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AI3: The Asteroid In-Situ Investigation – 3Ways to measure the interior of asteroid Apophis

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ABSTRACT

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.

A mothership serving as communication relay will carry 6 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.

Three 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.

A landing CubeSat, GRASP, will 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 GRASP and two landing DISCUS satellites. After the impacts GRASP and the third CubeSat will perform close up investigations of the craters.

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