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Sublimating grains model of cometary coma

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Abstract.

Billion years of space weathering produces a crust of organic matter (see e.g. Kanuchova et al. 2012) that will be released when a comet enter for the first time in the inner Solar System. New comets, coming form the Oort Colud at their first passage close to the Sun, are particularly important because they are not differentiated by the Solar radiation and they are supposed to have a large quantity of ice organic matter close to the surface. When a comet approach to the Sun, its activity is driven by the sublimation of these nucleus ices: if the heliocentric distances, R_H , is greater than 3 AU the sublimation of CO and CO_2 ices is the main source of comet activity, otherwise at shorter distances, the sublimation of water become the most important mechanism of activity. These gases, escaping from the nucleus, drag in the coma grains that can be refractory dust (silicates, carbon), water ice and/or organic ices. Oort comets at their first passage in the inner Solar System, should produce an halo of organic or water icy particles. Our group has been monitoring new, inbound, bright Oort comets (C/2011 F1, C/2012 S1, C/2012 K1, C/2013 V5, C/2012 F3, C/2013 US10, C/2013 X1) to search for these icy grains. The method consists in detecting the cloud of sublimating grains in the inner coma by using the ΣAf function (Tozzi et al. 2007) directly from images. However this over-population of grains, beside the sublimation, can be also due to short time activity (outburst) or too big grains expanding at very slow velocity, as it has been found in comet 67P/C-G (Tozzi eta al, 2011, A&A, 531, 54). To disentangle between the phenomena it is necessary to monitor the comet both at short timescale, for the outbursts (by repeating the observations after few nights), and at long term (weeks-months). If the cloud does not expand with the decreasing of the heliocentric distance there is high probability that we are in presence of organic and/or water ice grains. We can disentangle between organic and water icy grains by measuring their color and spectra. To understand solid cometary coma environment from observations it has been necessary to construct a theoretical model to connect each other the observational ΣAf profiles with a theoretical profile achived from physical laws. In this talk we will present the architecture of the model and the results obtained from the comparison between theoretical ΣAf profiles and observations of differents new Oort cloud comtes, in order to understand the nature of sublimating grains.

References

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