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Sculpting asteroid shapes during gravitational reaccumulation

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After the catastrophic disruption of a parent body, new objects are formed by the re-accumulation of the resulting fragments. A new dynamical family is thus formed. This phase is dominated by gravity, and the resulting bodies are cohesionless gravitational aggregates, also known as "rubble piles". Several lines of evidence suggest that a large fraction of the known objects in the Main Belt could fall in this category. Photometric observations show that they are probably characterized by a large variety of shapes. Here we discuss the possibility that those shapes originated directly during the reaccumulation event, as a result of the gravitational collapse of a set of fragments characterized by a certain amount of velocity dispersion and angular momentum. We simulated the collapse numerically using a set of equal-sized particles, showing that not all shapes are directly attainable (or achievable) by this process alone. This presentation concerns an update of our results [1], considering a larger variety of initial conditions and more realistic assumptions. The influence of the approximations introduced in the model and the possible role of secondary impacts and later re-shaping of the reaccumulated bodies are discussed.

[1]P. Tanga et al., ESPC2006-A-00415