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Spin and activity of comet 67P/Churyumov-Gerasimenko

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Abstract

ESA's spacecraft Rosetta is now on its final cruise towards comet 67P/Churyumov-Gerasimenko and will reach its target in 2014. The spacecraft will follow the comet as it comes back to the perihelion, monitoring the activity and releasing a lander to study the surface in-situ. In order to be ready for the final stage of the mission, many observations of the comet have been acquired during the last orbits but still many uncertainties remain. For instance several authors have published different spin axis orientations and the shape of the comet is not yet well constrained. Regarding the activity, Lara et al ([3]) have shown that the coma of 67P features many dust jets, indicating that the activity is not isotropically distributed on the surface, but rather enhanced in specific regions of the nucleus. As these dust jets can be a serious hazard for the space craft, especially for the lower orbital phases of the mission, we need to constrain them better.

Over the last 4 years we have developped a model of dust coma structures, aiming at simulating the behaviour of dust jets from the subsurface of cometary nuclei up to thousands of kilometers away from the surface. Our model was used succesfully to study several targets, the latest one being comet 9P/Tempel 1. For this comet we completely reproduced the behaviour of the jets from ground based observations only, with results in perfect agreement with in-situ measurements by the Deep Impact team (see [2]).

We are now applying the same method to images of 67P acquired in 2009, when the comet was in the post-perihelion phase of its orbit, and described in [3]. At that time the comet was very active and has shown many dust coma structures that we analyse to localize the active regions at the surface of the nucleus, and constrain the properties of the dust grains inside the jets.

Apart from reconstruction of dust features, our model provided as well good constrains on the rotation axis of several cometary nuclei (73P-B & 73P-C [1], 9P [2]). We use again this tool to improve our knowledge of 67P rotation state, and we will present our results combined with an inversion of a new set of lightcurves acquired between 2004 and 2007 (Tubiana et al [4]) when 67P was in the aphelion arc, leading to a new determination of the spin axis orientation of 67P.

References

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