

Near-Earth asteroids – threat mitigation and commercial possibilities

From 2011 to 2018 I led the development of the current state-of-the-art model of the population of near-Earth asteroids and comets (Granvik et al. 2018, Icarus 312, 181). That model is today the baseline used by space agencies such as ESA and NASA to inform them about the impact threat from near-Earth asteroids and comets. The model is also used by leading ongoing and future asteroid surveys such as the NASA-funded Catalina Sky Survey (CSS), Vera C. Rubin Observatory Legacy Survey of Space and Time (aka LSST), and NASA's Near-Earth Object Surveyor (NEOS) mission to optimize their system and survey designs. Privately-owned companies such as TransAstra Corp and Karman+ are using the model to inform them about potential targets for in-space resource utilization. The current model is based on observational data about near-Earth asteroids obtained during 2005–2012, and lacks information about, e.g., the material composition of the asteroids which is rather essential for planning threat mitigation and in-space resource utilization. We propose to hire a PhD student to develop the tools required for utilizing the enormous amount of asteroid data to be provided by LSST starting in 2024, and to develop the next state-of-the-art population model of the near-Earth asteroids. The LSST data will also include compositional information about the discovered asteroids and will thus allow for a significant improvement compared to the current state-of-the-art model. One of the predictions of the current model is that an extremely close Earth encounter at a distance of less than 32 thousand kilometers from the Earth's surface by a 370-m-diameter asteroid should occur only once in 7000 years. Yet that is exactly what asteroid Apophis will do on Friday April 13, 2029. This very rare event will allow us to study the interior structure of the asteroid as the tidal forces will likely cause landslides and even shape changes on the asteroid. Therefore we also propose to hire a PhD student to work on a nanosat mission to fly by asteroid Phaethon during the close encounter and observe the asteroid from directions that are not visible from the ground. This mission is a great opportunity to motivate and train the next generation of space engineers.

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