APPROACHING THE INTERNAL STRUCTURE OF THE NUCLEI OF COMETS

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It has been understood, since comet Halley flybys, that the density of cometary nuclei is very low. More recently, observations of the solar light scattered by dust ejected from nuclei, together with elaborate simulations, have suggested that a fair amount of the refractory component consists in fluffy aggregates built up from sub-micronic grains [1, 2]. Deep Impact and Stardust have recently confirmed these estimations. Amongst other unique results, these missions have respectively provided a fair estimation of the density of the nucleus of comet Tempel 1, 350 250 kg m-3 [3], and given evidence for the existence of both dense grains and aggregates with low bulk density within the coma of comet Wild 2 [4]. While it is now recognized that nuclei are most fragile and that fragmentation events reveal changes in the dust properties [5], the internal structure of the nuclei is still unknown. In less than 8 years, the CONSERT experiment on board the Rosetta probe should investigate the deep interior of comet Churyumov-Gerasimenko, from measurements of the propagation delay of long wavelength radio waves [6]. A detailed analysis of the waves passing through the nucleus will put constraints on the materials and on the heterogeneities within the nucleus. Meanwhile, further studies of the morphology of cometary dust and of the thermal structure of cometary nuclei should allow us to provide more constraints for the catastrophic disruption of dormant or defunct nuclei.

References

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