

# Hayabusa2 Extended Mission to rendezvous with Asteroid 1998 KY26: Investigations of an extremely small fast rotator for planetary defense

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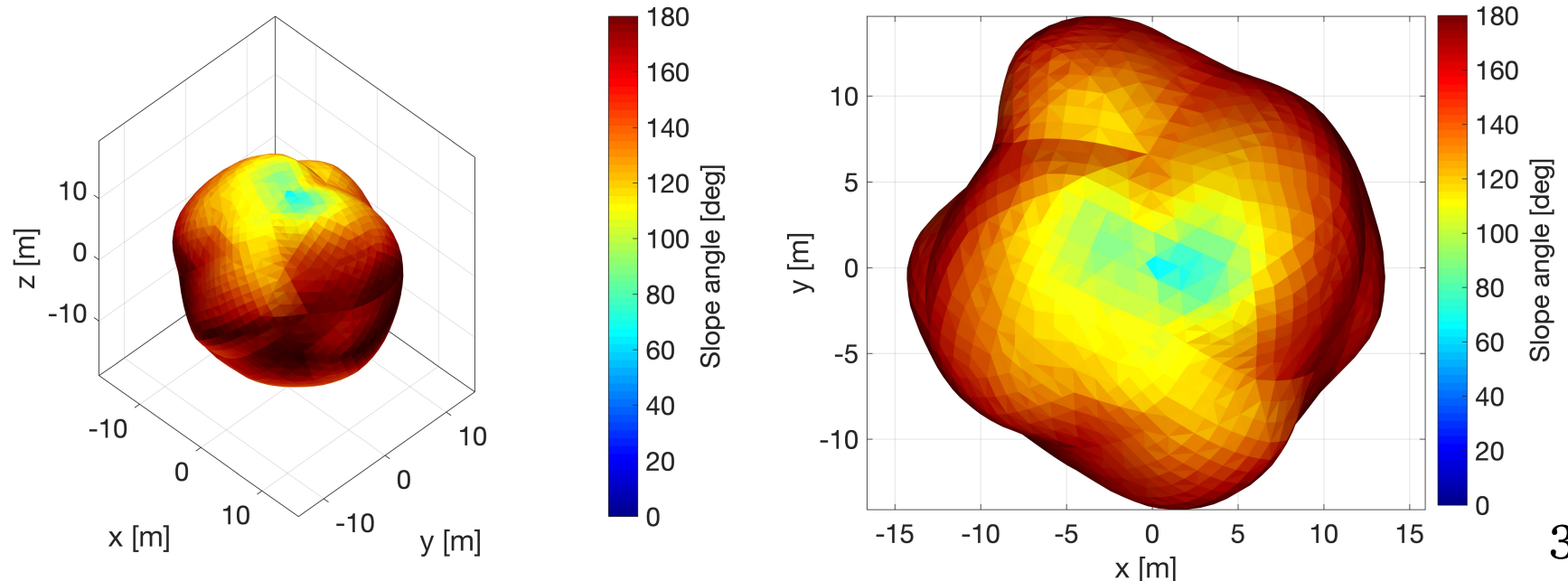
# The Hayabusa2 extended mission is a small-body rendezvous mission that uses the already-flying Hayabusa2 spacecraft.

- The extended mission follows its nominal mission that returned samples from the C-type asteroid, Ryugu, in December 2020.
- The spacecraft is currently flying without no critical issues.
- The extended mission explores:
  - Scientific advances in the inner solar system evolution and planetary defense, and
  - Engineering technologies for extremely long-term explorations.
- The extended mission is planned to continue until 2031.
- We are about to start the extended mission.

# The rendezvous target is asteroid 1998 KY26, a fast rotator with a size of $\sim 30$ m and a spin period of 10.7 min.

- Because of the fast spin, the surface slope exceeds 180 deg in major regions.
- Materials on the surface should be shed unless there is an attractive force.
- This asteroid is also considered to be a target of NASA's human spaceflight missions.

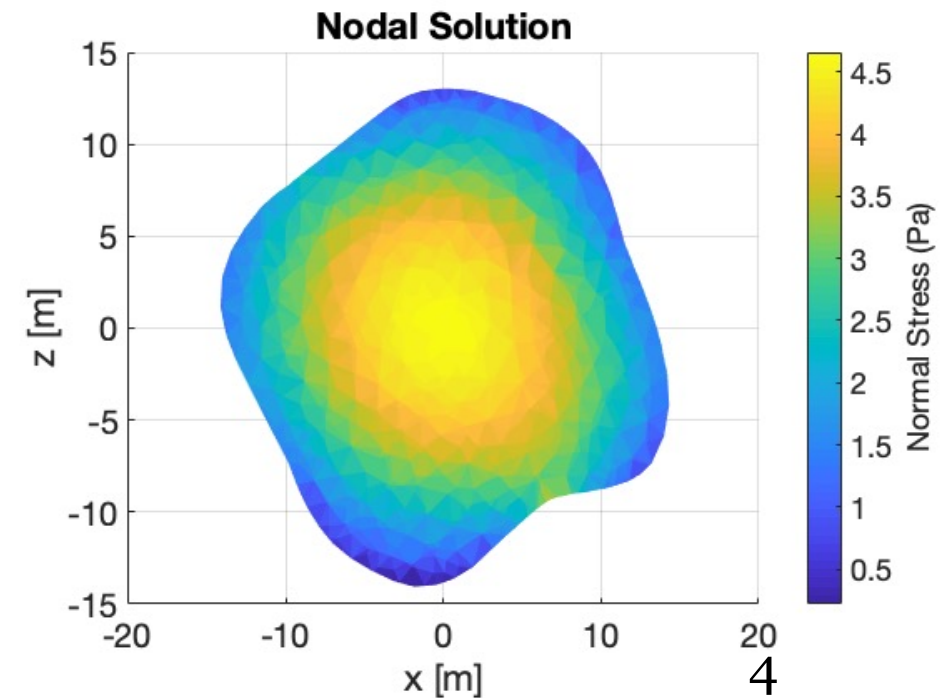
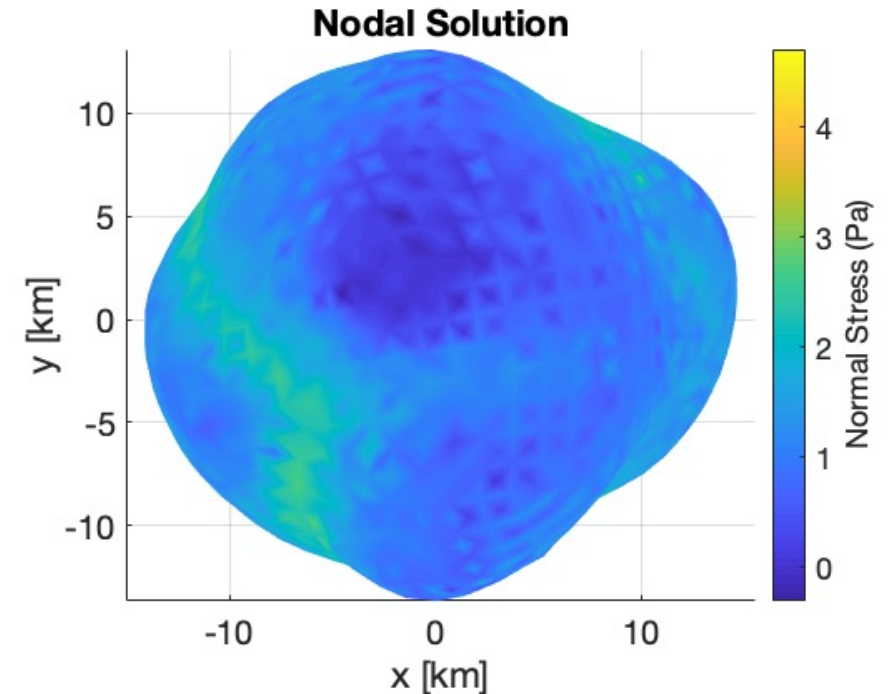
Properties	Values
Shape	Spheroidal
Equivalent diameter	$\sim 30$ m
Spin period	10.7 min
Tumbling mode	Not observed
Taxonomy	B, C, F, G, D, and P



Using the shape model by Ostro et al., 1999

Because of the fast spin, 1998 KY26 is expected to have unique surface and internal conditions.

- The stress components reach positive, and thus the interior always experience tension. However, the magnitude is not significantly high.
  - This asteroid is likely a monolithic, given the formation process.
  - However, given the stress level, a rubble pile structure is also a possible option.
- Loose materials can not exist in surface regions unless there is cohesion. If there exist such materials, there are additional attractive forces.
- Fractures, craters, and other geomorphological features correlate with this asteroid's evolution.
- Earlier radar observations imply that materials are dark, so it may be possible that this asteroid may be a carbonaceous asteroid.



# The mission contains five phases: three swing-by operations, one flyby at an asteroid, and a rendezvous with 1998 KY26.

- Long-term cruise to observe
- Zodiacal light, which is light scattering by dust distribution
  - Exoplanets.

## 2. Flyby at 2001 CC21 (2026)

Remote sensing observations while fast flyby operations.

## 4. Earth swing-by 2027

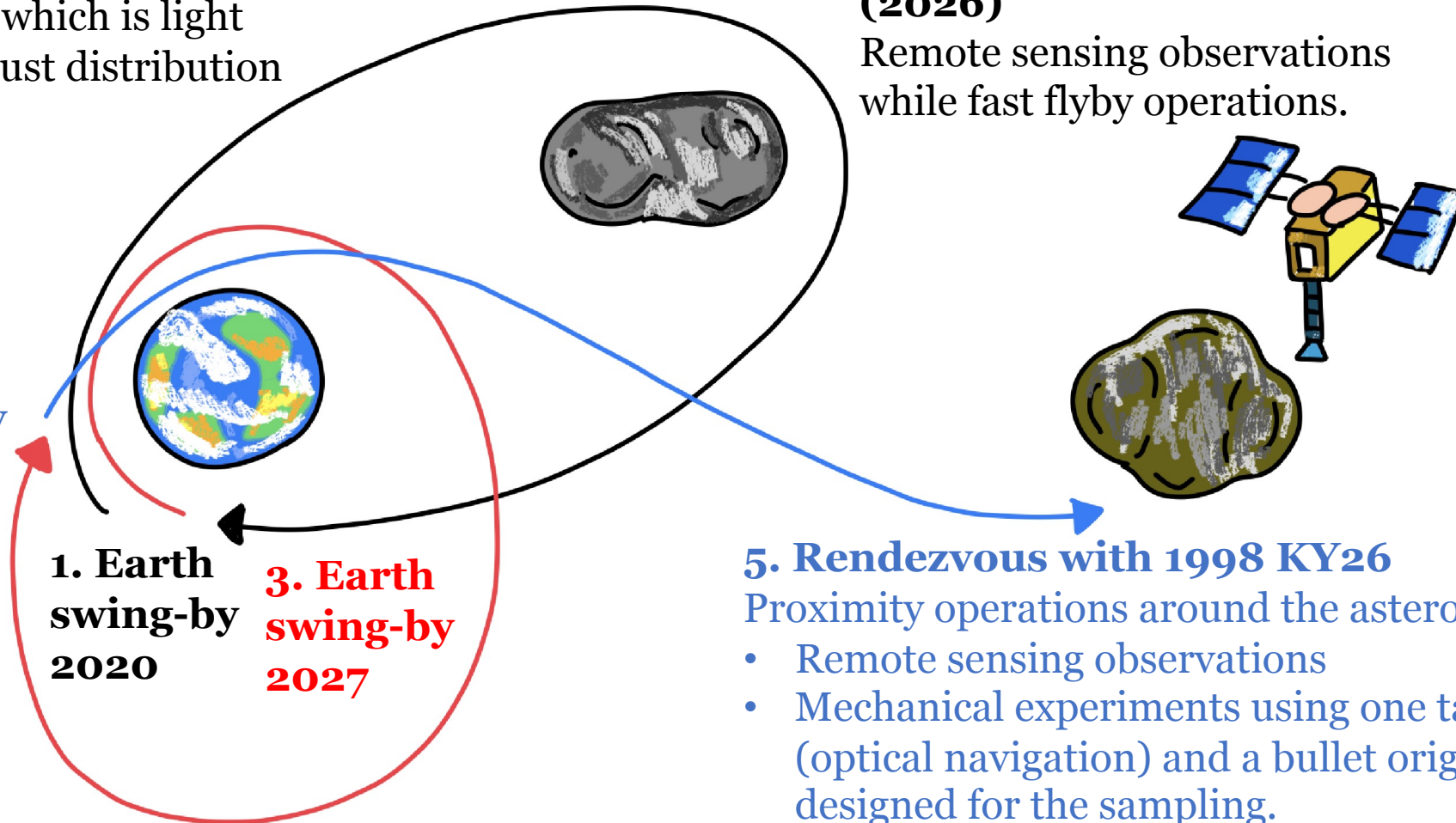
## 1. Earth swing-by 2020

## 3. Earth swing-by 2027

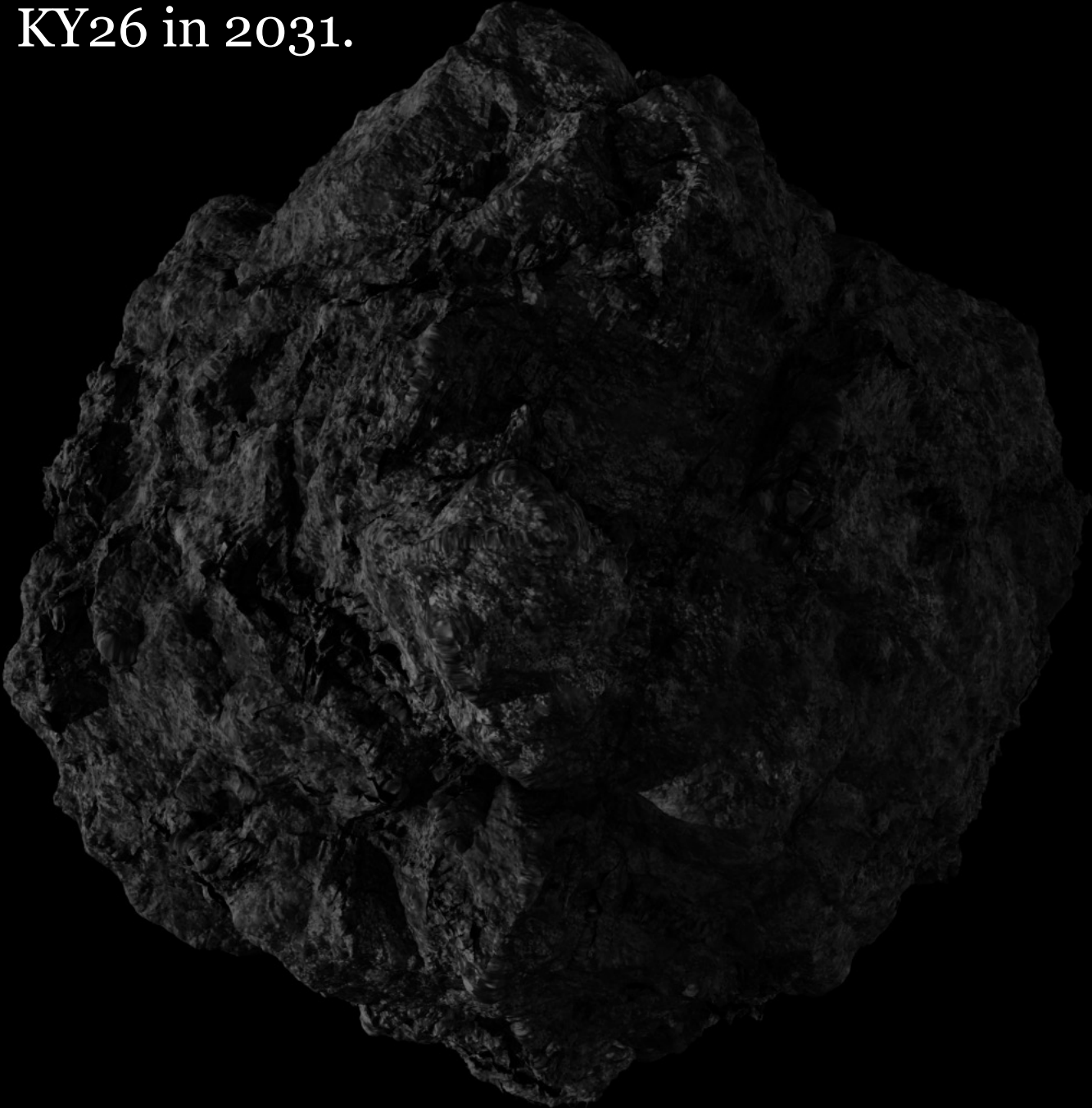
## 5. Rendezvous with 1998 KY26

Proximity operations around the asteroids

- Remote sensing observations
- Mechanical experiments using one target marker (optical navigation) and a bullet originally designed for the sampling.



Thrilled to see 1998 KY26 in 2031.



**Thank you!**  
**Questions?**