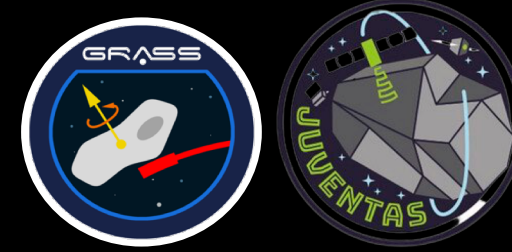


Surface Gravimetry on Dimorphos

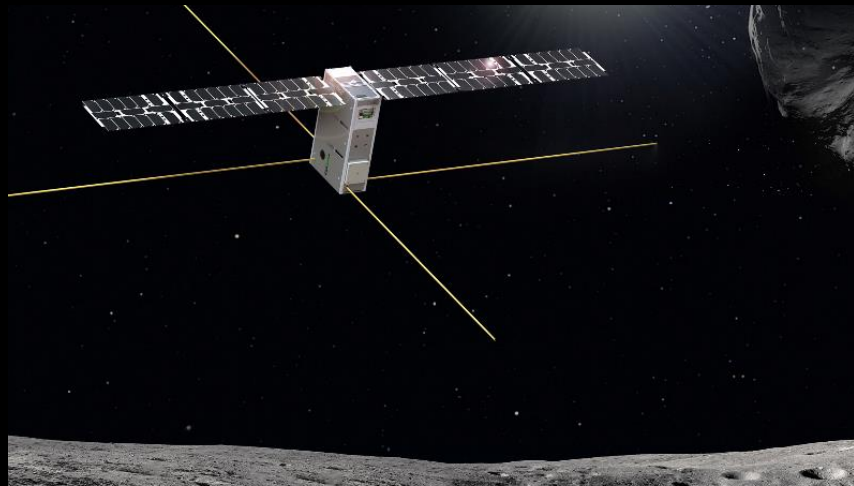
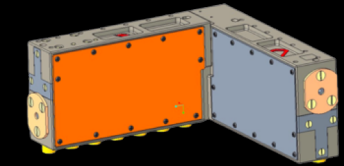
Karatekin, Ö.¹, Ritter, B.¹, Carrasco, J.², Noeker, M.¹, Umit, E.¹, Vanransbeeck, E.³, Alaves, H.¹, Tasev, E.,¹ Goli, M.¹, van Ruymbeke, M.,¹ Van waal, S.⁴, and Goldberg⁴

(¹) Royal Observatory of Belgium, (²) EMXYS (³) Royal Belgian Institute for Space Aeronomy, (⁴) GomSpace

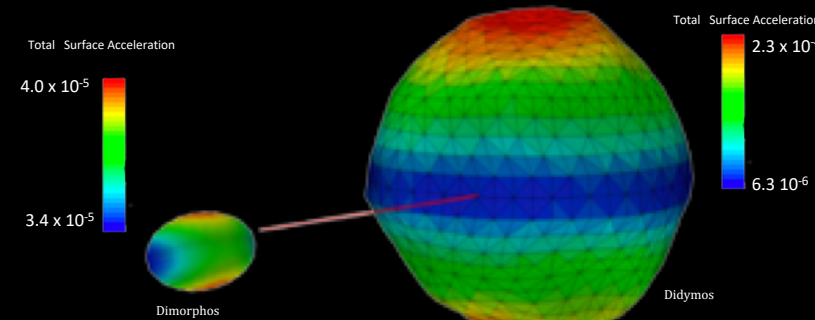


In the frame work of HERA mission, the gravimeter for small solar system objects (GRASS) has been developed to measure the local acceleration vector on the surface of the moonlet of the binary asteroid, Dimorphos.

The average gravitational force expected on the Dimorphos surface is around 5 mGal ($5 \times 10^{-5} \text{ ms}^{-2}$). Apart from the self-gravitation of the body, centrifugal forces and the acceleration due to the main body of the system contribute to the surface acceleration.



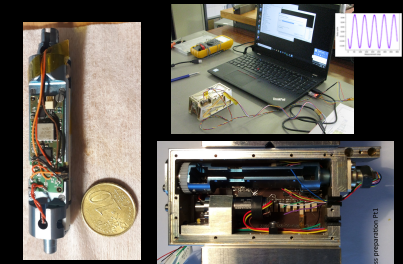
GRASS will be onboard Juventas CubeSat which is one of the two daughtercraft of ESA's Hera spacecraft. Launched in 2024 it will arrive in the binary system in 2026. Following the soft-landing of the Juventas CubeSat, GRASS will record the temporal variation of the surface gravity vector for at least 2 Didymoon orbits ~24 hours.



- Gravimeter to measure full gravity vector is based on deflecting cantilever beam and capacitive transducer
- Modulation of measured gravity vector by rotation
- Reconstruction of 3D gravity vector: amplitude and direction

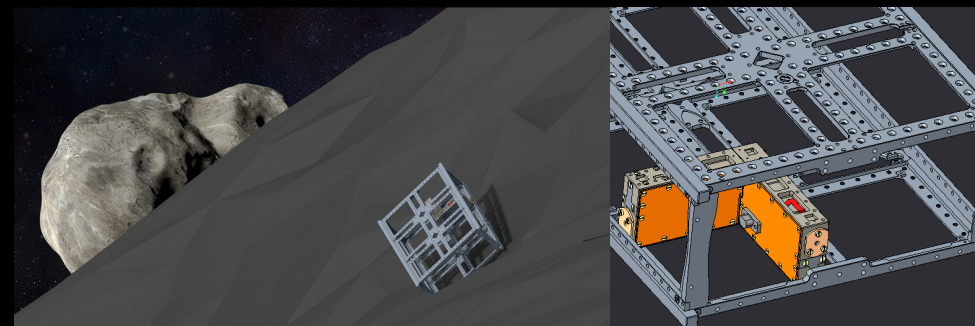
Dimorphos surface Acceleration

Contribution	(poles – equator) in ms^{-2}
Self-gravitation	$(5.13 - 5.70) \times 10^{-5}$
Centrifugal	$(0.04 - 2.26) \times 10^{-6}$
Tides	$(1.50 - 3.41) \times 10^{-6}$



Gravimeter development and timeline

- Breadboard Testing: 1st quart 2021
- Prototype integration and testing: 2nd quart 2021
- Engineering model: 4th quart 2021
- Flight model delivery: 4th quart 2022



ID	Objective	Measurement
S#1	Local subsurface inhomogeneities and global mass of Dimorphos	Determination of local gravity vector at landing location with accuracy of <1% in direction and amplitude
S#2	Dimorphos dynamical state: Surface acceleration variations due to rotation kinematics, tides, and orbital dynamics.	As S#1, but for several locations along the orbit of Dimorphos around Didymos
S#3	Global gravity solution, interior structure and surface mass transport	Synergy of data with other instruments (radar, radio, CubeSat decent, star trackers) to obtain holistic view of gravity and interior

