Minicolloque n° MMM11 **X Oral** **☐ Poster**

Interacting with granular materials on asteroid and small-body surfaces

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Small-bodies, such as asteroids, comets, and moons, can be covered by a layer of loose grains, referred to as regolith [1]. The shape and size distribution of the surface grains can vary drastically from one body to another, and the material properties of the grains are often unknown. The low-gravity found on small bodies coupled with the surfaces' unknown material properties makes it difficult to predict and understand the macroscopic behavior of the regolith. Fortunately, recent missions like OSIRIS-REx (NASA) and Hayabusa2 (JAXA) have provided us with new and fascinating insights into this problem [2, 3].

The OSIRIS-REx sampling mechanism met little resistance when it touched down the surface of the asteroid Bennu [2]. In contrast, the MASCOT rover deployed by the Hayabusa2 spacecraft rebounded several times off of the surface of the asteroid Ryugu [4]. Though surprising, the fluid-like response of Bennu's surface and the rebound of the MASCOT rover are not completely unexpected. In this talk, we discuss how granular materials behave differently under terrestrial and low-gravity conditions. We use results from drop-tower experiments [5] and Discrete Element Method numerical simulations [6] to show how landing and sinking behavior for varied gravity levels compares with predictions from existing phenomenological collision models [7, 8]. Finally, we present the implications of our findings in the context of several upcoming small-body missions.

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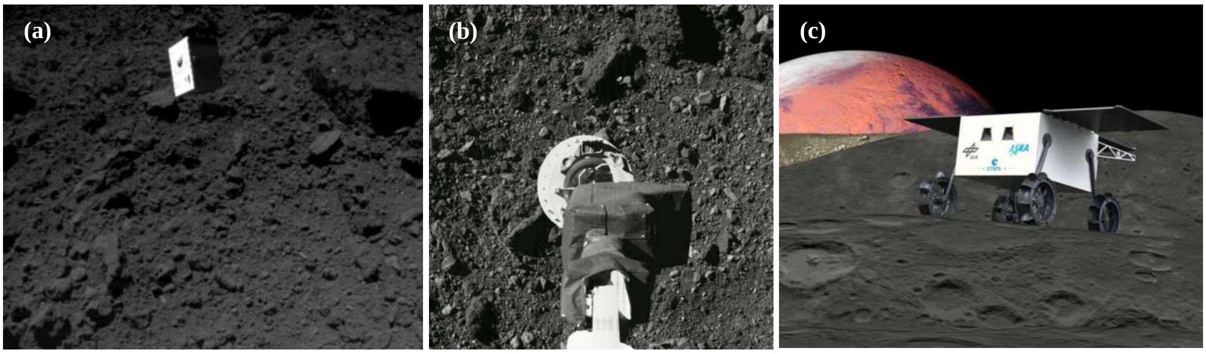

Figure 1 : (a) The MASCOT lander approaching the surface of Ryugu (DLR/CNES/JAXA), (b) the OSIRIS-REx sampling mechanism approaching the surface of Bennu (NASA/Goddard/University of Arizona), (c) an artist rendition of a rover on the surface of Phobos as part of the planned Martian Moons eXploration mission (CNES/DLR/JAXA).