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Nano-Landers for the geophysical exploration of Near Earth Objects

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ABSTRACT

In situ exploration of Near Earth Objects (NEO) by nano-landers would allow to study the surface environment, composition, near surface processes, as well as the deep interior: providing unique information complementary to remote measurements from spacecraft. Recent years have seen an explosion of cubesat missions, enabling novel approaches to robotic exploration that may not be practical with larger, more costly spacecraft. Landing in a low gravity environment with a cubesat and surviving harsh conditions up to 3 months for scientific investigation, have been studied in the frame of the Asteroid Geophysical Explorer (AGEX) [1]. AGEX was developed for the CubeSat Opportunity Payload Intersatellite Network Sensors (COPINS) payload on the ESA AIM spacecraft destined for the Didymos binary asteroid system. Similar nano-landers can be conceived for small bodies and moons in the solar system. For instance, the objective of the SOLVE proposal for the ESA Lunar study [2] is to study radiation, electric and magnetic field variations, and to characterize dust properties from the surface up to the top of lunar ionosphere.

In this study, we review cubesat lander mission concepts which are relevant to NEO characterization. We will present key scientific investigations and associated science instrumentation. Key technological and operational challenges including landing strategies, will be addressed.

[1] Ö. Karatekin and AGEX Team The Asteroid Geophysical Explorer (AGEX); A proposal to explore Didymos system using Cubesats, 41st COSPAR Scientific Assembly, Abstract B0.10-4-16, .2016

[2] B. Ritter, Ö. Karatekin, N. Gerbal, J. A. Carrasco, S. Ranvier, and J. De Keyser, “ LUCE: a small spacecraft for near lunar environment exploration”. European Geosciences Union General Assembly 2017 Vienna, Austria, 23–28 April 2017.

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