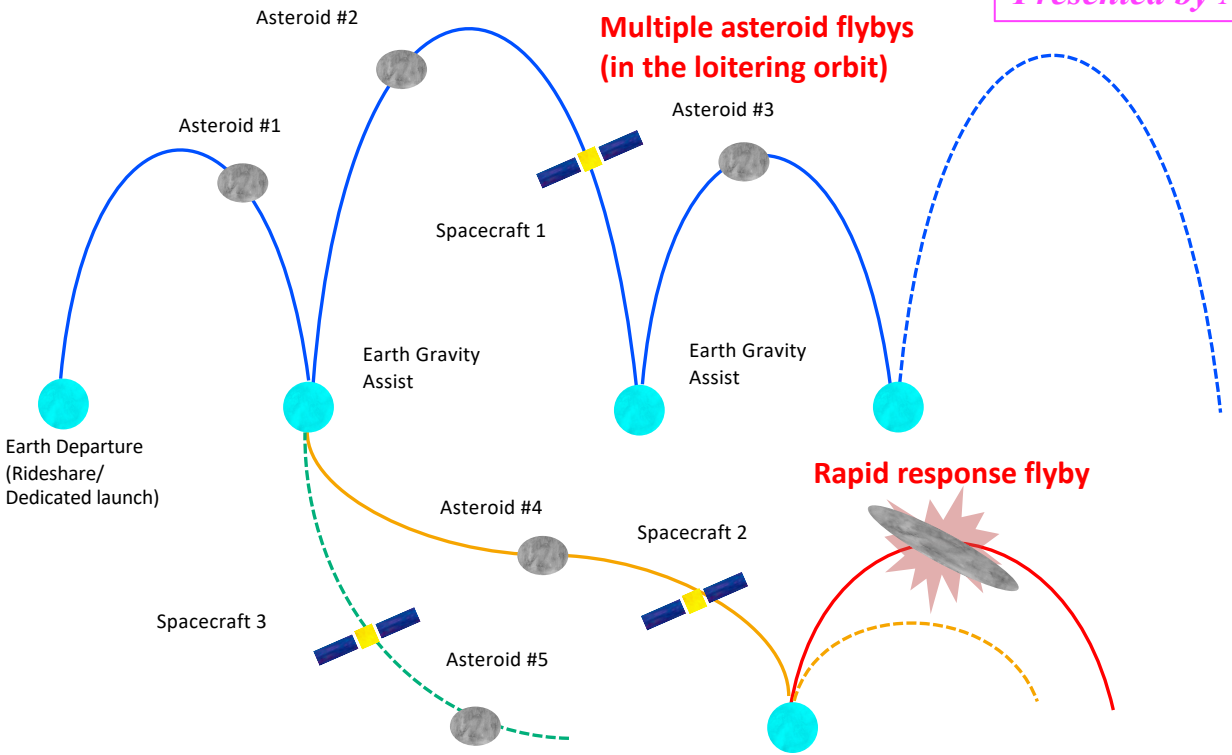


size ~ 30m
Spin period ~ 11min
Such asteroids like this will collide with the Earth once in 100 or 200 years.

(Image credit：JAXA)

Rapid Response Flyby Reconnaissance via Asteroid Flyby Cyclers

Presented by Naoya Ozaki at 16:20 on Wednesday



Ref. DESTINY$^+$, CONTOUR, Lucy

By adopting ***an asteroid flyby cycler orbit*** (alternating asteroid flyby and Earth swing by), we can perform **one NEO flyby per month** ($\Delta V \sim 10$ m/s per year, which is feasible for micro/nano spacecraft) for a 12-spacecraft configuration.

International activities

United Nations

COPUOS/UNOOSA

IAWN ：International Asteroid Warning Network

SMPAG：Space Mission Planning Advisory Group

JAXA is now applying the membership.

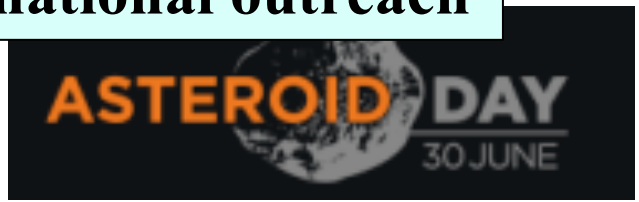
JAXA is one of the members.

International conference

PDC：Planetary Defense Conference

JAXA hosted PDC in Tokyo 2017.

International outreach



JAXA is cooperating with the events both in Japan and abroad.

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