A SIMPLE INSTRUMENT TO *IN SITU* CHARACTERIZE THE TENSILE STRENGTH OF COMETARY MATERIALS

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ABSTRACT

Comets and small asteroids are undifferentiated bodies that have consequently preserved primitive materials in their interiors [1]. Small bodies stored far away from the Sun probably have preserved their primeval physical properties since they have been exposed to low collisional processing. A few of these objects are visiting the Near-Earth region, being currently in the focus of future missions like perhaps a renovated Marco Polo mission joined by the different space agencies. Obviously, future sample return missions to these bodies will have the main goal to collect and preserve unaltered samples of cosmochemical significance. However, to return samples from these objects can be a significant technological challenge. Recent compiled evidence suggest that these primitive objects exhibit extremely low tensile strength and bulk density values [2] that need to be evaluated to guarantee the success of future sample-return missions. We remark that the expected strength for cometary bodies is several orders of magnitude lower than the measured for most fragile terrestrial rocks. On the other hand, such extreme physical properties would be characteristic of primitiveness, thus they need to be assessed carefully [3]. For all the above mentioned reasons, landing on a primitive body surface is a critical issue that requires an estimation of the tensile strength of its surface.

We present here a simple instrument to measure the tensile strength of granular materials presumably forming these primitive bodies. The idea is to use a cm-sized rectangularly shaped cell where the collected granular material from the surface is deposited. Once the cell is partially filled, it is rotated around its vertical axis at increasing rotation velocities while a wireless TV camera records the avalanches driven by the centrifugal force. A quick measurement of the material tensile strength is obtained from the analysis of these avalanches by means of image software [4]. Such a device could be small enough to be easily incorporated into a small lander or an orbiting spacecraft in order to measure *in situ* the tensile strength of the surface. The granular material to be tested would be collected from the surface with the help of a penetrator located in a robotic arm. In this way, orbital manoeuvres nearby the body (like the ones made during Hayabusa approach to asteroid 25143 Itokawa) would allow to get information on the consistence of its surface before landing. The penetrator would also allow taking samples at different depths, thus having the possibility of measuring the physical properties of materials at deeper layers of the primitive body.

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