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A SIMPLE METHOD FOR PROBING THE STRENGTH OF AN ASTEROID

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ABSTRACT

Recent theoretical work [1,2] and observations [3,4,5] of small solar system bodies has shown that small amounts of cohesive strength in the regolith of a rubble pile body can strengthen these bodies to the point where they can spin significantly faster than the gravitational spin limit, as a function of their size [6]. Whether or not a rapidly spinning asteroid is tenuously held together by weak cohesive forces or is monolithic and strong can have a significant influence on how best to mitigate that body, and thus is an important item to characterize and better understand.

While these theories and explanations of cohesive strength are consistent with the basic physics of surface forces, their direct validation have yet to be confirmed *in situ* on the surface of a small asteroidal body. In this contribution we provide details on a simple and direct way in which the cohesive strength of regolith on a small body surface can be determined through the use of relatively low-energy impact or explosive events that will create craters. Through the application of the basic scaling theory of impacts [7], such an approach can be used as a method to determine the cohesive strength of surface regolith, which can then be used as a proxy for the overall strength of the body.

The basic idea behind the proposed method is simple. An impact or explosive blast with a known energy is precipitated on the surface of an asteroidal body. Assuming that the local acceleration is known, the resulting crater size will sensitively depend on the cohesive strength of the material in which the impact occurs. Then, at first order, the measurement of the crater diameter through visual imaging will provide an

estimate of the cohesive strength of the surface material. Additional observations of the cratering dynamics and the morphology of the crater and ejecta field can also be used to further constrain the strength and cratering regime. For example, if the ejecta blanket is seen to be separated from the crater rim, this indicates an event in the strength regime. Also, if the time over which the crater evolves is long, this is indicative of an impact in the gravity regime. The final paper and presentation will discuss these details and carry out a simple analysis on the the accuracy of this strength determination method, based on the imaging resolution of the experiment and the accuracy to which the cratering energy can be delivered.

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