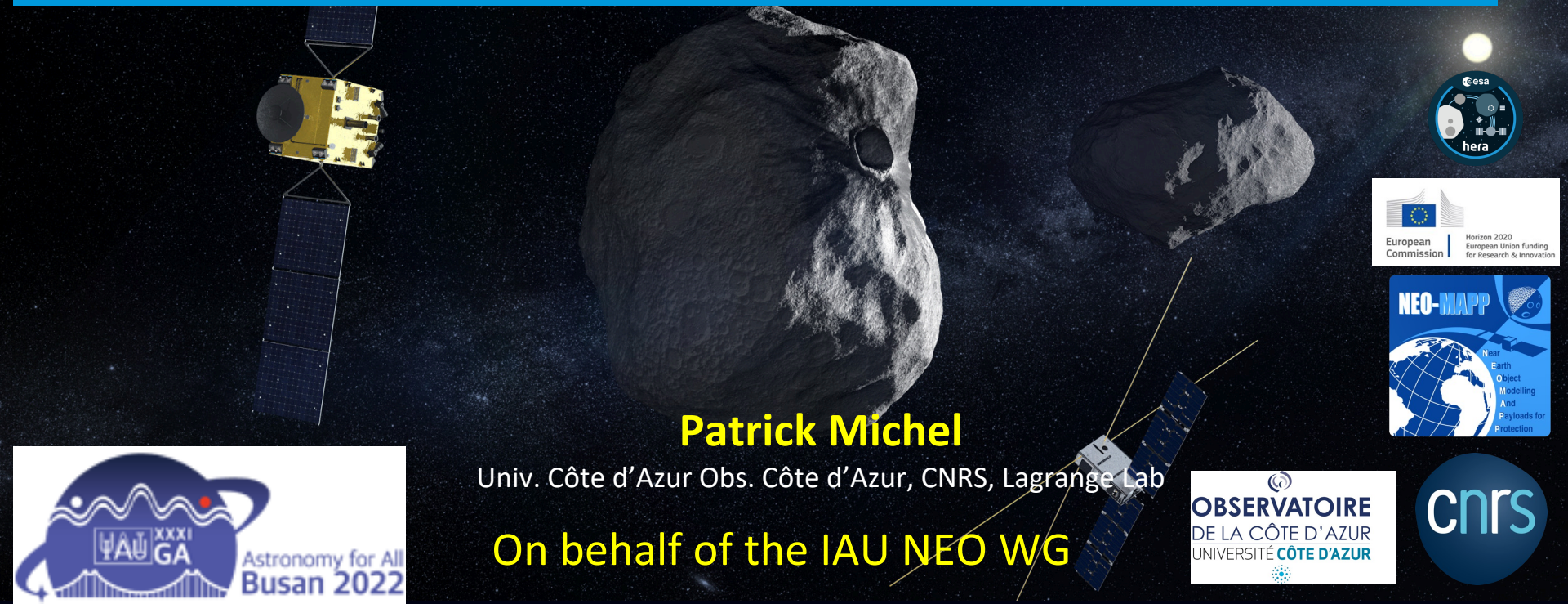
NEO Working Group : some new knowledge regarding NEOs, current projects and perspectives



Patrick Michel

Univ. Côte d'Azur Obs. Côte d'Azur, CNRS, Lagrange Lab

On behalf of the IAU NEO WG

The Near-Earth Object Working Group

NEO WG President

Patrick Michel, Univ. Côte d'Azur, Obs. Côte d'Azur, Laboratoire Lagrange, France

NEO WORKING GROUP MEMBERS (11)

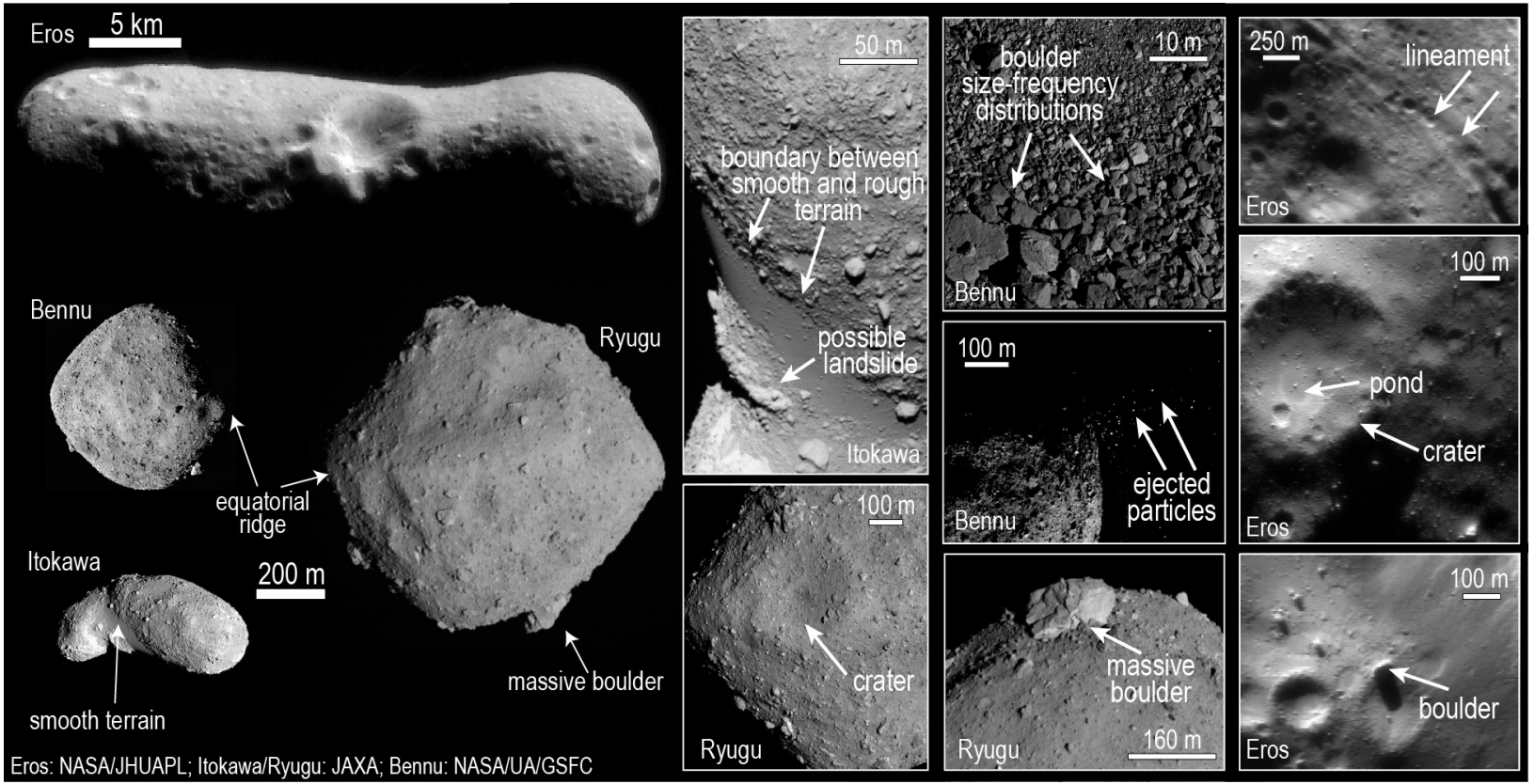
Chesley, S., Dotto, E., Fitzsimmons, A., Hestroffer, D., Lazzarin, M., Mainzer, A., Shustov, B., Spoto, F., Tancredi, G., Valsecchi, G., Yoshikawa, M.

STRUCTURE AND ROLE:

- Functional inter-Division A-F WG.
- Monitoring and participation to the international activities focused on planetary defense, of representing the IAU in international groups, such as the UN-endorsed International Asteroid Warning Network (IAWN).
- Contributes to public outreach efforts, noting that NEOs and planetary defense are of high interest for the public.

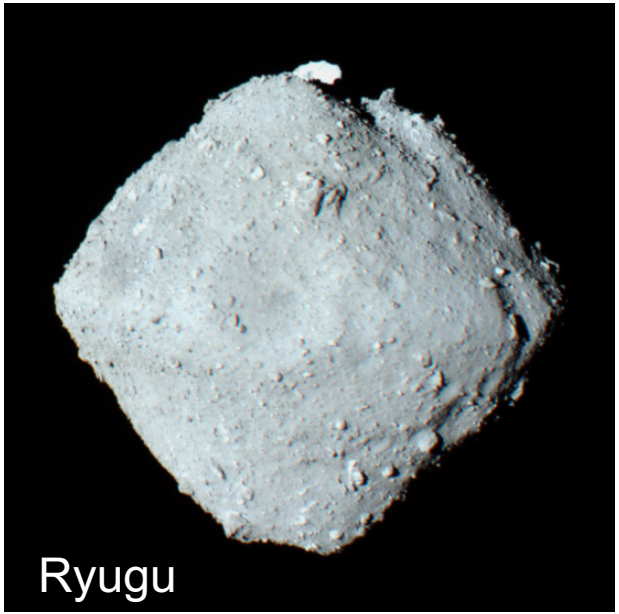
Important to know for Asteroid Planetary Defense

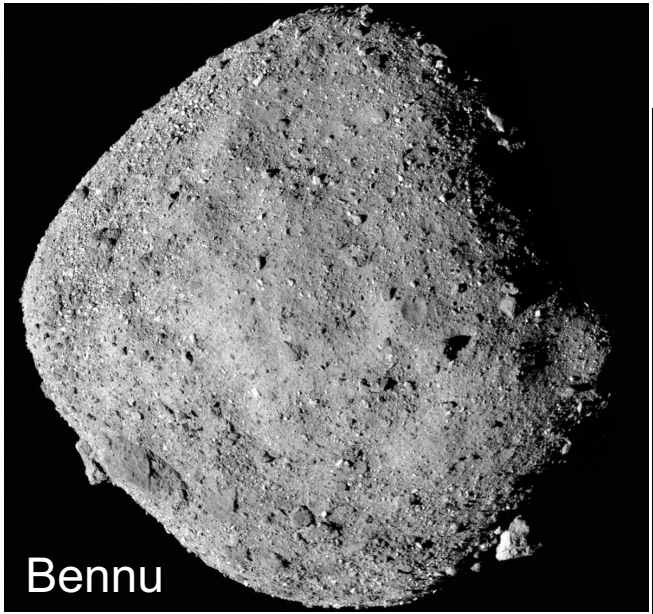
Asteroids show an incredible and fascinating geological and compositional diversity

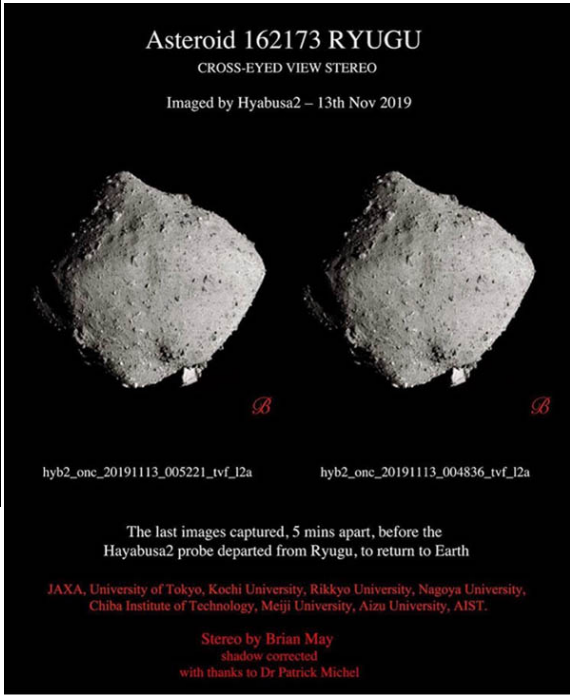


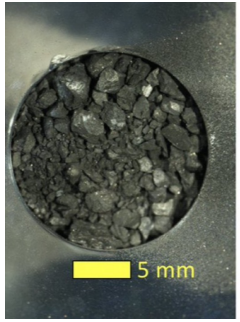
Unless we actively touch their surface, we cannot easily predict their surface response

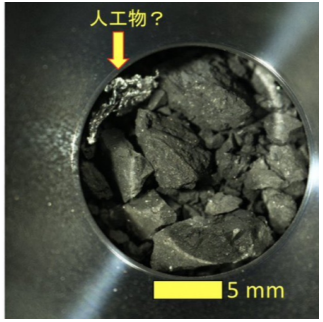
Successes of Hayabusa2 and OSIRIS-REx





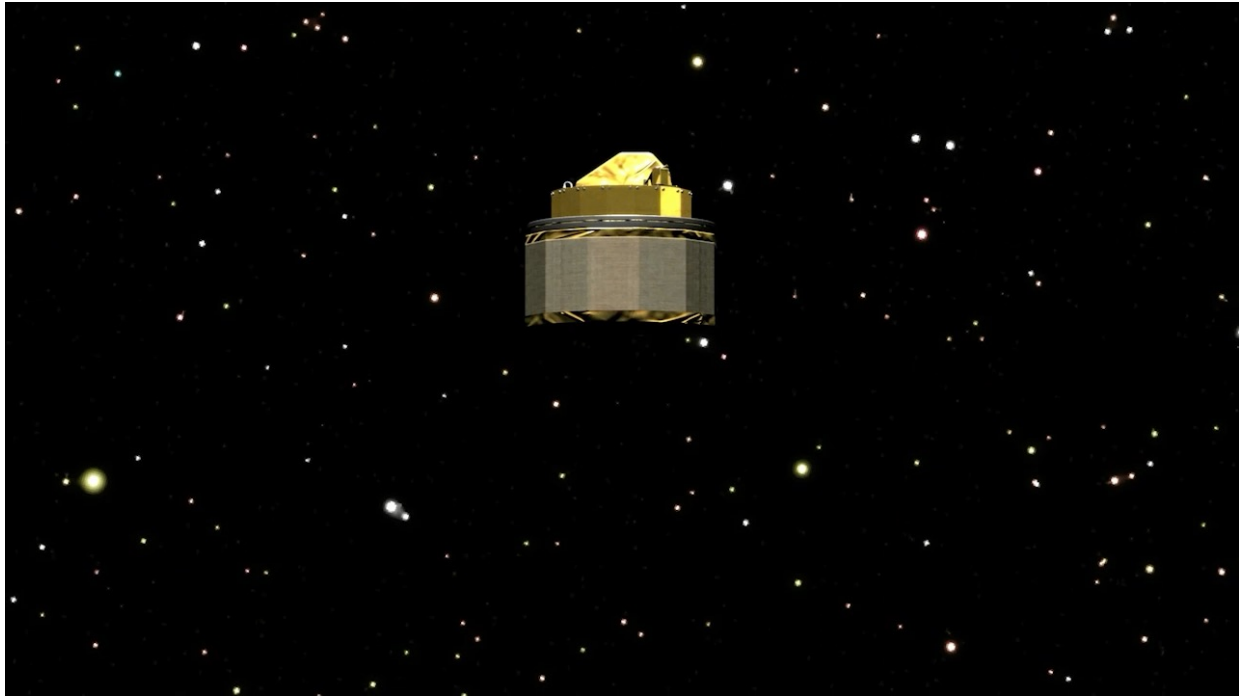






Stereo pairs
by Dr. Brian May
(Queen Guitarist)

Lessons learned from Hayabusa2 SCI impact

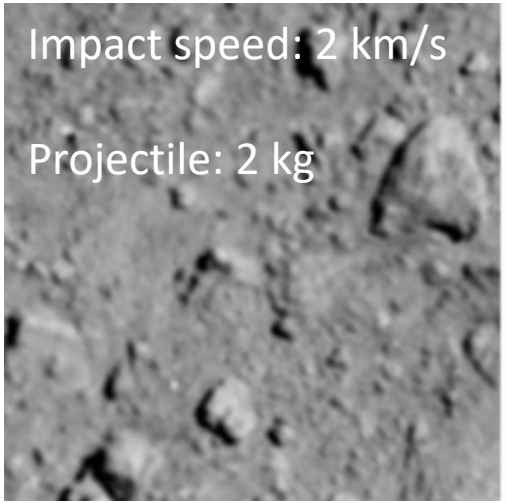


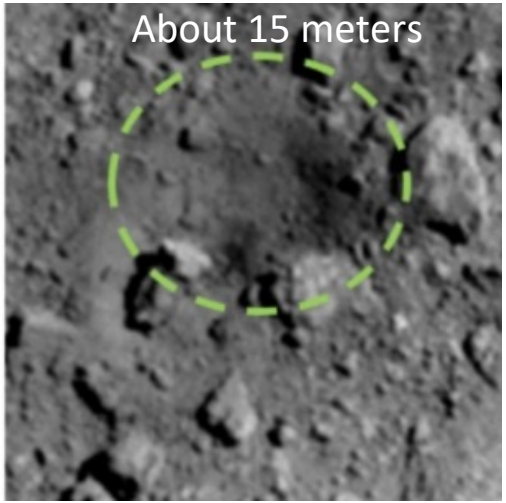
Hayabusa2 Small Carry-on Impactor
April 5, 2019

Arakawa et al. 2020, Science

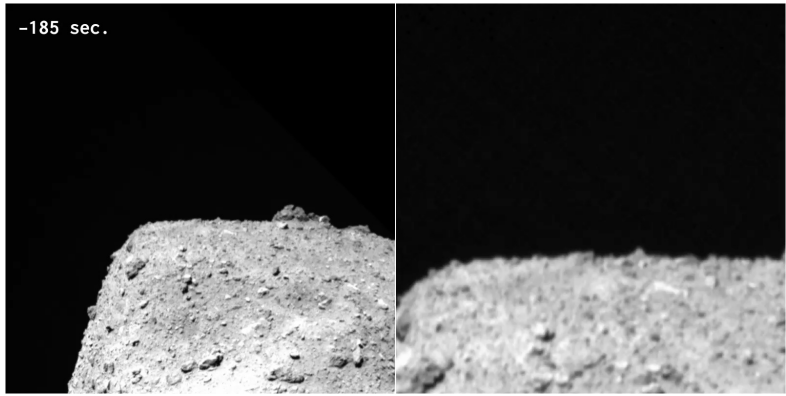
Cratering physics: Hayabusa2

Arakawa et al. 2020, Science





Movie of the impact (DCAM3)

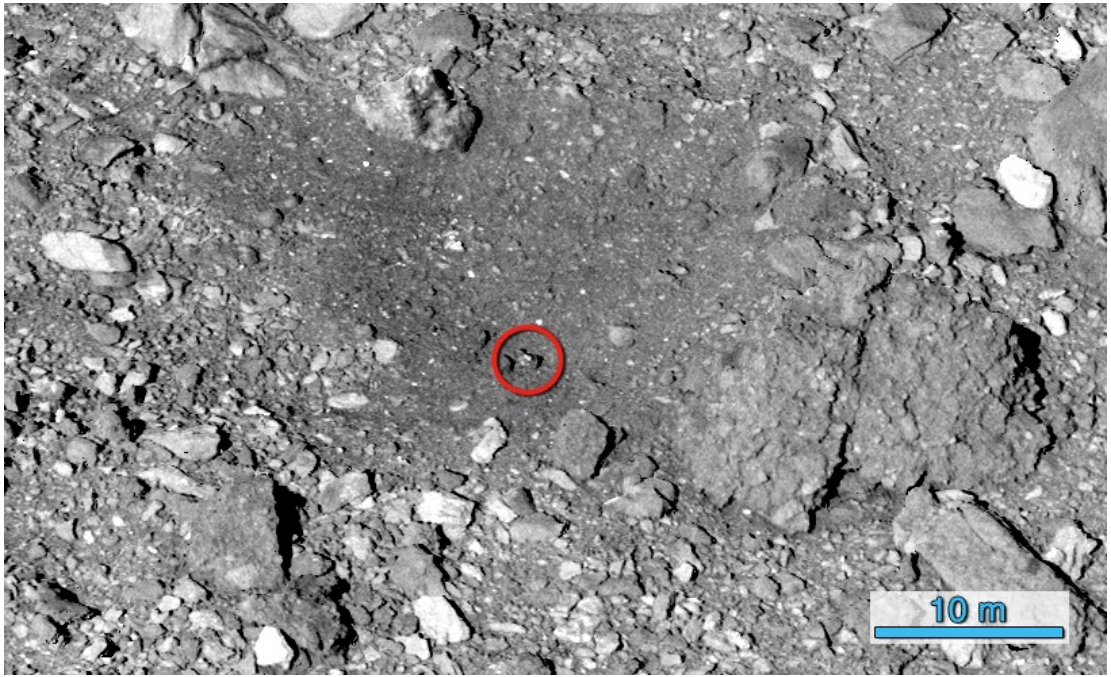


The large size of the crater can only be explain if the surface has no cohesion, which is a surprize! **Strong implications on surface age and deflection efficiency**

What about DART on a 165 m-size body? And how does cratering scale with impact speed (from 2 to 6 km/s)?

Lessons learned from OSIRIS-Rex Touch & Go Operation

A boulder field with almost no resistance! (Lauretta et al., Walsh et al. 2022)

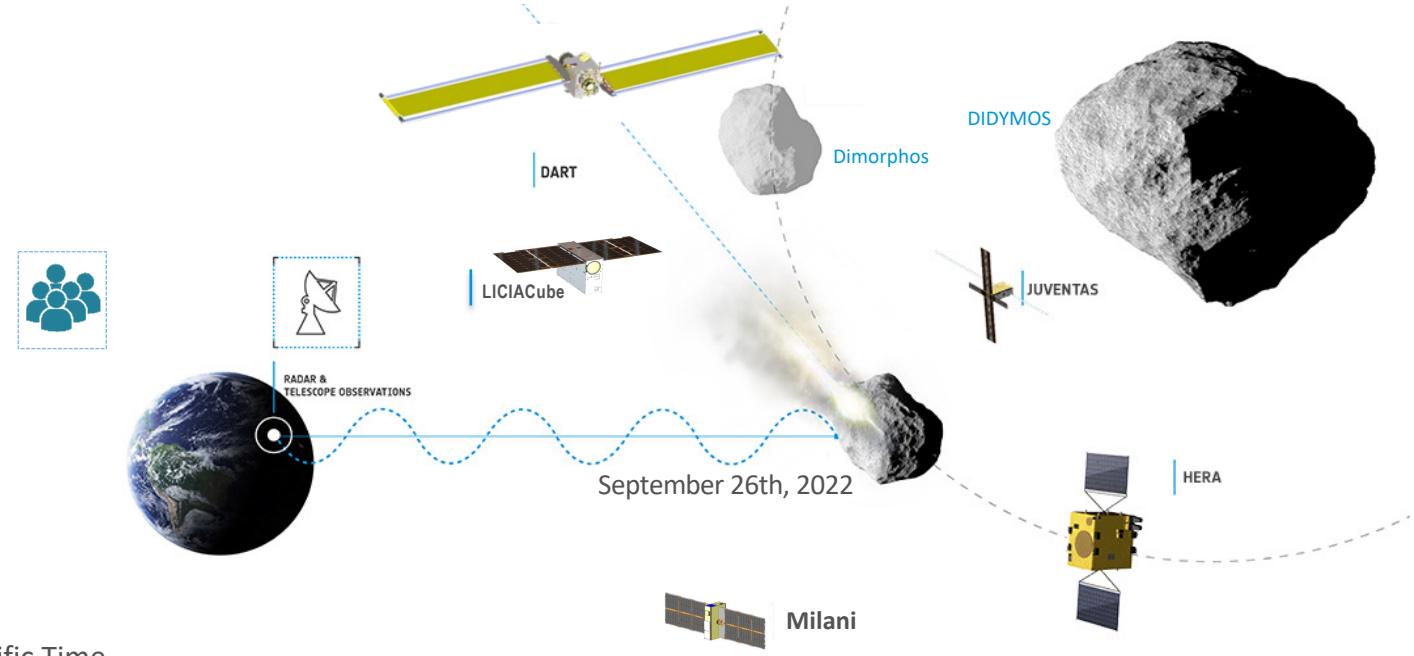


Credit: NASA/Goddard/University of Arizona

Unless we actively touch an asteroid surface, we cannot know its response

AIDA International Collaboration

November 23, 2021 at 10:20 pm Pacific Time



AIDA

Synergy from

NASA DART

First demonstration of asteroid deflection by kinetic impact on Dimorphos, to change its orbit

with

asi LICIACube

First prompt imaging of the impacted surface, ejecta plume evolution and of the non-impacted hemisphere of Dimorphos

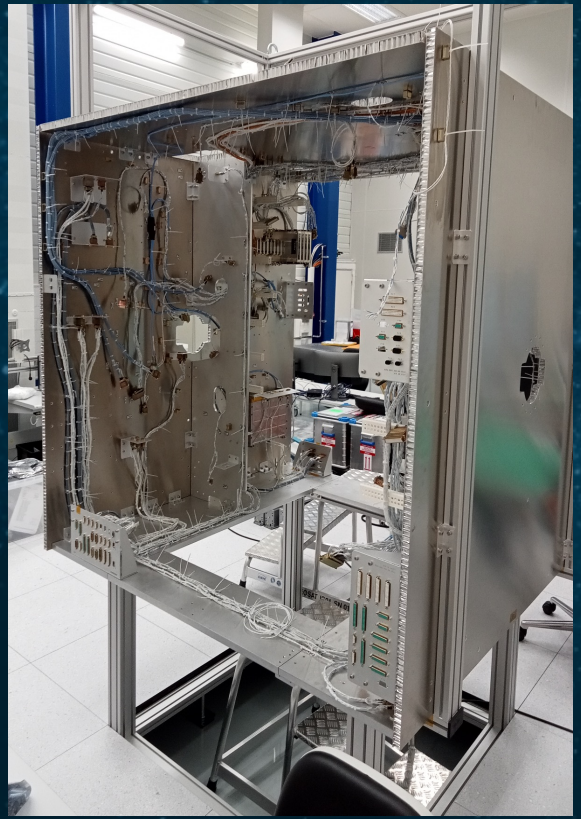
+

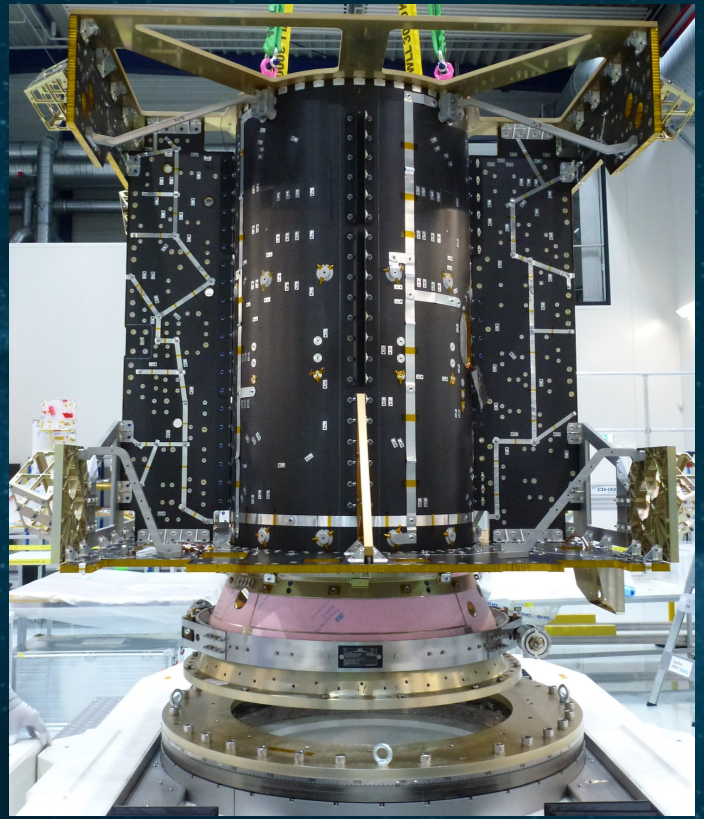
esa hera

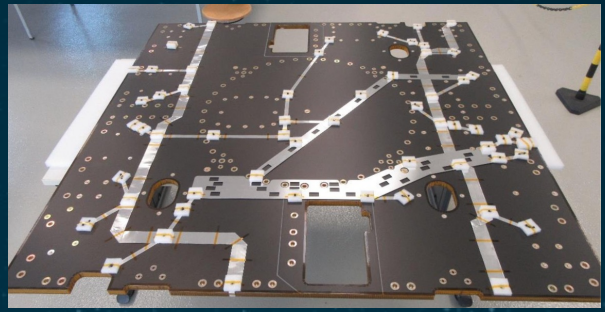
Mass of Dimorphos
Detailed dynamical characterization
Detailed investigation of final crater
Overall characterization of the asteroids including interior for the 1st time

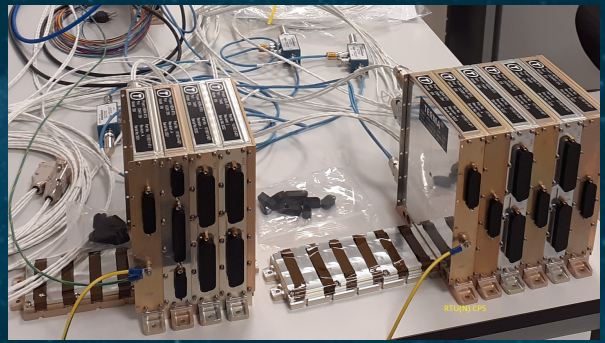

DART
NASA
DART impact on Sept. 26th, 2022, at 19:14 EST

Hera (launch in Oct. 2024) today in the clean room









Hayabusa2 Extended mission

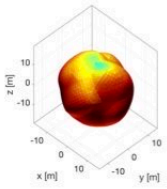
Asteroid flyby in 2026

Rendezvous with a fast rotator in 2031

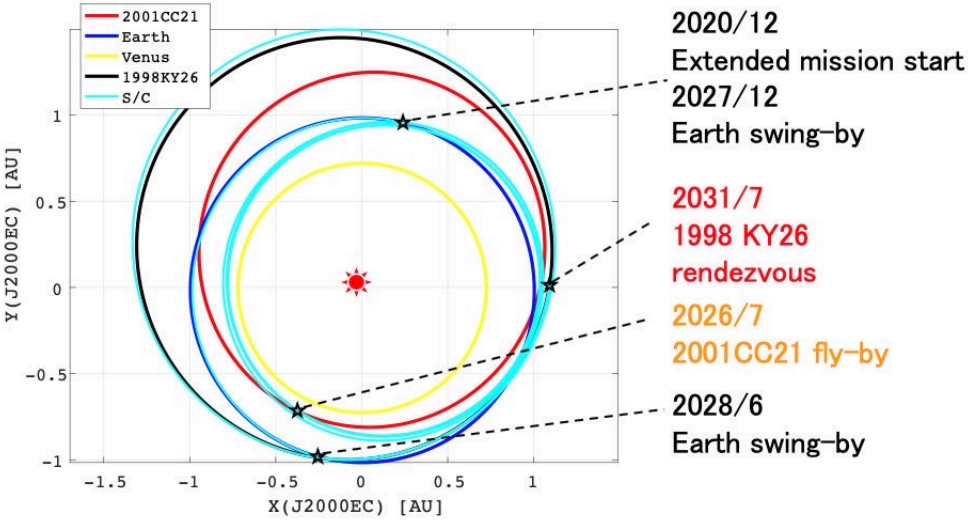
EAEEA scenario : to 1998 KY26

(Earth→Asteroid→Earth→Earth→ 1998 KY26)

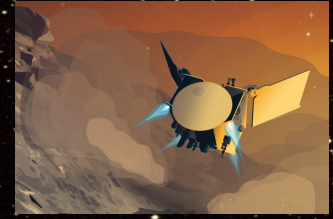
1998 KY26



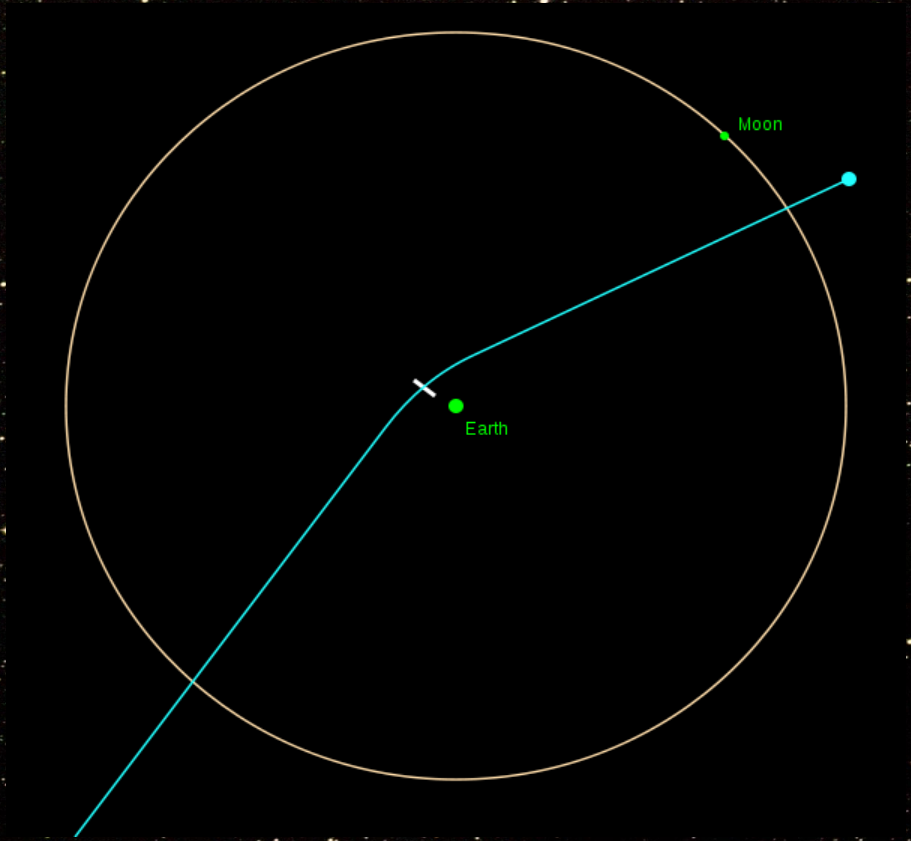
Shape	Spherical (from radar observation)
Av. diameter	About 30m
Spin period	10.7 min (0.178hr)
Tumbling motion	No short-term variability detected
Spectral type	Possible carbonaceous asteroid

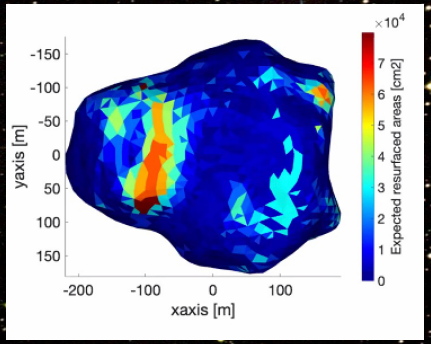


OSIRIS-APEX



Rendezvous with (99942) Apophis in 2029





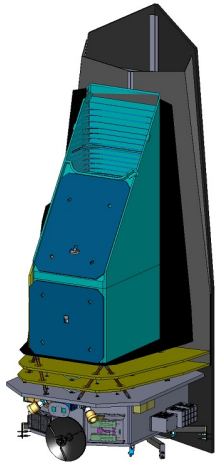
PI: Daniella DellaGiustina

Ground based and Space based Project

- **Successfull Apophis Planetary Defense exercise** conducted during the close approach to Earth by (99942) Apophis during 2020 December–2021 March (Reddy et al. 2022, Planetary Science Journal 3, 123).

- **Flye Eye telescope** (ESA) will be sat near the top of the 1865-metre Monte Mufara mountain in Sicily, Italy,; filed of view of 45 square degrees, will detect everything down to about 40 m in diameter, typically three weeks before a potential impact.

- **NEO Surveyor Mission (NASA) under development** (launch in 2026?); can characterize from space (including follow-up) 90% of NEOs larger than 140 m in 10 years.



European Commission Support

2012-2015

2015-2017

2020-2023

https://neomapp.eu

2020-2023

https://www.neorocks.eu

ASTEROID DAY

30 June

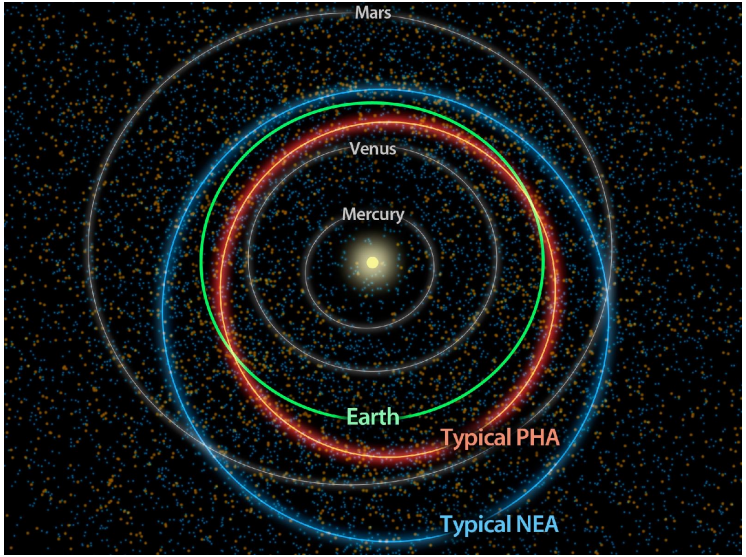
Officialized by UN

https://asteroidday.org

2022: 4 hours live broadcast in Luxembourg + many events in the world

A Topic to Discuss in the NEO WG

- **The term « Potentially Hazardous Asteroid » or PHA**
  - Source of confusion for the public and the media
  - Maybe find a new term or revise the definition



Often associated to a danger, but it's not necessarily the case!!

Next Relevant International Meetings

- **International Astronautical Congress** (Paris, Sept. 18-22)
  - Plenary Panel on Planetary Defense: B. Congdon, B. Lal, P. Michel, R. Moissl, B. Nye
  - Planetary Defense Quizz (by NEO Technical Committee)

- **EPSC 2022** (Grenada, Sept. 18-23)
  - Planetary Defense Session

- **AGU 2022** (Chicago, Dec. 12-16)
  - Special Session on DART

- **Planetary Defense Conference 2023** (April 3-7, 2023, Vienna)

DART

XXXI GA
Astronomy for All
Busan 2022

NEO-MAPP
HORIZON 2020

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870377.

esa
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Thank you for your attention!

Please contact michelp@oca.eu if you have any questions.