

## The concept of AI3 and impactors

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"Asteroid In-situ Interior Investigation - 3way" (AI3) defines a mission to investigate the interior of a rubble pile asteroid with three different complementary measurements: radar tomography, determination of the gravity field, and seismic sounding. AI3 has been proposed to ESA F-Class call and passed the first selection.

A mothership serving as communication relay will carry 4 CubeSats in the orbit of asteroid Apophis, observing the PHA during its extremely close approach to earth in 2029, getting as close as 0.1 Lunar distances, which is within the geostationary orbit.

Depending on the elongated shape of Apophis the earth fly by will trigger dynamic events on the asteroid and allow for extremely high data rates during the observation.

Two identical DISCUS satellites will be deployed to leverage the multi-point approach enabled by CubeSat technology, taking radar measurements to reconstruct the interior using computed tomography as well as determining the gravity field and analyzing surface composition using a hyperspectral imager. After completing the characterization phase, one of the DISCUS satellites will descent to the surface and measure the local surface gravity at several points on the asteroid. In the final phase, two impacting CubeSats will generate seismic waves, to be detected by the DISCUS satellite on the surface. The impact will be observed in high spatial and temporal resolution to add important data for impact studies in a before unexplored energy regime.

The concept has recently been invited to submit a detailed proposal to the Phase-2 of the ESA F-Class call.

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