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Asteroid Prospection Explorer (APEX) CubeSat for Hera mission

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ABSTRACT

Asteroid Prospection Explorer (APEX) is a 6U CubeSat for Hera spacecraft (ESA) with a unique set of instruments designed to provide a global characterization (Fig. 1) of the Didymos system – target of the joint ESA-NASA Asteroid Impact and Deflection Assessment (AIDA) mission. The instrument set includes ASPECT (Asteroid Spectral Imager), ACA (Asteroid Composition Analyzer), and MAG (Magnetometer).

Both ASPECT and ACA provide crucial information of the Didymos surface composition. While ASPECT can provide the mineral composition information at high resolution (2 m/px or better) from mineral absorption bands, ACA complements this by the elemental composition of sputtered ions from asteroid surface ejected by solar wind. Combining the information from these two instruments we can obtain a complex picture of the Didymos system composition and detect the compositional variations between Didymos I and II as well as along the bodies itself. MAG complements this information by searching for an intrinsic magnetization of the building blocks of the asteroids, thus being potentially able to distinguish between monolithic and various levels of rubble pile structure.

APEX scientific observations are planned in two stages. First, a global mapping phase is scheduled on 4.2 km, slightly inclined orbit around barycenter of the Didymos system. From this orbit, global composition and magnetic field mapping will be achieved at uniform resolution utilizing all three payload instruments. In the second phase, APEX will gradually transfer to locations nearby L4 and L5 points of the Didymos binary system. From here, APEX will engage in a high resolution compositional and magnetic mapping of both Didymos I and II. At the end of the mission, a landing of APEX on one of the Didymos asteroids will be tried.

APEX concept with its unique instrument set and capabilities can be applied in any future asteroid characterization projects from purely science and planetary defense driven missions to characterization of the asteroid ISRU potential.

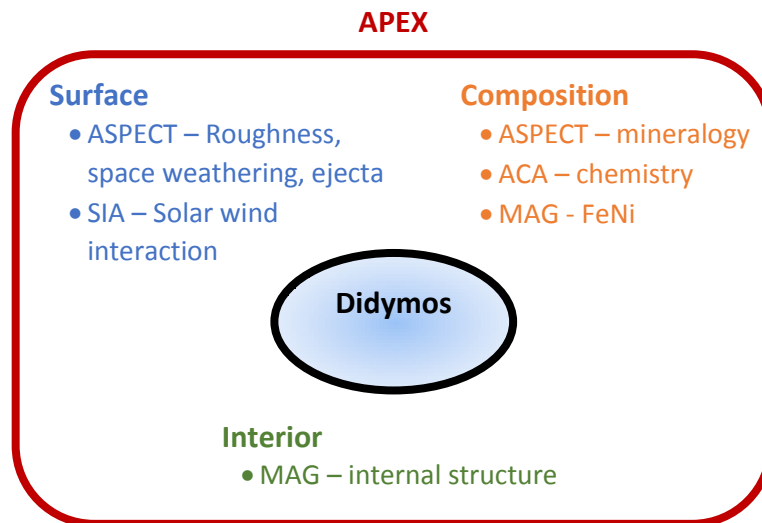


Fig. 1. APEX Science objectives and key payload.