ROTATIONAL DISRUPTION OF COMETARY NUCLEI

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The distribution of measured rotational periods for cometary nuclei is non-random, with several very slowly rotating nuclei and an apparent cut-off of rotational periods at values less than ∼5.3 hours. This cut-off is similar to what is observed for small asteroids, albeit at a different value for the period. In the case of the cometary nuclei, and assuming that the nuclei are strengthless rubble piles, the cut-off implies an upper limit on the bulk density of the nuclei of ∼0.6 g cm^{-3}. It is likely that irregular outgassing of volatiles on the surfaces of the nuclei result in jet forces that can alter the rotational periods of the nuclei on each perihelion passage. Such forces are already known to alter the orbits of the returning short-period comets, including such prominent ones as 1P/Halley and 2P/Encke, and can also explain why some dynamically new long-period comets appear to be on hyperbolic orbits, when they actually are not. Rotational spin-up may also provide an explanation for random disruption of cometary nuclei. Currently, there is no satisfactory explanation for random disruption events. This work was supported by the NASA Planetary Astronomy and Planetary Geology & Geophysics Programs, and was conducted at the Jet Propulsion Laboratory under contract with NASA.